Chapter 50

HEALTH, HEALTH INSURANCE AND THE LABOR MARKET

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Contents

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Abstract

This chapter provides an overview of the literature linking health, health insurance and labor market outcomes such as wages, earnings, employment, hours, occupational choice, job turnover, retirement, and the structure of employment. The first part of the paper focuses on the relationship between health and labor market outcomes. The empirical literature surveyed suggests that poor health reduces the capacity to work and has substantive effects on wages, labor force participation and job choice. The exact magnitudes, however, are sensitive to both the choice of health measures and to identification assumptions. The second part of the paper considers the link between health insurance and labor market outcomes. The empirical literature here suggests that access to health insurance has important effects on both labor force participation and job choice; the link between health insurance and wages is less clear.

JEL codes: I12; J32; J24

> … that the labor force status of an individual will be affected by his health is an unassailable proposition [because] a priori reasoning and casual observation tell us it must be so, not because there is a mass of supporting evidence. (Bowen and Finegan, 1969)

> Despite the near universal finding that health is a significant determinant of work effort, the second major inference drawn from [this] review is that the magnitude of measured health effects varies substantially across studies. (Chirikos, 1993)

1. Overview

This chapter provides an overview of some of the literature linking health and labor market behavior. The question is important because for groups as diverse as single mothers and older people, health is thought to be a major determinant of wages, hours, and labor force participation. Thus, an understanding of the effects of health on labor market activity is necessary for evaluations of the cost effectiveness of interventions designed to prevent or cure disease. Moreover, since the relationship between health and the labor market is mediated by social programs, an understanding of this relationship is necessary if we are to assess the effectiveness and solvency of these programs. In countries with aging populations, these questions will only become more pressing over time as more individuals reach the age where health has the greatest impact on labor market outcomes.

The two quotations above, one from 1969 and one from 1993, illustrate that a good deal of empirical evidence linking health and labor market activity has sprung up over the last 25 years. Indeed, the literature we review suggests that health has a pervasive effect on most outcomes of interest to labor economists including wages, earnings, labor force participation, hours worked, retirement, job turnover, and benefits packages. But unfortunately there is no consensus about the magnitude of the effects or about their size relative to the effects of other variables. We will, however, be able to shed some light on factors that cause the estimates to disagree.

Much of the best work linking health and labor market outcomes focuses on developing countries. This may be because the link between health and work is more obvious in societies in which many prime age adults are under-nourished and in poor health, and also because the theory of efficiency wages provides a natural starting point for investigations of this issue. However several excellent recent surveys of health and labor markets in developing countries already exist (see Behrman and Deolalikar, 1988; Strauss and Thomas, 1998). In order to break newer ground, this survey will have as its primary focus papers written since 1980 using US data, although we will refer to the developing country literature where appropriate.

2. Health and the labor market

2.1. Health as human capital

In his pioneering work on human capital, Becker (1964) drew an analogy between "investment" in health capital and investment in other forms of human capital such as education. This model was further developed by Grossman (1972). A simple version of his model follows. First, consumers are assumed to maximize an intertemporal utility function:

$$\sum_{t=1}^{T} E_t(1/1 + \delta)^t U_t + B(A_{T+1}), \tag{1}$$

where δ is the discount rate, $B(\cdot)$ is a bequest function, A denotes assets, and U_t is given by

$$U_t = U(Q_t, C_t, L_t; \boldsymbol{X}_t, u_1, \varepsilon_{1t}), \tag{2}$$

where Q is the stock of health, C is consumption of other goods, L is leisure, $\mathbf{X}$ is a vector of exogenous taste shifters, u_1 is a vector of permanent individual specific taste shifters, and ε_1 denotes a shock to preferences. Utility is maximized subject to the following set of constraints:

$$Q_t = Q(Q_{t-1}, G_t, V_t; \mathbf{Z}_t, u_2, \varepsilon_{2t}), \tag{3}$$

$$C_t = Y_t + P_t G_t - (A_{t+1} - A_t), \tag{4}$$

$$Y_t = I_t + w_t H_t + rA_t, \tag{5}$$

$$L_t + V_t + H_t + S_t = 1, \tag{6}$$

$$S_t = S(Q_t, u_3, \varepsilon_{3t}), \tag{7}$$

where G and V are material and time inputs into health production, $\mathbf{Z}$ is a vector of exogenous productivity shifters, u_2 are permanent individual specific productivity shifters, ε_{2t} is a productivity shock, Y is total income, P represents prices, I is unearned income, w is the wage, r is the interest rate, S is sick time, u_3 are permanent individual specific determinants of illness and ε_{3t} are shocks that cause illness. Endowments of health and assets, Q_0 and A_0, are assumed to be given.

This model has several features. First, the stock of health today depends on past investments in health, and on the rate of depreciation of health capital (which is one of the elements of u_2). Health is valued by consumers both for its own sake and because being sick is assumed to take time away from market and non-market activities. Non-market time is an input into both health production and the production of other valued non-market goods (e.g., leisure activities). This model can be solved to yield a conditional labor supply function in which labor supply depends on the endogenous health variable. From an empirical point of view, the main implication of the model is that health must be treated as an endogenous choice.

In principle, the stock of education is also determined by endogenous choices. But education is often treated as predetermined since the optimal investment profile dictates that most investment should occur early in the lifecycle (see Weiss, 1986). This is not the case for health since workers typically start with a large health endowment that must be continuously replenished as it depreciates and many investments in health occur later in life. Thus, the endogeneity of health may be a greater potential source of bias than the endogeneity of education in many applications.

Still, health is similar to general human capital in more traditional models, since it is valued by employers and employees take it with them from job to job. One implication is that individuals will bear the costs of investments in their health so that the costs of employer-provided health insurance, for example, should be passed on to employees in the form of lower wages. On the other hand, if there are complementarities between returns to health and returns to specific human capital, then employers may be willing to bear some of the costs of investments in health.

The simple model outlined above treats wages and all other prices as parametric. However, one of the major foci of the health and labor markets literature is measuring the effect of health on wages, usually by adding health measures to a standard Mincerian wage function (Mincer, 1974). Thus, a more complete model of the choices faced by individuals would recognize that investments in health may alter wages. Conversely, wages can affect investments in health, just as they affect educational decisions (Willis and Rosen, 1979). Thus, health is determined endogenously with both wages and labor supply.

An additional possibility is that wages and labor market activity have a direct effect on health. There is a large literature examining the effects of labor market activity on health, some of which is surveyed in Ruhm (1996).[1] In principle, exogenous changes in employment or wages can influence health by directly affecting the probability of workplace injury, stress and risk-taking behaviors, by changing the opportunity costs of investments in health capital, or by changing the return to health. In this case, the health measure may be correlated with the error in the wage equation, again suggesting that health ought to be treated as an endogenous choice.

In fact, most of the literature surveyed below treats health as an exogenous, if often mismeasured, variable. The implicit assumption is that exogenous shocks to health are the dominant factor creating variation in health status, at least in developed countries. This may not be an unreasonable assumption given that current health depends on past decisions and on habits that may be very difficult to break (e.g., smoking, or a preference for a high fat diet), and the fact that individuals often have highly imperfect information about the health production function at the time these decisions are made.[2] However, relatively little research has been devoted to assessing the empirical importance of the potential endogeneity bias.

One of the main differences between health and other forms of human capital is that health capital is often subject to large negative shocks.[3] If variation in current health is dominated by shocks, then uncertainty about the return to investments in health will be very important, and insurance should play a large role in mediating the relationship between health and the labor market. In his survey of the importance of education as human capital, Willis (1986) notes that researchers tend to focus on the supply of education rather than on the determinants of demand for education. An examination of the employer side of the market is especially important in the health and labor markets literature because of the key role of employer provided health insurance in the United States.

2.2. Measurement issues: what is health?

The concept of "health" is similar to the concept of "ability" in that while everyone has some idea of what is meant by the term, it is remarkably difficult to measure. Failure to properly measure health leads to a bias similar to "ability bias" (Griliches, 1977) in standard human capital models. That is, if healthier individuals are likely to get more education, for example, then failure to control for health in a wage equation will result in over-estimates of the effects of education. Similarly, if healthier individuals have lower labor supply elasticities, then failure to control for heterogeneity due to health in a labor

[1] Most studies of the effects of labor market participation on health have either used micro-data to compare the health of the employed and the unemployed, or used aggregate time-series data to look into the responsiveness of health measures such as mortality rates to aggregate economic conditions. Studies using micro-data tend to uncover a link between unemployment and various health problems, but these studies generally do not control for the potential endogeneity of employment status. Inferences drawn from aggregate data tend to be sensitive to the exact empirical specification chosen. Thus the link between exogenous changes in employment and health remains controversial.

[2] On the other hand, models of "rational addiction" show that people may start smoking cigarettes for example, even if they realize that the likely consequence is that they will become addicted (Becker and Murphy, 1988).

[3] Altonji (1993) explores the implications of uncertainty in the returns to education and shows that there can be large differences between ex ante and ex post rates of return.

supply equation will lead to smaller estimates of the elasticity of labor supply with respect to wages.

In one of the first papers to make this point, Lambrinos (1981) shows that in a sample of 18,000 disabled and non-disabled adults from the 1972 Social Security Survey of Disabled and Non-disabled Adults, the estimated elasticity of labor supply (with respect to wages) depends on whether a health variable is included and also on whether or not disability is used to exclude individuals from the sample.[4] The substitution elasticities range from 0.71 with no health controls, to 0.59 with a control for disability, to 0.48 in a sample that excludes the disabled. Including a health index constructed using data on activity limitations also improved model fit by 28%. The size of this "health bias" is likely to vary with the health measure used, and the exact magnitude may prove as difficult to pin down as the size of "ability bias" has been.

Ideally we would like some summary measure of health as it pertains to the ability and desire to work. Such a measure might be called "work capacity". In practice the types of measures usually available can be divided into eight categories: (1) self-reported health status (most often whether someone is in excellent, good, fair or poor health); (2) whether there are health limitations on the ability to work; (3) whether there are other functional limitations such as problems with activities of daily living (ADLs); (4) the presence of chronic and acute conditions; (5) the utilization of medical care; (6) clinical assessments of such things as mental health or alcoholism; (7) nutritional status (e.g., height, weight, or body mass index); and (8) expected or future mortality. Studies using data from developing countries often focus on measures of nutritional status, although some studies also look at ADLs, the presence or absence of health conditions, and the utilization of care. In contrast, the over-whelming majority of studies using data from more developed countries focus on self-reported health status, health limitations, or utilization of medical care.

Estimates of the effects of health on labor supply are quite sensitive to the measure used. Including multiple measures, or more comprehensive measures (e.g., an indicator for whether health limits the ability to work versus a specific limitation on an activity of daily living), increases the explanatory power of regression models a great deal, and may also change the estimated coefficients on demographic characteristics such as race and sex which are included as independent variables (Manning et al., 1982). Blau et al. (1997) report that when multiple measures are entered in a model of labor supply, self-reported measures of health status and health-related work limitations have the largest reported effects, although limitations on activities of daily living are also statistically significant. In contrast, indicators for specific conditions are not statistically significant once the self-reported measures are included.[5] These findings are perhaps unsurprising given that measures such as height, or whether or not you can walk up several flights of stairs,

[4] DaVanzo et al. (1976) also showed that excluding groups such as the disabled from the sample would alter estimates of labor supply elasticities.

[5] When they interacted the various health measures available in the Health and Retirement Survey, they found that the interactions were not jointly statistically significant.

may not be very directly related to ones' productivity as a computer programmer, for example.

While self-reported measures such as whether you have a health condition that limits work may be more directly related to productivity, they may also be more subject to reporting biases. Several studies suggest that self-reported measures are good indicators of health in the sense that they are highly correlated with medically determined health status (Nagi, 1969; Maddox and Douglas, 1973; LaRue et al., 1979; Ferraro, 1980). Mossey and Shapiro (1982) found that self-reported poor health was a better predictor of mortality than several more objective measures of health status. The relationship between more objective measures of health limitations and self-reported limits on ability to work also move in expected directions: e.g., Baldwin et al. (1994) find using the 1984 SIPP that impairments related to mobility and strength are more likely to lead to reported work limitations for men, while limitations on sensory capacities and appearance are more likely to lead to reported work limitations for women.[6]

The main problem with self-reported measures is not that they are not strongly correlated with underlying health as it affects labor market status. Rather, the problem is that the measurement error is unlikely to be random. Individuals who have reduced their hours or exited the labor force may be more likely to report that they have poor health status, functional limitations, various conditions, or that they utilize health care. This is because they may seek to justify their reduced labor supply, or because government programs give them a strong incentive to say that they are unhealthy. Self reports may also be influenced by whether or not the person has sought treatment, which in turn may be affected by education, income, employment, and health insurance status. An additional concern is that utilization of medical care typically increases with income, even though (as discussed below) the better-off are generally in better health (Currie, 1995; Strauss and Thomas, 1998). If utilization affects the diagnosis of certain conditions (such as hypertension), then it may be the case that higher wage individuals are systematically more likely to report these conditions, other things being equal. Finally, individuals who have health limitations may choose jobs in which their health does not limit their ability to work. It is not clear how these individuals will answer the "Does health limit work?" question, since health limits their occupation but not their ability to perform the tasks specific to their chosen job. Noise of this sort would be expected to bias the estimated effect of "limits" towards zero.

There is plenty of evidence that these concerns about non-random measurement error are justified:

- Chirikos and Nestel (1981, 1984) find that both impairments and low wages are significantly positively related to the probability of reporting a work-limiting health problem, although two-thirds of the variance in this variable remains unexplained.
- Parsons (1980, 1982) notes that the probability of reporting self-rated poor health rises

[6] On the other hand, Chirikos and Nestel (1981) found "instability" in self-reported impairments over time in a longitudinal sample of older men. It is not clear whether this represents genuine changes in health status or measurement error.

with the potential Social Security benefit level; he suggests using subsequent mortality as an alternative measure.

- Using the Longitudinal Retirement History Survey, Bazzoli (1985) finds that a report of work limitations prior to retirement had no impact on the probability of retirement before age 65, whereas a reported limitation at the time of retirement had a strong effect.
- Sickles and Taubman (1986) find that changes in Social Security benefits and eligibility for transfers influence self-rated health as well as the probability of withdrawal from the work force.
- Burtless (1987) finds that occupation, sociodemographic characteristics, and economic incentives all affect self-rated health more than they affect mortality. Also, he suggests that sectors in which health risks are greater may be more likely to develop institutions (such as pensions or disability insurance) that allow early retirement. That is, there may be a relationship between health risks and the structure of economic incentives.
- Butler et al. (1987) compare a self-reported measure of whether people have arthritis with a pseudo-clinical measure based on the number of arthritis symptoms they report and find that people who are not working are more likely to report arthritis for any given level of symptoms.
- Waidmann et al. (1995) note that there was an increase in the proportion of elderly who reported themselves to be in ill-health in the 1970s, but not in the 1980s, and argue that this may be due in part to incentives created by the expansion of income maintenance programs for the disabled in the 1970s.
- Using data from two health care experiments in which people were randomly assigned to different health care pricing regimes, Dow et al. (1997) report that although utilization of health care falls, self-reported general health status improves with increases in health care prices. They speculate that individuals who do not receive care are less likely to know of various conditions and thus more likely to report themselves to be in good health.

On the other hand, Ettner (1997) uses data from the National Survey of Families and Households and from the Survey of Income and Program Participation and finds that among women, self-reported measures of health are not affected by employment status. The health measure was instrumented using measures of the woman's parents' health. She points out that women may be under less pressure socially to attribute non-employment to ill health.

As Bound (1991) argues, measurement error in self-reported health biases the coefficient on health downwards, but the endogeneity of self-reported health may bias the estimated effect upwards. So self-reported measures could actually be "better" than more objective measures because they have two biases that may tend to cancel out, whereas, to the extent that more objective measures of health are not very accurate measures of "work capacity", they are biased towards zero only. This argument is consistent with the observation that when more objective measures are used, we tend to find smaller estimated effects of health (Chirikos and Nestel, 1981; Lambrinos, 1981; Parsons, 1982; Anderson and Burkhauser, 1984). And it is analogous to the finding in Griliches (1977), that the downward bias on the estimated effect of ability that is generated by measurement error is offset by an upward bias generated by the positive association between ability and education.

One possible solution to both the endogeneity and measurement error problems is to instrument self-reported measures using objective measures as in Stern (1989) (see also Haveman et al., 1989). However, if the measurement error is correlated with other variables in the model then the coefficients on these variables will be biased as well, and Stern's procedure will yield unbiased estimates of the effects of health, but not of the effects of these other covariates. Thus, the procedure cannot be used to examine the relative importance of health and other determinants of labor supply.

Bound (1991) illustrates this problem using the following example:

$$\mathrm{LFP} = \lambda_1 \eta + \beta_1 w + \varepsilon_1, \tag{8}$$

$$H = \lambda_2 \eta + \beta_2 w + \varepsilon_2, \tag{9}$$

$$D = \lambda_3 \nu + \varepsilon_3, \tag{10}$$

$$w = \lambda_4 \eta + \varepsilon_4, \tag{11}$$

$$\eta = \nu + u, \tag{12}$$

where LFP is labor force participation, H is a self-reported health measure, D is a more objective measure, w is the wage, and η is true health status.

If in Eq. (8), we use H as a measure of η, and instrument H using D, then we will purge H of dependence on ε_2, and so will correctly estimate λ_1. However, β_1 will still be underestimated by an amount $\beta_2\lambda_1$. The intuition is that we are using the projection of H onto D and w as a proxy for η, while what we need is the projection of η itself on D and w. Note that given another objective measure of health status, one could use D as the proxy for health in Eq. (9), and instrument D using the second measure thereby producing an unbiased estimate of β_2 that would allow one to calculate β_1.

As an illustration, Anderson and Burkhauser (1984) find that the estimated coefficient on wages in their model estimated using the Retirement History Survey, swings from an insignificant 0.074 when self-reported health is used, to a significant 0.364 when a measure of mortality (whether the respondent died by the end of the survey) is used. In a further exploration of these data, Anderson and Burkhauser (1985) show that in a joint model of wages and health, wages have a strong effect on the probability that health limits are reported, and thus that there is an indirect effect of wages on the probability of working even when self-reported measures are used. In fact they find that the net effect of wages on participation is similar when either measure of health is used, as long as the dependence of health on wages is accounted for.

Kreider (1996) proposes an alternative estimator which is based on the idea that unlike non-workers, workers who report health limitations have no incentive to systematically over-report such limits. Thus, the projection of H onto D for workers, for example, can be used to produce an estimate of limits for non-workers that is not contaminated by reporting biases. In this framework, Kreider finds that non-working blacks, high school dropouts, and former blue collar workers are more likely to over-report disabilities than white collar workers, and that men are more likely to over-report than women. These findings are consistent with the idea that workers in more physically demanding jobs may find disability a more compelling excuse for leaving the labor force than other workers, or alternatively, that white collar workers are less likely to feel that a given condition limits their ability to work.

In contrast to most of the literature, Stern (1989) concludes that there is little evidence of systematic reporting bias in self-reported measures of health. It is not clear whether this result is peculiar to the sample examined, or whether it is due to the low power of the statistical tests used to detect endogeneity bias.

In a second departure from the earlier literature, Frank and Gertler (1991) report that they find much the same effects of mental health conditions (including substance abuse problems) on earnings whether they use assessments of mental health based on detailed interviews with everyone in their sample, or self-reports of whether or not a person had ever received a diagnosis of a major mental disorder.

In summary, this section suggests that estimates of the effects of health on labor market activity may be very sensitive to the measure of health used, and to the way in which the estimation procedure takes account of potential measurement error. These points should be kept in mind in the review of the empirical literature which follows.

2.3. Effects of health on wages, earnings, and hours

There is a great deal of literature documenting a positive relationship between various measures of health and either wages or income. For example, Strauss and Thomas (1998) report that in a sample of US white males aged 27–35 from the National Longitudinal Survey of Youth, the elasticity of wages with respect to height is 1. In developing countries, the relationship is even stronger – e.g., in Brazil they report that the same elasticity is 3 or 4 even when education is controlled for. Strauss and Thomas also provide a summary of a close time series relationship between aggregate living standards and health in a diverse group of developing countries including Cote d'Ivoire and Vietnam. The historical literature again suggests that improvements in health as measured by declines in mortality and increases in body size are linked to changes in living standards over time (Fogel, 1994). But these relationships could reflect the effect of income on health rather than vice versa. Thus the question is: Can we isolate the effect of health on wages/income?

Several studies in developing countries use prices of health inputs or measures of the disease or health environment as instruments for health in a wage equation. The idea is that once health itself is controlled for, input prices should have no additional effect on wages.

Examples of this instrumental variables strategy include using calorie intakes as instruments for height or body mass index (weight/height^2), and using travel times to health services, water quality, or sanitation services as instruments for health status. A potential problem with this latter strategy is that variables measured at the community level may be only weakly correlated with health. An additional problem is that individuals may choose their locations in part because of the public health infrastructure (Rosenzweig and Wolpin, 1988).

Using these instrumental variables strategies, one tends to find a positive relationship between several measures of health (such as height, body mass index, calories) and wages/income in a range of developing countries. There is some evidence that these effects are non-linear (i.e., that wages go up with calories to some point and then the relationship flattens out), and also that they are stronger for men than for women which may reflect a greater propensity for men to be employed doing heavy physical work.

As in developing countries, the better educated and those with higher incomes in OECD countries are less likely to report any health limitations (Bound, 1991). Haveman et al. (1995) also present evidence that in the United States, the earnings disadvantage associated with health limitations increased over the period 1973–1988, although this may be an artifact of generally increasing wage inequality over the same period.

The evidence regarding the effects of health on wages, earnings, and hours of work in the modern United States is summarized in Tables 1–3. Several methodological points are immediately apparent. First, although the modal study looks at older white men, or groups all working aged people together, virtually every study focuses on a different measure of health. This suggests that on the one hand, it would be useful to have more information about other demographic groups, and on the other hand, that it would be useful for authors to examine a range of health outcomes so that there was greater scope for comparability across studies.

Despite these limitations, several patterns emerge. One common finding is that health has greater effects on hours of work than on wages. For example, Wolfe and Hill (1995) (see below for more discussion) find that health measures have little effect on the wages of single mothers when selection into the labor force is controlled for. Similarly, using a sample of older men from the NLS, Chirikos and Nestel (1981) find only weak effects of impairments on wages. In later work with the same data Chirikos and Nestel (1985) find that whites (but not blacks) with a history of ill health have lower wages than those in continuous good health, but that there are also large effects on hours.

These findings tend to be confirmed by studies examining the effects of specific illnesses. For example, Mitchell and Burkhauser (1990) estimate a simultaneous Tobit model of hours and wages using the 1978 Survey of Disability and Work and find that arthritis has a greater effect on hours than on wages. These effects on hours can translate into large earnings effects. Building on earlier work using the NAS-NRC twins data (Bartel and Taubman, 1979), Bartel and Taubman (1986) report that the onset of mental illness reduces earnings initially by as much as 24%, and that negative effects can last for as much as 15 years after diagnosis. Benham and Benham (1981) find that whether someone has ever been diagnosed as psychotic reduces earnings by 27–35%. These findings of large earnings effects through reductions in hours suggest that there may be large effects of health on participation, a topic that is investigated below.

In a series of papers about the labor market effects of alcoholism, Mullahy and Sindelar raise several issues that could be usefully explored in the context of other diseases (Mullahy and Sindelar, 1991, 1993, 1994, 1995). First, they find that in Ordinary Least Squares models, the size of the measured effect depends on the age of the sample. The effects tend to be negative for prime age workers, but may be positive for younger workers. The latter may reflect the way younger workers are selected into the labor force: early onset of alcoholism is associated with reduced educational attainment, but the additional labor market experience that results may give these workers an initial earnings advantage. The estimated effects of alcoholism tend to be much greater if education is excluded from the model, suggesting that diseases such as alcoholism may have large indirect effects on earnings by reducing investments in other forms of human capital. In addition to age/education effects, Mullahy and Sindelar also find gender differences in the OLS effects of alcoholism. For example, older alcoholic women tend to earn more than their non-alcoholic counterparts, but again this is likely to reflect selection into the labor force.

Finally, Mullahy and Sindelar suggest that a narrow focus on wages may be misleading because workers with particular conditions may prefer jobs with more generous health insurance, sick leave provisions, or flexibility in their hours. To the extent that better health is associated with reduced demand for these benefits, ignoring other elements of the compensation package will bias the estimated relationship between health and wages upwards. The focus on wage differentials also ignores a second potentially important source of lost welfare: increased variance of earnings among those with chronic illness. It would be interesting and straight-forward to examine the impact of health on the variance in wages and hours.

2.4. *Studies that treat health as an endogenous choice*

Tables 1–3 also indicate that although many studies attempt to go beyond ordinary least squares in order to deal with measurement error and the endogeneity of health, it is difficult to find compelling sources of identification. The majority of these studies rely on arbitrary exclusion restrictions, and estimates of some quantities appear to be quite sensitive to the identification assumptions.

Two studies that deal with the endogeneity of health and wages in a similar way are Lee (1982) and Haveman et al. (1994). Lee describes a three-step econometric procedure that takes into account the endogeneity of both health and wages as well as the fact that we generally observe only imperfect and discrete indices of health. Essentially, one first estimates reduced forms using OLS for the wage, and ordered probits for the health indicators. One then uses minimum distance techniques to recover the structural parameters. However, like other structural approaches, identification depends on the validity of exclusion restrictions. Using data from the NLS of Older Men, Lee assumes that assets can

Table 1
Evidence on the effect of health on wages[a]

Authors/dataset/sample	Labor force and health measures	Estimation techniques	Results
Mitchell and Burkhauser (1990) D: SDW (1978) S: Men and women 18–64	LF: Hourly wage Health: (1) arthritis diagnosis, (2) number of joints affected by pain, stiffness or swelling, (3) ordinal index to measure difficulty in performing routing activities	Simultaneous Tobit for hourly wage and hours worked. I. Estimate reduced form Tobit for wages and hours. II. Substitute predicted values as regressors in structural model and estimate second stage Tobit. Identification: different indicators of specific conditions included only in wage or hours equations; non-wage income only in hours equation	Arthritis reduces wages by (direct effect + indirect effect through hours worked): 27.7% (20.2 + 7.5%) for men 18–64; 42.0% (24.3 + 17.7%) for women 18–44; 49.4% (35 + 14.4%) for women 45–64
Chirikos and Nestel (1981) D: NLS Older Men (1976) S: Men 55–69 employed	LF: (1) Log hourly wage in 1976, (2) change in log hourly wage from 1971 to 1976 Health: (1) Impairment index measuring impairment severity from principal component analysis of ADLs and symptoms (I-Index), (2) self-assessed health better/worse from 1973 to 1976, (3) WL-Ability or WL-Kind, (4) improvement/deterioration in impairment from 1971 to 1976	Assumed OLS for log hourly wage (not specified)	Effect of health on wages in 1976: I-Index, −1%; WL-Ability, −12.4%; WL-Kind, −4.4%. Effect of health on change in wages (1971–1976): I-Index 1971, −1.8%; I-Index 1976, +0.6%; ↑ Impairment, +3.5%; ↓ Impairment, +13.5%; ↑ Health, −5.7%; ↓ Health, −11.2%; WL-Kind 1971, −13.8%; WL-Kind 1976, −9.4%; WL in both 1971 and 1976, −14.2%
Chirikos and Nestel (1985) D: NLS Older Men (1976) NLS Mature Women (1977) S: Individuals 45–64	LF: Current wage Health: 10-year health history of no health problems, continuous poor health (CPH), health improvement (H+), or health deterioration (H−)	OLS for log wages (Heckman correction for LFP). Identification: non-health human capital variables only in wage equation; other income only in hours equation	Wages relative to those with no health problems (CPH, H+, H−): white men (−11.4%, −14.2%, −36.2%); black men (−4.3%, −3.1%, −4.7%); white women (−11.7%, −14.0%, −48.1%); black women (−0.3%, −3.1%, −8.4%)

Table 1 (*continued*)

Authors/dataset/sample	Labor force and health measures	Estimation techniques	Results
Luft (1975) D: SEO (1967) S: Individuals 18–64	LF: Hourly wage Health: Work or housework limited in any way	OLS for hourly wage	Activity limits reduce wages by 11.6% for white men, 10.3% for black men, 9.8% for white women, and increase wages by 3.8% for black women
Bartel and Taubman (1979) D: NAS-NCR S: White male veterans twins	LF: Log weekly wage Health: Specific diseases	OLS for log weekly wage	Effect on wages of: Heart disease/ hypertension −6.4%; Psychoses/ neuroses −8.0%; Arthritis −22.2%; Bronchitis/asthma −19.7%
Lee (1982) D: NLS Older Men (1966) S: Men 45–59 with positive earnings	LF: Log hourly wage Health: WL-Amount or WL-Kind, SRHS (age normalized polychotomous variable)	Three-stage procedure[b] to estimate simultaneous system of log wages and latent health capital[c.] Identification: experience squared, region, race excluded from health equation; assets excluded from wage equation	Effect on wages of latent health capital[c]: Uncorrected, 222% Corrected for measurement bias, 160%
Stern (1996) D: PSID (1981) S: Individuals 25–60	LF: Log wages Health: WL-Amount or WL-Kind	(1) OLS for log wages with and w/o Heckman correction for LFP. Identification: marital status, asset income, and dependents interacted with sex excluded from wage equation. (2) Ichimura–Lee semi-parametric estimation	OLS: effect on wages of work limits: No selection correction, −11.7%; Selection correction, −23.8%; Semi-parametric effect on wages of work limits: Unrestricted, −1.7%; Unrestricted + monotonicity, −0.3%; Restricted,[d] −21.3%
Berkovec and Stern (1991) D: NLS Older Men (1966–1983) S: Men 45–59 in 1966	LF: Log annual wages Health: Health status defined from WL questions (0 = healthy, 1 = poor health, 2 = uncertain)	MSM (Method of Simulated Moments) for system of full-time wages and discrete job status choice	Poor health status reduces wages by 16.7%

Johnson and Lambrinos (1985) D: SDNA (1972) S: Individuals 20–64	LF: Log hourly wage Health: (1) Presence of a handicap; (2) health index derived from principal component analysis on measures and severity of impairments	GLS for log wages with Heckman correction for LFP	Effect of health index on wages[e]: Non-handicapped men, 2.1%; Non-handicapped women, 0.7%; Handicapped men, 1.8%; Handicapped women, 0.3%
Baldwin and Johnson (1994) D: SIPP (1984 Panel, Wave (3) S: Men who worked during 4-month survey period	LF: Log hourly wage Health: (1) Non-disabled/disabled/ handicapped; (2) three health factors defined from principal component analysis on measures and severity of impairments	WLS for log wages with Heckman correction for LFP	Effect of health factors on wages (factor1, factor2, factor 3): Non-disabled (3.6%, 0.2%, 1.3%); Disabled (4.7%, 0.1%, 1.2%); Handicapped (2.7%, −0.1%, 2.6%)
Baldwin et al. (1994) D: SIPP (1984 Panel, Wave (3) S: White men and women who report a work disability	LF: Log hourly wage Health: (1) WL-Amount or WL-Kind; (2) Indicators for sensory, mobility, or mental limitations	Two-stage estimation of quasi-reduced system for WLs and LFP. I. Estimate reduced form MLE probits for WLs and LFP; II. Estimate wage equation with selection correction for LFP and predicted probability of WLs calculated from I. Identification: functional limitations only in health limits equation; pre-school children (for women), non-wage income only in LFP equation	Predicted health limits reduce wages by 6.1% for men and 5.4% for women
Haveman et al. (1994) D: PSID (1976–1983) S: White males 25–64	LF: Log real hourly wage (annual earnings divided by annual hours) Health: polychotomous variable for whether health limits work not at all, a little, somewhat, or a lot.	(1) OLS for log wages, (2) GMM system for health, log wages and annual hours. Identification: set of instruments (demographic, job and economic variables) for each equation	Effect on wages of lagged health limits: OLS, −4.3%; GMM, −61.0% (really 61%, or 6.1%)

Table 1 (*continued*)

Authors/dataset/sample	Labor force and health measures	Estimation techniques	Results
Gustman and Steinmeier, 1986a D: HRS (1969–1975) PSID S: White males	LF: Log real hourly wage Health: (1) Indicators for long-term (1+ year) and short-term (<1 year) health problems, (2) indicator for health problem ended previous job	Assumed OLS for log wages (not specified)	Effect on wages in jobs started before age 55 (FT, PT): LT problem (−3.1%, −4.9%); ST problem (−0.7%, 12.0%); Health ends job (−18.4%). Effect on wages in jobs started after age 55 (FT, PT): LT problem (−8.4%, −7.2%); ST problem (−4.2%, −3.7%); Health ends job, −25.7%

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

[b] Three-stage procedure: I. Estimate reduced form by OLS along with ordered probit for the discrete health indicators as a function of wages and the other exogenous variables. II. Estimate reduced form parameters using NLS (minimum distance with weighting matrix equal to the covariance matrix estimated in the first stage). III. Estimate structural parameters using NLS (minimum distance first with no weighting and then with the estimated covariance matrix obtained from the second stage).

[c] Health capital is an unobserved variable for which two indicators are available (work limits and health status). The author comments that since the health capital is unobservable and arbitrarily scaled, the effect is qualitative and the quantitative measure is not relevant.

[d] The demand and supply coefficients are restricted to be the coefficients estimated in the non-participation equation.

[e] To a first approximation, $\delta E[\ln W_i]/\delta \text{Health}_j$ is calculated as $\beta_i \Phi(\cdot)$ where $\Phi(\cdot)$ is the probability of being employed. The LFP probit is not reported in the paper. We use the employment to population ratio for each group (non-disabled, disabled, handicapped) as an approximation of $\Phi(\cdot)$.

Table 2
Evidence on the effect of health on earnings[a]

Authors/dataset/sample	Labor force and health measures	Estimation techniques	Results
Mitchell and Burkhauser (1990) D: SDW (1978) S: Men and women 18–64	LF: Annual earnings Health: See Mitchell and Burkhauser (1990) in Table 1	Simultaneous Tobit for earnings and hours worked.	Arthritis reduces earnings by (covariance share between hours and wages in parentheses): men 18–64, 19.1% (30.8); women 18–44, 27.7% (14.2); women 45–64, 1.5% (41.4)
Mitchell and Butler, 1986 D: SDW (1978) S: Men 18–64	LF: Log annual earnings Health: See Mitchell and Burkhauser (1990) in Table 1	(1) OLS for log earnings w/o selection correction for LFP; (2) GLS for log earnings w/ Olsen selection correction for LFP (linear probability LFP regression). Identification: two different indicators of specific conditions excluded from earnings equation	Arthritis reduces earnings by: OLS w/o selection correction, 19.5%; GLS with selection correction, 32.6%
Chirikos and Nestel (1985) D: NLS Older Men (1976) NLS Mature Women (1977) S: Individuals 45–64	LF: Log annual earnings Health: See Chirikos and Nestel (1985) in Table 1	Two equation model: OLS for log earnings (selection correction for LFP) and Tobit for hours worked. Identification: see Chirikos and Nestel (1985) in Table 1	Relative to those with continuous good health in the previous 10 years, a poor health history reduces earnings by 20.4% for white men, 22.3% for black men, 12.5% for white women, and 27.8% for black women
Luft (1975) D: SEO (1967) S: Individuals 18–64	LF: Log total annual earnings Health: See Luft (1975) in Table 1	OLS for log earnings	Activity limits reduce wages by 35.8% for white men, 44.9% for black men, 32.5% for white women, and 37.8% for black women.
Bartel and Taubman (1979) D: NAS-NCR S: White male veteran twins	LF: Log annual earnings Health: See Bartel and Taubman (1979) in Table 1	OLS for log earnings	Effect on earnings of: heart disease/ hypertension, −8.5%; psychoses/neuroses, −24.8%; arthritis, −22.4%; bronchitis/ asthma, −28.7%

Table 2 (*continued*)

Authors/dataset/sample	Labor force and health measures	Estimation technique	Results
Bartel and Taubman (1986) D: NAS-NCR and Social Security earnings records (1951–1974) S: White male veteran twins	LF: Annual earnings 1951–1974 Health: First diagnoses of psychoses, neuroses, or other mental illness 11–15, 6–10 or 1–5 years prior to the date of earnings	Tobit for earnings (censored above at Social Security maximum taxable earnings)	Effect on earnings of diagnoses by time since first diagnosis[b] (11–15 years, 6–10 years, 1–5 years): psychoses (−32%, −44%, −47%); neuroses (−14%, −13%, −12%); other (−0.4%, −1.5%, −0.3%)
Ettner et al. (1997) D: NCS S: Individuals 18–54 (recipients only)	LF: Income in previous year (constructed from interval data) Health: (1) indicator variables for whether respondent met diagnostic criteria for various psychiatric disorders during previous 12 months; (2) indicator variable for any psychiatric disorder	(1) OLS for log earnings; (2) Two-stage IV (psychiatric disorders instrumented for by the number of psychiatric disorders exhibited by the respondent's parents and the number of psychiatric disorders experienced by the respondent before age 18)	Effect on predicted income of having any psychiatric disorder (men, women): OLS (−13.4%, −18.3%); IV-predicted (−9.5%, −28.9%); IV-latent (−20.4%, −52.3%)
Mullahy and Sindelar (1993) D: ECA–Wave I of the New Haven, CT site S: Men 30–59	LF: Log personal annual income Health: indicator variables for (1) any alcoholism ever, early onset (age <18) alcoholism, and alcoholism onset between ages 19–22; and (2) mental and physical SRHS excellent or good	OLS for log income	Effect on log income of: alcoholism ever, −19.1%; alcoholism last year, −15.0%; early onset alcoholism, −9.9%; alcoholism age 19–22, −17.5%; good mental health, +4.4%; good physical health, +37.7%

Mullahy and Sindelar (1994) D: ECA–Wave I of the New Haven, CT site S: Men 30–59	LF: Log personal annual income Health: indicator variables for (1) early onset alcoholism (age <22); and (2) SRHS excellent or good	OLS for log income	Early onset alcoholism reduces wages by 15.5%; good physical health increases wages by 43%
Mullahy and Sindelar (1995) D: ECA–Wave I of the New Haven, CT site S: Men 30–59	LF: Log personal annual income Health: indicator variables for (1) any alcoholism ever, early onset (age <18) alcoholism, and late onset (age >18) alcoholism; and (2) SRHS as excellent or good	GMM for log income	Effect on log income of: alcoholism ever, −20.2%; early onset alcoholism, −15.3%; late onset alcoholism, −22.2%; good physical health, +39.0%
Mullahy and Sindelar (1991) D: ECA–multiple sites S: Individuals 30–59	LF: Log personal annual income, log household annual income Health: indicator variable for any alcoholism ever	OLS for log income	Alcoholism reduces personal income by 10% for both men and women. It reduces household income by 8% for women and by 3% for men
Benham and Benham (1982) D: Lee Robin's data on child guidance clinic patients between 1924 and 1929 with follow-up after 30 years S: Individuals employed at time of the follow-up	LF: Log weekly earnings Health: (1) indicator variables for whether respondent met diagnostic criteria for various psychiatric disorders after age 18; (2) categorical SRHS	OLS for log earnings	Effect on weekly earnings due of: psychoses, +31%; neuroses, −17.7%; sociopathy, −14.4%; alcoholism, −4.7%; fair health, +13.1%; poor health, −23.6%

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.
[b] The predicted probability of log earnings $>$ limit given average $X(T)$ is reported to be $= 1$. Percentages are therefore not corrected for selection.

Table 3
Evidence on the effect of health on labor supply[a]

Authors/dataset/sample	Labor force and health measures	Estimation technique	Results
Mitchell and Burkhauser (1990) D: SDW (1978) S: Men and women 18–64	LF: Annual hours Health: See Mitchell and Burkhauser (1990) in Table 1	See Mitchell and Burkhauser (1990) in Table 1	Arthritis reduces hours by (direct effect + indirect effect through wages): 42.1% (37.7% + 4.4%) for men 18–64; 36.7% (31.6% + 5.1%) for women 18–44; 51.0% (36.7% + 14.3%) for women 45–64
Chirikos and Nestel (1985) D: NLS Older Men (1976) and NLS Mature Women (1977) S: Individuals 45–64	LF: Annual hours Health: 10-year health history of no health problems, continuous poor health (CPH), health improvement (H+), or health deterioration (H−)	Tobit for hours worked (including log wages as a regressor). Identification: non-health human capital variables only in wage equation; other income only in hours equation	Effect of poor health history on annual hours (direct effect + indirect effect through wages; ratio direct/indirect effect in parentheses): white men, 13.4% (0.41); black men, 20.6% (8.7); white women, 6.3% (−0.55); black women, 27.1% (25.5)
Luft (1975) D: 1967 SEO S: Individuals 18–64	LF: HPW Health: Work or housework limited in any way	OLS for HPW (including hourly wage as a regressor)	Activity limits reduce HPW by 3.6% for white men, 11.0% for black men, 9.8% for white women, and 15.5% for black women
Parsons (1977) D: NLS Older Men (1966) and PAS (1965) S: Men 45–69	LF: Annual hours Health: SRHS, WL-Amount or WL-Kind	(1) OLS for hours, (2) 2SLS for hours and other family income. Identification: SRHS in hours equation only; wife's education and WLs in other income equation only	Poor health reduces annual hours by 65% using either OLS or 2SLS. Splitting sample into single and married individuals, poor health reduces hours by 61% if married and by 84% if single (OLS results)
Bartel and Taubman (1979) D: NAS-NCR S: White male veteran twins	LF: Log HPW Health: See Bartel and Taubman (1979) in Table 1	OLS for log hours	Effect on hours of: heart disease/hypertension, −2.1%; psychoses/neuroses, −6.8%; arthritis, −0.9%; bronchitis/asthma, −8.9%

Chirikos and Nestel (1984) D: NLS Older Men (1976) and NLS Mature Women (1977) S: Individuals 45–64	LF: Annual hours Health: (1) WL-Amount of WL-Kind, (2) impairment index	Tobit for annual hours	Hours as a percentage of expected annual hours evaluated at the mean of all variables (WLs, Impairment): white men (29%, 19%); black men (75%, 60%); white women (27%, 12%); black women (125%, 91%)
Chirikos and Nestel (1981) D: NLS Older Men (1976) S: Men 55–69 employed	LF: (1) Annual hours in 1976, (2) change in hours from 1971 to 1976 Health: See Chirikos and Nestel (1981) in Table 1	Assumed OLS for annual hours (not specified)	Effect of health on hours in 1976: I-Index, −12.7%; WL-Ability, −5.9%; WL-Kind, −1.6%. Effect of health on change in wages (1971–1976): I-Index 1971, −4.2%; I-Index 1976, −30.3%; ↑ Impairment, −7.9%; ↓ Impairment, +9.8%; ↑ Health, +0.5%; ↓ Health, +15.1%; WL-Kind 1971, −2.1%; WL-Kind 1976, −1.2%; WL in both 1971 and 1976, +13.9%
Berger and Fleisher (1984) D: NLS Older Men (1970) S: Wives whose husbands reported no health limitations in 1966	LF: Weeks worked in 1970 Health: Health limits work (0/1)	OLS with Heckman correction for LFP. Identified from functional form	Marginal effect on weeks worked of husband's health limits is 0.9% and of wife's health limits is −0.1%
Haveman et al. (1994) D: PSID (1976–1983) S: White males 25–65	LF: Annual hours Health: See Haveman et al. (1994) in Table 1	See Haveman et al. (1994) in Table 1	Effect on hours of lagged health limits: OLS, −2.9%; GMM, −7.4%
Ettner et al. (1997) D: NCS S: Employed individuals 18–54	LF: Usual HPW Health: (1) indicator variables for whether respondent met diagnostic criteria for various psychiatric disorders during previous 12 months; (2) indicator variable for any psychiatric disorder	(1) OLS for HPW, (2) Two-stage IV (psychiatric disorders instrumented by number of psychiatric disorders exhibited by respondent's parents and number of psychiatric disorders experienced by the respondent before age 18)	Effect on predicted HPW of having any psychiatric disorder (men, women): OLS, −2.4%, −1.9%; IV-predicted, −5.4%, −2.7%; IV-latent, −14.3%, −6.7%

Table 3 (*continued*)

Authors/dataset/sample	Labor force and health measures	Estimation technique	Results
Kessler and Frank (1997) D: NCS S: Employed individuals	LF: Number of psychiatric work loss days and work cut-back days in the previous 30 days Health: indicator variables for whether respondent met diagnostic criteria for various psychiatric disorders during the past 30 days	(1) OLS for work loss and work cut-back days, (2) Impact of disorders on work impairment calculated for occupational clusters. I. Calculate predicted work impairment days from regression on pure and co-morbid disorders. II. Regress observed work impairment days on predicted work impairment days	Work loss/cut-back reductions in working days due to (loss, cut-back): affective disorder (33%, 40%); anxiety disorder (54%, 53%); substance disorder (10%, 16%); any disorder (52%, 65%). Effect of disorders on work loss and cut-back days by occupation relative to whole sample: engineer/therapist 2.80; lawyer/clergy 1.33; accountant/ programmer 1.07; sales clerk/bartender 1.48; janitor/cleaner 0.63

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

be excluded from the wage equation, while experience squared, SMSA, residence in the south and race can be excluded from the health equation. There is little justification of these exclusion restrictions. It is also assumed that the health limitation indicator is an objective measure of health. The results suggest that wages affect health and vice-versa, though the estimated health effects are improbably large.

Haveman et al. (1994) extend Lee's model by adding an equation for endogenously determined hours of work. Again, the estimation relies on exclusion restrictions that may be difficult to justify. For example, self employment is assumed to affect hours but not wages, while divorce is assumed to affect health status without affecting either hours or wages. The model is estimated using data on white males with strong labor force attachment from the PSID. This study concludes that estimates that do not take into account the endogeneity of (lagged) health status substantially underestimate its effects. As for hours, the authors conclude that the positive relationship between good health and hours of work estimated with OLS largely disappears when the endogeneity of health status is accounted for. Thus, the finding that health has a greater impact on hours than wages is sensitive to the identification strategy.

One of the interesting things about both of these studies is that they estimate the effect of wages and other variables on health. Both find a marginally significant effect of education, and a strong negative effect of age. Most previous studies have documented a strong positive relationship between education and health (Grossman, 1975). But the two papers discussed above suggest that the estimated effect of education is substantially reduced when simultaneous equations methods are used rather than OLS. However, Berger and Leigh (1989) also use instrumental variables methods and find that the relationship between schooling and health remains statistically significant. Thus, estimates of the strength of this relationship also appear to be sensitive to identification assumptions.

Ettner et al. (1997) have examined the impact of mental illness (including depression and substance abuse) on earnings conditional on being employed. Their definition of mental illness is broad, including depression and substance abuse. Using this definition they find that psychiatric disorders are very prevalent, affecting 30% of the non-institutionalized US population in any given year. Alcoholism alone is estimated to affect 1 in 10 men at some point in their lives. These diseases affect workers of all ages. Thus, they have potentially larger labor market effects than many of the purely physical conditions that much of the research has focused on, since physical conditions have a disproportionate impact on the aged.

Ettner et al. (1997) point out that previous estimates of the effects of mental illness are sensitive to the sample used, the type of disorder, and how the disorder was measured (e.g., self-reports versus diagnostic interviews). Their study is based on a survey with interview questions that were designed to allow the clinical diagnosis of a range of conditions. They also allow for the simultaneity of health and labor market outcomes. As they put it "A unique aspect of our dataset was the opportunity to use instruments that are solidly grounded in epidemiological research". Specifically, they use whether or not the parents of subjects had various mental conditions and whether the subject reports being diagnosed with a condition before age 18 as instruments. This idea of using clinical knowledge about the disease process to come up with plausibly exogenous instruments seems very promising. In contrast to much of the literature, Ettner et al. find small effects on hours of work (conditional on remaining employed), large effects on women's income (a 30% decline) and smaller effects on male income (a 10% decline).

2.4.1. Wage discrimination

The discussion in the previous section indicates that poor health is related to lower wages. Health can affect wages through various channels. First, poor health may lower productivity, resulting in lower wages; second, the employer costs of accommodating a worker in poor health may be passed on in the form of lower wages; and third, those in poor health may be subject to discrimination.

The question of whether there is discrimination against persons in poor health has come to the forefront with the passage of the Americans with Disabilities Act (ADA) of 1990. The issue is complicated because while people may be prejudiced against those with certain health conditions or disabilities, it may also be the case that people with these disabilities are less productive than other workers.

Johnson and Lambrinos (1985) and Baldwin and Johnson (1994) attempt to circumvent this difficulty by focusing on people who have disabilities that have been shown to evoke prejudice in attitudinal studies. They call these conditions "handicaps". By this criterion conditions such as back injuries would be disabilities, but not handicaps, while a condition such as blindness or deafness would be considered a handicap. They find using standard Oaxaca (1973) decompositions that there were large unexplained differences between the wages of the handicapped and those of the non-handicapped in their 1972 Social Security Survey of Disabled and Non-Disabled Adults data. The average handicapped man received a wage that was 44.5% of the wage of a non-handicapped man and one-third of this differential was unexplained. Handicapped women received wages that were more similar to those of other women (85%), and again about one-third of the differential was unexplained. Using the 1984 SIPP, Baldwin and Johnson also find unexplained differences between the handicapped and the disabled. They argue that this difference is likely to reflect prejudice rather than differences in productivity, but acknowledge that little evidence is available regarding the productivity of workers with different conditions. Some evidence that the "handicapped" are no less productive than the "disabled" would aid in the interpretation of their results.

Two recent papers directly examine the wage effects of the Americans with Disabilities Act. Angrist and Acemoglu (1998) focus on a question from the Current Population Surveys about whether the respondent has a disability that limits his or her capacity to work. They interact this variable with dummy variables for the years following the passage of the ADA and find little effect on average weekly earnings of the disabled. They point out that this result is perhaps unsurprising given that most of the litigation generated by the ADA deals with allegations of discrimination in employment rather than with allegations of discrimination in wages. On the other hand, Deleire (1997) uses data from the Survey of Income and Program Participation and defines disability using questions about actual physical and mental disabilities as well as debilitating illnesses. He finds that on the whole, the ADA had a significant effect on wages of the disabled, raising them by 3%. However, these effects were not distributed evenly across age and education groups– e.g.,, he finds larger effects for the less educated. This analysis is supplemented with an analysis of longitudinal data from the Panel Study of Income Dynamics, which also shows increases in wages. A potential caveat to both these papers is that there are clear increases in the number of people identified as disabled over time which could be related to the passage of the ADA itself.

2.5. Evidence regarding health and attachment to the labor market

Poor health may decrease wages as discussed above, but it may also reduce effective time endowments and affect the marginal rate of substitution between goods and leisure.[7] Thus the effects of health on labor force participation are theoretically ambiguous, although most research seems to assume that poor health will decrease participation. The estimated effects of health on labor force participation in the United States are summarized in Table 4. Table 4 suggests that although the question of how health affects participation has been intensively studied, little consensus on the magnitude of the effects has been reached. One reason is that once again, the definition of health has varied widely from study to study.

A second reason for the wide range of estimates reported in Table 4 may be that the effects of health on labor force participation are likely to be highly socially determined. For example, Costa (1996) finds that the labor force participation of men was much more responsive to body mass index (a cumulative measure of health and nutritional status that can be related to mortality risk) in 1900 than it is today, suggesting that health is now a less important determinant of retirement than it was in the past. This observation is also consistent with evidence cited above that health may be a more important determinant of wages in less developed rather than more developed countries. The size of the estimated effect may also be sensitive to the age, cohort, gender, and family circumstances of the sample individuals.

The fact that the relationship between health and participation is mediated by social institutions may explain Parsons' (1982) observation that trends in objective measures of health such as mortality do not seem to match well with trends in labor force participation, at least for men. (For women of course, participation has risen while mortality has fallen less sharply than it has for men.) Over the post war period, non-participation among men aged 45–54 has doubled while mortality has declined. Parsons believes that the introduc-

[7] In fact, Gustman and Steinmeier (1986b) develop a structural model of retirement in which the onset of an important health problem affects labor supply by influencing the marginal rate of substitution between goods and leisure. They estimate that the onset of a serious health problem steepens the indifference curve by about the same amount as 4 additional years of age.

Table 4
Effect of health on labor force participation[a]

Author/dataset/sample	Labor force and health measures	Estimation technique	Results
Luft (1975) D: SEO (1967) S: Individuals 18–64	LF: Any LFP in previous year, fraction of time unemployed (weeks looking for work/weeks in LF) Health: See Luft (1975) in Table 1	(1) OLS for LFP, (2) OLS for time unemployed	Effect of activity limits on (LFP, unemployment): white men (−0.1775, 0.0165); black men (−0.2692, 0.0321); white women (−0.1797, 0.0096); black women (−0.2171, 0.0221)
Bartel and Taubman (1979) D: NAS-NCR S: White male twin veterans	LF: NILF, unemployment Health: See Bartel and Taubman (1979) in Table 1	OLS for NILFOLS for unemployment	Regression coefficients for probability of being NILF of: psychoses/neuroses, 0.005; arthritis, 0.005. Coefficient for probability of unemployment of bronchitis is 0.004. Other conditions did not have a significant effect on LFP or unemployment
Parsons (1980, 1982) D: NLS Older Men (1969–1976) S: Men aged 48–62 in 1969	LF: LFP in survey week in 1969 Health: (1) year of subsequent mortality; (2) subsequent mortality index computed as weighted average of subsequent mortality dummies; (3) WL-Amount or WL-Kind	Probit for LFP and work limits	Marginal effect on LFP in 1967 of: mortality 1969–1971, −0.267; mortality 1971–1973, −0.049; mortality 1973–1975, −0.194; mortality 1975–1976, −0.021; mortality index, −0.089

Ruhm (1992) D: MWHS (1981–1982) S: Women 45–57	LF: LFP, PT employment, FT employment Health: (1) Depression index based in CESD scores; (2) indicator variables for medication usage (used to infer onset of health problems)	(1) Probits for LFP, employment and FT employment (2) Ordered probit for employment (non-employment (NE), PT-employment and FT-employment)	Change in predicted probability due to onset of specified ailment/ medicine usage (NE, PT, FT)[b]: cholesterol (−0.276, −0.410, −0.142; pain (−0.187, −0.180, −0.074); valium (−0.110, −0.131, −0.152); depression (−0.153, −0.163, −0.27). Change in predicted probability with depression score relative to persons with CESD score <8 (NE, PT, FT): 16–23 (−0.012, −0.031, −0.090); ≥24 (−0.091, −0.113, −0.132)
Stern (1989) D: SDW (1978) S: Individuals 25–60 D: HIW (1979) S: Individuals 25–65	LF: LFP Health: (1) WL-Amount or WL-Kind; (2) SRHS (ordered polychotomous); (3) indicators for self-reported medical conditions (classified by illness in SDW and by symptom in HIS)	Simultaneous system with latent value of LFP and latent measure of SRHS both endogenous. I. Estimate reduced form LFP probit and SRHS ordered probit. II. Estimate second stage LFP probit and SRHS ordered probit using predicted values from I. Identification: disability conditions only in SRHS equation and marital status only in LFP equation	Reduced form marginal effect on LFP of (SDW, HIS): SRHS fair (0.341, 0.449); SRHS good (0.594, 0.550); SRHS excellent (0.632, 0.556); WLs (−0.316, −0.319); health (−0.137, −0.037); mobility (−0.154, –); seizures (−0.290, –); heart conditions (–, −0.238); cancer (–, −0.230); lower paralysis (–, −0.252); upper paralysis (–, −0.291); mental illness (−0.158, −0.377); mental retardation (−0.241, −0.398). Simultaneous system marginal effect on LFP of (SDW, HIS): WLs (−0.287, −0.290); latent WLs (−0.162, −0.074); latent health (−0.186, −0.255)

Table 4 (*continued*)

Author/dataset/sample	Labor force and health measures	Estimation technique	Results
Kreider (1996): D: HRS S: Individuals 50–61 with some work history	LF: LFP Health: (1) Trichotomous WL (0 = none, 1 = health limits activities short of work, 2 = WL-Amount or WL-Kind); (2) Dichotomous WL (WL-Amount or WL-Kind); (3) Indicators for specific conditions	Simultaneous system of LFP and health limits. Limits estimated by bivariate probit (if dichotomous) or ordered probit (if trichotomous) with selection. Latent value of LFP is a function of latent work limitation. Identification: region variables only in LFP equation; health conditions only in WL equation	Reduced form marginal effect on LFP of: heart conditions, −0.055; stroke, −0.124; emotional conditions, −0.094; pain, −0.077. Simultaneous system marginal effect on LFP of latent WLs is −0.091
Berger and Fleisher (1984) D: NLS Older Men (1970) S: Wives whose husbands reported no health limitations in 1966	LF: LFP in 1970 Health: See Berger and Fleisher (1970) in Table 3	Probit for LFP	Marginal effect on LFP of husband's health limits is 0.04 (4.7%) and of wife's health limits is −0.16 (−16.9%)
Bazzoli (1985) D: RHS S: Men and single women 59–61 employed FT in 1961	LF: Early retirement (LF departure or hours reduction before age 65) Health: (1) Fillenbaum–Maddox health index for pre- and post-retirement; (2) WL-Activity and WL-Kind defined for pre- and post-retirement[c]	Probit for LFP	Marginal effect on early retirement of[d]: pre-retirement WL, 0.043; post-retirement WL, 0.148; pre-retirement health index, 0.140; post-retirement health index, 0.247
Costa (1996) D: NHIS (1985–1991) S: White men 50–64	LF: NILF (self-reported retirement or no occupation) Health: BMI	Probit for NILF including predicted income for LF participants and non-participants	Marginal effect on being NILF of BMI is −0.208[d]

Chirikos and Nestel (1981) D: NLS Older Men (1976) S: Men 55–69	LF: LFP during survey week in 1976 Health: See Chirikos and Nestel (1981) in Table 1	Assumed OLS for LFP (not specified)	Marginal effect of health on LFP in 1976: impairment index, −0.105; ability to work limited, −0.645; kind of work limited, −0.071
Chirikos and Nestel (1984) D: NLS Older Men (1976) NLS Mature Women (1977) S: Individuals 45–64	LF: LFP during 1976 (Older Men) or 1977 (Mature Women) Health: See Chirikos and Nestel (1984) in Table 3	Probit for LFP (coefficients not reported in the paper)	Percentage reduction in probability of LFP of[e] (WLs, Impairment): white men (3.7%, 2.4%); black men (17.5%, 13.5); white women (7.0%, 2.9%); black women (58.1%, 41%)
Stern (1996) D: PSID (1981) S: Individuals 25–60	LF: LF non-participation Health: See Stern (1996) in Table 1	See Stern (1996) in Table 1	Marginal effect of work limits on LF non-participation is 0.13 using parametric estimation (30% reduction in predicted LFP) and 0.24 using non-parametric estimation[f]
Anderson and Burkhauser (1984) D: RHS SL Men 58–63 in 1969	LF: LFP in 1969 Health: (1) Work or housework limited in any way; (2) Respondent died between 1969 and 1979 (0/1)	(1) Bivariate logit for LFP and work/housework limited, (2) Bivariate logit for LFP and death	Probability of working relative to probability of not working conditional on no WL is 2.3; conditional on having a WL is 2.1
Bound (1991) D: RHS S: Men 58–63 in 1969 who were or had been employed in the private sector	LF: LFP during 1969 survey week Health: (1) WL-Ability; (2) Health better/worse than that of other the same age; (3) Subsequent mortality index (higher values correspond to later death)	(1) OLS for LFP, (2) IV for LFP, (3) Simultaneous system with unobserved LFP, health and mortality. Identification from parameter restrictions	Marginal effect on LFP of (OLS, IV, system): limits (−1.37, 0.91, 0.51 to 0.76); poor health (−1.45, 0.84, 0.50 to 0.76). Marginal effect on LFP of death in (OLS): 1974–1979, −0.26; 1973, −0.31; 1972, −0.52; 1971, −0.92; 1970, −0.95; 1969, −1.02
Burtless (1987) D: RHS S: Men originally interviewed in 1969	LF: FT, PT, Not employed Health: WL-Amount or WL-Kind	Multi-period ordered probit for LF status	WLs reduce the probability of FT employment by 19%

Table 4 (*continued*)

Author/dataset/sample	Labor force and health measures	Estimation technique	Results
Sickles and Taubman (1986) D: RHS S: Men who were heads of household in 1969	LF: Retirement (0 = FT LFP, 1 otherwise) Health: SRHS compared to health status of others (better, same, worse, deceased)	FIML for simultaneous system with unobserved retirement and health stock as endogenous regressors. Health status included only in LFP equation Identification: age <62 and estimate of gain from postponing retirement excluded from health equation; SS and SSI benefits excluded from LFP equation	Marginal effect on retirement of health comparison index is 0.141
Bound et al. (1995) D: HRS S: White and black men 50–61	LF: LFP Health: (1) Mental and physical SRHS; (2) Dichotomous (WL-D) indicator for health limits/ prevents paid work; (3) Trichotomous (WL-T) indicator for health limitation (none, partial or severe); (4) Indicators for functional limitations, emotional health, obesity, cigarette/alchohol consumption	Logit for LFP	Percentage of black/white LFP gap explained by the following factors (beyond that explained by demographic controls): WL-D (17%), WL-T (38%), SRHS (20%), health conditions (14%), physical function (15%), health conditions + physical function (22%), health conditions + physical/emotion function + pain + weight (28%). Also estimate effects by education
Bound et al. (1996) D: HRS S: Individuals 50–61	LF: LFP Health: (1) Mental and physical SRHS; (2) Indicators for functional limitations, emotional health, cigarette/alcohol consumption, obesity; (3) Health index constructed from ordered probit for SRHS as function of health indicators	Logit for LFP. Logit includes predicted values from an ordered probit regression of SRHS on demographic characteristics and health conditions as a proxy for health status	Simulated effect of poor health on probability of being NILF (for 55 year-old with HS degree (black, white): MW (0.362, 0.255); SW (0.366, 0.307); MM (0.496, 0.316); SM (0.646, 0.356)

Mitchell and Anderson (1989) D: ECA S: Individuals 50–61 employed FT in first period	LF: LFP at the time of the second interview Health: (1) Mental health index based on symptom count from questions on depression and alcohol abuse; (2) Indicators for various physical health symptoms (e.g., headaches)	Two equation system of mental health and LFP. Predicted mental health index substituted into logit for LFP. Identification: imputed earnings and SS eligibility in LFP equation only; family income and veteran status in mental health equation only	Marginal effect on LFP of mental health index is −0.007
Ettner et al. (1997) D: NCS S: Individuals 18–54	LF: LFP (employed at time of survey)	Two-stage IV. See Ettner et al. (1997) in Table 2	Effect on predicted probability of LFP of having any psychiatric disorder (%, men/women): OLS, −10.7/−11.0; IV-predicted, −12.6/−14.2; IV-latent, −40.2/−33.8
Mullahy and Sindelar (1991) D: ECA–multiple site S: Individuals 30–59	LF: FT LFP (worked 12 months in past year) Health: See Mullahy and Sindelar (1991) in Table 2	Logit for LFP	Marginal effect on LFP of alcoholism is −0.16 for women and −0.07 for men
Mullahy and Sindelar (1993) D: ECA–Wave I of the New Haven, CT site S: Men 30–59	LF: FT LFP (worked 12 months in past year) Health: See Mullahy and Sindelar (1993) in Table 2	Probit for LFP	Marginal effect on LFP of alcoholism is −0.185 and of good physical health is +0.136. The negative effect of alcoholism on LFP is greater for those in poor health, and the negative effect of poor health on LFP is lower for alcoholics
Mullahy and Sindelar (1996) D: NHIS Alcohol Supplement (1986) S: Individuals 25–59	LF: Employed, Unemployed or NILF Health: (1) Alcohol abuse/dependence in the past year; (2) Ethanol consumed in 2 weeks preceding survey; (3) Indicators	HM/GMM for multinomial LF outcomes (NILF is excluded category). Identification using state-level excise taxes on beer and cigarettes, state-level average ethanol consumption, and indicators for	Marginal effect on employment of men (OLS, IV): abuse/depend (−0.02, −0.13); 90th percentile (−0.02, −0.15); 95th percentile (−0.02, −0.33). Marginal effect on employment of women (OLS, IV):

Table 4 (*continued*)

Author/dataset/sample	Labor force and health measures	Estimation technique	Results
	for ethanol consumption >90th and >95th percentile; (4) Indicator for residence with problem drinker before age 18; (5) Indicators for whether mother and father were problem drinkers; (6) SRHS	parental drinking problems and childhood residence with a problem drinker	abuse/depend (0.01, −0.15); 90th percentile (0.01, −0.13); 95th percentile (−0.01, −0.26). Marginal effect on unemployment of men (OLS, IV): abuse/depend (0.02, 0.06); 90th percentile (0.01, 0.07); 95th percentile (0.02, 0.19). Marginal effect on unemployment of women (OLS, IV): abuse/depend (0.03, 0.10); 90th percentile (0.02, 0.04); 95th percentile (0.02, 0.14)
Baldwin et al. (1994) D: SIPP (1984 Panel, Wave 3) S: White men and women who reported a work disability	LF: LFP (worked at any time during previous 4 months) Health: See Baldwin, Zeager and Flacco (1994) in Table 1	See Table 1	Marginal effect on LFP of predicted health limits is −0.02 for men and −0.07 for women
Wolfe and Hill (1995) D: SIPP (1984 Panel, Wave 3) S: Single mothers	LF: LFP at time of survey Health: (1) Number of mother's ADL limitations; (2) SRHS poor or fair; (3) Indicator of child disability	Probit for LFP	Marginal effect (percentage reduction in parentheses) on LFP of mother's ADLs is −0.115 (12%), of poor/fair health is −0.005 (6%), and of child's disability is −0.264 (29%)
Benham and Benham (1982) D: Lee Robin's data on child guidance clinic patients between 1924 and 1929 with follow-up after 30 years S: Individuals alive at time of the follow-up	LF: LFP Health: See Benham and Benham (1982) in Table 2	OLS for LFP	Marginal effect on LFP of: psychoses, −0.164; neuroses, −0.214; sociopathy, 0.006; alcoholism, 0.050; fair health, 0.046; poor health, −0.348

Blau et al. (1997) D: HRS (Waves I and II) S: Men 51–61	LF: Employment transition from Wave I to Wave II Health: (1) SRHS; (2) WL-Amount or WL-Kind; (3) Indicators for various 'serious' health conditions; (4) Indicators for various 'less serious' health conditions; (5) ADL limitation	FIML joint estimation of: (1) Employment transition probabilities (from MNL and bivariate probit); (2) Initial employment probability; (3) Attrition probability; (4) Health outcome probabilities (MNL). Identification: variables excluded from employment transition equation	Effect on exit (from LFP to NILF) and entry (NILF to LFP) transitions of (exit, entry): good to poor health (0.110, −0.084); not disabled to disabled (0.106, −0.087); good healthnot disabled to poor health/disabled (0.225, −0.118)
Ettner (1995b) D: SIPP (1986–1988 Panels) S: Women 35–64	LF: LFP (Hours >0) Health: (1) Categorical variable for the amount of time spent caring for parents; (2) Indicator variable for functional disability of parent; (3) Own WL-Ability	Two-part model: Probit for LFP and OLS for HPW given LFP = 1. Endogeneity of caregiving accounted for with two-stage IV[g]. Identifying instruments are number of siblings and parental education.	Coefficients on constant term and log average wage not reported, thus marginal effect of own health limits on LFP could not be computed
Ettner (1997) D: NSFH (1978) SIPP (1986 and 1987 Panels) S: Women 25–65	LF: LFP (employed) Health: (1)WL-Amount of WL-Kind; (2) any ADL limitation (0/1); (3) CES-D depressive symptom scale; (4) SRHS (5) Bed days in previous 4 months; (6) Child's assessment of parents' health status; (7) Indicators for deceased parents	Two-stage IV for health and LFP. (1) Probit for LFP; (2) Probit for WL; (3) Ordered probit for SRHS; (4) Two-part model for bed days; (5) OLS for CES-D scale. Identification: instruments for LFP are state UR and mother's LFP when daughter 16; instruments for health are child's assessment of parents' health	In the SIPP (no IV), effect on LFP of: poor health, −1.40; WLs, −0.57; ADL limits, −1.03; bed days, −0.02. In the NSFH (no IV), effect on LFP of: poor health, −0.97; WLs, −1.29; ADL limits, −0.84; CES-D, −0.01. In the NSFH (IV), effect on LFP of: poor health, −0.35; WLs, −0.51; ADL limits, −0.44; CES-D, −0.04[h]
Loprest et al. (1995) D: HRS (Wave I) S: Men and women 51–61	LF: LFP(working week prior to survey) Health: (1) WL-Amount or WL-Kind; (2) Six-category functional limitation index; (3) set of trichotomous health condition variables denoting no, non-severe or severe condition; (4) Index of 2-year mortality risk	Logit for LFP	Marginal effect on LFP of functional limitations[i] (married men, single women, married women): Level 1 (−0.65, −0.44, −0.30) Level 2 (−0.66, −0.53, −0.32) Level 3 (−0.28, −0.27, −0.10) Level 4 (−0.08, −0.20, −0.01) Level 5 (−0.14, −0.06, + 0.01) Level 6 (−0.04, −0.12, −0.04)

Table 4 (*continued*)

Author/dataset/sample	Labor force and health measures	Estimation technique	Results
Dow et al. (1997) D: HIE (1991 and 1993) S: Men and women from families enrolled in the experiment	LF: LFP Health: Health affected by random assignment of families to insurance plans varying in generosity	Difference-in-difference comparison of LFP rates across groups: $[(T_{93}-T_{91})-(C_{93}C_{91})]$, where T denotes the treatment group with free insurance and C denotes the control group with a positive copayment/deductible	Effect on LFP of free medical care for (men, women) for: all (0.007, 0.035); HS dropouts (0.087, 0.042); HS graduates (−0.018, 0.034)

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

[b] The change in predicted probabilities is defined as $\Pr(\text{LFP} = 1 \mid X_j = 1) - \Pr(\text{LFP} = 1 \mid X_j = 0)$. The marginal effects could not be calculated because some of the regression coefficients and their means were not reported.

[c] Pre-retirement $WL = 1$ if a limiting health condition is reported in the survey year prior to early retirement or immediately prior to age 65 if retirement occurs after age 65; Post-retirement $WL = 1$ a limiting health condition is reported in the survey immediately after early retirement or immediately after turning 65 if retirement occurs after age 65. Pre-retirement *WL* measures presumably not influenced by ex-post rationalization of retirement and more likely to incorporate information on true health.

[d] Marginal effects computed by evaluating the marginal probabilities reported in the paper at the means of all explanatory variables.

[e] The marginal effects could not be calculated because the probit results for LFP are not reported in the paper.

[f] The marginal effect of the probit estimate is evaluated at the means. The interpretation of the non-parametric estimates depends on the empirical distribution function. The author reports that if an individuals who has a 50% of non-participation becomes 10% disables, the index would increase by 0.151 with parametric estimation and by 0.238 with non-parametric estimation.

[g] I. MNL for choice of caregiving (none, non-coresidential, coresidential). II. Predicted probabilities from I used as identifying instruments in WLS regressions for the probability of each type of caregiving. III. Predicted probabilities from II used to replace actual indicators of caregiving in the second stage of the two-part model.

[h] The reported results here are the coefficient estimates from a probit regression of employment on each of the health measures (exogenous or latent). Marginal effects could not be calculated because the probit regression is not reported.

[i] Levels are defined as follows: 1, very difficult to do one or more basic functions; 2, some difficulty with one or more basic functions; 3, very difficult to do one or more physical or sedentary work functions; 4, some difficulty with one or more physical or sedentary work functions; 5, very difficult to do one or more very physical functions; 6, some difficulty with one or more very physical functions; 7, no limitations.

tion and expansion of social insurance programs is primarily responsible for this relationship, and that those in poor health are now more likely to withdraw from the labor market than they were previously. This hypothesis is discussed in greater detail below. Once again, the potential importance of changing institutions implies that estimates of the effects of health on labor force participation could be very sensitive to samples, time frames, and omitted variables biases of various types.[8]

A possible exception to the generalization that trends in health and trends in labor force participation have been moving in the wrong direction (for men) is that the incidence of mental health problems may have risen over time, although little reliable data is available. Robins and Regier (1991) found that as many as 3% of men and 4.5% of women report that they were unable to work or carry out their usual activities at some point in the past 3 months due to emotional problems. Mitchell and Anderson (1989) argue that mental health impairments are "the only important determinant" of labor force participation in their data from the National Institutes of Mental Health Epidemiologic Catchment Area Program. In the study discussed above, Ettner et al. (1997) find that in aggregate, psychiatric disorders reduced the probability of employment by about 14–15% for both men and women.

As early as 1969, Bowen and Finegan noted that self-reported poor health seemed to be a major determinant of labor force participation when health was treated as an exogenous variable in an OLS model. As shown in Table 4, many others have repeated this observation. For example, Diamond and Hausman (1984) use the NLS Mature Men data to estimate hazard models for the probability of retiring and find that of the demographic variables they examine, an indicator for "bad health" has the largest impact (other variables include education, marital status, the number of dependents, and wealth).

What might be termed "second generation" studies attempt to deal explicitly with the endogeneity and measurement error issues in an instrumental variables framework. As discussed above, Stern (1989) and Kreider (1996) fall into this category. The majority of these studies focus explicitly on the retirement decision rather than on early exit from the labor market by younger workers.

An alternative approach involves estimating models that include person-specific random effects in order to capture unobserved characteristics that could be correlated with both health and labor force participation. Sickles and Taubman (1986) estimate a model of health and retirement in which health affects retirement, but not vice-versa. The random effects are assumed to be uncorrelated across the retirement and health equations. The estimation technique is complex, involving 10-dimensional integration of the multivariate normal density function. But this does not obviate the need for arbitrary exclusion restrictions: it is assumed that an age dummy and "the gain from postponing retirement"

[8] On the other hand, Schoenbaum (1997) finds that the relationship between poor health and retirement is similar in Taiwan and in the United States, despite the fact that the former has little in the way of pension and disability insurance programs.

(which depends on the wage among other things) can be excluded from the health equation, while Social Security Insurance eligibility and Social Security benefits are excluded from the retirement equation. The authors find that poor health does indeed hasten retirement. But a limitation of the paper is that the magnitude of the effect is difficult to interpret given their health index (a variable ranging from 1 if health is better than others of the same age to 4 if the person is dead).

Blau et al. (1997) take this approach further by estimating models that include semi-parametric random effects in order to account for unobserved heterogeneity that affects not only health, but also employment at the time of the initial survey and attrition from the survey. These variables are all assumed to depend on the same set of random effects. The complete model is identified using non-linearities in these equations, as well as the fact that several variables assumed to affect health, initial employment, and attrition are excluded from the fourth equation for employment transitions (the equation of primary interest). The inclusion of the random effects reduces the estimated effects of self-reported health measures, although they remain important.

Berkovec and Stern (1991) estimate a model of retirement that includes not only unobserved individual effects, but also unobserved job-specific "match" effects. Their model focuses on dynamics by comparing a version in which people consider the value of future income flows (calculated as the solution to a dynamic programming problem) and a static model in which these flows are ignored. Health is coded as a 0 if there are no work limitations, a 2 if there are limitations, and as a 1 if health status is uncertain. The model requires future health data to be simulated which is done by assuming that people have a fixed probability of becoming ill, but that once they become sick they stay that way. Individuals are assumed to have no uncertainty about their future health, an important limitation of the model. The model is solved using simulated method of moments techniques. The results suggest that poorer health increases the value of retirement relative to either part-time or full-time employment. The dynamic model is found to provide a better fit to the data than a static alternative model, suggesting that it is important to take beliefs about future health into account.

In a further departure from previous literature, Stern (1996b) asks whether health influences labor force participation primarily through supply or through demand factors. The model is a semi-parametric generalization of Heckman's (1974) formulation in which "supply" can be thought of as the participation decision while "demand" conditions are captured by the wage conditional on participation. Demand is identified by excluding marriage, the number of dependents interacted with a dummy variable if the respondent is female, and asset income, while supply is identified by excluding the local unemployment rate and the local wage rate. The estimates indicate that self-reported health limitations on the ability to work have larger effects on labor supply than on labor demand, which suggests that programs aimed at affecting the demand for the disabled (by reducing discrimination for example) may have limited effects. A potential problem in view of the discussion above is that the self-reported health measure may be a better measure of a person's attitude to work or of the available alternatives than of their productivity.

Finally, the two studies of the ADA mentioned above examine effects on employment as well as wages. Although, as Angrist and Acemoglu (1998) point out, the employment effects are theoretically ambiguous, both they and DeLeire (1997) find that the ADA reduced employment. Deliere suggests that these effects are largest among young, poorly educated, and mentally disabled workers. Again, an important caveat to both these studies is that employment among the disabled appears to have been falling before the advent of the ADA. Thus, although disemployment may have accelerated after the passage of the law, it is important to understand the underlying causes of this trend before the effects of the ADA can be conclusively identified.

2.5.1. Links between health and the effects of race and socio-economic status on labor force participation

Unlike the time trends in labor force participation and health, differences in labor force participation between blacks and whites and by socio-economic status (SES) are suggestive of effects of health on participation. The participation rates of older working-age black men are lower than those of white men, and we see similar differences between men with lower and higher levels of education (Parsons, 1980). The health status of older black men is also worse than that of whites – for example, black men 45–64 are 1.5–2.5 more likely to have hypertension, circulatory diseases, diabetes, arthritis, and various nervous and mental disorders (Manton et al., 1987). Finally, we know that death rates are higher for black men at most ages and for most causes; that health status tends to improve with social status (House et al., 1990); and that black men and less educated men tend to have more physically demanding jobs (Park et al., 1993).

These patterns all lead one to wonder to what extent differences in health *cause* differences in participation between socio-economic groups. In an analysis of the National Longitudinal Survey of Older Men, Hayward et al. (1989a,b) found that high-wage workers were more likely to exit the labor market through retirement while lower-wage workers were more likely to exit through disability, even controlling for health status and education (where health was measured using a zero/one indicator for whether "health limited work"). Moreover, although blacks had a higher risk of disability, there was no racial difference in the probability of exiting the labor force through disability once health status was included in the model along with education and wages. Similarly, Hayward et al. (1996) report that much of the racial gap in labor force participation can be accounted for by differences in the fraction reporting that health limits their capacity to work.

Bound et al. (1995) conduct a more refined accounting of the role of health in producing racial and educational differences in labor force participation using data on people born between 1931 and 1941 from the first wave of the Health and Retirement Survey (HRS). This survey offers detailed health information including 39 variables describing specific conditions and 20 functional limitation measures, as well as questions about health limitations on the capacity to work, and general health status. Depending on the measure used, they find that between 30 and 44% of the gap in participation rates between these older black and white men (0.70 compared to 0.84) can be explained by demographic characteristics (primarily age and education) and by the health measures.

The participation rates for those with less than high school, high school, and college are 0.73, 0.82, and 0.87 respectively. Bound et al. (1995) find that models including health variables tend to "overexplain" these gaps. That is, in the absence of health restrictions, the models predict that the less educated would have higher labor force participation rates. Note that this prediction is not in keeping with traditional human capital models that focus only on education – these predict that those who have made smaller investments in human capital will have shorter working lives, other things being equal.

Bound et al. (1996) are careful to point out that these results do not establish a causal linkage between health and participation, though they are suggestive. In addition, they show that there are some clear reporting differences between blacks and the less well educated and others. For example, demographic variables and measures of specific conditions or physical limitations can explain the racial gap in whether an individual reports that health limits their work, but they cannot explain the gap in the proportions of white and black men who report that they are *unable* to work. Thus, "unable" may not simply be a more severe version of "limited" – it may also reflect social or economic incentives to attribute non-participation to disability as discussed above. For example, the ratio of disability benefits to previous labor income is likely to be higher for blacks than for whites. Similarly, they show that differences in the types of jobs held by high school and college graduates can explain a significant fraction of the differential in the fraction of individuals stating that they are unable to work.

Bound et al. (1996) examine racial differences in the labor force participation of HRS women. Black women have higher labor force participation than white women at all ages, but the difference narrows as women age. They find that more than a third of black women currently out of the labor force would be working if they had the same health and demographic characteristics as white women. Most of these women are currently on disability rather than retired.

Wolfe and Hill (1993, 1995) examine the relationship between health and labor supply among single mothers, another disadvantaged group. They report that in the March 1989 CPS, 7% of single mothers reported a disability or health problem that limited work, compared to 3% of married mothers. The number rises to 12% among single mothers who are not employed. In Tobit models estimated using the 1984 SIPP, the authors find that both "poor-to-fair" health and limits on activities of daily living are associated with fewer hours of work. However, only the ADLs were associated with a lower probability of participation.

2.5.2. Gender differences in the effects of health on participation

Table 4 indicates that relatively few studies examine both men and women in the same framework, making it difficult to make generalizations about gender differences. However, Loprest et al. (1995) observe that the effects of disabilities on labor force participation are greater for men and single women than for married women. Women may be less likely to give disability as a reason for leaving the labor force if they are in less physically demanding jobs, but this cannot explain the difference between single and married women, unless married women hold different jobs. Alternatively, it is possible that married women who work are selected to be more attached to the labor market to begin with. There is also some evidence that women find being out of the labor force less stigmatizing than men, so that there is less reporting bias among women (Ettner, 1997).

2.5.3. Health of other family members and participation

Although most of the literature linking health and labor force participation focuses on the individual, there is a growing literature examining the relationship between labor market activity and the health of other family members, especially spouses. Some of this literature is summarized in Table 5. For example, Parsons (1977) looks at the way the labor supply of wives changes when husbands become ill, and finds little effect. He speculates that the income effect may be counter-balanced by the need to spend more time in "home production" looking after the sick spouse. Parsons also makes use of time budget data and finds that men increase home production time and women increase market work time when a spouse becomes ill, but that these increases come out of leisure time. In contrast, Berger (1983) finds that women increase market work and men reduce market work in response to spousal illness, while Berger (1983) reports that the extent to which a wife increases market work depends on the extent to which income from sources such as transfer programs is available.

Other researchers have examined the effects of caring for elderly parents on the labor supply of adult children. Ettner (1995a,b) finds that the labor supply of women is significantly reduced by coresidence with an elderly disabled parent, primarily because of withdrawal from the labor market. She uses predictors of the parent's health status (education, age, and marital status) and of the number of brothers and number of sisters as instruments for co-residence. The argument in favor of using the latter as an instrument is that people with more siblings are likely to devote fewer hours to caring for their parents. Boaz and Muller (1992) look at people caring for elderly parents and report that hours spent caregiving are associated with reductions in hours of work from full-time to part-time. Stern (1996a) sets up a model in which hours of work, caregiving, and distance between the parent and child are estimated simultaneously. Simulations of the model suggest that caring for an elderly parent reduces the probability of labor force participation by 18–22%, whether the caregiver is male or female. On the other hand, Wolf and Soldo (1994) examine married women, a group with both high labor supply elasticities and a higher than average likelihood of having the responsibility of caring for an elderly parent or in-law. They find no effect of caregiving on hours of market work. Some of the discrepancy between their results and those of other researchers may be due to the fact that they define "caregiving" more broadly – all those who lived with someone who required care in the

Table 5
Evidence on the effect of health on labor supply of family members[a]

Authors/dataset/sample	Labor force and health measures	Estimation technique	Results
Inman (1987) D: National Institute of Neurological and Communicative Disorders and Stroke Study (1976) S: Multiple Sclerosis (MS) patients	LF: Annual earnings of MS patients and their spouses Health: (1) Indicators on the degree of mobility and task performance limitation due to MS (none, mild, moderate, maximal); (2) Pre-MS SRHS fair or poor	(1) Tobit for own earnings for single patients. (2) Simultaneous equations Tobit for own and spousal earnings for married couples using two-stage procedure[b]. Identification from functional form	Percentage change in expected earnings at each level (mild, mod, max) of MS severity[c]: SM (39%, −79%, −99%); SW (−51.2%, −81.4%, −79%); MM (−51.3%, −31.3%, −59%); wife (+40.5%, +12.4%, −10); MW (−65.1%, −46.2%, −70%); husband (−9.7%, −9.5%, +2%)
Berger (1983) D: CPS March (1978) S: Individuals 35–64	LF: LFP (annual hours > 0) and annual hours Health: See Berger (1983) in Table 3	See Berger (1983) in Tables 3 and 4	In response to the poor health of their spouse, women increase labor supply while men decrease labor supply
Berger and Fleisher (1984) D: NLS Older Men and NLS Mature Women S: Wives whose husband reported no health limitation in 1966	LF: Wife's LFP and annual weeks worked in 1970 Health: See Berger and Fleisher (1984) in Table 3	See Berger and Fleisher (1984) in Table 3	Marginal effect[d] on wife's LFP of husband's health limits is 0.04 (4.7%); husband's health limits increase wife's weeks worked by 0.9%; wife's health limits reduce wife's weeks worked by 0.1%
Parsons (1977) D: NLS Older Men (1966) and PAS 1965 S: Men 45–69	LF: Annual market hours, annual productive hours (market + home) Health: See Parsons (1977) in Table 3	See Parsons (1977) in Table 3	Poor health reduces annual hours by 65% using either OLS or 2SLS. Splitting sample into single versus married, poor health reduces hours by 61% if married and by 84% if single (OLS results)

Bazzoli (1985) D: RHS S: Men and single women 59–61 employed FT in 1961	LF: Early retirement (LF departure or hours reduction before age 65) Health: See Bazzoli (1985) in Table 4	Probit for early retirement	Marginal effect on early retirement of wife's health[e]: pre-retirement WL, −0.006; post-retirement WL, −0.003; pre-retirement health index, −0.010; post-retirement health index, −0.014
Bartel and Taubman (1986) D: NAS-NCR S: White male twin veterans	LF: LFP of spouse (any hours in previous year) Health: See Bartel and Taubmen (1986) in Table 2	Probit for spouse's LFP	Positive effect of husband's mental illness on wife's LFP
Ettner (1995a) D: NSFN (1987) S: Men and women age 19+	LF: Weekly hours, LFP Health: (1) Child's assessment of parents' health status; (2) Indicator for whether respondent provides care for a non-coresident parent; (3) Indicator for whether respondent lives with a disabled parent	See Ettner (1995b) in Table 4	Reduction in HPW for non-coresident care (no IV, IV): men 0.3%, 11.6%); women (7.0%, 41.1%). Reduction in HPW for coresident care: men (2.5%, 20.0%); women (2.6%, 27.2%)
Ettner (1995b) D: SIPP (1986–1988 Panels) S: Women 35–64	LF: Hours worked in preceding 4 month period Health: See Ettner (1995b) in Table 4	See Ettner (1995b) in Table 4	Reduction in hours due to (no IV, IV): 10+ h care (0.5%, 1.3%); coresidence (1.2%, 6.1%); own WL (8.3%, 6.9%)

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

[b] The latent indicator of potential earnings of the spouse is introduced in each equation as an explanatory variable of the latent potential earnings of the patient.

[c] [E(earnings | limitation)−E[earnings | previous limitation)]/E(earnings | previous limitation).

[d] Marginal effect is defined as $\delta E(Y)/\delta X_j = \Phi(\beta\′X)\beta_j$ where $\Phi(\cdot)$ is the standard normal CDF.

[e] Marginal effects computed by evaluating the marginal probabilities reported in the paper at the means of all explanatory variables.

past 12 months or who cared for an elderly relative outside the home in the past 12 months are categorized as caregivers.

Finally, a few researchers have examined the relationship between parent's labor supply and child health. Blau et al. (1995) argue that when the endogeneity of labor supply is taken account of (using 2nd and higher lags as instrumental variables in a first-differenced model), maternal labor supply has little effect on child height or weight in the Philippines. Researchers in the United States have focused on the effects of maternal work on the cognitive and mental health of young children but have not demonstrated any significant effects one way or the other (Blau and Grossberg, 1992). Looking at the question the other way around, Wolfe and Hill (1995) find that among single mothers, having a disabled child significantly reduces the number of hours worked and the probability of labor force participation.

2.6. Health and type of work

As discussed above, most research to date has focused on disability as a reason for exiting the labor force. However, many working age people with health limitations continue to work. For example, Burkhauser and Daly (1993) find using the PSID that 46% of men aged 25–59 who reported a disability in two consecutive years continue to work, while Daly and Bound (1996) find that in the HRS, over 70% of the 51–61 year old men and women with health impairments continue to work. This observation raises several questions: To what extent have workers with disabilities been accommodated by their employers (even before the advent of the 1990 Americans with Disabilities Act or ADA)? Do workers who are not accommodated adjust by changing occupation? And to what extent do the effects of disability vary with occupation?

Burkhauser et al. (1995) examine 1978 data from the Survey of Disability and Work in order to establish a baseline for the extent of employer accommodation prior to the passage of the ADA. They find that 30% of workers with a limitation were explicitly accommodated by employers, and that accommodation increased the amount of time that workers remained in the labor force by about 5 years, with a mean expected duration of employment after the onset of a limitation of 3.5 years.

Daly and Bound (1996) also found that among workers who stayed with their old employers (50%), about one-third were accommodated and that accommodation was more likely in large firms. Workers were usually accommodated by a change in job duties, assistance with the job, a change in work schedule, a shorter work day, and/or more breaks. Another 24% of men and 21% of women adapted to their limitation by changing jobs. These workers typically reported larger changes in job descriptions than those who remained with their old employers.

Older workers and African-American women, however, were more likely to either remain with their old employers or to exit the labor force altogether than to find a new job. High school dropouts were also less likely to change employers. Chirikos and Nestel (1981) found little evidence that older men adjusted to changes in health status by changing occupation using the National Longitudinal Survey of Older Men. These findings suggest that those with the lowest returns to investments in human capital are the least likely to make the specific investments involved in changing occupations.

Kessler and Frank (1997) examine variations in the effects of psychiatric disorders (including substance abuse) by occupation. They report that although the incidence of illness varies by occupation (with professionals reporting the lowest incidence), the total number of days lost due to illness shows little variation with profession. Hence, professionals reported more work days lost per person with a disorder.

An interesting unresolved question is the extent to which the effects of health on labor market activity are mitigated by the sorting of workers into the jobs in which their disabilities are least limiting. Mullahy and Sindelar (1992) report that alcohol dependence reduces the probability that a man is in a management, administrative, technical or professional occupation. Occupational choice may also be affected by the composition of benefits packages, as discussed above.

2.7. Child health and future labor market outcomes

The studies reviewed above focus on the relationship between adult health and adult labor market outcomes. But there is growing evidence that poor health in childhood can have profound effects on future outcomes, both because of effects on adult health, and because of effects on the accumulation of other forms of human capital such as education.

Many authors (Grossman, 1975; Perri, 1984; Wolfe, 1985; Wadsworth, 1986) have noted that poor health in childhood is associated with reduced educational attainment. In turn, individuals with less schooling receive lower wages and have weaker labor force attachment. Reduced educational attainment may also have a causal effect on adult health if the more educated are better able to process health inputs, choose better inputs, or if education makes people more "future oriented". In their survey of the effects of education on health, Grossman and Kaestner (1997) conclude that the weight of the evidence does support a causal relationship between education and health, although the exact mechanism is controversial.

Child health is also likely to affect adult health (and hence labor market outcomes) more directly through physiological processes. The extent to which children can recover from some insults to their health (e.g., those caused by under-nutrition or illness) early in life is controversial. However, there is growing evidence that even health in the womb affects adult health. For example, Barker and his colleagues have linked a number of adult disorders, including heart disease, to under-nutrition of the mother during critical gestational periods (Barker and Osmond, 1986).

Child health may also affect cognition. Many studies find positive effects of anthropometric measures of health such as birth weight, weight, height, head circumference, and absence of abnormalities on the cognitive development (measured using test scores) of children of various ages.[9] For example, Broman et al. (1975) examine 4 year olds; Edwards and Grossman (1979) examine white children 6–11 years old, and Shakotko et al. (1981) look at teenagers. Chaikind and Corman (1991) and Rosenzweig and Wolpin (1994) look at the effects of birth weight on later cognitive achievement. Kaestner and Corman (1995) find positive effects of birth weight, and negative effects of stunted growth (e.g., weight or height less than the 10th or 25th percentiles) in models estimated using cross-sectional data, although these effects largely disappear when child fixed effects are added to the model. Given measurement error in the test scores this result is perhaps to be expected. Alternatively, Kaestner and Corman suggest that their results may be weaker than those of Rosenzweig and Wolpin (who use the same data) because Rosenzweig and Wolpin focus on a subsample of more disadvantaged children. That is, the ill effects of poor health on cognition may be greater for more disadvantaged children than for children who are better off. Korenman et al. (1995) also find negative effects of stunting on test scores.

These studies suggest that health in childhood could be an important determinant of future labor market success, a question that has received little attention to date, perhaps because of data limitations.

2.8. Health and the labor market: summary

There are several conclusions that can be drawn from the preceding discussion. First, the way health is measured matters a great deal. It would be useful for authors to consider a range of health measures, or at least to consider what significance the choice of a particular measure may have for their results. The choice of a specific measure is likely to depend in part on the question to be addressed – e.g., if the aim is to do a cost/benefit analysis of a specific treatment then it makes sense to focus on a particular disease or condition, while if the aim is to make a statement about what effect better "health" might have on hours worked then some broader definition of health is necessary. It is interesting that in the US in any case, impairments of mental health seem to have such a large impact. This may be in part because they affect prime age workers whereas other measures such as limitations on activities of daily living affect primarily elderly people who already have reduced labor force attachment.

Second, estimates of the relationship between health and labor force outcomes vary widely and are sensitive to the identification assumptions employed. Many of the studies discussed above either ignore endogeneity issues altogether or rely on exclusion restrictions that are not easy to justify. While many would argue that it is desirable to take a

[9] Birth weight is the single most important indicator of infant health since children of low birth weight (birth weight less than 2500 g) experience post-neonatal mortality rates 10–15 times those found among infants of normal birth weight (US Office of Technology Assessment, 1987). Height can be thought of as a longer run measure of child health, while weight is a shorter run measure. Anthropometric measures like these reflect not only the effects of under-nutrition, but also the effects of illness, since frequent illness interferes with growth. See Martorell and Habitch (1986) for more discussion of the interpretation of various anthropometric measures.

structural econometric approach to measuring relationships between health, wages, and labor force participation, it is difficult to see how this can be done in a sensible way in the absence of sensible identification assumptions. One of the more promising avenues may involve taking the "production function" approach to health more seriously, and looking into the medical determinants of various conditions. Some risk factors, such as a family history of a particular illness, might arguably be said to explain health while being legitimately excluded from equations for labor market outcomes.

Third, a glaring limitation of the existing literature is the intense focus on elderly white men, to the virtual exclusion of most other groups. Studies to remedy this situation would be most useful.

3. Health insurance and the labor market

The model outlined in Section 1.1 suggests that health affects labor market outcomes both through its direct effects on productivity, and indirectly by altering tradeoffs between income and leisure. This simple models suggests several possible roles for health insurance. First, if health insurance reduces the cost of health care, and if health care improves health, then health insurance should affect labor market outcomes by improving health. This effect may be difficult to pin down however, if investments in health care today have payoffs over a long period. Second, health insurance may change the utility associated with leisure. On the one hand, people may enjoy leisure more if they are healthier. On the other hand, risk averse consumers will enjoy leisure less if leisure brings with it more uncertainty about health care expenditures. Thus, if health insurance is tied to employment, it is likely to increase labor force participation, while if it is not, it may well reduce labor force participation.

Most of the empirical research on health insurance has been devoted to exploring the links between health insurance and employment. Little evidence is available regarding the effects of health insurance on health, although the famous Black Report in Great Britain noted that socio-economic gradients in mortality actually increased after the introduction of National Health Insurance in that country (Townsend and Davidson, 1988). While it seems unlikely that National Health Insurance reduced the quality of health care available to the poorest, these results do suggest that it may not be easy to uncover the hypothesized positive relationship between health insurance and health status.

Because the US is the country with the strongest link between health insurance and employment, most of the research on health insurance and labor market outcomes has been confined to the US. Consequently, this section focuses largely on the US, although we do cite some evidence from other countries when it is available. The research has much broader relevance, however. First, although labor market institutions, and in this context health insurance institutions, invariably differ from country to country (see Blau and Kahn in this volume), the analytical approach for thinking about the effects of these institutions is much more general. Thus, as in Section 1, we try to frame the issues broadly, although much of the empirical work exploits variation that derives from institutional features unique to the US. Second, the institutions for the provision of medical care and/or health insurance are still evolving in many developing countries throughout the world. As these countries look to the developed world for models to adapt to their own circumstances, the evidence on health insurance and labor market outcomes in the US (and elsewhere) will aid in the evaluation of various alternatives (see Gertler, 1999 to be published in the *Handbook of Health Economics* for a discussion of health care provision in developing countries).

3.1. Health insurance provision in the United States: background

One of the major economic trends of the twentieth century has been the growth in the fraction of GDP devoted to health care expenditures. Between 1960 and 1995, health care expenditures in the US ballooned from a modest 5.3% of GDP to 13.6% of GDP, almost a three-fold increase. While the US is an outlier in terms of health care expenditure growth, almost every other developed country has seen sizeable increases in the fraction of GDP devoted to health care. Medical care differs from other goods such as food or housing which also command a large fraction of personal income, because the demand for medical care is both unpredictable and highly variable. Consequently, increases in health care expenditures have been accompanied by the development of institutions to provide insurance against their inherent uncertainty.

In contrast with most other developed countries in the world, health insurance in the US is both provided and financed predominantly by employers, especially for working-aged individuals (see Table 6). This link between health insurance and employment creates obvious problems for individuals who are not employed and are thus precluded from participation in the employer-provided insurance market. An eclectic mix of other institutions has developed to “fill-in-the-gaps” for such individuals: Medicare for those over 65 (the “retired”) and the permanently disabled; Medicaid for children in lower income families and women who are on welfare; a small non-group private insurance market for the self-employed or individuals otherwise lacking insurance; and other miscellaneous programs such as university-provided health insurance for students who are no longer dependents of their parents. A non-trivial number of individuals either choose not to participate in any of these markets or are precluded from doing so by either their income (which affects both the ability to purchase private non-group insurance and the ability to obtain government-provided health insurance), their health status (which affects the ability to purchase private non-group insurance and, as discussed in Section 1, may also affect the ability to participate in the labor market and obtain employer-provided health insurance), or their employability (which affects income and the ability to obtain both employer-provided health insurance and government-provided health insurance). These individuals either pay for their own health care expenditures directly or do not pay at all, receiving “uncompensated care” for their medical treatment.

Table 6
Sources of health insurance coverage for the non-elderly US population, 1995[a]

Sources of health insurance coverage	All	Employment status			
		Children	Full-time	Part-time	Non-worker
Total private	70.7	66.1	81.8	65.5	38.7
Employer	63.8	58.6	76.0	51.9	31.0
Own name	32.7	0.6	38.7	26.1	17.0
Dependent	31.1	58.0	37.3	25.8	13.9
Other private	6.9	7.5	5.9	13.6	7.8
Total public	16.6	26.4	8.1	16.0	44.0
Medicare	1.8	NR	NR	NR	NR
Medicaid	12.5	23.2	4.9	12.9	36.0
CHAMPUS/VA	3.2	NR	NR	NR	NR
Not insured	17.4	13.8	13.9	22.7	23.4

[a] Source: EBRI (1996, Tables 1 and 2). Based on calculations from the March 1996 Current Population Survey. Percentages may add up to more than 100% because individuals may have more than one source of coverage.

Table 6 illustrates the importance of these various sources of health insurance coverage for the non-elderly (<65) US population in 1995. The most significant source of health insurance is employers: almost two-thirds (63.8%) of the non-elderly population is covered by employer-provided health insurance, either directly or as a dependent through a family member's coverage. The second-largest source of health insurance in the US is the government, which provides coverage to 16.6% of the population. Note, however, that four-times as many individuals are covered by employment-related health insurance as are covered by government programs such as Medicare and Medicaid. Other private sources of health insurance cover only 6.9% of the non-elderly population. A sizeable fraction of the population has no health insurance coverage (17.4%).

The labor market significance of this eclectic array of insurance-providing institutions derives from the "rules" governing the participation of both individuals and institutions in the health insurance market (Table 7). Some of these "rules" are legislated (e.g., the tax-deductibility of employer expenditures on health insurance, or the Medicare eligibility age of 65); others are the result of competitive pressures in an insurance market that is particularly susceptible to problems of adverse selection and moral hazard (e.g., administrative costs lower the per worker cost of providing health insurance in large relative to small firms, or the preexisting conditions exclusions that characterize much employment-based and almost all private health insurance coverage that is not employment based). These "rules" give employers and individuals incentives to behave in certain ways that may impact a variety of labor market outcomes of economic interest, including turnover, labor force participation, hours worked and wages. Table 7 lists some of these "rules" in the United States. While many of the institutional "rules" are specific to the US, most of the market "rules" are not, and apply more generally to health insurance provision in many settings.

Although much research has been directed at assessing the labor market impact of other employee benefits such as pensions, social security, unemployment insurance, and workers' compensation, less work has focused on health insurance. Indeed, most of the academic research on the interaction between health insurance and labor market outcomes has been fairly recent. This is due in large part to the fact that it is only in recent years that health care expenditures have been deemed substantive enough to be of widespread interest. In 1965, neither Medicare nor Medicaid existed, total health care spending constituted just 5.0% of GDP, employer expenditures on health insurance represented a mere 1.1% of total compensation and were far exceeded by outlays on private pensions (2.8% of compensation) and social security (1.9% of compensation). Thirty-five years later, the picture is quite different. Total health care expenditures constitute almost 15% of GDP, employer-provided health insurance accounts for 7.3% of total compensation (a fraction which now exceeds the 4.1% of total compensation devoted to pensions and the 4.1% in mandatory Social Security contributions), and Medicare and Medicaid insure some 65 million individuals (all of the preceding numbers come from the EBRI, 1995). The magnitude of health care expenditures coupled with the institutions and "rules" for health insurance provision have made health insurance an important parameter in the labor market decisions of both individuals and firms. The second part of this chapter seeks to consolidate the current research on health insurance and labor market outcomes and to point out areas where future research is warranted.

3.2. Estimating the effect of health insurance on labor market outcomes: identification issues

The empirical problems associated with estimating the impact of health on labor market outcomes in Section 1 centered around the issue of defining and measuring "health", and of distinguishing between the effects of health and the effects of other closely related factors. There are similar empirical problems associated with estimating the impact of health insurance on labor market outcomes. A key issue in the literature on health insurance and the labor market is one of identification – how to distinguish the effects of health insurance from the effects of other variables that are correlated with both health insurance and labor market outcomes.

There are two major factors that contribute to this identification problem. Consider the following econometric specification for the relationship between health insurance and labor market outcomes:

$$[\text{Labor market outcome}] = \alpha \cdot HI + \beta' \cdot \mathbf{X} + \varepsilon, \tag{13}$$

where $\mathbf{X}$ is a vector of observed individual and/or job characteristics, HI is either the availability or value of health insurance coverage, and the labor market outcomes of interest include things such as hours, employment, wages, and turnover. If $\mathbf{X}$ fully captures

Table 7
Health insurance "rules" in the United States

Institutional "rules"	Market "rules"
Tax Rules ● Employer expenditures on health insurance are not included in taxable income unless employers fails to satisfy non-discrimination rules ● Individual expenditures on health insurance are deductible from taxable income (a) to the extent that such expenditures exceed 7.5% of taxable income, and (b) only if an individual itemizes deductions ● Health insurance expenditures of the self-employed receive a limited tax deduction ● Medical savings accounts are tax exempt ● Firms that self-insure are exempt from state insurance taxes (ERISA) *Program rules: Medicare* ● Everyone eligible for Medicare at age 65 ● Federal disability insurance recipients < 65 eligible for Medicare ● Medicare does not provide dependent coverage *Program rules: Medicaid* ● In general, Medicaid eligibility tied to AFDC receipt ● Exception: Medicaid available for pregnant women and children in low- to middle-income families ● Exception: Medicaid available to non-AFDC eligible individuals if medical expenses great enough (Medically Needy program) *Federally Mandated Benefits* ● COBRA: Individuals in firms of > 20 employees must be allowed to continue purchasing insurance through a former employer for up to 18 months following departure from the firm or for up to 36 months following a loss of dependent status due to events such as divorce ● HIPAA: Insurance providers, including employers, cannot exclude coverage for preexisting conditions if an individual has been continuously insured for the previous 12 months *State Mandated Benefits* ● Over 1000 different state laws mandate that insurance providers cover various treatments/conditions ● ERISA exempts employers who self-insure from compliance with state mandates *Uncompensated care* ● Hospitals cannot refuse to give care to individuals who come to the emergency room	*Cost of Health Insurance Provision* ● Average administrative costs of health insurance provision are lower in big firms/groups than in small firms/groups ● Variance in average costs of health insurance provision is lower in big firms/groups than in small firms/groups *Experience rating* ● Large firms/groups self-insure → perfect experience rating ● Small firms/groups purchase insurance with premiums based on past claims record → imperfect experience rating ● Experience rating implies that the cost to employers/groups of providing health insurance will depend on the demographics and health status of the insured group ● Preexisting conditions exclusions and medical underwriting can be viewed as a type of perfect experience rating for individuals *Adverse selection* ● Because individuals may have more information about their own health status than do insurers, those who need health insurance most are the ones most likely to purchase it *Moral hazard* ● The use of medical services will depend on whether or not insurance is available *Employer-provided health insurance* ● Administrative systems for pay determination typically divorced from administrative systems for tracking health care utilization ● Few firms provide health insurance to part-time workers ● Employer-provided health insurance typically much more generous than that provided in the individual non-group market ● Some employers provide health insurance to retirees ● Health insurance can be viewed as a fixed cost of employing an additional worker

all of the non-health insurance related factors that affect labor market outcomes, then $\hat{\alpha}$ will give an unbiased estimate of the effect of health insurance on the labor market outcome of interest.

The first problem in empirically identifying α in Eq. (13) above is that the vector **X** that is observable to the econometrician does not fully capture all of the non-health insurance related factors that affect labor market outcomes. Moreover, it is likely that the variables that are omitted from **X** are correlated with the availability or value of health insurance. If this is the case, Eq. (13) can be rewritten as:

$$[\text{Labor market outcome}] = \alpha \cdot HI + \beta' \cdot \mathbf{X} + \gamma + \varepsilon, \tag{13$'$}$$

where γ is a vector of unobserved individual and/or job characteristics. If health insurance availability is correlated with these unobserved characteristics, then $\hat{\alpha}$ will be biased:

$$\hat{\alpha} = \alpha + \frac{\text{cov}(HI, \gamma)}{\text{var}(HI)}. \tag{14}$$

What factors might lead to such a bias? Several possibilities related to different labor market outcomes have been noted in the literature:

- *Wages.* If more capable individuals command higher wages in the marketplace and health insurance is positively related to income, then the inability to observe ability will lead to a positive correlation between health insurance and γ in Eq. (13$'$) and an upward bias in the coefficient $\hat{\alpha}$.
- *Retirement.* Employers who wish to encourage early retirement may both structure their pension plans so that individuals have an incentive to retire before age 65 and provide post-retirement health insurance coverage. If the specific provisions of the pension plan are unobserved, the availability of post-retirement health insurance will be positively correlated with γ in Eq. (13$'$) and the magnitude of $\hat{\alpha}$ will have an upward bias.
- *Turnover.* If the underlying propensity of individuals to change jobs is unobserved and if individuals who have a short time horizon are more willing to accept a job without health insurance because they anticipate changing jobs soon, then health insurance will be negatively correlated with γ in Eq. (13$'$) and this will lead to a negative bias in the estimated coefficient $\hat{\alpha}$.

Four approaches (broadly classified) have been taken to mitigate the potential effects of this omitted variables problem. The first is to conduct a social experiment in which participants are randomly assigned to "treatment" and "control" groups. In a large enough sample, the random assignment will ensure that both the observed and unobserved characteristics of the groups are the same on average before treatment. Thus, any differences observed after one group is treated (by assigning them to an insurance status) can be attributed to the effects of insurance coverage. The most well known social experiment of this type was the RAND Health Insurance Experiment (RHIE) conducted from the mid-1970s to the early 1980s. This experiment included approximately 2000 non-elderly families who were assigned to one of 14 insurance plans. Some plans provided free care, while others incorporated varying degrees of cost sharing.

Newhouse (1993) reports that among the poorest participants, those who were assigned to the free care group experienced improvements in health status as measured using objective indicators such as blood pressure, anemia, vision correction, dental health and mortality. Dow et al. (1997) find using difference-in-difference techniques that among women, being assigned to the free care group was also associated with significant increases in labor supply relative to groups that had to pay for health care. They also report similar results from an Indonesian health care experiment.

The pros and cons of conducting experimental evaluations of social programs have been widely discussed in the literature (Heckman and Smith, 1995). On the "pro" side, the results of a well-conducted experiment are extremely compelling and easy to interpret. On the "con" side, experiments are costly relative to the analysis of existing datasets. They often suffer from differential attrition between those in the treatment and those in the control group, with the result that the control group becomes less similar to the treatment group over time. Moreover, participants assigned to the control group may take action to gain access to services comparable to those enjoyed by the treatment group. Finally, it may be difficult to extrapolate the results obtained from an experiment to slightly different situations, or to examine the impact of the experiment on subgroups in the subject population. For all these reasons, most evaluations of the effects of health insurance on labor market outcomes rely on non-experimental methods.

A second approach taken to mitigate the potential effects of omitted variables is to include an exhaustive set of controls, including variables that proxy for any omitted variables that might be of concern. For example, in a study on the effects of health insurance on job turnover, Buchmueller and Valletta find a baseline coefficient on employer-provided health insurance of -0.678 (1996, Table 1, panel A). When whether or not an individual has a pension is included, the coefficient on health insurance falls to -0.471, and when job tenure is included, the coefficient on health insurance falls further to -0.346. This suggests that health insurance is correlated with a variety of individual and job characteristics and that the potential for omitted variables bias is something that should be taken seriously. This approach of using an exhaustive set of controls is of course limited by the availability in the data of appropriate control variables which are exogenous.

A third approach is to use either multiple observations on individuals or multiple observations within the firm to difference out the effects of any unobserved variables that are correlated with health insurance. Smith and Ehrenberg (1983) argue that if the unobserved individual and firm-specific factors, γ, are constant across all individuals within the firm (e.g., if firms that hire disproportionately high ability people at one level within the organization also hire disproportionately high ability people at all levels within the organization), then the unobserved factors can be purged by taking differences *across individuals* within the firm. For certain types of fringe benefits, they show that this procedure does in fact lead to the expected reduction in the magnitude of the estimated coefficients.[10] In a similar approach, Buchmueller and Lettau (1997) use multiple observations on individuals over time within a panel of firms. They purge the data of these unobserved factors by taking differences across the same individual over time.[11]

The fourth approach is to make identifying assumptions based on the variation across individuals in the availability of health insurance generated by either (a) the institutional arrangements for the provision of health insurance or legal rulings which change these institutional arrangements, or (b) based on variation across individuals in the demand for health insurance coverage generated by variations in personal circumstance. For example, a non-trivial fraction of individuals live in households in which both spouses work for employers that provide health insurance. With the potential of health insurance coverage from a spouse, the value of own employer-provided health insurance, which essentially duplicates the coverage available from a spouse, is substantially lower. Thus, we might expect that employer-provided health insurance will have a different effect on labor market outcomes depending on whether or not health insurance coverage not attached to an individual's own employment is also available.

This variation in the value of health insurance can be used to divide individuals into two categories – those who have only one source of health insurance and who are likely to place a high value on this health insurance, and those that have more than one source of health insurance and are likely to place a low value on either source of health insurance. The effect of health insurance on labor market outcomes can be identified by estimating Eq. (13′) separately for both groups of individuals:

$$\text{Group 1}: \quad [\text{Labor market outcome}] = \alpha_1 \cdot HI + \beta_1' \cdot \mathbf{X} + \gamma + \varepsilon, \qquad \alpha_1 \neq 0,$$

$$\text{Group 2}: \quad [\text{Labor market outcome}] = \alpha_2 \cdot HI + \beta_2' \cdot \mathbf{X} + \gamma + \varepsilon, \qquad \alpha_2 = 0. \tag{15}$$

For the first group, it is hypothesized that health insurance does indeed affect labor market outcomes, so that $\alpha_1 \neq 0$, while for the second, health insurance has no bearing on labor market outcomes, or $\alpha_2 = 0$. Because health insurance is correlated with γ, the unobserved individual or job characteristics, for both groups, the regressions in Eq. (15) will yield biased estimates of the coefficient on health insurance for the two groups of:

$$\text{Group 1}: \quad \hat{\alpha}_1 = \alpha_1 + \frac{\text{cov}(HI, \gamma)}{\text{var}(HI)},$$

$$\text{Group 2}: \quad \hat{\alpha}_2 = \frac{\text{cov}(HI, \gamma)}{\text{var}(HI)}. \tag{16}$$

[10] For example, they find that the coefficients on paid holidays in a log wage regression range from 2.28 to 2.45 when the data is not purged of potential firm-specific factors; when this difference approach is used, the coefficients fall, as expected, to − 0.36–1.62 (Smith and Ehrenberg, 1983, Tables 10.4 and 10.6).

[11] Buchmeuller and Lettau (1997) do not report results from a baseline regression which does not difference out any unobserved factors so it is not possible to ascertain whether their procedure changes the magnitude of the estimated wage-health insurance tradeoff in the expected way.

If cov(HI,γ)/var(HI) is the same for both groups, then α_1 can be identified by differencing the two estimated coefficients: $(\hat{\alpha}_1 - \hat{\alpha}_2) = \alpha_1$. Note that the identification of α_1 rests on two critical assumptions. First, that health insurance does *not* have an effect on the labor market outcomes of the second group, or $\alpha_2 = 0$; and second, that the correlation between health insurance and the unobserved individual or job characteristics in Eq. (15) is the same for both groups.

The violation of the first assumption may not be particularly damaging if the goal is to establish whether or not there is an effect of health insurance on labor market outcomes rather than to precisely estimate the magnitude of any possible effect. As long as α_1 and α_2 are of the same sign and $|\alpha_2| < |\alpha_1|$, then $(\hat{\alpha}_1 - \hat{\alpha}_2)$ will give a lower bound estimate of the magnitude of α_1. The violation of the second assumption is of potentially of greater concern. Indeed, many critics of this approach argue that the division of individuals into different groups is likely to be based on the strength of the correlation between HI and γ. For example, suppose that individuals who know they are likely to change jobs in the near future take steps to minimize the potential costs of such a job change by lining up a second, non-employment related source of health insurance. In this case, individuals with a small γ (low underlying propensity to change jobs) will have only one source of health insurance, and individuals with a large γ (high underlying propensity to change jobs) will have two sources of health insurance. Consequently, cov(HI,γ) will not be equal across the two groups rendering the identification strategy invalid. This identification strategy is most defensible when the division of individuals into groups is based on truly exogenous factors which increase the availability or value of health insurance for one group relative to another.

An alternative empirical implementation of this identification strategy is to estimate one equation of the form

$$[\text{Labor market outcome}] = \eta_0 \cdot HI + \eta_1 \cdot (GROUP\_2) + \eta_2 \cdot (HI \times GROUP\_2) + \beta' \cdot \mathbf{X} + \varepsilon, \tag{17}$$

where *GROUP–2* denotes belonging to Group 2 in Eq. (15) (in the context of the example framing Eq. (15) this would be individuals who have health insurance from a source other than their own employment). *HI* × *GROUP–2* is an interaction term for having both own employment-based health insurance and other health insurance. Rather than dividing individuals into two groups and running separate regressions as in Eq. (15), this approach includes everyone in a single regression and bases the identification of the effect of health insurance off of the coefficient on the interaction term, η_2. The coefficient on *HI*, $\hat{\eta}_0$, will capture the effects of both own employer-provided health insurance and the effect of omitted individual or job characteristics that are correlated with this type of health insurance. The coefficient on *GROUP–2*, $\hat{\eta}_1$, will capture the effect on labor market outcomes, if any, of being a member of Group 2 along with the effect of any omitted individual or job characteristics that are correlated with membership in Group 2. The coefficient on the interaction term *HI* × *GROUP–2*, $\hat{\eta}_2$, will be purged of any correlation between either *HI* and γ (this is picked up by $\hat{\eta}_0$) or between membership in Group 2 and γ (this is picked up by $\hat{\eta}_1$). As long as the second identifying assumption above holds, that the correlation between health insurance and the unobserved individual or job characteristics, γ, is the same for both groups so that the interaction term $HI \times GROUP\text{–}2$ is independent of γ, $\hat{\eta}_2$ will be an unbiased estimate of the effect of health insurance on labor market outcomes.

Note that this approach makes one additional identification assumption, namely that the coefficient vector β' is the same for the two groups (indeed, this approach imposes the equality of these coefficients). While this assumption may be viewed as somewhat severe, when valid it makes the econometric specification much more parsimonious and increases the overall efficiency of the parameter estimates. For this reason, this approach is often implemented when sample sizes are small.

The second problem with identifying α in Eq. (13) is that many sources of non-employment based health insurance are coupled with other factors that also impact labor force participation. For example:

- The normal age of Medicare eligibility, 65, is also the Social Security normal retirement age. Thus, the effect of Medicare eligibility on labor market outcomes is difficult to distinguish from the effect of reaching the Social Security normal retirement age.
- Medicare coverage before age 65 is available to Disability Insurance recipients (Disability Insurance provides cash assistance and health insurance through the Medicare program to the long-term disabled who are unable to work). Thus, it is difficult to distinguish the effect of Medicare on Disability Insurance participation from the effect of potential Disability Insurance benefits.
- Medicaid coverage has historically only been available to AFDC recipients (AFDC is a state-run program which, prior to 1997, provided cash assistance to lower income households, primarily those headed by single mothers). Thus, the effect of Medicaid coverage on the labor market outcomes of lower income individuals is difficult to distinguish from the effect of AFDC.
- Firm provision of many fringe benefits begins at 20 h per week. Thus, it is difficult to disentangle the effect of health insurance on the choice between full- and part-time employment from the effect of other employee benefits.

The problem, then, is one of multicolinearity. The joint impact of health insurance and these other factors that are coupled with health insurance provision can be estimated, but it is difficult to separately distinguish the effect of health insurance from that of these other collinear factors.

Separate identification requires something that breaks the multicolinearity. One approach is to exploit variation in the institutional features of health insurance provision in such a way that some groups are subject to the multicolinearity problem while others are not. For example, legislative changes in Medicaid eligibility rules in the late 1980s severed the link between AFDC participation and Medicaid coverage for some individuals. This approach, of course, relies on the existence of variation in the availability of health insurance to individuals.

A second approach is to estimate a structural model of utility maximization which specifies the general form of the relationship between utility, health insurance, and the factors that are collinear with health insurance. For example, in their dynamic programming model of retirement, Rust and Phelan (1997) specify a constant relative risk aversion utility function in which utility depends on consumption. Consumption is defined as income net of out-of-pocket medical expenditures where the probability of any given level of health care expenditures is based on the assumption of a Pareto distribution for health care expenditures. Various forms of health insurance (or lack of health insurance) correspond to different values of the single parameter that characterizes the Pareto distribution. Once the parameters of the structural model have been estimated, the effect of alternative forms of health insurance provision on labor market outcomes can be simulated. This type of structural approach is potentially quite powerful, especially for policy analysis, because it can be easily used to simulate changes in behavioral and other outcomes under different scenarios. The assumptions underlying such structural models, however, are often untestable.

3.3. Employer provision of health insurance

The first labor market outcome of interest is the extent to which employers actually do provide health insurance. Why are employers the predominant supplier of health insurance in the US? In answering this question, it is useful to start by considering the history of employer provision of health insurance.

As the quotes at the beginning of this chapter illustrate, academic research has only recently substantiated that health is a consequential determinant of labor market outcomes. Economic agents, however, have long recognized the importance of this relationship. By the start of the nineteenth century, many US and European guilds, unions, fraternal organizations, and other private groups had undertaken measures to protect members and their families from the income losses associated with the illness or death of the family breadwinner (Institute of Medicine, 1993). Concerns about the impact of workplace injuries on earnings capacity further expanded these efforts during the Industrial Revolution. It is interesting to note that these early precursors of modern health insurance provided protection not against the costs of medical treatment, but against the wage losses resulting from poor health. This is not entirely surprising since, at that time, the lack of effective medical treatment for many diseases meant that the most significant costs associated with illness were in fact lost earnings rather than expenditures on medical care.

By the end of the 19th Century interest in medical treatment as well as income protection began to grow. Many of the organizations mentioned above started to offer not only protection against lost income, but coverage for medical expenses as well. Even so, in 1917 only 1% of the benefits paid out by such groups went for medical expenses. By the late 1800s, companies in the railroad, mining, lumber, and other industries also began hiring company doctors. The employees in these industries often worked in isolated areas where replacement workers were difficult to find, and the company self-interest in return-

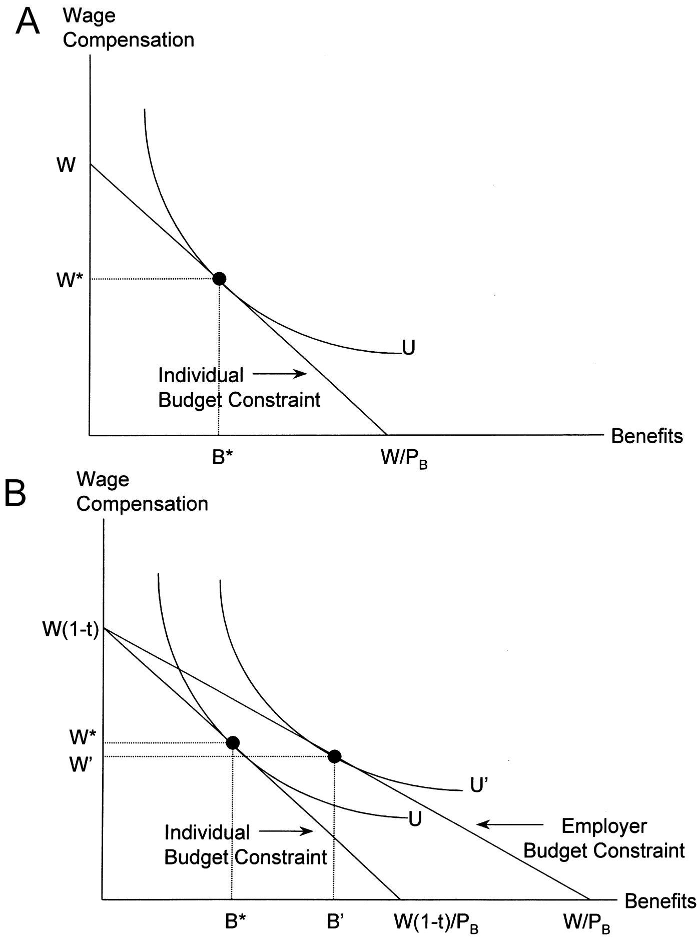

Fig. 1.

ing injured or sick workers to full health in such circumstances is self-evident. The passage of workers' compensation legislation in the early 20th Century further increased the financial incentives of employers to both prevent and treat workplace injuries. The provision of health insurance was a natural extension of these health promotion and income insurance activities in which companies were already engaged,[12] and the early precursors of Blue Cross/Blue Shield began providing health insurance to individuals in the private

[12] Montgomery Ward, in 1910, and the International Ladies Garment Workers Union, in 1913, are two of the earliest organizations to provide some form of health insurance for their employees (Institute of Medicine, 1993).

market in the late 1920s and early 1930s. In the context of this chapter, it is interesting to note that the genesis of employer-provided health insurance is rooted in employment-based programs implemented precisely because health impacts labor market activity and labor market activity impacts health.

Although companies and unions began providing insurance to their employees in the early 1900s, the wide-spread availability of employment-based health insurance is largely a post-war phenomenon. And it is in the post-war period that the institutions for the provision of health insurance in the US and other industrialized countries began to diverge. The move toward socialized medicine that supplanted the role of both private and employer-provided health insurance in many European countries was rejected by the US in the 1930s. In the absence of governmental health insurance provision, the two alternative sources of health insurance coverage available to individuals in the 1930s and 1940s were private Blue Cross/Blue Shield types of plans or, if available, employer-provided health insurance.

What are the factors responsible for the eventual dominance of employers over the private market in the provision of health insurance in the United States? We can break the reasons for employer provision of health insurance into two categories: demand-side reasons driven by employee preferences for employer-provided rather than private market health insurance, and supply-side reasons driven by employer preferences for providing employees with health insurance even in the absence of employee demand.

On the demand side, why might employees prefer employer provision of health insurance to independent purchase of such coverage in the private market? Fig. 1A illustrates the individual choice of how to allocate after-tax compensation between health insurance and wages available to purchase other consumption goods. The optimal choice for the individual is bundle (B^*,W^*), where the indifference curve is tangent to the budget constraint. Note that if individuals face the same price for purchasing health insurance as do employers, individuals will be completely indifferent between a compensation package with wage W^* and health insurance B^* and a compensation package of wage W and $B = 0$ because the individual can replicate the first, and preferred, consumption bundle by purchasing benefits $B = B^*$ for the sum of \$$(W - W^*)/P_B$ in the private market where P_B is the price of health insurance benefits. Note, however, that if the employer provides the wrong level of benefits (perhaps because employers do not know the true preferences of their workers, of perhaps because non-discrimination rules constrain the employer to provide only one bundle of health insurance even though workers within the firm have heterogeneous preferences) and individuals cannot "sell" excess health insurance benefits ($B > B^*$) or incrementally supplement deficient health insurance benefits ($B < B^*$), then the individual is worse off with employer provision of health insurance than without it.

This analysis suggests that a likely reason for employer-provision of health insurance is that individuals do not face the same price for purchasing health insurance as do employers, and in particular, that the cost of health insurance in the private market is greater for individuals than is the cost to employers of providing health insurance to their employees.

If this is the case, then as depicted in Fig. 1B, employees will prefer that their employers provide health insurance. In this figure, individuals can use wage compensation to purchase any bundle of health insurance and other consumption goods along the individual budget constraint. Employers, however, have a cost advantage in the provision of health insurance. This means that if employers provide health insurance, the menu of options available to the employee expands to those on the employer budget constraint. Note, however, that the consumption bundles on the employer budget constraint are only available to the individual if the employer provides health insurance – the individual cannot replicate these options in the private market.[13] Note also that given an employer cost advantage, there is quite a bit of leeway for employers to get the wage/benefits bundle "wrong" and still leave employees better off than they would be if given only wage compensation and left to their own devices.

There are several reasons why employers have a cost advantage in providing health insurance. The first is the differential tax treatment of health insurance provided by employers relative to that purchased by individuals in the private market. A 1943 IRS ruling deemed that non-wage forms of compensation such as pensions and health insurance are excludable from taxable income. Thus, as illustrated in Fig. 1B, $\$W$ in wage compensation yields $\$W(1-t)$ available for non-benefit consumption by employees, whereas $\$W$ in benefit compensation yields a full W/P_{B} in benefit consumption.[14] The post-war expansion in both the tax base and marginal tax rates dramatically increased the magnitude of this price advantage in benefit provision enjoyed by employers, increasing the attractiveness of paying compensation in the form of benefits rather than wages. Gruber and Poterba (1996) estimate that the tax-induced reduction in the "price" of employer-provided health insurance is about 27% on average. Many papers have estimated the effect of taxes on employer provision of health insurance and/or other benefits (see Woodbury and Huang, 1991; Gruber and Poterba, 1994; Gentry and Peress, 1994 for a discussion of this literature). Virtually all of these studies conclude that taxes are an important factor in the provision of fringe benefits, although, not surprisingly, there is a wide range in the magnitude of the estimates.

Another potentially important source of the price advantage enjoyed by employers results from the selection of who is and who is not covered by employer-provided health insurance. Because health impacts the capacity to work, the non-employed are likely to have a higher than average incidence of adverse health risks. But, they are also excluded by their labor force status from the market for employer-provided health insurance. This

[13] This is because individuals cannot "sell" excess employer-provided health insurance benefits or incrementally supplement deficient health insurance benefits (at least not at the same price as can employers).

[14] In fact, private market purchases of health insurance enjoy some limited tax benefits. Currently health insurance (and other medical expenditures) in excess of 7.5% of adjusted gross income are deductible from taxable income if individuals itemize. However, Gruber and Poterba (1994) report that less than 5% of tax returns claim itemized medical deductions. Self-employed individuals enjoy slightly more generous tax benefits (see Gruber and Poterba, 1994; Madrian and Lefgren, 1998 for greater detail on the tax treatment of health insurance for the self-employed).

selection will be reflected in a higher price of health insurance in the private market. A related source of cost advantage is that employers, like any other large group, can reduce adverse selection and lower administrative expenses through pooling. These two factors together reduce the cost of providing insurance in large firms relative to small groups by almost 35% (Congressional Research Service, 1988). As with the tax deductibility of employer health insurance expenditures, these price reduction factors shift the wage/health insurance budget constraint such that individuals demand more employer provision of health insurance. These factors are commonly cited as the reasons why large firms are much more likely to offer health insurance than are small firms (see Brown et al., 1990).

One important factor which may limit the value of the price reduction that can be obtained by employers is the low-cost (or no-cost) availability of alternative sources of health insurance coverage not related to one's own employment. For example, married individuals may be covered as dependents on their spouse's health insurance policy, or individuals aged 65 and older may be covered by Medicare. If own employer expenditures on health insurance essentially replicate the coverage that is already available, the value of employer-provided health insurance is greatly reduced. This situation is illustrated in Fig. 2. We can view the availability of such types of alternative health insurance as adding a non-convexity to the individual's budget constraint at benefit level B_G, the level of alternatively available health insurance benefits. The budget constraint thus shifts from *WZ* to *WXYZ*. As is the case with many non-convexities, the incentive for many individuals will be to locate at the kink, *X*, "purchasing" no health insurance from their current employer. Feldman et al. (1997) estimate that the propensity of small firms to offer any health insurance is indeed negatively related to the fraction of the firm's workforce that is married and thus, presumably, has greater access to health insurance through a spouse (alternatively, this may result from self-selection of married secondary earners into firms that do

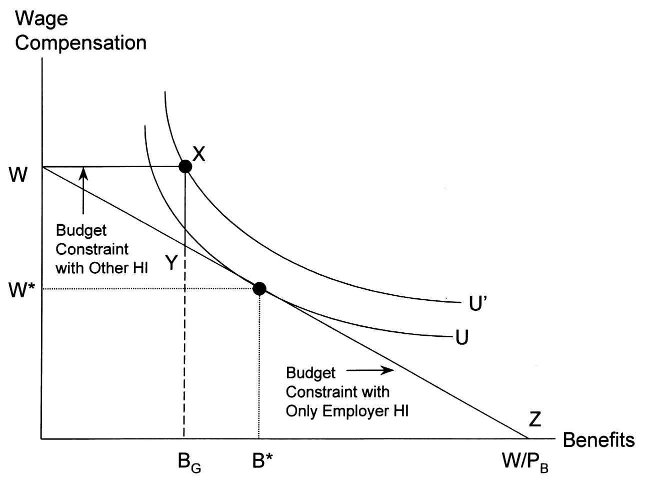

Fig. 2.

not offer health insurance, presumably in exchange for higher wages). Sections 3.5 and 3.6 discuss the evidence on how the availability of an alternative source of health insurance affects individual labor market behavior.

Finally, the demand for health insurance coverage will be impacted by individual preferences regarding the tradeoff between other consumption goods and health benefits (the shape of the indifference curves). To the extent that employers have a cost advantage in the provision of health insurance, an overall increase in the demand for health insurance will result in increased demand for employer-provided health insurance as well. Gender, marital status, age, family status, preferences toward risk, and health may all affect the demand for health insurance. Indeed, Long and Marquis (1992) suggest that many of the employed uninsured may lack health insurance not because they are employed in firms that do not supply health insurance, but because they don't demand health insurance coverage at the price that they or their employers would face.

Even in the absence of the price and demand factors discussed above, employers may nonetheless want to provide health insurance because offering a compensation package comprised of both wages and health insurance is more profitable than offering wages alone. Health insurance may encourage self-selection of "desired" employees into the firm if preferences for health insurance are correlated with other employee characteristics that the firm desires (e.g., individuals with children may demand more health insurance, and individuals with children may be less mobile, thus the firm can attract employees who anticipate establishing a long-term employment relationship by offering health insurance).[15] Ippolito (1992) discusses the correlation between pension provision and employee self-selection. It is likely that health insurance provision would have similar effects as well. Employers may also use the provision of health insurance to motivate certain types of desired behavior (e.g., to reduce turnover or impact retirement behavior as discussed in Sections 3.5 and 3.6).

3.4. The relationship between health insurance and wages

The first attempts to link health insurance to labor market outcomes were done in the context of compensating wage differentials for fringe benefit provision. In a competitive product market, economic theory suggests that what matters to profit maximizing firms is the value of the total compensation package that they must offer to attract labor services. If the level of compensation is too low, the firm will not be able to attract the desired level of labor input. If the level of compensation is too high, the firm will be driven out of business by other companies with lower labor costs. Thus, to attract and retain workers, employers will offer employees a compensation package commensurate to that offered by other firms drawing workers from the same labor pool. To remain competitive, however, the firm must reduce wages by $1 for each $1 increase in health insurance expenditures. Individuals will

[15] Note that offering health insurance may also lead to adverse selection: those individuals who are likely to find health insurance extremely attractive are those that need it most–those in ill health.

Table 8
Evidence on the relationship between health insurance and wages[a]

Author/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Leibowitz (1983) D: RAND Health Insurance Study (1974–1978) S: Employed <62	LF: Log wages HI: premium paid by employer Health: none	OLS for log hourly wage	Positive but insignificant relationship between wages and HI
Monheit et al. (1985) NMCES (1977)	LF: Log wages HI: EHI Health: none	OLS for log hourly wage	Positive relationship between wages and HI (magnitude not reported)
Eberts and Stone (1985) D: New York City Public School Districts (school years 1972–1973 and 1976–1977) S: Full-time teachers who did not change school districts between 1972 and 1976	LF: Annual salary HI: change in log cost of health benefits Health: none	OLS for change in log salary	$1 increase in the cost of health benefits corresponds to a $0.83 reduction in wages
Olsen (1992) D: CPS January DWSs (1984, 1986, 1988); CPS March 1989 S: Individuals <60 employed FT at time of survey and prior to job displacement	LF: Log weekly wage HI: EHI Health: none	OLS for change in log weekly wage from pre- to post-displacement job	Displaced workers who lost health insurance have post-displacement wages 25% below those of displaced workers who were able find new jobs which also offer health insurance coverage

Table 8 (*continued*)

Author/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Gruber (1994) D: CPS May (1974, 1975, 1977, 1978); CPS March (1978, 1979, 1981, 1982) S: Men and women 20–65 in selected states; not self-employed	LF: (1) Hourly wage, (2) HPW, and (3) LFP HI: whether individual lived in a state covered by a state mandated maternity benefits law or the federal Pregnancy Discrimination Act Health: none	(1) OLS for log hourly wage, (2) OLS for HPW, (3) Probit for LFP	Mandated maternity benefits resulted in a wage decline of 2.1–4.3% for married women; estimated wage declines for single women and married men of a similar magnitude but statistically insignificant; no effect on single men. Results corresponds to shifting of 50–200% of the cost of the mandate onto wages
Sheiner (1994) D: CPS (1990–1991) S: Men and women 25–59 working more than 15 h per week and more then 26 weeks per year	LF: Annual earnings HI: EHI, Family EHI, city-specific cost of HI Health: none	(1) OLS for annual earnings, (2) OLS for log annual earnings, (3) NLS for annual earnings	Older workers, who are more expensive to insure, have lower wages in cities with high health care costs relative to older workers in cities with low health care costs
Gruber and Hanratty (1995) D: Monthly Survey of Employment and Weekly Payrolls from Canada (1961–1975). Data aggregated to industry/province level	LF: Average weekly earnings HI: Share of employees in firms that provide HI to a majority of their employees in 1965; implementation of national health insurance (NHI) Health: none	OLS for log average weekly earnings	NHI leads to a 1.4–4.2% increase in average weekly earnings; effects are bigger in industries with low initial private HI coverage rates

Miller (1995) D: CES (1988) S: Men and women age >18 employed but not self-employed	LF: Log hourly wage HI: EHI Health: none	(1) OLS for log hourly wage, (2) OLS for difference in log hourly wage	Levels: wages of workers with EHI are 17–20% higher than wages of workers without HI. Differences: health insurance corresponds to an 11% reduction in wages
Buchmueller and Lettau (1997) D: Employment Cost Index micro data (12/97–12/94) S: Private sector jobs with annual hours >1500	LF: Log wages HI: Change in per hour cost of EHI at the firm level Health: none	OLS and 2SLS for log change in per hour cost of non-HI compensation (2SLS instruments the change in HI cost with the average change in HI cost for other jobs in the same firm)	Positive relationship between wages and EHI
Thurston (1997) D: 1970 Census (1%) and 1990 Census (5%); CPS (March 1990–1993) S: Data collapsed to industry averages for all workers with positive hours	LF: Industry average wages HI: EHI Health: none	OLS and median regression for change in average wages in Hawaii relative to the rest of the US	Effect of HI coverage on wages depends on how changes in HI coverage are measured as well as on estimation technique (OLS versus median regression); effects range from negative and significant to positive and significant
Ryan (1997) D: SIPP (1988 Panel) S: Men aged 24–64 not self-employed	LF: Hourly wage (level) HI: Generosity of employer-provided health insurance Health: SRHS	(1) OLS for hourly wage in levels, (2) OLS for difference in hourly wage	Levels: positive relationship between wages EHI; Differences: negative relationship between wages and EHI

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

then sort themselves into firms based on the wage/health insurance bundle that best matches their preferences.

Fig. 3A illustrates this outcome. If all firms face the same tradeoff between wages and benefits in total compensation, then the wage/health insurance bundles that are observed in the marketplace will reflect the sorting of employees across firms on the basis of their heterogeneous preferences for health insurance (note that Fig. 3A assumes that total compensation for both Employee A and Employee B is the same). This framework is the motivation for much of the literature on the tradeoff between wages and health insurance or other fringe benefits. The empirical implementation of the wage-health insurance tradeoff pictured in Fig. 3A has typically been the estimation of Eq. (13) using wages or log wages as the labor market outcome of interest and expenditures on health insurance as the measure of *HI*. Conditional on **X** and in the absence of tax considerations, the theory would predict $a = -1$.[16] The empirical validity of Eq. (13) with respect to wages, however, has been difficult to establish. The typical estimates of a are either wrong-signed, insignificant or both. The literature has thus focused not on the magnitude of the wage-health insurance tradeoff, but on the reasons why economists cannot find evidence that there is one.

A frequently cited problem is a lack of suitable data (Smith and Ehrenberg, 1983). To estimate Eq. (13) requires data on both compensation and fringe benefit expenditures. The firm-level datasets which include information on benefits expenditures are usually aggregated at the firm level – they include aggregate benefits expenditures and wage compensation rather than individual level compensation. They do not, however, typically include the types of human capital variables that might allow one to control for the productivity of the workforce. The problem created by these omitted variables is illustrated in Fig. 3B. If total compensation increases with average worker productivity and both benefits and other consumption goods are normal, then a regression using such firm-level data will yield a positive relationship between wages and benefits rather than the postulated one-for-one negative tradeoff.

One alternative is to use an individual-level dataset such as the Current Population Survey which does have human capital variables that might control for ability. One drawback to these datasets, however, is that they only include information on whether or not individuals have employer-provided health insurance; they have no information on actual employer expenditures. It is possible, however, to merge in average employer expenditures by industry from a firm-level dataset. Even so, such methods still usually lead to a positive relationship between health insurance and wages. For example, Leibowitz (1983) uses the RAND Health Insurance Study[17] to estimate the wage/fringe benefit tradeoff. The

[16] The presumption that $dW/dHI = -1$ is a useful benchmark, however the actual tradeoff between wages and health insurance that the firm is willing to make could be less than (or greater than) -1 if the provision of health insurance alters employee behavior in desirable (undesirable) ways. For example, suppose that health insurance reduces job turnover and job turnover is costly to the firm. The firm might then be willing to provide an additional dollar in health insurance benefits for less than a dollar reduction in wages because the costs associated with job turnover fall at the same time (Triplett, 1983). The tax considerations outlined in Section 2.3 suggest that the actual tradeoff should be $-1/(1 - t)$ rather than -1.

[17] This dataset is also known as the RAND Health Insurance Experiment (RHIE).

RAND Health Insurance Study, which is a survey of individuals, actually contacted employers to obtain information on employer health insurance expenditures before survey respondents were enrolled in the study. Even with this "ideal" dataset, Leibowitz estimates a positive (although insignificant) effect of employer health insurance expenditures on wages.

The explanation given in the literature for such results is that productivity is determined by both observed human capital variables and unobserved (to the econometrician) ability (γ in Eq. ($13'$)). This implies that even conditional on observed human capital variables, some firms employ higher ability workers and pay a higher level of total compensation. But, as shown in Fig. 3B, if this higher level of compensation is allocated to both wages and benefits, we will estimate a positive relationship between wages and fringe benefits despite using human capital controls.

Various approaches have been taken to circumvent this problem of omitted ability bias. Smith and Ehrenberg (1983) use a firm-level dataset that contains information on wages and fringe benefits for three jobs that have comparable job requirements in all firms. They argue that if there are "high ability" firms and "low ability" firms, then the magnitude of the omitted ability factor (conditional on job requirements) will be similar across all jobs within the firm (it can be viewed as a firm-specific fixed effect).[18] If so, then this unobserved variable can be purged by differencing Eq. ($13'$) across job classifications within the firm. Unfortunately, the fact that health insurance expenditures are the same for all workers within a given firm in their data means that they cannot use this estimation strategy to estimate the tradeoff between wages and health insurance. When they look at other fringe benefits, they find that accounting for such an unobserved fixed effect has no impact on the estimated wage-pension tradeoff (they find no evidence of such a tradeoff using either estimation strategy), but that the estimated wage-paid vacation trade off is biased upward, as expected, when these unobserved fixed effects are ignored.

Buchmueller and Lettau (1997) adopt a different approach. They use an employer-level dataset that tracks compensation and benefit expenditures for various jobs within the firm over a 4-year period. Since ability is presumably constant over time, they purge Eq. (13) of unobserved productivity differences by differencing Eq. ($13'$) over time, essentially examining the impact of the growth in health insurance expenditures over time on changes in wages over time. Even so, they find no evidence of a negative tradeoff between health insurance and wages (indeed, they estimate a positive relationship between wage growth and health insurance expenditure growth).

Olson (1992), Miller (1995) and Ryan (1997) adopt an approach similar in spirit to that of Buchmueller and Lettau, using panel datasets of workers to estimate the effect of changes in health insurance coverage on changes in wages. A fundamental problem with this approach, however, is that the majority of changes in health insurance coverage

[18] Note that this estimation strategy rests on the assumption that the omitted variable "ability" is in fact a firm-specific fixed effect. If firms only hire unobservedly high ability people for some jobs but not for others, this identifying assumption will not hold and the differencing strategy proposed will be biased as well.

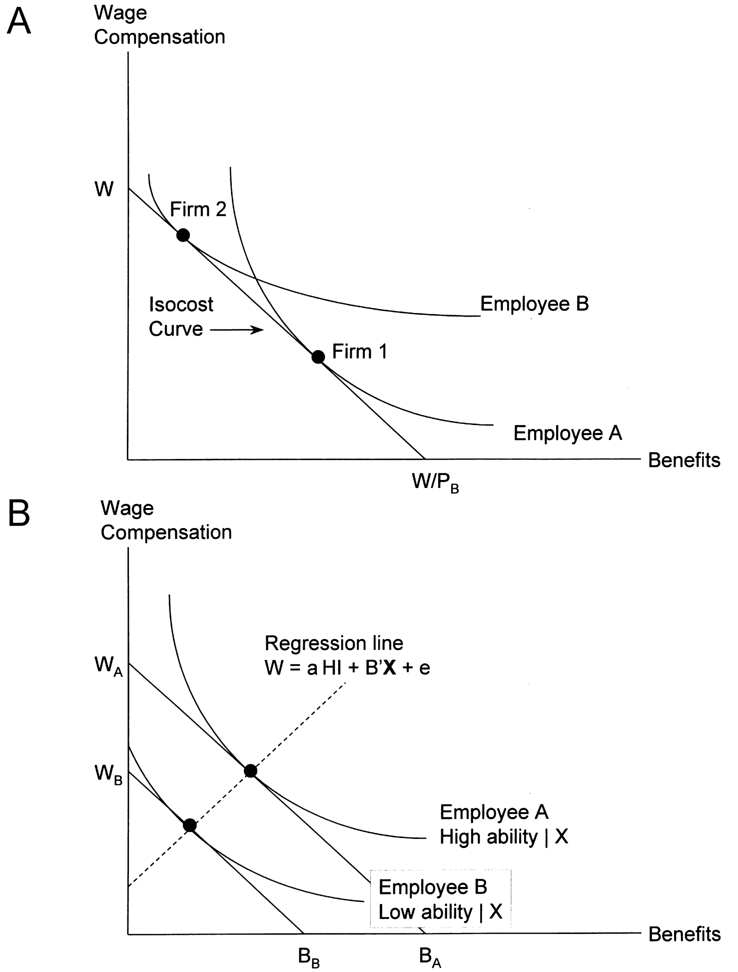

Fig. 3.

are generated by job change. So, while this approach may successfully purge Eq. (13′) of any unobserved individual productivity differences, the unobserved job characteristics that also impact compensation and which are unlikely to be constant following a job change will remain. Moreover, because the effect of health insurance on wages is identified using job changers, concerns about the determinants of job changing are important as well.

The evidence on the wage–health insurance tradeoff from this type of estimation strategy is mixed. Using the 1984, 1986 and 1988 January CPS Displaced Worker Surveys, Olsen (1992) finds that displaced workers who had health insurance before job displacement but who were later reemployed at jobs without health insurance had wages approximately 25% lower than displaced workers who were able to maintain health insurance coverage. These results are not supportive of a wage–health insurance tradeoff. They are contradicted, however, by Miller (1995) and Ryan (1997). Exploiting the panel aspects of the Consumer Expenditure Survey (Miller) and the Survey of Income and Program Participation (Ryan), they both estimate a positive relationship between health insurance coverage and the level of wages, but a negative relationship between changes in health insurance coverage and changes in wages. Miller places the wage–health insurance tradeoff at about 11%. Little consideration has been given in either of these papers, however, to the selectivity issues generated by identifying these effects off of job changes. The study by Olsen is less subject to this criticism as his sample of displaced workers is exogenously selected by the closing of a plant or similar event.

Another explanation given in the pension literature for the similarly elusive empirical tradeoff between wages and pension benefits is that for benefits such as a pension, what really matters is not the contribution that the firm makes on the worker's behalf today, but the present discounted value of the pension to the worker (Montgomery et al., 1992). While health insurance does not share the deferred compensation features of a pension (although workers could perhaps desire the option value of a generous health insurance package just in case they should need it), it does share the feature that the "contribution" that the firm makes on behalf of the individual need not closely resemble the value that the individual places on that contribution. Much of the variation in average employer contributions toward health insurance depends not on the value of the health insurance package that is actually provided, but on loading factors and other administrative costs, and the demographic composition of the entire group being insured (Cutler, 1994). While individuals may be willing to accept a wage reduction in return for a more generous health insurance package or because they share the characteristics of the more expensive group to which they belong, it is not clear that they will be willing to accept a wage reduction simply because their employer faces higher administrative costs than other employers or because other employees in the firm are more expensive to insure. The problem, then, is really one of data availability. Empirical researchers typically only have information on the cost to employers of providing health insurance (if that), but the wage reduction that employees are willing to accept depends on the value they place on the insurance, and this may not equal the employer's cost. Thus, the use of cost data can be seen as a type of measurement error which will bias the coefficient on health insurance toward zero, making it more difficult to find evidence of a tradeoff between wages and health insurance even if one exists.

While we have so far painted a rather pessimistic picture of the literature on the relationship between health insurance and wages, there is some evidence that such a tradeoff exists. Gruber (1994) exploits a different source of variation in identifying the tradeoff between wages and health insurance. In the mid- to late-1970s, many states passed laws which required employers who offered health insurance to treat pregnancy and childbirth the same as any other health condition. Before these laws, insurance coverage for expenses related to pregnancy and childbirth was typically extremely limited (see Gruber for more detail). These laws forced employers to provide an expensive benefit that was presumably of value to some employees. Gruber finds that wages for those groups most likely to benefit from the law (women of child-bearing age and husbands of women of child-bearing age) fell in direct proportion to the anticipated cost of the benefit. Overall his results are consistent with a full shifting of employer health insurance costs onto wages.

Finally, Sheiner (1997) estimates the effect of health insurance costs on the wage profile. Sheiner notes that health care costs vary widely across geographic areas with costs in high-cost areas more than double those in low-cost areas (this is based on city-level cost data). Because the cost to employers of providing health insurance increases with employee age, she hypothesizes that the wages of older individuals in high-cost areas should be lower than the wages of older individuals in low-cost areas conditional on other factors which also affect wages. This, indeed, is what she finds. Like those of Gruber (1994), her results suggest that employers are able to shift the cost of health insurance onto the groups who are the most expensive to insure.

Health insurance may also affect wages through mechanisms other than a direct tradeoff between wages and fringe benefits. For example, health insurance has the potential to affect the job matching process. Madrian (1994b) suggests that the costs of relinquishing health insurance upon job change may lead individuals to remain in their current jobs even if higher productivity job alternatives are available (see Section 2.6 for a discussion of the effects of health insurance on job turnover). This productivity loss would presumably result in lower levels of compensation as well. Gruber and Madrian (1997) find evidence that unemployed individuals who have access to continued health insurance coverage while out of work spend more time unemployed (presumably searching for better jobs) and are subsequently reemployed at higher wages. This evidence is at least suggestive that health insurance may impact the process through which workers are sorted into jobs where their productivity is greatest.

3.5. The relationship between health insurance and labor force participation: evidence on employment and hours worked

If there is no price differential between health insurance in the private market and that available through employers, individuals will participate in the labor market if the utility derived from working exceeds the utility derived by not working:

$$\text{Work if } U(C(Y+W), B(Y+W), H) > U(C(Y), B(Y), 0), \tag{18}$$

where C is non-health insurance consumption, B is health insurance consumption, Y is non-labor income, W is labor income, and H is hours worked. The labor force participation decision will depend solely on the tradeoff between the marginal utility of the increased consumption derived from labor income, $\mathrm{d}U/\mathrm{d}W$, and the marginal disutility of work derived from decreased leisure, $\mathrm{d}U/\mathrm{d}H$.

One of the explanations noted above for why employers are the predominant suppliers of health insurance is that individuals can only avail themselves of the favorable tax

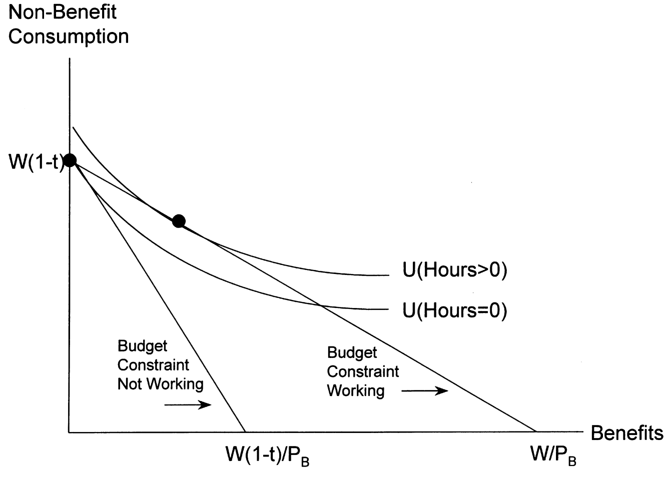

Fig. 4.

treatment and other price reductions associated with employer provision of health insurance by "purchasing" their health insurance from an employer rather than in the private market. An obvious implication is that individuals can only avail themselves of the price reductions associated with employer provision of health insurance if they are in fact employed. If, however, employment reduces the price of health insurance, then the condition for labor market participation is changed:

$$\text{Work if } U(C(Y+W,P),B(Y+W,P),H) > U(C(Y,1),B(Y,1),0), \tag{19}$$

where $P < 1$ is the price of employer-provided health insurance and 1 is the normalized price of health insurance in the private market. Clearly this price reduction expands the opportunity set available to the individual and increases the benefits associated with employment – working confers to the individual not only the marginal utility of labor income, but also a price reduction for the purchase of health insurance As shown in Fig. 4, this may induce labor force participation among some of those who might otherwise not be employed.[19]

The key issue in estimating the effect of health insurance on labor force participation is one of identification: coverage by employer-provided health insurance and labor force participation are jointly determined. Several strategies have been pursued.

[19] As drawn, Fig. 4 assumes that the marginal utility of the income gained from work, $\mathrm{d}U/\mathrm{d}W$, is just offset by the negative disutility of work, $-\mathrm{d}U/\mathrm{d}H$, so that the y-intercept can be treated as unchanged by the decision to work. Alternatively, if the price reduction associated with employer provision of health insurance is obtained with an infinitesimal amount of labor supply and a correspondingly small wage, W is essentially zero as is $-\mathrm{d}U/\mathrm{d}H$ so that the y-intercept is in fact unchanged by the decision to work.

3.5.1. Health insurance and retirement

The most substantial body of literature on health insurance and labor force participation examines the issue of retirement – to what extent does health insurance affect the retirement decision of older workers? There are three main sources of health insurance coverage for older individuals. The first is employer-provided health insurance that is contingent on continued employment. Workers with this type of health insurance coverage face an interesting dilemma. On the one hand, health tends to depreciate with age making retirement more attractive. On the other hand, being in poor health raises the value of employer-provided health insurance, increasing the cost of labor force departure. If health insurance loss is costly, then this type of health insurance coverage will motivate continued employment.

However, not all individuals lose their health insurance upon retirement. The second source of health insurance coverage for older individuals is employer-provided post-retirement health insurance. Some employers continue to provide health insurance coverage to their employees following retirement while others do not. Most post-retirement health insurance for early retirees provides equivalent coverage to that of active workers at a similar cost.[20] For these individuals, health insurance will not be a factor determining when to retire. Rather, the retirement decision will be determined solely by individual preferences and the financial incentives associated with pensions, social security, and other personal assets.

The third type of health insurance coverage for older individuals is Medicare. There are two populations eligible for Medicare coverage: all individuals over the age of 65, and disability insurance (DI) recipients who are under the age of 65. For non-DI recipients with employer-provided post-retirement health insurance, Medicare should, once again, have little impact on retirement. For non-DI recipients with employer-provided health insurance, Medicare reduces the cost of retirement by replacing the health insurance lost through retirement.[21] Thus, the effect of Medicare for these individuals is to postpone retirement until age 65.[22] In contrast, for those who are uninsured or who have employer-provided post-retirement health insurance, there should be no impact of Medicare on retirement. The possibility of Medicare receipt with DI for individuals younger than 65 could also create an incentive for some individuals to leave the workforce in order to qualify for DI. That the level of DI benefits impacts labor force participation and DI receipt among older workers (see, e.g., Leonard, 1986; Bound, 1989; Gruber, 1996) suggests the possibility that Medicare eligibility could have an impact as well.

[20] Presumably retirees have already paid for the full cost of post-retirement health insurance through lower wages during their employment years. To our knowledge, the magnitude of this particular wage-health insurance tradeoff has not been empirically estimated.

[21] In fact, Medicare is much less generous than the typical employer-provided health insurance policy. As a result, the majority of Medicare recipients have some type of supplemental ("Medigap") insurance, either through their former employers or purchased in the private market. The private market for this type of insurance is regulated and is not in general plagued by the adverse selection problems typical of the private market for basic non-group coverage.

[22] Medicare is a commonly cited explanation for the "excess" spike in retirement rates at age 65 beyond what is predicted by the financial incentives associated with pensions and social security.

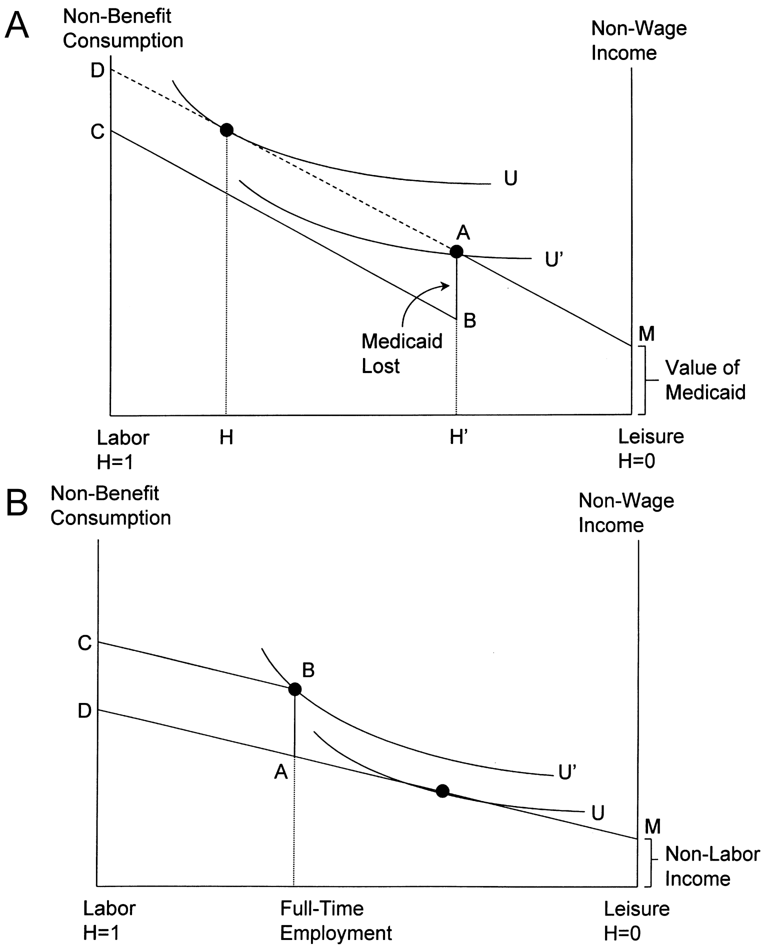

Fig. 5.

What then, is the evidence on whether health insurance affects retirement? Despite using a variety of estimation techniques and several different types of datasets, almost every examination of the topic has found an economically and statistically significant impact of health insurance on retirement. Employer-provided health insurance for active employees is estimated to reduce the retirement rate by about 5% (Blau and Gilleskie, 1997). Estimates of the effect of employer-provided post retirement health insurance suggest that it increases the retirement rate by 30–80% (Gruber and Madrian, 1995; Karoly and Rogowski, 1994; Blau and Gilleskie, 1997) and reduces the age at retirement by 6–24 months (Madrian, 1994a; Blau and Gilleskie, 1997). Blau and Gilleskie (1997) also find that the magnitudes of the effects of both employer-provided health insurance for active employees and employer-provided health insurance for retirees increase with age. Perhaps surprisingly, none of the empirical analyses of health insurance and retirement find evidence that the effects of health insurance vary with health status.

Evidence on the relationship between Medicare eligibility and retirement is much more limited. Identification of the effect of Medicare is complicated by the fact that Medicare eligibility coincides with the social security normal retirement age. Rust and Phelan (1997) use a dynamic programming model in which the effect of Medicare is identified from the expected distribution of medical care expenditures and a risk aversion parameter included in the dynamic program. They find that men with employer-provided health insurance but without employer-provided retiree health insurance are indeed less likely to leave the labor force before age 65 than men whose health insurance continues into retirement. Somewhat paradoxically they find that even after age 65, men with employer-provided health insurance but without employer-provided retiree health insurance have a lower retirement hazard. They suggest that this may be due to the fact that Medicare coverage is much less generous than the "cadillac" health insurance coverage provided by employers. One reason for this, posited by Madrian and Beaulieu (1998), is that employer-provided health insurance typically covers dependents while Medicare does not. Consequently, a labor force departure for an individual with employer-provided health insurance but not post-retirement health insurance will result in a loss of health insurance coverage for *both* one's self and one's spouse. The lack of Medicare dependent coverage creates an incentive for men with employer-provided health insurance who are themselves Medicare eligible to continue working until their wives reach age 65 and are Medicare eligible as well.[23] Madrian and Beaulieu (1998) show that at all ages, the retirement hazard for 55–69 year-old married men increases substantially when their wives reach age 65 and are eligible for Medicare, suggestive evidence of yet another link between health insurance and retirement.

A final piece of evidence on health insurance and retirement comes from an evaluation of the effects of mandatory continuation coverage which allows individuals to maintain their health insurance from a previous employer for a period of up to 18 months.[24] This coverage comes at some cost to the employee and individuals do not receive the same preferential tax treatment enjoyed by employers; they do, however, benefit from the other price-reducing benefits of employer-provided health insurance. In addition, it allows individuals to maintain continuous coverage which may be important in families with medical conditions likely to be denied coverage because of the preexisting conditions

[23] Wives are, on average, 3 years younger than their husbands (Madrian and Beaulieu, 1998).

[24] Minnesota, in 1974, was the first state to pass a continuation of coverage law. These laws mandate that employers must allow employees and their dependents the option to continue purchasing health insurance through the employer's health plan for a specified period of time after coverage would otherwise terminate (the reasons that health insurance might terminate include things such as a job change, a reduction in hours, or an event which would cause a dependent to lose coverage such as a divorce). Several states passed similar laws over the next decade. The federal government mandated this coverage at the national level in 1986 with a law referred to as COBRA. See Gruber and Madrian (1995, 1996) for more detail on continuation coverage laws.

Table 9
Evidence on the effect of health insurance on labor force participation of older individuals[a]

Authors/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Madrian (1994a) D: NMES (1987) S: Men 55–84 NILF D: SIPP(1984, 1985 and 1986 panels) S: Men 55–84 NILF	LF: age of self-reported retirement (NMES), age last worked (SIPP) HI: RHI Health: none	(1) Regression for age at retirement, (2) Probit for retirement before age 65 (sample restricted to ages 70–84)	Effect of RHI on age at retirement: NMES, 14–18 months; SIPP, 5–14 months. Effect of RHI on probability of <65 retirement: NMES, 15 pp; SIPP, 6–7.5 pp
Karoly and Rogowski (1994) D: SIPP (1984, 1986 and 1988 panels) S: Men 55–62 employed during 1st wave	LF: "Permanent" (6 + month) departure from the labor force HI: probability of RHI (imputed from firm size, industry and region) Health: SRHS poor (0/1)	Probit for labor force departure	RHI increases probability of retirement by 8 pp (47%); poor health increases probability of retirement by 15 pp (88%)
Gustman and Steinmeier (1994) D: RHS (1969–1979), NMCES (1977) S: Men 58–63 in 1969	LF: FT work, FT retirement or partial retirement HI: value of EHI and value of RHI imputed from the NMCES Health: none	Structural model of labor force participation (FT work, FT retirement or partial retirement)	RHI delays retirement until age of eligibility for RHI and accelerates it thereafter; overall RHI decreases retirement age by 3.9 months.
Lumsdaine et al. (1994) D: Proprietary data from a single large firm (1979–1988). S: Men and women employed at the firm	LF: Departure from the firm HI: value of EHI and RHI (imputed as average firm cost), value of Medicare (average per person Medicare expenditures) Health: none	Structural model of retirement (departure from the firm)	Value of Medicare has little effect on age at retirement

Table 9 (*continued*)

Authors/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Gruber and Madrian (1995) D: CPS March 1980–1990 S: Men 55–64 worked in previous year D: SIPP 1984–1987 Panels S: Men 55–64 worked in 1st wave	LF: Self-reported retirement (CPS), departure from the labor force (SIPP) HI: availability and months of continuation coverage Health: none	(1) CPS: Probit for self-reported retirement (CPS), (2) SIPP: Hazard for labor force departure	Effect of 1 year of continuation coverage: increases retirement hazard by 30%; similar effects in CPS and SIPP; no apparent differences by age
Headen et al. (1995) D: CPS August 1988 S: Men and women 55–64 either active workers or self-reported retirement	LF: Categorical length of time retired (active worker, retired <2 years, 2–4 years, 5–9 years, 10 + years) HI: EHI Health: covered by Medicare (proxy for disability status)	Ordered probit for length of time retired	Effect of RHI: increases probability of being retired by 6 percentage points (30%); effect stronger at younger ages. Medicare increases the probability of being retired by 48 percentage points (280%)
Gruber and Madrian (1996) D: CPS MORG 1980–1990 S: All men 55–64	LF: Self-reported retirement and NILF HI: availability and months of continuation coverage Health: none	Probit for self-reported retirement or being NILF	Effect of 1 year of continuation coverage: increases probability of self-reported retirement by 1.1 percentage points (5.4%); increases probability of being NILF by 1.0 percentage points (2.8%)
Hurd and McGarry (1996) D: HRS (wave I) S: Men 51–61and women 46–61, full-time, not self-employed	LF: Self-reported probability of working FT after age 62 and after age 65 HI: EHI, RHI Health: SRHS, self-reported prospective mortality	Non-linear regression for probability of working full-time past age 62 or age 65	EHI increases probability of working past age 62 (but insignificant) and age 65 (5.3 pp). RHI decreases probability of working past age 62 (5.3 pp); smaller impact on working past 65. Poor health or higher prospective mortality decrease probability of working past 62 or 65

Rust and Phelan (1997) D: RHS (1969–1979) S: Men 58–63 in 1969 without a pension	LF: Categorical employment status of FT, PT or NILF HI: EHI, PHI or RHI, MCD, NI Health: SRHS	Structural dynamic programming model of labor supply	PHI, RHI and MCD decrease FT work by 10.0 pp (12%) at ages 58–59, 20.0 pp (29%) at ages 60–61, and 16.2 pp (25%) at ages 62–63 Poor health decreases FT work by 4.4 pp (5.1%) at ages 60–61, 5.0 pp (6.3%) at ages 62–63
Blau and Gilleskie (1997) D: HRS (waves I and II) S: Men 51–61 in 1992	LF: Employment transition from wave I to wave II is same job (J-J), new job (J-NJ), exit LF (J-N) or enter LF (N-J) HI: EHI, SHI, RHI Health: SRHS fair or poor (0/1)	Dynamic multinomial logit for employment transition between waves (omitted group is no transition). Model allows for unobserved heterogeneity and endogeneity of initial job characteristics	Effect of RHI on employment transitions: ↓ J-J transition by 4.1–5.3 pp (50–65%); ↑ J-N transition by 2–6 pp (26–80%); ↑ N-J transition by 1–3.3 pp (6–20%). No differential effects by age or health status. No effect of SHI on any transitions
Rogowski and Karoly (1996) D: HRS (waves I and II) S: Men 51–61 in 1992 employed full-time in 1992	LF: NILF and self-reported retirement in wave II HI: EHI, RHI, PHI Health: 2+ self-reported chronic conditions (0/1), BMI, SRHS, ADL impairments	Probit for retirement between Wave I and Wave II	RHI increases retirement probability by 4.3 pp (62%). No significant interaction between RHI and health status. No significant impact of other types of HI
Madrian and Beaulieu (1998) D: US Census (1980 and 1990) S: Married men 55–69 who worked 1+ week in the previous calendar year	LF: NILF HI: spouse is age eligible for Medicare Health: none	OLS linear probability model for being NILF	The probability of retirement increases with the age of a man's spouse until the spouse becomes eligible for Medicare at age 65, after which the retirement hazard is constant

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

exclusions that are pervasive in private market policies and many employer-provided policies as well. The value of identifying the effect of health insurance on retirement from this type of health insurance coverage is that in contrast to post-retirement health insurance, it is completely independent of omitted personal characteristics that may be correlated with both post-retirement health insurance and the incentives to retire, and it is completely independent of omitted job characteristics, such as pension plan provisions, that may be correlated with both employer-provided and retiree health insurance. Thus, it provides a relatively clean source of variation for identifying the effect of health insurance on retirement. Gruber and Madrian (1995, 1996) find that such coverage increases the retirement hazard by 30%. This effect, while large, is about half that estimated by Blau and Gilleskie (1997) for the effect of employer-provided retiree health insurance on retirement. One would expect the effect of continuation coverage to be smaller than that of retiree health insurance because continuation coverage is of only limited duration (18 months for most individuals) while retiree health insurance typically lasts at least until individuals become eligible for Medicare.

Despite the consistency of the evidence that there is an effect of health insurance on retirement, there is still quite a lot of research to be done in quantifying the magnitude of this effect. This is due in large part to data constraints that limit the reliability or the generality of the results in the current literature.[25] Recent research on retirement has recognized that for many individuals, retirement is not the "absorbing state" that simplified theories portray it to be. A non-trivial fraction of workers move from full-time employment to part-time employment and then to complete retirement (see Ruhm, 1990; Perachhi and Welch, 1994 for a more complete discussion of "bridge jobs" to retirement). Many other older workers make several transitions in and out of the labor force before making the final "absorbing" switch to retirement. And a sizeable fraction of non-retired workers state a preference for a gradual transition from work to retirement (Hurd and McGarry, 1996). Health insurance, however, may be an important factor limiting the ability of workers to "retire" as they wish. Because health insurance is usually attached to full-time rather than to part-time work, it may be difficult for workers to gradually transition to part-time work if doing so involves relinquishing health insurance. Rust and Phelan (1997) estimate that men with employer-provided retiree or other non-employment based health insurance are much less likely to be working full-time than men whose employers provide health insurance but not retiree health insurance, but they are much more likely to be working part-time. This suggests that health insurance may indeed be an important factor determining whether older workers are able to make a gradual transition from work to retirement as desired.

[25] Data limitations include the lack of information on pension plan availability (Madrian, 1994a; Karoly and Rogowski, 1994; Gruber and Madrian, 1995, 1996) or lack of information on specific pension plan incentives (Rogowski and Karoly, 1997; Blau and Gilleskie, 1997); the lack or quality of measures of employer-provided or retiree health insurance (Gustman and Steinmeier, 1994; Karoly and Rogowski, 1994; Madrian 1994a; Rust and Phelan, 1997); the restrictiveness of the sample (Rust and Phelan, 1997; Lumsdaine et al., 1994); and the age of the data (Gustman and Steinmeier, 1994; Rust and Phelan, 1997).

Consistent with most of the retirement literature, the literature on health insurance and retirement has focused almost exclusively on men. This is because the labor force participation rate of older women has historically been low, and among older women who do work, a sizeable fraction are in fact insured by their husbands. Consequently, it has been assumed that the potential behavioral impact among women is small. As the labor force participation rate of older women increases, however, and as an increasing number of older women become the sole head of household or the primary insurers of their families, the question of whether health insurance impacts women differentially than men warrants further investigation.

3.5.2. Health insurance and the labor supply of lower income women

Retirement may be the most-studied, but it is not the only aspect of labor force participation that may be impacted by the availability of health insurance. Because the vast majority (89%) of prime-aged men work regardless of whether or not they receive employer-provided health insurance, the group whose labor force participation decisions are most likely to be impacted by the availability of health insurance are women, particularly married women. One group of women for whom health insurance is likely to be particularly important are unskilled, less educated, single mothers. As parents, they are likely to have a higher demand for health insurance coverage than single women without children. But, as single women, these individuals do not have access to health insurance coverage through their spouses. And, as unskilled workers they are qualified for primarily low wage jobs–jobs which are much less likely to come with health insurance because, as noted in Section 3.4, employer provision of health insurance is positively correlated with wages. One source of health insurance coverage that is potentially available to these women is Medicaid. However, until recently, welfare participation was a virtual precondition for the receipt of Medicaid benefits: employment which generated income sufficient to disqualify an individual from receiving further welfare benefits also disqualified an individual from further receipt of Medicaid. Thus, many low income (primarily female) workers faced a choice between not working or working part-time and receiving Medicaid, or working full-time and losing both welfare benefits and Medicaid coverage. The budget set for these individuals is shown by budget constraint MABC in Fig. 5A. As depicted in Fig. 5A, the non-linearity in the budget set generated by the loss of Medicaid (segment AB) created an incentive to reduce labor supply from H to H'.

Because Medicaid participation has historically been collinear with welfare participation, the "Medicaid effect" on labor supply was difficult to distinguish from the "Welfare effect".[26] Two identification strategies have been pursued. The first exploits the fact that a series of legislative initiatives in the late 1980s severed the link between Medicaid and welfare participation for various groups of mothers and children. These initiatives allowed women to maintain their Medicaid coverage for a pre-specified period of time after leaving

[26] This also suggests that estimates of the effect of AFDC on labor supply that do not recognize the colinearity of AFDC and Medicaid may overstate the effects of AFDC.

welfare, and extended Medicaid coverage to many groups of low-income children indefinitely (in terms of Fig. 5A, these initiatives change the budget constraint from MABC to MD). Yelowitz (1995) finds evidence that these expansions in Medicaid availability led to a small but statistically significant increase in the labor force participation rate of single mothers. A second identification strategy exploits variation in the demand for health insurance coverage generated by differences in expected medical expenditures. Using this approach, Moffitt and Wolfe (1992) find that the value of maintaining Medicaid coverage had a significant negative impact on the labor force participation rate of single mothers.[27]

3.5.3. Health insurance and the labor supply of married women

Married women are a second group whose labor force participation is likely to be impacted by the availability of health insurance coverage. Relative to men or single women, married women are typically estimated to have a large labor supply elasticity. Given their responsiveness to wage changes, one might expect a sensitivity to the availability of health insurance coverage as well. Because most companies that offer health insurance make it available to both individuals and their dependents, many married women receive health insurance coverage through their spouses. The availability of this type of health insurance coverage is thus analogous to the availability of retiree health insurance for older workers.

In fact, the labor supply decision of individuals is somewhat more complicated than that presented earlier for retiree health insurance because one of the "rules" of employer-provided health insurance provision is that most employers do not provide health insurance benefits to part-time workers.[28] As shown in Fig. 5B, this creates a non-convexity in the choice set faced by individuals. In the absence of employer-provided health insurance, individuals face choice set MD. If individuals obtain health insurance only when they reach full-time employment, then there is a discrete jump in the value of employment at this point, as illustrated by choice set MABC. (Note that this choice set presumes that there is in fact a discrete jump in the value of employment when an individual obtains health

[27] Yelowitz (1995) also finds that the Medicaid expansions lead to a 3.5% decrease in the AFDC participation rate; Moffitt and Wolfe (1992) obtain similar results – an increase in the value of Medicaid leads to an increase in the AFDC participation rate.

[28] Seventy-seven percent of full-time workers in large firms receive health insurance benefits; in contrast only 19% of part-time workers receive similar benefits (US Department of Labor, 1995). There are several reasons why firms are less likely to provide health insurance to part-time than to full-time workers. First, employers may find it more difficult to pass the cost of health insurance onto part-time employees because the necessary wage reduction for a part-time worker will be disproportionately greater than that for a full-time worker and thus employers are more likely to be constrained by minimum wage laws. Second, as is discussed later in Section 3.5, health insurance is a fixed cost of employment. Consequently, employers can reduce their expenditures on this fixed cost (and others) by hiring fewer full-time workers rather than more part-time workers. Employers create "demand" amongst workers for full-time rather than part-time employment by offering health insurance only to full-time workers. Third, employers are constrained in their ability not to offer health insurance to full-time workers. Health insurance non-discrimination laws stipulate that employers who provide health insurance must make it available to almost all full-time workers; part-time workers, however, are exempt from these rules (as are temporary or seasonal workers). Thus, some full-time workers who do not value health insurance may in fact receive it in order to satisfy the non-discrimination rules.

insurance. As noted above in Section 3.4, economic theory suggests that there should be an equivalent drop in wage compensation when health insurance benefits are provided, and this would leave the choice set unchanged at MD. Most of the empirical evidence presented above on the wage-health insurance tradeoff is, however, not inconsistent with the view that there is a discrete jump in the value of compensation associated with health insurance provision.)

The identification of the effect of health insurance on labor force participation and hours worked comes from comparing the labor force participation and hours worked of married women whose husbands have employer-provided health insurance with the labor force participation and hours worked of married women whose husbands do not. This identification strategy rests on the assumption that a husband's employer-provided health insurance is exogenous. This assumption is clearly problematic if husbands and wives make joint labor supply and job choice decisions. Putting this caution aside, both Olson (1997) and Buchmueller and Valletta (1999) find strong evidence that the employment and hours decisions of married women do in fact depend on whether or not health insurance is available through a spouse's employment. Buchmueller and Valletta estimate that the availability of spousal health insurance reduces the labor force participation of married women by 6–12%; Olsen estimates a similar 7–8% reduction in labor force participation. Using a multinomial logit to categorize employment outcomes (full-time jobs with health insurance, full-time jobs without health insurance, part-time jobs with health insurance, part-time jobs without health insurance, and non-employment), Buchmueller and Valletta also estimate that spousal health insurance reduces the probability of working in a full-time job with health insurance by 8.5–12.8 percentage points, increases the probability of working in a full-time job without health insurance by 4.4–7.8 percentage points, and increases the probability of working in a part-time job by 2.8–3.3 percentage points. Using an interesting application of semi-parametric estimation techniques, Olsen estimates an average decline in weekly hours of 7–15% (3–4 h per week) for married women whose husbands have health insurance.

Olsen also shows how sensitive the estimated labor supply outcomes can be to econometric specification and the underlying identification assumptions. For example, he shows that probit and Tobit estimates of the effect of husband's health insurance on the labor force participation and hours worked of wives significantly overstate those obtained from semi-parametric estimation.[29] In estimating the effect of having a job with health insurance on wives' hours worked, Olsen also finds serious discrepancies in the results estimated using a Heckman correction versus an instrumental variables approach to account for the endogeneity of health insurance coverage. In the instrumental variables estimation, the availability of health insurance from a husband's job is used as an instrument for health insurance coverage in the wife's job. In the Heckman approach, an initial regression for the probability of a wife having her own employment-based health insurance which

[29] Mroz (1987) also argues that the Tobit specification leads to an overestimate of female labor supply elasticities.

Table 10
Evidence on the effect of health insurance on labor force participation of non-elderly individuals[a]

Authors/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Blank (1989) D: NMCUES (1980) S: Female heads of household with at least one child <21	LF: (1) HPW, (2) AFDC participation HI: state-specific value of MCD for 1 adult+3 child household Health: (1) Number of restricted activity days of head and of others in household, (2) activity limitation of head (0/1), (3) household average SRHS	Joint estimation of AFDC participation (probit), Medicaid participation (probit), and hours worked (Tobit)	Value of MCD has no impact on AFDC participation (effect on HPW and LFP not estimated). All health measures have negative impact on hours worked and positive impact on AFDC participation.
Winkler (1991) D: CPS March (1986) S: Female heads of household 18–64 with at least one child <18	LF: (1) LFP, (2) Annual hours, (3) AFDC participation HI: state-specific value of MCD for family of 3 Health: none	(1) Probit for LFP, (2) Heckman 2-step for hours worked, (3) Tobit for hours worked, (4) Probit for AFDC participation	Effect of 10% increase in value of MCD: 1 pp decline in LFP; No impact on hours or AFDC participation
Moffitt and Wolfe (1992) D: SIPP (1984 panel, waves 3 and 9) S: Female heads of household NMCUES (1980)	LF: (1) LFP, (2) AFDC participation HI: family-specific value of expected medical expenditures if covered by (1) MCD, or (2) PHI; state-specific value of MCD Health: none	(1) Expected medical expenditures under MCD and PHI imputed from the NMCUES based on personal characteristics and SRHR and disability status, (2) Probit for LFP, (3) Probit for AFDC participation	Effect of $50/month increase in value of MCD: 2.0 pp ↑ in AFDC participation rate; 5.5 pp ↓ in LFPR. Effect of $50/month increase in value of PHI: 5–7 pp ↓ in AFDC participation rate; 12–16 pp ↑ in LFPR. State-specific value of MCD has no effect on AFDC participation or LFP

Yelowitz (1995) D: CPS March (1989–1992) S: Single women 18–55 with at least one child <15	LF: (1) LFP, (2) AFDC participation HI: extent to which MCD eligibility is independent of AFDC recipiency Health: none	Probit for LFP and AFDC participation	Effect of expansions in MCD eligibility: 1 pp (1.4%) increase in LFP; 1.2 pp (3.5%) decrease in AFDC recipiency
Montgomery and Navin (1996) D: CPS March (1988–1993) S: Single women aged 18–65 with at least one child <15	LF: (1) LFP, (2) HPW HI: State MCD spending per recipient, per adult recipient, per child recipient, per scaled family Health: none	(1) Probit for LFP, (2) OLS hours (Heckman correction for participation), (3) Includes state fixed effects (FE), (4) Includes state random effects (RE)	10% increase in value of MCD w/o FE, RE or IV leads to a 0.36 pp decrease in LFP (0.6%) and a increase in HPW of 0.04–0.10 h (0.11–0.25%). With state RE the effect on LFP substantially reduced and no effect on HPW. With state FE no effect on LFP or hours
Buchmueller and Valletta (1997) D: CPS April EBS (1993) S: Married women 25–54 not self-employed	LF: (1) LFP, (2) HPW, (3) Job has HI HI: SHI, spouse offered SHI, EHI Health: none	(1) Probit for LFP, (2) Tobit for LFP and hours worked, (3) Multinomial logit for NILF and hours in combination with whether or not job has HI	SHI reduces LFP by 6–12% (probit) and reduces HPW by 15–36% (Tobit). Multinomial logit: SHI reduces probability of FT work with EHI by 8.5–12.8 pp; increases probability of FT work w/o EHI by 4.4–7.8 pp; increases probability of PT work by about 3 pp
Olsen (1997) D: CPS March (1993) S: Married women <64 in single family households	LF: (1) LFP, (2) HPW HI: EHI, SHI Health: none	(1) Probit for LFP, (2) Tobit for LFP and HPW, (3) OLS for HPW $\mid$ HPW $>$ 0, (4) Heckman 2-step for HPW $\mid$ HPW $>$ 0, (5) IV for HPW $\mid$ HPW $>$ 0 (EHI instrumented by SHI), (6) Semiparametric analysis of HPW and LFP	Probit: SHI reduces LFP by 8.2 pp (11%). Tobit: SHI reduces LFP by 7.1 pp (8.5%) and HPW by 5.3 pp (20%) Effect of EHI on hours depends on estimation technique: OLS (+6.1 h), Heckman (+3.7 h), IV(+9 h). With semiparametric analysis SHI reduces HPW by 2.8–3.9 pp (7–15%); SHI reduces LFP (magnitude not given)

Table 10 (*continued*)

Authors/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Wellington and Cobb-Clark (1997) D: CPS March (1993) S: Married couple households with both husband and wife 24–62 and not covered by CHAMPUS, MCR or MCD	LF: (1) LFP, (2) Annual hours HI: SHI, SHI only Health: none	(1) Bivariate probit for husbands' and wives' LFP, (2) OLS for hours (2SLS and 3SLS estimated with similar results and not reported)	SHI reduces LFP by 19.5 pp (23%) for both white and black women; reduces LFP by 4.1 pp (4%) for white men and by 9.1 pp (10%) for black men. SHI reduces annual hours by 17% for white women, 8% for black women, 4% for white men, and has no effect for black men
Chou and Staiger (1997) D: Taiwan Survey of Family Income and Expenditure (1979–1985 and 1991–1995) S: Married women	LF: LFP HI: Availability of non-employment based HI Health: none	Probit for LFP	The availability of non-employment based HI reduces LFP by 2.5–6.0 percentage points; effects are larger for wives of less-educated husbands
Gruber and Madrian (1997) D: SIPP (1984–1988 panels) S: Men aged 25–54 employed in first wave	LF: (1) Transition from employment to NILF, (2) Weeks NILF, (3) Earnings HI: EHI, continuation coverage Health: none	(1) Probit for transition from employment to NILF, (2) OLS for weeks NILF, (3) OLS for re-employment earnings	Continuation coverage increases the transition from employment to NILF by 15%, increases time NILF by 15%, and increases reemployment earnings by 22%

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

includes the availability of health insurance from a husband's job as a regressor is estimated. This is used to calculate the inverse Mill's ratio which is then included as a regressor in the hours equation (health insurance from a husband's job is excluded from the hours equation). The IV and Heckman estimation should yield identical results if the underlying identification assumptions are met. Olsen attributes the differences to the fact that the validity of the Heckman correction rests on a bivariate normal distribution of the error terms while a plot of the residuals shows that they are clearly not normally distributed.

In one of the few studies of health insurance and the labor market using non-US data, Chou and Staiger (1997) examine the effects of health insurance on spousal labor supply in Taiwan. Before March, 1995 when Taiwan implemented a new National Health Insurance program, health insurance was provided primarily through one of three government-sponsored health plans which covered workers in different sectors of the economy. Historically these plans covered only workers and not their dependents. Thus, own employment was the only way for most individuals to obtain health insurance. There was one exception – coverage for spouses was extended to government workers in 1982, and subsequently to children and parents as well. By exploiting this variation in the availability of dependent health insurance coverage, Chou and Staiger are able to identify the effect of health insurance on employment. They estimate that the labor force participation rate of women married to government employees declined by about 3% after they were able to obtain coverage as spousal dependents relative to the labor force participation rate of women married to other private-sector workers. They estimate similar declines in labor force participation for the wives of private-sector workers following the 1995 implementation of National Health Insurance which made health insurance available to all individuals.

3.5.4. Other evidence on health insurance and labor supply

In the only study of health insurance and employment among prime-age men, Gruber and Madrian (1997) exploit the continuation of coverage mandates discussed above to consider the impact of health insurance on the transition from employment to non-employment and on the subsequent duration of non-employment. They find that mandated continuation coverage increases the likelihood of experiencing a spell of non-employment by about 15%. It also increases the total amount of time spent non-employed by about 15%. Although Gruber and Madrian note that the availability of health insurance while without a job might be expected to increase the duration of non-employment spells, they are unable to test this proposition because the effect of health insurance on transitions from employment to non-employment implies the possibility of a composition effect in the group of individuals who are non-employed. This issue is, however, clearly one of interest, and warrants further research.

Finally, the literature on workers' compensation and employment outcomes and on Disability Insurance and employment outcomes is also relevant here. Workers' compensation is a state-mandated employer-provided insurance program which furnishes income replacement and medical benefits to employees who are injured while performing work-related duties.[30] Disability Insurance is a federal social insurance program which provides cash benefits and health insurance through Medicare for individuals with long-term disabilities which preclude them from gainful employment. Both Workers' Compensation and Disability Insurance can be viewed as providing a very broad type of "health" insurance. Like more traditional health insurance, these programs cover the medical expenditures associated with workplace injuries and/or permanent disability. In addition, however, they also provide insurance against the income loss associated with workplace injuries and permanent disability. The empirical evidence on workers' compensation suggests that when the income replacement rates are increased, the take-up rate for workers' compensation benefits increases (Krueger, 1990) as does the duration of workplace injuries (Meyer et al., 1995). By extension, then, this type of insurance leads to a reduction in labor supply. The literature on disability insurance and employment also suggests that the level of potential benefits impacts labor force participation behavior, although the magnitude of these effects is the subject of some dispute (see chapter by Bound and Burkhauser in this volume for a review of the literature on Disability Insurance).

Overall, the body of empirical literature on the effects of health insurance on labor supply gives strong and consistent support to the notion that health insurance affects individual labor supply decisions. When there is a ready source of health insurance available not attached to one's own employment, individuals (particularly older workers and married women) are much less likely to be employed. This suggests that the institutional link between health insurance and employment may be a significant factor in the employment decisions of individuals.

3.6. Health insurance and job turnover

Another important labor market outcome affected by the availability of health insurance is job turnover. In the standard model of job turnover, individuals change jobs when the value of the alternative job exceeds the value of the current jobs. When health insurance is attached to employment, turnover involves not only changing jobs, but also changing health insurance. If employees place a high value on health insurance, the type and cost of health insurance coverage available from one employer relative to another will impact their job choice decisions. Thus, individuals will only change jobs if:

$$W_A + VHI_A > W_C + VHI_C, \tag{20}$$

where W denoted wages, VHI denotes the value of health insurance, and the subscripts C and A refer to the current and an alternative job respectively. Consider an employee in a job which currently offers health insurance who is considering an outside offer from another company that also offers health insurance. If the basic model underlying the

[30] Each state in the US has its own Workers' Compensation program; in addition, the federal government has two programs to cover federal employees and longshore and harbor workers. The exact nature of the insurance provided under each of these programs varies widely (e.g., the maximum level of income replacement benefits will differ from one state to another). Employer participation is mandatory.

wage-health insurance tradeoff outlined in Section 3.4 holds and employees value health insurance at the cost to their employers of providing it, then health insurance is just another component of the compensation package and its effects on turnover should be no different than receiving the cash equivalent of health insurance in wage compensation.

In practice, however, the role of health insurance in job turnover may be much more complicated. There are several things worth noting. First, since it is the employee making the decision about whether or not to change jobs, it is the value of health insurance *to the employee* that matters, not the actuarial cost of providing such health insurance to the employer. (This assumes that to the extent there is a wage-health insurance tradeoff, employers reduce wages for any particular employee by the *average actuarial cost* of providing health insurance to the whole group of employees rather than reducing the wages of any given employee by either the employee's actual health insurance costs – in which case the employer would just be acting as a payment middleman rather than providing any actual insurance – or by the employee's actuarially projected costs – in which case the employer does not give the employee any of the advantages associated with risk pooling. Note that this assumption is consistent with the traditional treatment of other job amenities that generate compensating wage differentials – the employer provides a wage/job amenity package to all employees rather than negotiating a separate wage trade-off individually. As noted in Section 3.4, however, Gruber (1994) and Sheiner (1997) both find evidence that employers can engage in somewhat more refined wage shifting).

Second, the value of health insurance may vary widely across employees, depending on a variety of factors – many of them discussed in Section 3.3 – including family size, health status, risk aversion, and the availability of alternative sources of health insurance. This implies that employees who place a high value on their own employer-provided health insurance are receiving greater "compensation" than employees who place a low value on their own employer-provided health insurance.

Third, the value of health insurance in the current job may differ significantly from the value of health insurance on an alternative job for a variety of reasons: the alternative job may not offer health insurance, the employee or his/her dependents may have preexisting conditions that will not be covered under the alternative health insurance, there may be differences in parameters such as copayment rates or deductibles so that one package is more attractive than another, or the health plans may be restricted to different sets of physicians so that a change in health insurance also involves severing the current doctor/patient relationship. Taken together, these factors suggest that even if two companies offer equivalent health insurance packages that are of equal value to *current* employees who are also "equivalent", the value of the "same" health insurance package may be much less for a new employee than for an existing employee if the package excludes preexisting conditions or requires a change in physicians. Thus, workers with family health problems or who place a high value on seeing their current doctor are in essence earning "health insurance rents" on their current job. This will act to discourage voluntary job turnover among this group of employees.

Finally, note that from the perspective of an employer who offers health insurance, a

Table 11
Evidence on the effect of health insurance on job turnover[a]

Author/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Mitchell (1982) D: QES (1973, 1977)	LF: Voluntary job change and job departure HI: EHI Health: none	Probit for job change and job departure	No effect of health insurance on job change or job departure
Cooper and Monheit (1993) D: NMES (1987) S: Wage earners 25–54 not covered by governmental HI	LF: Voluntary job change HI: EHI, SHI, PHI Health: recording of self-reported chronic conditions to reflect whether they would lead to denial of HI coverage, exclusion of coverage for those conditions, or higher premiums	I. Estimate reduced form job change probit and calculate inverse Mill's ratio; II. Estimate change in wage and HI as a function of turnover (including Mill's ratio); III. Compute difference between actual and predicted wage and HI associated with job change; IV. Include these variables in probit for job change	EHI reduces turnover by 25% for married women, 38% for married men, 29% for single men, and 30% for single women Being likely to gain HI as a result of turnover increases turnover by 28–52%; being likely to lose HI as a result of turnover reduces turnover by 23–39%. The effect of health conditions on turnover varies in sign and significance with condition
Madrian (1994b) D: NMES (1987) S: Married men 20–55 employed but not self-employed at first interview	LF: Voluntary job departure HI: EHI, SHI, PHI Health: pregnancy	(1) Probit for job departure, (2) Random effects probit for job departure	EHI reduces turnover by 25–30% when identified from SHI, by 32–54% when identified from family size, and by 30–71% when identified from pregnancy; these magnitudes correspond to expected medical expenses for each group
Gruber and Madrian (1994) D: SIPP (1984–1987 Panels) S: Men 20–54 not self-employed	LF: Job departure HI: EHI, availability and months of continuation coverage Health: none	Probit for job departure	One year of continuation coverage increases job turnover by 10%

Holtz-Eakin (1994) D: PSID (1984–1987) S: Men and women 25–54 employed full-time in 1984 D: GSOEP (1985–1987) S: Not specified (presumably similar to PSID)	LF: 1-year and 3-year job change HI (PSID): EHI, SHI HI (GSOEP): HI premium likely to increase with job change PSID Health: (1) SRHS in 1984, (2) SRHS in 1986 (future health), (3) change in SRHS from 1982–1984 (worse health), (4) work limitation (0/1)	Probit for job change	PSID: No effect of EHI on job turnover GSOEP: Some estimates are significant and suggest that HI does reduce turnover, but results are sensitive to the definition of whether the HI premium is likely to increase and are not consistent across various samples (married men, single men, single women); paper only presents probit coefficients–no marginal probabilities calculated
Penrod (1995) D: SIPP (1984) panels 3–9, NMCUES (1980) S: Men 24–55 who are employed but not self-employed	LF: Voluntary job departure HI: EHI, SHI Health: SRHS, predicted medical care expenditures, pregnancy, medical care utilization, disability status	Probit for job departure	Finds little evidence supporting an effect of health insurance on job departure
Buchmueller and Valletta (1996) SIPP (1984 panel) Individuals 25–54 employed but not self-employed in August 1984	LF: 1-year job change HI: EHI, SHI Health: none	(1) Probit for job change, (2) Jointly endogenous probit for job change in dual-earner couples (I. Estimate reduced form probit for husbands and wives. II. Form fitted probabilities. III. Include fitted probability for spouse's job change in job turnover probit)	EHI reduces turnover by 35–59% for married men, 37–53% for married women, 18–33% for single men, and 35% for single women. Among those with EHI, SHI increases turnover by 26–31% for married men and 34–38% for married women. Endogenous probit estimates of similar magnitude but slightly reduced significance. In general estimated magnitudes are stable but statistical significance varies

Table 11 (*continued*)

Author/dataset/sample	Labor force, health insurance and health measures	Estimation techniques	Results
Holtz-Eakin et al. (1996) D: SIPP (1984, 1986 and 1987, Panels waves 3–6; 1985, Panel waves 5–8) S: Individuals 16–62 D: PSID (1984–1986) S: Individuals 16–62 working 5+ h/week	LF: 1-year (SIPP) and 2-year (PSID) transitions from employment to self-employment HI (SIPP and PSID): EHI, SHI, months of continuation coverage Health (SIPP): (1) disabled child (0/1), (2) hospital nights and Dr. visits in last 4 months and last 12 months, (3) predicted medical expenditures Health (PSID): SRHS	Logit for transition from employment to self-employment	No significant impact of HI on job-to-self employment transitions in either the SIPP or the PSID using a variety of measures for the value of maintaining one's EHI
Anderson (1997) D: NLSY (1979+) S: Non- self-employment jobs held by men and women older than age 20	LF: Job duration, job departure HI: EHI, other HI Health: pregnancy, work limitation	(1) Proportional hazard for job departure, (2) Probit for job departure	EHI reduces job mobility for those for whom losing coverage would be costly; the lack of EHI increases mobility for those who would benefit most by attaining it
Slade (1997) D: NLSY (1979–1992) S: Continuously employed men and women who were interviewed at least 8 times after reaching age 21	LF: Job change HI: (1) EHI, (2) state PHI coverage rate, (3) state hospital room charge rate Health: illness-related work absence	(1) Probit for job change, (2) Probit for HI coverage, (3) Discrete factor probit model for job departure and HI coverage with correlated errors, (4) Fixed effect probit for job change	Individuals who change jobs frequently are less likely to be employed in jobs with HI Effect of HI availability and demand for HI on job change is sensitive to empirical specification

Kapur (1998) D: NMES (1987) S: Married men 20–55 employed but not self-employed at first interview; not laid-off during the sample year	LF: Voluntary job departure HI: EHI, SHI Health: (1) number of chronic medical conditions in family, (2) cost-weighted medical conditions index, (3) health utilization index	Probit for job departure	No significant or substantive impact of health insurance on job departure

[a] See Appendix A for an explanation of the dataset and other acronyms used in the tables.

sick employee is potentially costly in two ways. First, a sick employee may have reduced productive capacity. Second, a sick employee (or a healthy employee with sick dependents) is likely to generate higher medical expenditures. If employers are constrained in their ability to reduce compensation in accordance with either the reduced productivity of sick employees or their increased health expenditures (either because of administrative pay practices, minimum wage laws, or anti-discrimination legislation), such employees become relatively more attractive targets for layoffs. Thus, health insurance and health may affect both voluntary and involuntary job turnover.

The identification strategy pursued in most analyses of job turnover has been to compare the probability of turnover of otherwise observationally equivalent employees who differ only in the value that they are likely to place on a current employer's health insurance policy. Various measures of the value of health insurance have been used. In an empirical analysis of the turnover of married men, Madrian (1994b) uses the availability of a non-employment based source of health insurance, family size, and whether or not a spouse is pregnant as measures of the value of maintaining one's own employer-provided health insurance. She concludes that employer-provided health insurance reduces the magnitude of job turnover by 25%. Cooper and Monheit (1993) and Buchmueller and Valletta (1996) obtain estimates that are of a similar magnitude. Cooper and Monheit identify the effect of health insurance on job turnover from the likelihood that an individual will gain or lose health insurance by changing jobs. Buchmueller and Valletta identify the effect of health insurance from both the availability of spousal health insurance and from the inclusion of an exhaustive set of controls meant to purge the health insurance coefficient of its correlation with the error term. Both Cooper and Monheit and Buchmueller and Valletta also examine the turnover of both women and men. They find that the effects of health insurance on turnover are of a similar magnitude for both women and men, perhaps slightly larger for women. Gruber and Madrian (1994) base their identification off of continuation of coverage laws (see the discussion above in Section 3.5.1 in the context of retirement). They also find that health insurance reduces job turnover. Their effects are of a somewhat smaller magnitude, but this is to be expected given that the type of health insurance coverage they consider is of only limited duration. Using the NLSY, Anderson (1997) finds evidence of both reduced turnover among those with health insurance who also have a higher demand for maintaining such coverage, and of higher turnover among those without health insurance who have a high demand for obtaining insurance coverage.

In contrast, Holtz-Eakin (1994), Penrod (1995), Slade (1997) and Kapur (1998) all find little evidence to substantiate claims of job-lock. The first three of these papers all use identification strategies similar in spirit to those described above. Slade takes a somewhat different approach, using state-wide availability of health insurance and hospital room charges as direct proxies for the value of maintaining coverage rather than the methodology used throughout much of the rest of the literature.

Holtz-Eakin also considers the impact of health insurance on job turnover in Germany and finds no effect there either. It is not clear, however, whether one would even expect health insurance to affect job turnover in Germany given that the institutional and legal relationship between employment and health insurance provision is much different in Germany than it is in the US. In Germany, low and middle income workers receive mandatory health insurance from an insurance fund chosen by their employer. This health insurance is financed by a payroll tax which, by statute, is split evenly between the employee and the employer. The level of this payroll tax varies by firm and is based on the average cost of insurance within each insurance fund. Higher income workers may participate voluntarily in this same system; alternatively, they may purchase private insurance or choose to go uninsured. For those higher income workers who do not participate in the mandatory system, health insurance is not attached to employment and there is no potential for job-lock. For workers in the mandatory system, the health insurance "cost" of changing jobs consists not of the possibility that preexisting conditions may be uncovered, but of a possible increase in the payroll tax used to finance health insurance premiums. Whether this should, in fact, affect turnover decisions depends on the incidence of the payroll tax. If German workers employed in companies with high health insurance payroll taxes are compensated with higher wages so that their after-tax income is the same as if they were employed in a different firm with a lower payroll tax, then there is little reason to think that health insurance would affect turnover in Germany. Holtz-Eakin does not, however, explore the relationship between the health insurance payroll tax and wages in Germany.

Most of the literature on job turnover has considered the effect of health insurance on job departures or job-to-job transitions. Holtz-Eakin et al. (1996) consider the impact of health insurance on transitions from employment to self-employment. While the self-employed receive some limited tax benefits for their health insurance purchases, they, in general, face a much higher price for health insurance in addition to the potential costs associated with relinquishing the health insurance provided by a current employer. They find no evidence, however, that health insurance impacts the transition from employment to self-employment.

The empirical literature on health insurance and job turnover stands in marked contrast to that on health insurance and retirement. Using several different datasets and a wide range of identification and estimation strategies, the literature on health insurance and retirement has almost universally found rather large effects of health insurance on retirement. In contrast, the research on health insurance and job turnover has arrived at rather contradictory results despite the widespread similarity in methodological approaches and the use of similar datasets. For example, Madrian (1994b) and Kapur (1998) reach opposite conclusions although both use a similar sample from the 1987 National Medical Expenditure Survey. Anderson (1997) and Slade (1997) reach opposite conclusions using the National Longitudinal Survey of Youth, and Penrod (1995) and Buchmueller and Valletta (1996) derive contradictory results from the 1984 Panel of the Survey of Income and Program Participation. With the exception of Kapur (1998), no serious attempt has been made to reconcile these differences. Kapur traces her divergent results to differences in how the appropriate sample is defined and in how the independent variables used to measure the effect of health insurance are defined. This literature could benefit greatly from a systematic analysis of what constitutes a valid strategy in identifying the effect of health insurance on job turnover and of how robust empirical estimates are to changes in sample composition, changes in variable definitions, and changes in estimation strategy.

What are the welfare implications of health-insurance induced reductions in job turnover if this type of job-lock does in fact exist? The job matching literature developed by Jovanovic (1979) and others suggests that individual productivity may depend not only on characteristics of the worker, such as education and experience, which make the worker more valuable everywhere, but also on the nature of the idiosyncratic match between the employee and his or her job. When a new job starts, workers and firms have only imperfect information about the quality of a job match. Over time, however, they learn whether the match is "good" or "bad". Job turnover is the mechanism which reallocates workers from "bad" matches where worker productivity is low to "good" matches where worker productivity is high. Thus, anything which impedes this productivity-enhancing job mobility has welfare consequences.

Quantifying these effects is difficult, however. Monheit and Cooper (1994) perform a rough calculation: using their estimate of the health insurance-induced reduction in job mobility, they derive the number of individuals affected by health-insurance induced job-lock and multiply this by the average wage increase that accrues to individuals who change jobs. This yields a productivity loss equal to about one-third of 1% of GDP. But clearly this calculation is deficient: accurately estimating the wage increase that accrues to individuals who change jobs is difficult because of the selection of who does and does not change jobs; the increase in wages that accompanies voluntary job change may be a poor proxy for productivity because wages need not equal marginal product if there are long-term employment relationships; the welfare effects will depend on whether the productivity losses are permanent or transitory which depends in part on whether the causes of job-lock are long- or short-term in nature; finally, the welfare effects will depend on whether and how the productivity increases that derive from uninhibited mobility compound over time.

3.7. Health insurance and the structure of employment

A final aspect of the labor market that may be impacted by the institutions for health insurance provision is the firm's demand for labor input. There are two salient features of health insurance provision that are particularly relevant. First, health insurance is a fixed cost of employment and not a variable cost. Employer expenditures on health insurance do not increase when hours increase, and they do not increase when compensation increases. The second important feature of health insurance is that, as is the case with employer provision of other benefits such as pensions, employer provision of health insurance must satisfy IRS non-discrimination rules in order to receive favorable tax treatment. These non-discrimination rules basically stipulate that if the firm is to provide health insurance, it must make it widely available to almost all employees (that is, the firm cannot provide a benefit which receives favorable tax treatment if the benefit is only made available to or utilized by a select group of workers). However, the non-discrimination rules do not apply to part-time, temporary or seasonal workers. The firm can exclude these groups of employees from its health plan without imposing any additional tax liability on its full-time, full-year workers.

What implications do these features of health insurance provision have for labor market outcomes? That health insurance is a fixed cost gives firms an incentive to try and amortize this fixed cost over as many units of output as possible. The firm can do this in two ways. The first is to employ higher productivity workers. There is no direct empirical evidence on this front; however, the empirical evidence discussed in Section 3.4 on the lack of a tradeoff between wages and health insurance is consistent with the idea that firms with health insurance are hiring more productive workers. Firms with higher expenditures on health insurance employ higher productivity workers and higher productivity workers command higher wages. As a result, there is a positive correlation between wages and health insurance expenditures.

The second way that firms can amortize their fixed health insurance costs over as many units of output as possible is to substitute hours for workers in allocating labor input between the number of workers to employ and hours per worker. This is because when the firm hires an additional worker, it must pay both the fixed cost of providing health insurance and the marginal compensation costs associated with soliciting the services of an additional worker. When it increases the hours of an existing worker, however, it only incurs the marginal compensation costs because the health insurance costs have already been incurred. Cutler and Madrian (1998) provide evidence corroborating this type of labor substitution. They find that the rapid growth in health insurance expenditures in the 1980s led to an increase in hours worked among employees who received employer-provided health insurance, while employees without employer-provided health insurance actually experienced a decline in hours worked. Several papers on overtime and total expenditures on fringe benefits also suggest that higher non-wage compensation costs imply greater utilization of overtime (see, e.g., Ehrenberg, 1971; Ehrenberg and Schumann, 1982; Beaulieu, 1995). All of these papers find a link between health insurance and other benefits costs and hours worked, providing indirect evidence on the substitution of hours for workers. However, none of these papers consider both employment and hours. A natural extension would be to use firm-level data to examine employment along with hours worked to look directly for this type of substitution. Such an investigation would provide a stronger test of the theory.

The non-discrimination rules will impact the structure of employment by giving firms an incentive to hire part-time and temporary workers rather than full-time employees. This is because firms can avoid paying for health insurance for part-time and temporary work-

[31] Magnum et al. (1985) estimate that utilization of temporary help services increases with the level of fringe benefits, while Davis-Blake and Uzzi (1993) find no relationship between the level of fringe benefits at the industry level and the firm's use of contingent workers.

ers without violating the non-discrimination rules. There are two things worth noting about the possibility of such an effect. First, the presumption that firms can reduce compensation costs by hiring part-time workers who can be denied health insurance rests on the assumption that the tradeoff between wages and fringe benefits is not perfect. If it were, firms who hired temporary or part-time workers in order to avoid increased health insurance expenditures would pay higher wages to these workers to make-up for the fact that they are not receiving health insurance; if there were a one-for-one tradeoff between health insurance and wages, total compensation expenditures would remain unchanged. As noted previously, the evidence on the wage-fringe tradeoff and on the choice between full-time and part-time work for married women is consistent with these types of labor market imperfections. Second, the interests of employers in hiring part-time and temporary workers in order to avoid providing them with health insurance may run contrary to the interest of workers, discussed above in Section 3.5.3, who have an incentive to seek full-time employment in order to obtain the health insurance that goes along with such jobs. Thus, the outcome that will be observed in the labor market will depend on both supply and demand factors.

The evidence on the tradeoff between full-time and part-time employment is mixed. Owen (1979) finds that the ratio of part- to full-time employees is lower in the industry-occupation groups which have higher indirect labor costs. In contrast, Scott et al. (1989) and Galloway (1995) find a positive relationship between the share of fringe benefits in compensation and the fraction of the work-force that is part-time, while Ehrenberg et al. (1988) find little relationship between the relative likelihood of health insurance coverage for part- to full-time employees and the inter-industry ratio of part- to full-time employment. Montgomery and Cosgrove (1993), in an analysis of child-care centers, find that the fraction of hours worked by part-time workers falls when the fraction of compensation accounted for by fringe benefits payments increases, while Montgomery (1988) finds some evidence both for and against the notion that higher fixed costs increase utilization of full-time labor. The research on utilization of temporary workers is similarly inconsistent.[31]

There are several potential explanations for the inconsistencies in these empirical results. The first is that most of these studies do not account for the fact that the firm's demand for full- or part-time workers may be determined jointly with its fringe benefit policies. For example, suppose that the technology of production is such that the firm would like to employ a substantial fraction of part-time workers. Many of the potential employees who will find part-time work attractive, for example, married women, teen-

[32] The instruments used are whether the entity has corporate status and whether the entity is a branch or subsidiary of a larger organization. Because fringe benefits are tax deductible business expenses for corporations but not for sole proprietorships or partnerships, corporate status should be positively correlated with fringe benefit provision. Buchmueller argues that there is no reasons to think, however, that it might directly affect the mix of part- versus full-time employees hired. Being a branch or subsidiary should also be positively correlated with fringe benefit provision because such establishments can benefit from economies of scale not available to similarly-sized establishments which are independent. It is less clear that being a branch or subsidiary would be uncorrelated with the mix of part- versus full-time workers.

agers, or older workers who want to partially retire, will have a low demand for health insurance because they can obtain these benefits elsewhere: married women through a spouse, teenagers through their parents, and older workers through Medicare or retiree health insurance. In this case, the correlation between employee preferences for part-time work and for wages relative to health insurance benefits will lead to a negative bias in the estimated relationship between fringe benefit expenditures and part-time employment. Buchmueller (1996) addresses this bias by instrumenting for employer provision of fringe benefits. He finds that the estimated effect of fringe benefit expenditures on part-time employment increases substantially. With OLS, a $1 increase in hourly fringe benefit provision leads to a 2.3 percentage point increase in part-time workers' share of total hours. Using instrumental variables for fringe benefit provision[32], this effect more than triples, to an 8.3 percentage point increase in the share of hours worked by part-timers.

Thurston (1997) examines the experience of Hawaii which, in 1974, mandated employer provision of health insurance to full-time but not part-time workers. Hawaii is the only state in the US to have done this. Mandated health insurance partially mitigates the endogeneity between benefits provision and the demand for full- and part-time workers because firms have no choice in offering benefits to full-time workers – doing so is a legal mandate (the endogeneity related to benefits provision to part-time workers would, however, remain). He estimates that the industries that were most affected by the implementation of mandated health insurance saw the greatest shift from full- to part-time employment: a 10 percentage point increase in the fraction of employees covered by health insurance as a result of the mandate lead to a 1 percentage point increase in the fraction of workers employed in low hours, exempt jobs.

Another explanation for the seemingly contradictory empirical results regarding part-time employment is that the effect of fringe benefit provision on whether firms employ more or fewer part-time workers depends on whether the firm gives benefits to part-time workers. While part-time workers are much less likely to receive health insurance and other benefits than are full-time workers, about 20% of them do in fact receive employer-provided health insurance. If the firm does provide health insurance and other benefits to part-time workers as a human resource policy, then this may in fact create an incentive to hire fewer part-time workers (that is, to turn the part-time workers into full-time workers, essentially substituting hours for workers as discussed above) rather than more. Of course, this is subject to the caveat that firms that are providing benefits to part-time workers are probably very different from firms that are not. With effects potentially going in both directions, it is easy to see why failing to account for whether benefits are provided to part-time workers could result in a wide range of estimates.

Finally, the literature on part-time employment (and hours worked) has largely ignored the fact that these types of market outcomes will depend on both demand and supply factors. The outcome that prevails, more part-time relative to full-time jobs or less, obviously depends on the relative strength of individual and employer preferences for full- and part-time work. An integration of both the supply and demand sides of the market is important in assessing the impact of health insurance on this particular labor market outcome, although almost all of the literature on part-time work has focused on only either the demand side or the supply side (Hashimoto and Zhao, 1996).

De la Rica and Lemieux (1994) point out another potential effect of health insurance on the structure of the labor market. They consider the case of Spain where health care is provided by the government and financed out of a mandatory payroll tax paid partially by the firm and partially by the employee. Payment of the payroll tax entitles both workers and their spouses and dependent children to health care as well as to a pension and sick leave coverage (about one-quarter of the tax finances health care). De la Rica and Lemieux find that among married men who are employed, compliance with the payroll tax is almost universal. Among married women who are employed, however, 28% work in the underground sector of the economy where the "required" payroll taxes are not paid. They hypothesize that this is because these women have health insurance coverage through their spouses and compliance with the payroll tax buys them nothing extra.

Overall, the evidence regarding the relationship between health insurance and the firm's demand for labor is weaker than the evidence relating health insurance and individual employment and job choices. This weakness is due in part to a lack of firm-level datasets with which to conduct such empirical analyses. The anecdotal evidence coupled with the research briefly detailed in this section suggests, however, that health insurance could have potentially important effects on the behavior of firms, and this is likely to be a fruitful area for further research.

3.8. Health insurance and the labor market: summary

Section 3 suggests that there is an important relationship between labor market outcomes and the institutions and rules governing health insurance provision. A large body of evidence supports the notion that health insurance affects employment outcomes by giving individuals who rely on their current employer for health insurance an incentive to remain employed, and by giving individuals with other sources of health insurance provision less reason to participate in the labor market. The effects appear to be strong among both older workers and married women, although there appear to be effects on prime-aged men as well. There is some evidence that health insurance affects job turnover. The magnitudes are large in those studies which have found an effect, but several studies have found no relationship or a very imprecise relationship between health insurance and job transitions. The biggest puzzle in this literature is the dearth of evidence supporting a negative relationship between health insurance and wages in spite of a strong (and uncontroversial) presumption that such a tradeoff should exist. The conflicting evidence on this front underscores the difficult identification issues associated with isolating the impact of health insurance, as separate from other factors, on labor market outcomes.

As with the literature on health and labor market outcomes, identification issues here are critical. There is abundant evidence that health insurance is correlated with unobserved job and individual characteristics. Researchers need to think carefully and be explicit about the identification assumptions necessary to "purge" empirical estimates of this type of omitted variables bias.

The empirical literature has focused largely on health insurance and individual employment decisions. While the conclusions from this branch of research are hardly firm and the issues here certainly warrant further investigation, a promising avenue for future research will be an evaluation of how health insurance interacts with the employment decisions of firms.

4. Conclusions

The evidence in this paper suggests that both health and health insurance have important effects on labor market outcomes. Poor health reduces the capacity to work and has substantive effects on wages, labor force participation, and job choice. However, as we have shown, the exact magnitudes of the estimated relationships are sensitive both to the choice of health measure and to identification assumptions. Future research should take account of this sensitivity by considering a range of health measures and by placing more emphasis on the credibility of identification assumptions. One promising avenue is for researchers to take the health production function paradigm more seriously, and use medical knowledge about exogenous causes of disease to find suitable instruments for health status. Finally, most research about the effects of health on labor market outcomes has focused on elderly white men. It would be useful to have more investigation of these relationships among other demographic groups.

Health insurance, too, has important effects on both labor force participation and job choice, although the link between health insurance and wages is less clear. Health insurance may also have significant effects on the firm's demand for labor, but little research has been conducted in this area.

Of course, health, health insurance, and labor market outcomes are likely to be connected in more complicated ways than have been explored in this paper and in the literature to date. An important question which we have not addressed is how health insurance and medical care expenditures impact health. Given the substantial fraction of GDP now devoted to health care, an important measure of the value of these expenditures is the extent to which they increase the productive capacity of individuals. This is an important area for future research.

There are other interesting questions that have been raised by the research summarized in this paper. That health and health insurance have a substantial impact on labor market outcomes such as wages, labor force participation, hours worked and job turnover suggests that they could have an impact on other, less researched outcomes as well. For example, poor health is likely to impact not only the average level of employment and/or earnings, but the variability in these measures as well. The role of health as an explanation for observed differences in labor market outcomes across groups, such as wages and labor force participation, is also worth further consideration. If health is important in explaining these outcomes and if inequities in access to either medical care or health insurance are important in generating differences in health, this suggests that medical care and health insurance may be potentially overlooked redistributive mechanisms with which to increase equality in economic opportunity and outcomes. Some research has investigated the role of health and health insurance in the sorting of workers across jobs, and this too, is a labor market outcome which warrants further consideration.

Finally, we know very little about the longer-term relationship between health, health insurance and labor market outcomes. How does health today affect labor market outcomes one, two, or even three decades hence? To what extent are the wage and employment effects of ill health permanent, and to what extent are individuals able to recover? Do the long-term consequences of poor health differ by age? How do fluctuations in health or access to health insurance affect labor market outcomes? These are all interesting and important questions. To better understand this set of issues will, however, require longitudinal datasets which follow individuals over long periods of time.

In conclusion, while research over the past several years has greatly enhanced our knowledge about the relationship between health, health insurance and the labor market, many important questions remain unanswered. What we do know, however, suggests that health is a significant factor in explaining many economic outcomes of interest. Research in the years to come will hopefully help clarify this important relationship.

Appendix A.

The following table gives the dataset and variable acronyms used in Tables 1–11.

Acronym	Name/definition
Datasets	
CPS	Current Population Survey
CPS DWS	CPS Displaced Worker Survey
CPS EBS	CPS Employee Benefit Supplement
CPS MORG	CPS Merged Outgoing Rotation Group
GSOEP	German Socio-Economic Panel Survey
HIE/HIS	RAND Health Insurance Experiment/Survey
HRS	Health and Retirement Study
MWHS	New England Research Institute's Massachusetts Women's Health Study
NAS-NRC	National Academy of Science-National Research Council (survey of white male veteran twins born from 1917–1927)
NCS	National Comorbidity Survey
NHIS	National Health Interview Survey
NIMH ECA Survey	National Institute of Mental Health Epidemiologic Catchment Area survey
NLS Older Men	National Longitudinal Survey of Older Men
NLS Mature Women	National Longitudinal Survey of Mature Women
NLSY	National Longitudinal Survey of Youth
NMCES	National Medical Consumption and Expenditure Survey
NMES	National Medical Expenditure Survey

Acronym	Name/definition
NSFN	National Survey of Families and Households
PAS	Productive American Survey
PSID	Panel Study on Income Dynamics
QES	Quality of Employment Survey
RHS	Retirement History Survey
SDNA	Survey of Disabled and Non-disabled Adults (conducted by the Social Security Administration)
SDW	Survey of Disability and Work (conducted by the Social Security Administration)
SEO	Survey of Economic Opportunity
SIPP	Survey of Income and Program Participation
Variables	
Health variables	
ADL	Activities of daily living[a]
BMI	Body mass index: height (in m)/weight^2 (in kg)
SRHS	Self-reported health status (excellent, good, fair, poor)
WL	Work limitation (usually derived from question on whether health limits the ability to work or the kind of work an individual can perform)
Labor force variables	
FT	Full-time employment
HPW	Hours per week
LFP	Labor force participation
NILF	Not in the labor force
PT	Part-time employment
UR	Unemployment rate
Health insurance variables	
EHI	Own employer-provided health insurance
HI	Health insurance
MCD	Medicaid
NHI	National Health Insurance
NI	Not insured
RHI	Employer-provided retiree health insurance
SHI	Spouse has employer-provided health insurance

[a] Reading with glasses or lenses; hearing normal-volume conversation; having one's speech understood; walking a quarter-mile; lifting ten pounds; climbing a flight of stairs; moving without a walking aid; getting around one's home.

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