

Disability, Earnings, Income and Consumption

Bruce D. Meyer and Wallace K. C. Mok*

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Abstract: Using longitudinal data for the period 1968-2005 for a sample of male household heads, we determine the prevalence of disability during the working years and examine how the extent of disability affects a range of outcomes, including earnings, income, and consumption. We have seven main findings. First, disability rates are high. We divide the disabled along two dimensions based on the persistence and severity of their work-limiting condition. We estimate that a person reaching age 56 has a 53 percent chance of having been disabled at least once during his working years, and a 19 percent chance that he has begun a chronic and severe disability. Second, the economic consequences of disability are frequently profound. Ten years after disability onset, a person with a chronic and severe disability on average experiences a 68 percent decline in earnings, a 32 percent decline in after-tax income, a 22 percent decline in food and housing consumption and a 21 percent decline in food consumption. Third, the various economic consequences differ sharply across disability groups. The outcome declines for those with a chronic and severe disability are often more than twice as large as those for the average disabled. Fourth, our findings show the partial and incomplete roles that individual savings, family support and social insurance play in reducing the consumption drop that follows disability. Only about half of this most disabled group reports receiving Social Security Disability Insurance or Supplemental Security Income. Fifth, we find a noticeable fall in earnings and income prior to the onset of a reported disability. Consumption also falls somewhat, suggesting that future disability is partially but incompletely predictable in the short run. Sixth, time use and detailed consumption data further indicate that disability is associated with a decline in well-being. Seventh, the quantities we have estimated, combined with elasticities from the literature, allow us to examine the optimality of current compensation for the disabled. We find that the current compensation for our most disabled group appears to be lower than is optimal.

*Meyer: Irving B. Harris Graduate School of Public Policy Studies, University of Chicago, Chicago IL 60637.

Email: bdmeyer@uchicago.edu

Mok: Department of Economics, Northwestern University, Evanston IL 60208.

Email: k-mok@northwestern.edu

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1. Introduction

This paper examines the lifetime prevalence of disability and how the disabled fare before and after the onset of disability. Disability is one of the main risks individuals face during their lifetime. The Social Security Administration (SSA) estimates that a twenty year old worker has nearly a 30 percent chance of becoming disabled before reaching age 65.¹ A recent report by the Institute of Medicine concludes that the number of people in the U.S. with disabilities currently exceeds 40 million.² Census of Population data from the year 2000 indicate that 20.9 million families (28.9 percent of all American families) have at least one disabled member, and 12.8 percent of these families are living in poverty; the corresponding poverty rate for families without disabled members is only 7.7 percent.³

Disability is one of the primary reasons for public insurance spending. In 2006, Social Security Disability Insurance (SSDI) payments equaled \$92 billion and the share of Supplementary Security Income (SSI) for the blind and the disabled was \$36 billion.⁴ Private spending on the disabled was also high, with \$55 billion spent on Workers' Compensation in 2005.⁵ These expenditures are high even compared to some other social insurance or welfare programs, such as Unemployment Insurance benefits (\$40 billion in 2004) and Food Stamps (\$30 billion in 2006).⁶ Looking forward, Autor and Duggan (2006) predict that the SSDI receipt rate will rise 71 percent before reaching a steady state rate of approximately 7 percent of non-elderly adults.

Despite high disability rates and high costs, there are major gaps in our understanding of the economic consequences of disability. The dynamic nature of disability calls for longitudinal measures that reflect its persistence and prevalence over an individual's lifetime.

¹ See Baldwin and Chu (2006) who also estimate that the probability of receiving Social Security Disability Insurance by age 67 is 38 percent for men and 31 percent for women.

² See Institute of Medicine (2007). The conclusion is based on reviewing a selection of survey results, including the National Health Interview Survey, Survey of Income Program Participation, Census of Population, American Community Survey. The results from many studies are also reviewed, including Wang (2005), Steinmetz (2006) and Centers for Disease Control and Prevention (2006).

³ See Wang (2005).

⁴ Specifically, the federal government spent \$33 billion on SSI for the blind and the disabled (age 0-64), while another \$3 billion was spent in state supplementation (U.S. Social Security Administration 2007).

⁵ See Sengupta et al. (2007). The \$55 billion includes payments for medical treatment and cash benefits.

⁶ For Unemployment Insurance, see Council of Economic Advisers (2006). For Food Stamps, see U.S. Department of Agriculture, Food and Nutrition Service Program Data (2007). In addition, spending on Temporary Assistance to Needy Families in 2004 was \$9 billion (U.S. Social Security Administration 2005).

To date, however, few studies examine the long-term economic circumstances of the disabled.⁷ Our study aims to bridge this gap in the literature.

Certain information is important to design and evaluate disability policies. To calibrate the life-cycle consequences of disability (Chandra and Samwick 2005), it is especially helpful to have information on the prevalence of disability and the consumption fall that comes with disability onset. Similarly, the calculation of optimal disability benefits (Chetty 2006) depends on the fall in consumption with disability, the frequency of disability, and the moral hazard effects of disability benefits (as well as utility function parameters). While there is an extensive literature on the moral hazard effects of disability,⁸ we have less information on lifetime disability rates and the fall in consumption with disability.

In this study, we look at the economic situation of the disabled from many angles. First, we examine disability rates by the extent of disability, which we characterize along the two dimensions: persistence and severity. Second, we examine how important outcomes such as earnings, income and consumption change during the five years prior to disability onset and the subsequent ten years. Third, we show how these outcomes differ by the extent of disability. We examine the overall pattern of transfer receipt, as well as the role it plays for various disabled subgroups. Finally, using our estimates, we examine the optimality of current compensation programs for the disabled.

We use data over a 38-year period from the Panel Study of Income Dynamics (PSID). The longitudinal structure of these data allows us to examine changes in the variables of interest before and after individuals suffer disability onset. Of necessity, our analyses rely on a self-reported measure of disability. Self-reports are the only feasible option, given that a large share of disabilities, even those compensated by SSDI, cannot be determined by an explicit physical marker (because they are psychological or involve pain).⁹ In addition, program-based definitions miss non-recipients and non-reporting recipients. Past studies also indicate that self-reported disability has many desirable features (Stern 1989; Benitez-Silva et al. 2004), though this view is not universally held.

⁷ Important past work on this topic includes Haveman and Wolfe (1990) who study the difference between the incomes and earnings of the disabled and non-disabled using the Current Population Survey. Bound and Burkhauser (1999) also compare earnings of the disabled and the non-disabled. Bound and Waidman (2002) look at employment rates among the disabled. Charles (2003) examines earnings, hours and wages after disability. Stephens (2001) analyzes some of these outcomes as well as food consumption. There is also related work by Rupp and Davies (2004) and others.

⁸ See for example, Parsons (1984, 1991), Haveman and Wolfe (1984a, b), Bound (1989, 1991), Gruber (2001), Black et al. (2002), and Autor and Duggan (2003).

⁹ Autor and Duggan (2006) report that more than half of SSDI awards in 2003 were for either mental disorders or musculoskeletal disorders (e.g. back pain).

Our study differs from the literature in several ways. First, we analyze a comprehensive range of variables that capture the economic circumstances of the disabled: earnings, work hours, employment, income, public transfer receipt, poverty rates, food consumption, housing consumption, and leisure time. In taking this wider view, we obtain a better picture of the general well-being of the disabled. Second, we make use of the most recent data. Third, we confront the issue of public transfer under-reporting, which can lead researchers to overestimate income declines as well as the poverty rate of the disabled. Fourth, we go beyond a uniform characterization of the disabled by dividing the population based on a disability's duration (persistence) and severity. To our knowledge, almost all previous economic studies have examined the disabled as a single homogeneous group or only along a single disability dimension – persistence or severity.

This paper makes several key findings. First, disability rates are high. We estimate that by age 50, about 11 percent of male household heads have begun an enduring and severe disability. By age 56, that number rises to 19 percent. An even larger share of men have experienced some type of disability. A man reaching age 56 has a 53 percent chance of having been disabled at least once during his working years and about a 37 percent chance of experiencing a chronic disability that lasted at least four years.

Second, disability is associated with worsened economic outcomes. Ten years after disability onset, those with a chronic and severe disability condition have experienced a 68 percent decline in earnings, a 32 percent decline in after-tax income, a 22 percent decline in food and housing consumption and a 21 percent decline in consumption of food alone. In addition, about two-thirds of these most disabled individuals never return to work in the long run.

Third, there are sharp outcome differences across disability groups; the outcome declines for those with chronic and severe disabilities are often more than twice those for the average disabled.

Fourth, our findings indicate the partial but incomplete roles that individual savings, family support, and government and private insurance play in reducing the consumption drop that follows disability. Despite the various government programs available, the incomes of about one-sixth of families with a chronically and severely disabled head drop below the poverty line in the long term – even after accounting for in-kind transfers and the under-reporting of benefits.

Fifth, we find a noticeable fall in earnings and income prior to the onset of a reported disability. Consumption also falls somewhat prior to reported onset, indicating that future disability is partially but incompletely predictable in the short run.

Sixth, since consumption is the outcome of a home production function that uses time as an input (Becker 1965), we have also explored the disabled's time-use patterns. Evidence from time-use surveys does not suggest that the disabled do more shopping, which might enable them to enjoy lower prices through greater search effort. We also find that instead of working more on home and food production, the disabled spend more time watching television, relaxing, sleeping and using medical services. Together these findings indicate a real decline in material well-being after the onset of disability, especially for those who are more disabled. To further substantiate our claim that consumption declines following disability, we examine food surveys and find that the diet of the disabled is worse than that of the non-disabled in many dimensions.

Seventh, based on our estimates, others from the literature, and reasonable assumptions on parameter values, we find that the current compensation for the most disabled appears to be lower than is optimal.

The rest of the paper is organized as follows. Section 2 describes the conceptual framework for interpreting disability and its consequences. Section 3 describes our dataset and sample, and how we define and categorize the disabled. This section also discusses lifetime prevalence of disability, and outlines the empirical strategy for the rest of the paper. Section 4 examines the change in earnings and employment following disability onset. Section 5 examines the fall in income following disability onset, the rise in poverty and public transfer receipt. Section 6 summarizes the changes in consumption of food and housing. Section 7 discusses a series of robustness checks. We also revisit the change in food consumption and consider the time use of the disabled. Section 8 examines the optimality of current provisions for the disabled, and Section 9 concludes. The appendices include additional results concerning the impact of disability on food quantity and quality, as well as the usage of time.

2. Conceptual Framework for Interpreting Disability and its Consequences

The canonical model for examining income shocks and consumption patterns and their welfare implications over the lifetime of an individual is the life-cycle model.

A. *The Life-Cycle Model and Consumption*

The life-cycle framework models individuals as maximizing the present discounted value of expected utility, subject to an inter-temporal budget constraint. The life-cycle model has clear predictions that in the absence of uninsured shocks to income, the pattern of the marginal utility of consumption should move slowly over time. Absent other changes, this result implies that consumption has a roughly constant or slowly trending time pattern. Following Dynan (1993) and Bernheim, Skinner and Weinberg (2001) we can write the expected proportional change in consumption from one period to the next as

$$(1) \quad \frac{E_t(C_{t+1}) - C_t}{C_t} \approx \frac{1}{\gamma} \left(1 - \frac{1}{\alpha_t} \right) + \frac{\rho}{2} \sigma_{t+1}^2.$$

where γ is $-U''C_t/U'$, the coefficient of relative risk aversion, ρ is $-U'''C_t/U''$, the coefficient of relative prudence, where U is a standard utility function. α is the ratio of one plus the interest rate to one plus the discount rate, adjusted for the survival rate, while σ^2 is the variance of $\ln(\text{consumption})$. If the individual has full insurance we expect the right hand side of the above equation to be small, implying that consumption change should be small following disability. If consumption falls noticeably with disability, then we have evidence that insurance is incomplete.

B. *Optimal Disability Insurance*

While a fall in consumption with disability suggests that insurance is not complete, whether insurance is less than optimal depends on other factors, especially the degree of moral hazard. Chetty (2006) provides a very useful optimal social insurance benefit formula that illustrates the importance of measuring changes in consumption in assessing whether

current disability benefits are optimal. This result also highlights the importance of the degree of moral hazard in any optimal benefit calculations. His Proposition 2 states that the optimal benefit rate b^* is approximately defined by

$$(2) \quad \frac{\Delta \bar{c}}{\bar{c}}(b^*) \gamma \left[1 + \frac{\rho}{2} \frac{\Delta \bar{c}}{\bar{c}}(b^*) \right] \approx \frac{\varepsilon_{D,b}}{1-D}$$

where $-\frac{\Delta \bar{c}}{\bar{c}}(b^*)$ is the drop in mean consumption with disability as a function of the benefit level, γ and ρ are as above, D is the fraction of a lifetime spent disabled, and $\varepsilon_{D,b}$ is the elasticity of D with respect to b . This formula provides a way of checking whether current benefits are optimal. If the left hand side is greater than the right hand side, benefits are too low; if the reverse is true, benefits are too high. This equation highlights the importance of knowing the consumption fall with disability in designing disability policy. The details of applying this formula to existing disability programs are discussed in Section 8.

One last factor or caveat should be emphasized. The previous equations relied on the assumption that the marginal utility of consumption (at a given consumption level) does not change over time, in particular with disability. A concern with directly applying the above results is that the additional non-market time available to the disabled may allow the marginal utility of consumption to remain unchanged even if consumption falls, if time and money are substitutes. For example, it may be that the disabled are able to substitute cooking for prepared foods, and careful shopping may allow them to purchase goods at lower prices. We examine the extent of this substitution below. Disability may also directly affect the marginal utility of consumption by making individuals less able to enjoy certain activities (vacations), but shifting out the demand for other goods (ranch homes). Alternatively, one might argue that the disabled are purposely taking more leisure (and less income), because the marginal utility of income (at a given consumption level) has fallen. This alternative version is hard to address directly, but we note that the average disabled head does spend a large share of his time visiting the doctor. Given that the most severely disabled in our analyzes are much worse off than average disabled, this pattern may be even more true for the group on which we focus.

C. The Time Pattern of Disability and its Consequences

A conceptual framework to understand disability must also recognize that disability is a dynamic process. In many cases, disability is a process that unfolds over many years and that the disabled person cannot predict accurately. To help think about the evolution of disability over time, we consider the following simple model. Let D be an indicator variable for a self-reported disability, and S be an indicator variable for a self-reported severe disability, when an individual reports that he can do little or no work. We have in mind that a person states he is disabled if $D^*(W, P, T, F) > K_D$. Similarly, a person states he is severely disabled if $S^*(W, P, T, F) > K_S$. Here D^* and S^* are latent continuous disability indicators that are functions of W (productivity in the labor market), P (the pain or disutility of work), T (transfers available for the disabled) and F (support from family). K_D and K_S are individual specific tolerance thresholds for declaring disability and severe disability respectively. We have in mind that W and P are in many (probably most) cases not fully observable to a researcher, doctor or caseworker. This situation is most likely in cases where the disability is due to chronic pain or a mental illness.

That disability is not defined wholly by a physical condition affects its observability. Disability is defined by mental functioning and pain tolerance, and it is a function of work and workplace accommodations that are available to the impaired. W is an interaction of a person's physical and mental condition with his skills and training. Finally, the declaration of disability is a function of available insurance mechanisms, whether family, SSDI or other means of support. A substantial literature examines the behavioral response of people to the availability of jobs and alternative means of support such as social insurance (for example, see Parsons 1984; Black et al. 2002; Autor and Duggan 2003). We expect that dS/dW , dS/dT , dD/dW and dD/dT are substantial.

Our focus here is on the fall in income and consumption over time in the presence of a disability. We should also note that declaration of disability and severe disability are correlated with the receipt of transfers such as SSDI, but they are not the same as many severely disabled people work, and some who receive SSDI indicate that they are not severely disabled.

There is likely to be some feedback from the poor outcomes we observe that lead someone to call himself disabled. From a welfare perspective, disability does not need to be exogenous. In fact, the optimal benefit formula above recognizes that it is endogenous.

Nevertheless, we refer to the outcomes we examine as the consequences of disability. Consistent with this characterization, we provide evidence that health clearly worsens prior to a person's first declaration that he is disabled; we find less evidence of increased frequency of unemployment just prior to disability onset. We also note that prior to disability, the disabled look fairly similar to the non-disabled and work only slightly fewer hours. Consequently, we also find that the disabled do not seem to have had a very different taste for leisure.

Thus, we describe what we examine as the consequences of disability, subject to the caveat that this is likely only mostly true. Offering additional support for our interpretation, we show that the most disabled have fairly undesirable economic circumstances. We also report substantial evidence that self-reported disability is associated with higher rates of physical and mental limitation, and a higher frequency of specific limiting health conditions diagnosed by doctors.

3. Data, Categorizing the Disabled and the Prevalence of Disability

A. Data

We use the PSID, a longitudinal dataset begun in 1968 with an initial sample of about 4,800 U.S. households and 18,000 individuals. The initial sample had two components, both of which we use: a nationally representative sample (Survey Research Center sample) and a national sample of low-income families (Survey of Economic Opportunity sample). The latter group included about 1,800 households.

Households were interviewed annually between 1968 and 1997, and biannually since then.¹⁰ Children in sample households are followed as they leave and form their own families. Since the survey's initial focus was the dynamics of poverty, questions are asked about benefits received, work hours, earnings, income, health, and other outcomes. A particularly attractive feature of the PSID is that it collects information on housing and family food expenditures, variables that are available in few other microeconomic surveys.

¹⁰ Some data are available for intervening years. For example, the 1999 survey asked about both 1998 and 1997 earnings.

Many authors have used this particular feature to measure the material well-being of individuals. As of 2005, the PSID has collected information on 67,271 individuals.

In this study, we use the entire PSID panel, beginning with 1968 and continuing through the 2005 wave. Most of our analysis focuses on male household heads who are 22-61 years old in the survey year.¹¹ We focus on those 22 and older because those below this age are unlikely to be household heads. The choice to focus on male household heads is necessary because the PSID did not ask disability questions of spouses until 1981 (see Burkhauser et al. 2006). The PSID defines the household head in a married couple family to be the male, except when he is so severely disabled that he is unable to respond to the survey. In order to assure sufficient information about the variables of interest, we select male household heads who are interviewed for at least six years and who are 22-61 years old for at least four interviews, three of which are consecutive.

B. Disability Questions, Limitations and Severity

The main disability question in the PSID is, “*Do you have any physical or nervous condition that limits the type or amount of work you can do?*” This question is asked of household heads consistently throughout the life of the survey.¹² After determining the presence of a work-limiting condition, a severity question asks the extent that this condition limits the work capability of the head. We group the responses to this question into two categories: “Severely Disabled” and “Not Severely Disabled.” We define **Not Severely Disabled in Year t** to be those who respond “Just A little,” “Somewhat,” “Not Limiting,” or “Not at all” to the severity question in the year t survey. **Severely Disabled in Year t** are those who respond “Can do nothing,” “Completely,” “A lot,” or “Severely.”

Table 1 tabulates the unweighted and weighted disability rates for male household heads aged 22-61 during the 1968-2005 period. These rates are usually between 11-15 percent and are comparable to those found by Burkhauser et al. (2006). The table also

¹¹ We retain any data on disability for people outside this age range because it may be useful in determining the persistence or severity of an individual’s disabling condition. As we will explain later, the degree of persistence is determined based on the frequency of positive limitation reports after disability onset. Thus, ignoring information after the age of 61 may lead to an individual being misclassified, especially if his age of disability onset is close to 61. Similarly, the onset age cannot be correctly determined if we exclude all data outside the age range. For example, a person whose disability began at age 18 could have his onset age mistakenly set to 22 if we disregard the responses to the disability question outside the age range.

¹² In the period 1973-1975, this disability question was asked only of new entrants to the survey. We assume the disability status of these new entrants has not changed until the 1976 survey.

reports the share of the disabled with a severe disability. The fraction of the disabled classified as severe is usually about one-third. However, during the 1977-1985 period the possible responses to the severity question in the survey were more limited, apparently leading to a higher fraction of respondents indicating that their condition limited their work capability “A lot.”¹³ We have investigated the sensitivity of our disability rates and outcomes to reduced reliance on these years, and have found only small impacts given the averaging over time and classification system we use, as discussed below.

C. Validation of Self-Reported Disability

1) Self-Reported Disability Status

Several authors question the validity of self-reported disability status and choose to focus instead on those who receive benefits such as SSDI or SSI.¹⁴ Such an approach is not without its limitations, however. First, some disabled individuals may not file for SSDI or SSI because of the paperwork and the requirement that the disabling condition is expected to last for at least 12 months. Second, not all disabled individuals will meet these programs’ qualifications. For example, SSDI requires the applicant to have worked sufficiently during the years prior to disability,¹⁵ and SSI has a stringent asset limit. Third, the denial of an SSDI or SSI application does not necessarily imply that an individual is not disabled (Nagi 1969; Bound 1989), as indicated by the high acceptance rates for those who appeal denials (Benitez-Silva et al. 1999 report that in 1993, of the 48 percent of denied SSDI claimants who requested reconsideration, 50 percent were accepted).¹⁶ Fourth, SSDI and SSI benefits are unavailable to those who earn above certain amounts despite their disabilities. In 2006, an SSDI recipient could not earn more than \$860 after a trial period, and SSI recipients had their monthly benefits reduced by 50 percent of the amount of any monthly earnings above \$85 (U.S. Social Security Administration 2006).

¹³ See the data appendix (Appendix 3) for the exact wording of the question in different periods. No severity question was asked during 1969-1971.

¹⁴ See Bound et al. (2007), Kreider and Pepper (2007), and Kreider (1999) for discussions of the limitations of self-reported disability.

¹⁵ Only about 80 percent of working age individuals are insured by SSDI (Autor and Duggan, 2006).

¹⁶ Bound (1989) suggests that many rejected SSIDI applicants are in fact incapable of work. Citing the study by Nagi (1969), Bound states: “Of the population denied benefits, 35.6 percent were found incapable of any work, and another 12.3 percent were only capable of work at home or in sheltered environments.” In addition, Bound cites the study of Treitel (1976), which suggests that many rejected applicants did not work despite the SSDI denials. Using administrative follow-up records, he shows that 13.8 percent of those denied benefits in 1967 died within the next six years.

Past researches, however, have also pointed out the merits of self-reported disability measures. Benitez-Silva et al. (2004) suggest that self-reported disability responses are an unbiased indicator of SSDI eligibility decisions. Stern (1989) finds that a self-reported disability question is close to exogenous. To the extent self-reported disability was endogenous, the relationship was the opposite of what had been hypothesized in the literature (i.e. health tended to deteriorate when working rather than disability being used to justify not working). In their comparison of the Current Population Survey (CPS) and the National Health Interview Survey (NHIS), Burkhauser et al. (2002) argue that the self-reported work-limitation-based definition of disability may even underestimate disability rates. Given that alternative definitions have their own endogeneity problems or are often too narrow, we believe that self-reported disability status responses, while not perfect, offer the best available method of measurement.

2) Self-Reported Severity

The main difficulty in using self-reported disability severity responses is that they are necessarily subjective. One may argue that more objective measures, such as the number of everyday tasks the individual has difficulty with, should be used instead (see Bound 1989). For example, the Census Bureau partly bases its definition of *severely disabled* on how many Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and functional activities an individual cannot perform.¹⁷ Surveys such as the PSID or the CPS, however, do not ask these questions on a regular basis.

The PSID asked questions about physical limitations and specific medical conditions diagnosed by a health professional in 1986, and the 1999-2005 surveys. In Appendix 1, we provide extensive comparisons of our disability measures to these measures of health limitations. We show that the severely disabled group in our sample has on average much greater numbers of physical and health limiting conditions, as well as more serious forms of these conditions, relative to the non-severe group and the non-disabled. For example, the

¹⁷ Specifically, using the Survey of Income and Program Participation (SIPP), the Census Bureau (McNeil 2001) defines severe disability using the following criteria: 1) The person used a wheelchair, a cane, crutches or a walker, 2) The person had any other mental or emotional condition that seriously interfered with everyday activities, 3) The person received federal benefits based on an inability to work, 4) The person had Alzheimer's disease, 5) The person had developmental disability or mental retardation, 6) The person was unable to perform or needed help to perform one or more of the functional activities, ADLs or IADLs, 7) The person was unable to do housework, 8) The person was in the age range 16-67 and had a condition that made it difficult to work at a job or business. A person who falls in any one of the above criteria is considered to be severely disabled.

average number of activity limitations (difficulty walking, bending, driving, etc.) is 2.74 for the Severe group, 1.21 for the Not-Severe group and 0.11 for the non-disabled. The average number of doctor diagnosed severe health conditions (high blood pressure, diabetes, asthma, etc.) is 1.1 for the Severely disabled, 0.1 for the Not-Severely disabled and 0.01 for the Non-Disabled. These results strongly indicate that self-reported disability severity captures important features of the true severity of individual disabilities.

D. Sample Construction

We divide our sample of male household heads into disabled and non-disabled individuals. The non-disabled sample consists of those who never report that they have a physical or nervous limitation during the survey years. Members of the disabled sample report a limitation in at least one year.

Determining the year of limitation onset for the disabled requires combining information from multiple years of data. A valuable feature of the PSID is a retrospective question on when a work limitation began that is available for the 1969-1978 waves (except 1976 and 1977). For those disabled on or before 1978, we use the responses to this question to determine their year of onset.¹⁸

Determining the year of onset for the disabled who have no work limitations between 1968 and 1978 is more difficult because the survey asks no questions about when the condition began. We also need to account for interviewees who enter the survey after 1978. Such individuals will have data missing for 1968-1978, so we cannot simply take the first year that they report a disability as the onset year. Thus, for those who first report having a disability after 1978, we additionally require that such individuals report no limitations in the two consecutive survey years immediately prior to the year in which they first report having a work limitation.¹⁹

Our focus is on disabilities that begin during the working years; accordingly, we exclude those whose onset age is under 18. In order to have sufficient information after

¹⁸ Some individuals may have more than one response due to the panel nature of the data. Because the possible responses to these questions were coded in intervals (except in the 1978 survey, when the exact number of years is given), we determine the intersection of the intervals given by these questions and take the earliest year within the intersection as the year of disability onset.

¹⁹ For example, if an individual first reports having a limitation in 1980, then the year of onset would be 1980 if he has no limitations in 1978 and 1979. Since there is only one survey per year, we also adjust the year of onset by determining the midpoint in time of adjacent interviews. See the data appendix.

onset, we require that a disabled individual in our sample be in the survey for a minimum of three years during the ten years after onset. This restriction is important to determine the disability persistence and severity groups (which we introduce in Section E below). Due to the restrictions that we impose in selecting our sample, we slightly understate the extent of work limitations, as discussed further below. We replace missing demographic information (age, marital status, years of education, number of family members, number of children and state of residence) by the non-missing value in the nearest wave.²⁰ We exclude, however, individuals who are missing key demographic variables (education, age and marital status).²¹ The application of these restrictions results in a primary sample of 6,301 male household heads, 1,819 (29 percent) of whom are classified as ever disabled.

E. Categorizing the Disabled

Besides determining how the disabled fare around disability onset, we are interested in examining how various economic outcomes evolve for different types of disabilities. We find that following the onset of disability, different groups differ sharply in their earnings, income, public transfer receipts and consumption. We exploit the data's panel nature, coupled with limitation and severity questions, to divide the extent of disability along two dimensions: persistence and severity.

Our notion of persistence is a modification of the notion of *chronicity* in Charles (2003) and is based on the disabled person's number of positive post-onset limitation reports during the ten years after disability onset. Our notion of disability severity divides disabilities into those that are severe and those that are not severe based on the self-reported severity assessments described above. Finally, we combine our persistence and severity measures into a single disability measure by dividing the chronically disabled into those with chronic and severe disabilities and those with chronic and not severe disabilities.²² These divisions allow us to compare the outcomes of those with differing degrees of disability.

We divide the disabled into three persistence groups. The **One-Time Disabled** are those who report a disability once, but do not report a disability again during the next ten years. The **Temporarily Disabled** are those who have one or two positive limitation reports within the ten years after disability onset. Thus, including the onset report, a temporarily disabled individual will have at most three positive limitation reports through the tenth year

²⁰ Approximately 400 people have missing data substituted in this way.

²¹ We exclude 75 individuals (1.2 percent of the sample) because key demographic information is unavailable.

²² We do not subdivide the non-chronically disabled.

after onset. The **Chronically Disabled** are those who have three or more positive limitation reports during the ten years after disability onset.

To reduce the dependence of the definition on time in survey, we use all the survey waves and require that a disabled individual be in the survey for at least three years within the ten years after onset.²³

Given that the severity questions are asked nearly every year of reported disability, we need to determine which of the many possible responses to use. Two natural choices are the average severity over the course of the disability and the initial severity (at the onset of disability). We choose to rely on average severity throughout the paper, because it captures a more complete picture of the disabling condition.²⁴

We define the **severity ratio** as the fraction of the time the individual reports he is severely disabled in the year of onset and the subsequent ten years after onset.²⁵ We then define the **Severely Disabled** to be those whose severity ratio is greater than 0.5. That is, starting from the year of onset to the tenth year after onset, more than 50 percent of the observed severity reports consist of the following responses: “Can do nothing,” “Completely,” “A lot” or “Severely.” The **Not Severely Disabled** are the disabled whose severity ratio is less than 0.5. In the case where exactly half of the responses indicate severe disability (that is, a severity ratio of 0.5), we classify the disabled individual based on the first observed severity report.²⁶

We combine the two disability dimensions in our main analyses by splitting the Chronically Disabled into two groups. The **Chronic-Not Severe** are chronically disabled, but not severely disabled under the severity classification. The **Chronic-Severe** are chronically disabled and severely disabled. Hence, this classification yields four groups of

²³ If we require more than three (four to six) post-onset positive limitation reports to be in the chronic group, the results are very similar. Our disability persistence classification differs from that of Charles (2003), who defines his most chronically disabled group to be those who report a positive limitation in every year after onset (as long as they are in the survey). Thus, in his classification system, whether an individual is chronic partly depends on the number of years an individual is in the survey, and his use of a shorter panel (1968-1993) increases this dependence. Thus, a disabled person is more likely to be in the most chronic group the closer his year of onset is to 1993.

²⁴ The results are similar if we use only the initial severity report.

²⁵ 25 individuals in the main analyses are dropped who never respond to the severity question in this 11-year period (year of onset and the subsequent 10 years).

²⁶ Of the 1,819 disabled, 100 have a severity ratio of 0.5. Of the 846 chronically disabled individuals, only 43 have a severity ratio of 0.5.

interest – **One-time, Temporary, Chronic-Not Severe and Chronic-Severe**, which we collectively call the **Extent of Disability groups**.²⁷

Table 2 reports the descriptive statistics for the extent of disability groups, where individuals are classified by their first observed disability. Of the 1,819 disabled individuals, 418 (23 percent) are One-Time disabled, 555 (31 percent) are Temporary disabled, 531 (29 percent) are Chronic-Not Severe and 315 (17 percent) are Chronic-Severe. The average age at disability onset is highest for the Chronic-Severe group (41.6 years), followed in descending order by the Chronic-Not Severe group (36.7 years), the Temporary group (35.2 years) and the One-Time group (35 years). The Chronic-Severe group is also the least educated group – only 18 percent have ever attended college; by comparison, 46 percent of the One-Time group have attended college.

Members of each of the four disabled groups have participated on average in the survey for at least 10 years after disability onset, though the Chronic-Not Severe participated on average 6.2 more years than the One-Time group. It is also encouraging to see that all four disabled groups have participated in a similar number of surveys, at least 17 on average. This similarity in years in the survey, especially after onset, should reduce any concerns that the One-Time group members are categorized as such because they are more likely to have exited the survey after disability.

Members of the Chronic-Severe group have more persistent disabilities on average than the Chronic-Not Severe group. The Chronic-Severe group reports a mean of 6.3 positive limitation reports within ten years after disability, while the Chronic-Not Severe group reports a mean of 5.4. The average severity ratio of the Chronic-Severe group (0.84) is more than six times that of the Chronic-Not Severe group (0.12).

To summarize the dynamic nature of disability status, Table 3 reports a modified second-order Markov transition matrix. A given row conditions on disability status (non-disabled, Currently Not Severely Disabled, Currently Severely Disabled) during the previous two years. The probability of the various outcomes over the next two years are then reported. We see that there is very strong persistence over time in disability status, especially for those who are non-disabled or Severely Disabled. There is a 0.97 probability that someone non-disabled for the past two years will be non-disabled this year, and the probability is 0.96 next year. However, someone Severely Disabled the past two years has a 0.77 probability of

²⁷ In principle, these four groups are not fully ordered. We cannot say, a priori, that the Chronic-Not Severe group is “more disabled” than the Temporary group. In practice, though, the Chronic-Not Severe group fares much worse than the non-chronic groups, as we see in our analyses.

being disabled this year and a 0.71 probability of being disabled next year. Among those moving into disability from the non-disabled, a transition to Severely Disabled tends to be long-lived. Such individuals have only a 0.32 probability of being non-disabled the following year, and a 0.38 probability the year after. Despite the overall tendency for change, the persistence of severe disabilities that are present for more than one year is indicated by these results.

F. Disability Rates and Lifetime Prevalence

We saw in Table 1 that roughly one in seven male household heads experiences a work limitation in a given year. Comparing disability rates among surveys, Burkhauser et al. (2006) find that PSID disability rates are higher than those in the March CPS, but are generally lower than those found using the Survey of Income Program Participation (SIPP) or the National Health Interview Survey (NHIS).²⁸ These differences may be due to the range of disabling conditions covered, question wording, or the definition of disability itself. The PSID focuses on conditions that limit work, but disability definitions used in the NHIS and SIPP include conditions that limit other activities besides work. Using the NHIS, Burkhauser et al. (2006) find that about 16.7 percent of people aged 25-61 have a disability in the year 2002 when non-work limitations are included. Using the SIPP, this rate in the year 2002 is 18.7 percent. These examples illustrate that other disability rates in the U.S. may be much higher than those found using definitions of disability that focus exclusively on work limitations.

A statistic that more naturally feeds into calculations of the insurance value of disability insurance is the probability that a person becomes disabled some time during his working life.²⁹ With data currently spanning 38 years, the PSID is ideally suited for this calculation. We define the **working lifetime prevalence of disability** as the probability of

²⁸ The CPS disability screening question is worded as follows: “Do you/Does anyone in this household have a health problem or disability which prevents (you/them) from working or which limits the kind or amount of work (you/they) can do?” Although this question asks about health problems, the lack of any probing regarding specific health problems seems to cause respondents to give fewer positive responses (Hale 2001). Second, it is also not clear whether interviewees regard mental or nervous problems as a “health problem.” Third, the word “disability” is used without any qualification of what it means, and the disability question is asked after questions about Social Security and SSI. It is plausible that interviewees may take the SSA’s definition of disability into consideration when answering.

²⁹ The information relevant in a full life-cycle model of insurance might be more extensive, including probabilities of disability at each age, the duration of the disability or the probability of recovery, the change in consumption, and any effects on the mortality rate.

an individual becomes disabled during his working life by a given age. We calculate this measure for all ages 28-64. For this purpose we use the information on disability reports and severity in a rolling ten-year-ahead window to classify an individual's current disability for each survey year. Accordingly, this measure fully accounts for the potential worsening of a condition over time. We then classify individuals by the most serious form of disability ever experienced and rank the disability types in increasing order of seriousness, as follows: One-Time, Temporary, Chronic-Not Severe and Chronic-Severe.

In these analyses, we use sample weights to better approximate U.S. averages.³⁰ As the number of years after 1968 increases, so does the number of years of past information in the PSID. In addition, we use up to ten years of future information on persistence and severity to classify a person's current condition. Thus, in order to have the best data to summarize disability histories, we focus on those individuals in the survey's middle years (1980-1990) who have been in the survey for at least ten prior years. Using the survey's initial waves would understate the prevalence rate because we do not have information about the individual prior to 1968 and many will have had a disabling condition well before the PSID began.³¹ By contrast, using the most recent years would not give us the full ten years of data after onset to classify a given disability.

We first report the chance of experiencing disability by the time an individual reaches a given age. Table 4 shows the lifetime prevalence rates for the 1980-1990 subsample, sorted by age.³² Not surprisingly, the chance of experiencing disability rises with age. By the time a person reaches age 56, there is a 53 percent chance that he has experienced some kind of disability during his working years. In particular, there is a 19 percent chance that an individual has ever experienced a Chronic-Severe disability by that age. The corresponding rates for One-Time, Temporary and Chronic-Not Severe disabling conditions are 8 percent, 8 percent and 18 percent. The rise in the prevalence of Chronic-Severe disability with age is steep. The chance of ever experiencing a Chronic-Severe disability by age 50 is almost five times that of experiencing one by age 40. Similarly, the probability by age 60 is about twice that by age 50.

³⁰ We use the current year weights in these analyses. Using the initial year weights (the first observed weight in the 1980-90 window) yields almost identical percentages.

³¹ Recall that the retrospective question was asked only if an individual was disabled at the time.

³² These prevalence rates may still be understated because of sample attrition and because the PSID does not interview the head if he is totally incapacitated. We have examined the reasons for attrition and find that the main causes are refusal and death, with total incapacitation accounting for less than 5 percent of all attrition.

In Appendix Table 3 we also report working lifetime disability rates over time for two different age groups: 40-49 and 50-59. Generally, we see a rise in disability prevalence over the 1980-1990 period – the probability of experiencing a disability at least once before reaching age 50 rises from 28 percent to 34 percent over this period. Most of the rise comes from an increase in One-Time disability, which more than doubles over this period. By the time an individual is in his 50s, the probability of his experiencing disability is close to 50 percent in the 1980s. There is little time trend in disability rates shown in this age group. More extensive analyses (not shown here), which account for definitional and sample changes, suggest a modest decline in disability rates over time.

There are a number of possible biases in these disability rates, most of which lead to an understatement of the rate, and most are small. If the head becomes totally incapacitated or dies before providing the minimum number of responses after disability onset, he is no longer in our sample. The mortality rate is noticeably higher for the disabled, about 1.25 percentage points higher annually, for those 31-50 (mortality rates seem to be somewhat understated in the PSID, so this is likely an understatement). Rates of total incapacitation are low and similar for the disabled and nondisabled. The other main source of attrition, refusal to answer the questionnaire, is substantial, but similar for the disabled and nondisabled. We also exclude those disabled before age 18 and those disabled before the start of the survey, if the age of onset is not reported retrospectively. This exclusion removes disabled individuals from both the numerator and denominator, decreasing the calculated rate.

G. Changes in the Severity Questions and Resulting Prevalence Rates

In the 1977-1985 surveys, the possible responses to the severity question are more limited with only three possibilities: “A lot,” “Somewhat,” or “Just a little.” In the other survey years, however, the range of possible responses to the severity question is wider, with options such as “Can do nothing,” “Completely,” “Severely,” and “Not at all” also available. An individual’s self-assessment of disability severity may be affected by the number of response options he faces and we do see that relatively more disabled are classified as severely disabled during 1977-1985 (see Column 4 of Table 1). This questionnaire change likely means that there is some change over time in the interpretation of severe disability. To examine how this questionnaire change affects our lifetime prevalence rates, we re-compute the severity ratio of each disabled individual without using their 1977-1985 responses to the

severity questions, and re-estimate the prevalence rates. Thus, the severity ratio of each disabled individual is determined using a more consistent and broad set of response categories.³³ In general, this restriction turns out to have a relatively small impact on our results, reducing the chance of having a Chronic-Severe disability by age 40 from 2.4 percent to 2.3 percent, by age 50 from 11.1 percent to 10.9 percent, and by age 60 from 23.1 percent to 21.3 percent.³⁴ In our main analyzes, we will use the 1977-1985 severity data to not unnecessarily reduce the sample size.

H. Empirical Methodology

To measure the change in economic outcomes before and after the onset of disability, we estimate the following fixed effect model for person i in year t :

$$(3) \quad y_{it} = \alpha_i + \gamma_t + X_{it}\beta + \sum_g \sum_k \delta_k^g A_{kit}^g + \varepsilon_{it},$$

where y_{it} is the outcome of interest (such as labor earnings) for person i in year t , α_i is an individual fixed effect and γ_t is an indicator variable for year t . X_{it} is a set of time-varying explanatory variables including marital status, state of residence, age and age-squared, education, and number of children. Additional controls are included, depending on the dependent variable.³⁵ A_{kit}^g is an indicator variable that equals one if in year t , individual i belongs to disability group g and he is k years from the year of onset, and ε_{it} is a potentially serially correlated error term.

The sample for our analyses consists of the nondisabled and the disabled during all years prior to disability onset through the ten years after onset. Throughout this study, we focus on a set of outcomes five years before and ten years after the year of disability onset, thus $k \in \{-5, 10\}$. Given the inclusion of individual fixed effects, δ_k^g measures the change in

³³This restriction reduces the number of disabled to 1,739 individuals, with 16 percent of them classified as Chronic Severe. Recall that we drop those chronically disabled who are unclassified under the severity dimension. When we ignore the 1977-1985 severity data, the number of Chronic-Not Severe individuals falls from 531 to 490 individuals. For the Chronic-Severe group, the sample size falls from 315 to 216 individuals.

³⁴ For the 1980 disability prevalence estimates, the chance of experiencing a Chronic-Severe disability is 6.4 percent for a 40-49 and 17.8 percent for a 50-59 year old, which is very similar to the original results in Appendix Table 3. For the 1990 estimates, they rates are 4.4 percent for those 40-49 and 14.8 percent for those 50-59 years old.

³⁵ The number of members in the family is included in the income regressions. For earnings, hours, hourly earnings and income, we also include interactions of education with age, age-squared and time since 1968. For the food and housing consumption regressions, variables for the numbers of family members of different genders and ages are also included. For more details, see the data appendix (Appendix 3).

the dependent variable k years away from the year of onset for those in disability group g relative to the value of their dependent variable more than five years prior to disability. The non-disabled are included to improve the precision of the estimated effects of age, education and the other control variables. This way of modeling the time pattern of economic outcomes is similar to the approach of Jacobson, LaLonde and Sullivan (1993), Stephens (2001) and Charles (2003).³⁶

4. Employment and Earnings Following Disability

We first focus on labor supply and investigate the changes in annual earnings, annual hours worked, probability of work and hourly wage during the five years before and ten years after disability onset. For earnings, we begin by looking at the level changes and their corresponding percentage changes. It might seem more natural to estimate equation (3) with the dependent variable in logarithms in some cases in order to analyze percentage changes directly. As we will show, however, many disabled people have zero earnings and zero hours of work following disability, and taking the log of zero is not possible. Defining a lower cutoff (that is, $\log(y) = \log(a)$ for $y < a$) is also not ideal, as the estimates are sensitive to this cutoff due to the large percentage of disabled who have zero earnings and the differences in this fraction across groups and over time.³⁷ All monetary variables are reported in 2005 dollars, adjusting for inflation using the Consumer Price Index Research Series using Current Methods (CPI-U-RS).³⁸

A. Earnings

Table 5 shows the results of estimating equation (3) with annual earnings as the dependent variable. Column 1 shows the results for the disabled as a whole. We see that earnings decline rapidly around the year of disability onset, falling about \$4,000 by the year prior to onset and \$6,400 by the year of onset, relative to the years more than five years prior

³⁶ The analysis of Charles (2003) includes individual-specific time trends, which is one of the approaches in the Jacobson, LaLonde and Sullivan (1993) analysis of earnings of the displaced. We suspect that disabling conditions have effects prior to disability onset, however, and we have found that the results tend to be sensitive to the period over which such trends are estimated.

³⁷ Charles (2003) analyzes outcomes in logarithms, omitting observations with zero values and includes a selection correction term (inverse Mill's ratio).

³⁸ See the data appendix (Appendix 3).

to onset (that is, $k < -5$, where $k = 0$ in the year of disability onset). Annual earnings fall further throughout the years after disability onset. The average long-term (six to ten years after disability onset) decline in yearly earnings is about \$10,000.

We obtain the implied percentage changes by dividing these coefficient estimates by the average earnings of the disabled more than five years prior to disability (\$43,309). Column 2 shows these estimates, which are displayed in Figure 1. Earnings fall 15 percent on average by the year of disability onset; this decline continues over the next two years, reaching about 21 percent. The earnings drop remains at around this level through the ten years after onset. These results are very similar to those of Stephens (2001).³⁹

Changes in average earnings for all disabled hide great heterogeneity across the Extent of Disability groups. In columns 3 through 10, we report each disability group's estimated average dollar change followed by its implied percentage change (Figure 1 shows these implied percentage changes). Not surprisingly, earnings drop the least after disability for the One-Time and Temporary groups. For the One-Time group, they fall \$4,300 (10 percent) by the year of onset. By the fifth year after onset, the decline reaches about \$7,100 (16 percent). In the second five year period (six to ten years after disability onset), annual earnings drop about \$5,500.⁴⁰ While many of the single-year changes in earnings for the One-Time group are substantial and statistically significant, by years 9 and 10 the effects are much smaller and not statistical significant. As one might expect, a short-lived disability does not greatly affect an individual's earning ability in the long run.

A slightly different pattern emerges for the Temporary group. Earnings drop 9 percent by the year of onset and 12 percent by the year after onset. By the third year after onset, the earnings drop shrinks to about 6 percent. The estimated yearly changes from this time on are mostly small and statistically not different from zero.⁴¹

³⁹ Stephens (2001) finds that disabled individuals experience a decline in annual earnings of about 10 percent during the year of onset and experience a long-term loss in annual earnings of about 22 percent. Both our results and those of Stephens's are not comparable with those of Charles (2003) because the analyses in Charles exclude those with zero earnings. As we summarize in Mok, Meyer, Charles and Achen (2008), we are unable to reproduce results in Charles (2003).

⁴⁰ These estimates are obtained by estimating equation (1) with four time groups instead of the 16 years from onset indicator variables. The four time groups are $k = -5$ to $k = -2$, $k = -1$ to $k = 1$, $k = 2$ to $k = 5$ and $k = 6$ to $k = 10$, where k is the year from onset.

⁴¹ An F-test of the null hypothesis that all estimates after $k = 5$ are zero has a p-value of 0.32; it thus fails to reject the null hypothesis.

For the Chronic-Not Severe group, earnings drop about 17 percent by the year of disability onset. This decline in earnings continues through the following ten years; by the tenth year after disability onset, it reaches about 32 percent.

The decline in the earnings of the Chronic-Severe group is especially large. By the year of onset, earnings fall 32 percent. In the following year, they fall an additional 18 percentage points, resulting in a cumulative loss of about 50 percent. This downward trend continues, and by the tenth year after onset, earnings have dropped by almost 69 percent. Such a drop is almost triple that of the average disabled. As we will see, this pronounced drop is due to the large number of people who work zero hours after disability.

A closer examination of the two chronic groups suggests that they both experience a decline in earnings prior to disability onset. By the year before onset, earnings of the Chronic-Not Severe group and the Chronic-Severe group drop 12 percent and 17 percent, respectively. Our conceptual framework provides an explanation for this observation. We argued that the willingness to state that one is disabled is a function of several factors and current productivity (as opposed to the expectation of future productivity) is just one of them. Thus, a slight decline in productivity may not be enough to prompt a person to say he is disabled. This decline in productivity will decrease his earnings, however, as our results indicate. We would expect that the productivity decline would be larger for the more disabled groups, and our results concur; the chronic groups experience a larger pre-onset decline in earnings than the One-Time and Temporary groups.

B. Hours of Work and Employment

In this subsection, we examine how annual hours of work and employment change with disability. Column 1 of Table 6 shows the changes in annual hours of work of the average disabled, and Figure 2 depicts these changes. Similarly, column 2 reports the percentage of the average disabled working zero hours; these results are displayed in Figure 3. By the year of onset, annual hours of work are estimated to decline about 240 hours for the average disabled, with about 6 percent of this population not working during this year. By the following year, the drop increases to 355 hours with 13 percent of the disabled not working. From then on, the change in annual hours of work remains roughly flat, but the percentage of the disabled who work zero hours continues to rise. In the long term (six to ten

years after disability onset), almost one-fifth of the average disabled do not work at all during the year.

Columns 3 through 10 of Table 6 report the hours and employment changes for the Extent of Disability groups. We see relatively small changes in annual work hours for the One-Time group; they are estimated to drop by only about 100 hours during disability onset and by an additional 15 hours by the following year. From then on, the fall diminishes. An F-test that all estimates of the change in hours after $k = 5$ are zero fails to reject the null hypothesis (p -value = 0.22) for our One-Time group. We observe a similar pattern for the Temporary group. By the tenth year after onset, about 7 or 8 percent of people in the One-Time and Temporary groups work zero hours.

Changes in yearly hours of work are much larger for the Chronic-Not Severe group, with an estimated decline of almost 200 hours by the year of onset. By the fifth year after onset, this group's work hours are estimated to decline by about 300 with about 10 percent of these individuals not working at all. In the long run (six to ten years after disability onset), yearly work hours are estimated to decline by more than 260 with about 10 percent of these household heads not doing any work during the year.⁴² Although these declines are large, they are much smaller than those of the Chronic-Severe group, whose annual hours of work are estimated to plummet by almost 690 by the year of onset. By the following year, annual hours are estimated to decline by about 1,100, and about 40 percent of this group is doing no work during the year. In the long run (six to ten years after onset), annual hours of work for the Chronic-Severe group are estimated to decline by about 1,400. We also see that only about 30 percent of this group will do any work in a year during this period. Note, however, that the rise in this zero-work percentage is not instantaneous; it rises gradually from about 40 percent in the year after onset to about 65 percent by the tenth year after onset. An explanation might be that these people's disabilities worsen over time, and eventually they find themselves incapable of doing any work.

C. Hourly Earnings Following Disability

The above results suggest a rise in non-work following disability onset. We now examine what happens to hourly earnings conditional on working. It is unlikely that those who are working are a random sample of the disabled population. Instead, we expect disabled

⁴² See footnote 38 for how we estimate average changes for years six to ten.

individuals who are working to be experiencing disproportionately lower hourly earnings losses. We measure hourly earnings as annual earnings divided by hours of work, and classify as working those who work 500 hours or more during the year. Figure 4 displays the change in log hourly earnings before and after disability onset for all disabled and by extent of disability groups.⁴³ For the One-time and Temporary groups, there is no evidence that their hourly earnings decline at all throughout the first ten years of disability, as all estimates are small (almost all are below 4 percent) and imprecisely measured. The Chronic-Not Severe and Chronic-Severe groups, however, experience drastic declines in hourly earnings following disability even among those who are working. By the fifth year after disability onset, hourly earnings drop 13 percent for the Chronic-Not Severe group and 18 percent for the Chronic-Severe group. In the long-run (six to ten years after disability onset), hourly earnings decline an estimated 19 percent for the Chronic-Not Severe group and about 22 percent for the Chronic-Severe group. These findings contrast sharply with those in Charles (2003), who finds very small changes in hourly earnings (no more than 3.2 percent and most of the changes found are statistically insignificant).

5. Changes in Income, Poverty and Transfers with Disability

A. After-Tax Income

Our results in the previous section suggest that earnings decline after disability, especially for the Chronic-Severe group. It would be premature to conclude, however, that these large declines translate into large reductions in economic well-being. The effects of lowered earnings may be cushioned by many factors, including 1) public benefits, 2) intra-family risk-sharing through earnings of a spouse or children, 3) inter-family transfers such as support from friends and relatives and 4) reductions in taxes or increases in tax credits from programs such as the Earned Income Tax Credit that supplement income for the working-poor. In this section, we examine changes in family income after disability.

Using the summary family income variable provided by the PSID, which is the sum of labor, asset and transfer income, may be unsatisfactory even after we account for federal

⁴³ The estimates for the change in log hourly earnings are reported in Appendix Table 4.

income tax liabilities.⁴⁴ First, this measure does not include in-kind transfers such as Food Stamps and subsidized housing. Second, public transfer income is generally under-reported in household surveys, and transfers to the disabled in the PSID are no exception.⁴⁵

We formulate two income measures that are useful when examining the material well-being of the disabled. First, we define “After-Tax Pre-Public Transfer Income” as family income less federal taxes and benefits from the main types of public benefit programs.⁴⁶ This income measure enables us to see how much non-labor earnings, and intra- and inter-family transfers mitigate the income loss due to the lowered earnings of the head that result from disability.

Second, we define “After-Tax Post-Transfer Income” as the sum of after-tax family income, Food Stamps and the amount of any housing subsidy received.⁴⁷ In addition, we account for under-reporting in the main public benefit programs by scaling the benefits received using the program-specific reporting rates as reported in Meyer, Mok and Sullivan (2006). These reporting rates are calculated by comparing the weighted sum of the benefits received by the entire PSID sample with those reported to have been paid out by government agencies. By scaling up benefits in this way, we implicitly assume that non-reporting recipients share the same characteristics as reporting recipients. The difference between our two income measures will enable us to see how the receipt of benefits from various public programs affects the drop in income after disability.

Table 7 reports the estimated changes in the dollar amount of after-tax pre-public transfer income received, as well as the corresponding percentage changes. The percentage changes are also displayed in Figure 5. For the disabled as a whole (Column 2), after-tax pre-public transfer income drops about 11 percent by the year of disability onset. The declining trend continues and the drop by the tenth year after onset is about 18 percent.

Before examining the changes for the other disability groups, let us consider how public transfers mitigate the income drop for the average disabled. Table 8 reports the estimated changes in after-tax post-transfer income, which are also displayed in Figure 6.

⁴⁴ We use TAXSIM to generate tax liability estimates. See the Data Appendix (Appendix 3) for details. A technical appendix discussing how we deal with the family issues in estimating federal tax liabilities via TAXSIM is available upon request.

⁴⁵ See Meyer, Mok and Sullivan (2008) for evidence of under-reporting of public transfers in several datasets including the PSID.

⁴⁶ The public benefit programs are Social Security, Supplemental Security Income, unemployment insurance, workers’ compensation, Aid to Families with Dependent Children/Temporary Assistance for Needy Families, Veterans (VA) pensions and other welfare.

⁴⁷ See the Data Appendix (Appendix 3) for how we estimate the value of housing subsidies.

Including public transfers almost halves the income drop for the average disabled, to about 6 percent by the year of onset and about 11 percent by the tenth year after onset.⁴⁸

It is also evident that changes in family income vary considerably among the disabled groups. For the Chronic-Not Severe group, pre-public transfer income drops an estimated 9 percent by the year of onset. Public transfers reduce this drop to 4 percent (but this is imprecisely estimated). Income continues to fall through the ten years after disability. By the tenth year after onset, pre-public transfer income has fallen by almost 20 percent. With public transfers, the income drop is reduced to about 12 percent. For the One-Time and Temporary groups, post-transfer income changes by the tenth year after disability onset are generally small and statistically insignificant.

For the Chronic-Severe group, there is significant evidence of a pre-onset fall of about 11 percent in both income measures. As we saw earlier, this drop is primarily due to a fall in earnings prior to disability. We will later see some evidence that suggests that there is worsening of health prior to onset. By the year of onset, the drop in after-tax pre-public transfer income is about 25 percent, but only 15 percent when public transfers are included. The role of public transfers in alleviating the post-onset income drop is evident throughout the Chronic-Severe group's disability history. By the tenth year after onset, pre-public transfer income drops about 56 percent; when public transfers are included, the income drop is reduced to 32 percent.

B. Poverty

A standard indicator of well-being is the percentage of a group with income below the poverty line. Figure 7 shows the percentage of the different disabled groups living below poverty in the years before and after disability onset. Here we deviate from the official poverty measure and incorporate some of the improvements that are commonly suggested. In particular, we account for taxes and in-kind transfers (food stamps and the value of subsidized housing). We compare this after-tax post-public transfer income to the official poverty thresholds published by the U.S. Census Bureau which depend on the number of family members and children.

⁴⁸ Stephens (2001) finds that family income falls about 7.4 percent by the year of onset and 15.5 percent by the fifth year after onset. He does not, however, account for benefit under-reporting.

Not surprisingly, the Chronic-Severe group has the highest poverty rates. Over 17 percent of the Chronic-Severe disabled group lives below poverty during the year of disability onset; the number reaches almost 23 percent by the following year. The poverty rate for this group remains at roughly this level until the ninth year after onset when it starts to decline. By the tenth year after onset, about 18 percent of the Chronic-Severe group has income below the poverty threshold. In contrast, there is little change in the poverty rate for the One-Time disabled group over time. Poverty among the Temporary group rises to a peak of around 15 percent in the second year after onset, and then declines steadily.

C. Public Transfer Income and Dissaving

Our estimates above reveal that the Chronic-Severe group suffers the largest average decline in earnings and income. A comparison of the changes in our two income measures also suggests that the Chronic-Severe group receives substantial public transfers. To see this result, we estimate equation (3) with public transfers received as the dependent variable (adjusted for benefit under-reporting, including Food Stamps and subsidized housing). Figure 8 shows these estimates for various disabled groups. The Chronic-Severe group receives by far the largest amount of public transfers; total benefits increase \$6,000 by the year of onset. Benefits received continue to rise steadily through the next ten years. By the tenth year after onset, members of this group receive on average about \$12,000 per year in public transfer income. In contrast, members of the Chronic-Not Severe group receive only about \$2,300.

Given the significant public transfer income the disabled receive in the long run (six-ten years after disability onset), it is useful to examine their participation in various social insurance programs. In Appendix Table 5 we report receipt rates for disabled individuals who are in their sixth to tenth year after disability onset. Not surprisingly, most of the disabled in the Chronic-Severe group receive benefits – 48 percent receive Social Security retirement or disability benefits (42 percent receive SSDI),⁴⁹ 9 percent receive SSI (and that about 50 percent receive SSDI or SSI), and 24 percent receive food stamps. These rates are considerably higher than those of the Chronic-Not Severe and Temporary groups. In the case of SSDI, the receipt rate of the Chronic-Severe group is about ten times that of the Chronic-

⁴⁹ The SSDI receipt rate is based on 1984-1992 surveys, as these are the only years when the type of Social Security payments received was recorded for the household head.

Not Severe group. But as we will see in our next section, those in the Chronic-Severe group still suffer on average from a large drop in living standards despite these relatively high benefit receipt rates.

Appendix Table 5 also reports the share of each disability group that neither receives benefits nor works. This fraction is especially high for the Chronic Severe group of which 13 percent does not have an obvious means of nonpublic support besides family member earnings or asset returns. The last two rows of Appendix Table 5 report pre-onset and post-onset median net wealth. We see that for the Chronic-Severe group there is a substantial decline in assets over time from 39 thousand dollars to 23 thousand dollars. On the other hand, median assets rise sharply for the other less disabled groups. This difference suggests that a substantial part of the resources that prevent an even larger consumption fall for the Chronic-Severe disabled come from dissaving.

The calculations in the previous paragraph are medians for different individuals over time. We have further explored the extent of dissaving by calculating the annual change in wealth when possible. Here we examine true changes using the five-year apart wealth measures beginning in 1984 and the two-year apart measures which begin in 1997. These numbers also indicate a sharp difference in the saving/dissaving of the Chronic-Severe group compared to the other disabled groups and the nondisabled. While the median annual change in wealth is about two thousand dollars for all other groups, for the Chronic-Severe group it is essentially zero (though the point estimate is positive). Again, the estimates suggest that the Chronic-Severe group only maintains consumption by drawing upon wealth, though the estimates are imprecise given that we have just under 200 observations on wealth changes.⁵⁰

We have also studied the degree of spousal risk sharing by estimating the changes in the annual hours of work of wives of disabled heads.⁵¹ Appendix Table 6 shows these results. The general pattern suggests a decline in hours worked by the wife, particularly for those

⁵⁰ We have also investigated how annual wealth falls for the Chronic-Severe disabled during their later years of disability. First, we define annual change in wealth to be the difference in reported wealth in two adjacent surveys (when wealth data are available), divided by the number of years between these surveys. We then run a regression of annual change in wealth (per adult) on age, age-squared, individual fixed effects, indicator variables for years of education (12, 13-15, 16, 17 and above), indicator variables for years, number of family members, number of children, and time from onset indicator variables for each disability group (-5 to -2, -1 to 5, 6-10). We find that for the Chronic-Severe group in the 6-10 years after disability, wealth is estimated to fall by about \$4,500 per year, relative to their pre-disability years. However, this estimate is very imprecise due to the small sample.

⁵¹ A priori, there is no reason to believe that the wife of a disabled husband will unequivocally work more, as she may prefer to spend less time working and instead care for her husband. While we find little evidence of increased spousal work, as we also later indicate, we also find little evidence of increased spousal time caring for other adults in the family.

with a chronically and severely disabled husband; the evidence is not conclusive, however.⁵² Although not reported, we have also examined changes in marital status of the disabled over time. We find that the share of disabled male heads that report their marital status as “Divorced” or “Separated from Spouse” rises sharply over time relative to the nondisabled, after accounting for age, education, children and other characteristics. The rise is especially sharp for the more disabled groups.⁵³ On the surface, these findings suggest that badly disabled men often lose support from their wives as well.

This part of the paper illustrates the economic hardship of the disabled and their reliance on public transfer programs. This pattern is particularly true for the Chronic-Severe group, which suffers large earnings losses and has a high receipt rate of public transfer income. Despite the various public transfers they receive, about one-fifth of this group has incomes below the poverty line in the long term.

6. Consumption Changes Surrounding Disability

Economic theory suggests that material well-being is more directly tied to current consumption than to current income. Conceptually, income is subject to transitory fluctuations caused by events such as job or family composition changes. Living standard may remain unaffected despite large income changes, however, if savings can be drawn upon (Poterba 1991, Cutler and Katz 1991). Consumption may also lend itself to more accurate reporting than income for those who are disadvantaged. There is substantial evidence suggesting that income is under-reported. For example, Meyer, Mok and Sullivan (2008) find that major household surveys sharply under-report many types of government transfer income, and this under-reporting is rising. Meyer and Sullivan (2003) argue that income is badly measured for those who are at the bottom of the resource distribution, likely because this group has many small irregular sources of income. Measuring disposable income entails the further complication of accounting for taxes. By contrast, analyzing consumption may reduce or even eliminate many of these problems. Furthermore, consumption is more closely

⁵² Although not reported, we have also studied the degree of intra-family risk sharing by examining the changes in earnings of other family members during the head’s period of disability; we find that they are generally small and insignificant, consistent with the findings of Nagi and Hadley (1972).

⁵³ A study by Charles and Stephens (2004) finds no change in the divorce hazard after disability.

associated with other measures of well-being for the disadvantaged (Meyer and Sullivan 2003, 2007).

The life-cycle model briefly summarized in Section 2 indicates that consumption should be relatively smooth following disability onset. A few comments on the assumptions and applicability of the model to the disabled are in order. First of all, the model only implies small consumption changes if the interest rate is not too far from the discount rate adjusted for mortality and if precautionary saving motives are small. In general, we expect these conditions to hold for most households. Second, the marginal utility of consumption must not fall sharply with disability onset. In principle, the marginal utility of consumption could rise or fall. Marginal utility might rise if disability sufficiently increases demand for uncovered medical or nursing care, wheelchairs, scooters, elevator buildings, and ranch houses. It might fall if travel, eating out, and recreation demand fall.⁵⁴ Third, and probably most importantly, the model is most suitable for a representative individual. We find, however, that disabled households on average have about 4 members, falling to about 3.5 ten years after onset. Thus, disabled households are not that different from nondisabled households in terms of the applicability of the usual prediction of smooth life-cycle consumption.

A. Food and Housing Consumption

We focus on the two components of consumption that can be measured well in the PSID: food and housing.⁵⁵ Food consumption is defined as the sum of family food consumption expenditure at home, family food consumption expenditure outside the home and the face value of Food Stamps received.⁵⁶ We define housing consumption as the sum of owned dwelling service flows calculated as 6 percent of current housing value, rent payments

⁵⁴ For recent empirical evidence on the effect of bad health on the marginal utility of consumption see Finkelstein, Luttmer and Notowidigdo (2008) and the discussion and references there.

⁵⁵ Many authors have used the food and housing variables in the PSID to impute total consumption expenditures (Skinner 1987; Meyer and Sullivan 2003; Blundell et al. 2005) via the use of the Consumer Expenditure Survey (CE Survey). A potential problem in predicting consumption for the disabled is that the relationship between characteristics and consumption differs between the disabled and non-disabled, and the CE Survey question on disability is very different from the PSID question. In the CE Survey the question is only asked of those who have not worked in the past 12 months, and includes disability along with other reasons for not working.

⁵⁶ The PSID food-spending question is “How much do you (family) spend on food in an average week?” We assume that the question refers to the time of interview rather than the previous year.

and the rental subsidy for those with free or subsidized housing.⁵⁷ Note, that both consumption outcomes are measured at the household level, so in most cases a fall in these variables reflects a decline in consumption for more than the disabled head.

Table 9 reports the estimated changes in food consumption and food plus housing consumption for our disabled groups; these estimates are also shown in Figure 9 (food) and Figure 10 (food plus housing). For the disabled as a whole, food consumption (Column 1) falls 2 percent by the year of onset while food plus housing (Column 2) drops about 3 percent.⁵⁸ By the tenth year after onset, food consumption drops 8 percent on average while food plus housing drops 9 percent. These estimates are very similar to those in Stephens (2001). Overall, our estimates imply that by the tenth year after disability onset, the average disabled man faces a decline in earnings of 25 percent, in after-tax post-transfers income of 11 percent, in food plus housing consumption of 9 percent and in food consumption of 8 percent. The smaller decline found for disposable income than for earnings and the even smaller decline in consumption is plausible given other sources of income and the drawing down of savings by some households.

Across the Extent of Disability groups, we again see that the decline in consumption is most dramatic for the Chronic-Severe group. By the year before onset, food consumption has fallen an estimated 12 percent and food plus housing consumption has fallen by a similar magnitude. Consumption continues to decline through the next ten years – by the tenth year after disability onset, food consumption has fallen by about 21 percent and food plus housing by about 22 percent. These large declines are more than triple those of the Temporary and Chronic-Not Severe groups, for whom food consumption drops 5 percent and 7 percent, respectively. Compared with our previous estimates for the Chronic-Severe group, earnings fall 68 percent, after-tax post-transfers income falls 32 percent, food plus housing falls 22 percent and food falls 21 percent. These declines are close to triple those of the average disabled. The pattern also reflects the incomplete roles that savings, family support and social insurance play in reducing the consumption drop following disability for the Chronic-Severe group.

⁵⁷ The PSID does not ask questions about the amount of any rental subsidy received, especially for those whose dwelling is partially publicly subsidized. We thus construct a rental subsidy for a head by predicting the rent he would pay if he lived in market housing and then subtracting the actual rent paid from this predicted rent. Details on how we construct the rental subsidy are included in the data appendix (Appendix 3).

⁵⁸ Note that these are logarithmic regressions – we obtain the percentage change by taking the exponent of the coefficient and subtracting one.

We also note that food consumption has fallen by about 12 percent the year before onset for the Chronic-Severe disabled. According to our conceptual framework, a person may not immediately report he has a disability even when his productivity has fallen. During this period of decreased productivity, however, he might expect that his future income will be permanently lowered. Consequently, such a person may immediately adjust his consumption downwards as suggested by the Permanent Income Hypothesis.

B. Food Eaten at Home and Outside Home

The above estimates suggest that food consumption falls after disability. It is important to remember that our food consumption variable primarily consists of food eaten at home and food eaten outside, and the latter is more expensive. If the observed fall in food consumption were due purely to a switch from meals eaten outside home to meals eaten at home, then it would be premature to conclude that a fall in food consumption translates to a fall in actual material well-being. To clarify this issue, we look at the change in food eaten at home and outside the home separately. The results are depicted in Figure 11 (food at home) and Figure 12 (food outside home).⁵⁹

Focusing on the Chronic-Severe group, it is evident that they suffer the greatest drop in expenditure on food eaten at home and outside the home. Although the estimates suggest a pre-onset fall in both measures, these changes are imprecisely measured.⁶⁰ The decline in consumption of food at home (12 percent) is first apparent in the second year after disability onset. From this point on, consumption fluctuates around this level. By the tenth year after onset, food at home and food outside the home have fallen about 13 percent and 46 percent, respectively.

That both food eaten at home and food eaten outside fall substantially after disability suggests that the drop in overall food consumption for the Chronic-Severe disabled is not mostly due to a shift towards more meals eaten at home.

C. Exploring the Source of Changes in Housing Consumption

⁵⁹ Appendix Table 7 reports the underlying estimates.

⁶⁰ An F-test that all pre-onset estimates are zero has the p-value 0.15 for food at home and 0.39 for food outside the home.

We saw in Table 9 that food and housing consumption fall after disability. Exactly how the fall in housing consumption occurs is unclear because on the surface housing consumption seems hard to adjust. We examine the importance of post-disability housing adjustments, such as selling a house and becoming a renter, buying a smaller house or renting a smaller apartment. To analyze the sources of the decline, we decompose the changes in housing consumption into changes in housing type and consumption given the housing type. Let C_{it} be the housing consumption for person i in year t , defined as the sum over housing types of the product of an indicator for housing type j , S_{it}^j , and the consumption of housing type j , C_{it}^j where $j \in \{\text{own, rent, public housing}\}$. In other words

$$(4) \quad C_{it} = \sum_j S_{it}^j C_{it}^j .$$

We let the corresponding variables without the subscript i denote averages over i . By appropriately adding and subtracting terms, we can then write the change between two periods, denoted 1 and 2, as

$$(5) \quad C_2 - C_1 = \sum_j (S_2^j - S_1^j) C_2^j + \sum_j (C_2^j - C_1^j) S_1^j .$$

Equation (5) shows that the change in consumption between two periods depends on the change in shares (S^j) and the changes in consumption, given type (C^j). To estimate these terms, accounting for individual characteristics, we run a series of fixed effect regressions similar to equation (3) above. We focus on changes specifically after the fifth year of disability onset. First, we run a series of fixed effect linear probability models of the form

$$(6) \quad S_{it}^j = \alpha_i + \gamma_t + X_{it} \beta + \sum_g \sum_k \delta_k^g A_{kit}^g + \sum_g \theta^g B_{it}^g + \varepsilon_{it}$$

where S_{it}^j is a dichotomous variable that equals one if individual i consumes a particular housing type j , α_i is a fixed effect, γ_t is a set of time indicator variables, and X_{it} is a set of time-varying explanatory variables (including marital status, state of residence, age and age-squared, education, and the number of children). A_{kit}^g is a dichotomous variable that equals one if individual i is in disability group g and is k years after disability onset, where $k \in \{-5, -4, \dots, 4, 5\}$. B_{it}^g is a dichotomous variable that equals one if the individual i is in disability group g and is in year six through ten after disability onset. ε_{it} is a potentially serially correlated error term, as before. We run the fixed effect linear probability model three times, once for each housing type. We again focus on our four disability groups, so $g \in \{1, 2, 3, 4\}$. The coefficients of interest are the θ^g , which represent the estimated change in the

probability of consuming a housing type j in the long run (six to ten years following disability).

Panel A of Table 10 shows the results. For the Chronic-Not Severe and the Chronic-Severe group, the likelihood of living in public housing increases in the long run by 1.8 percent and 5.7 percent, respectively, with the change for the Chronic-Severe group statistically significant. The likelihood of these groups renting or owning a home, however, does not change significantly in the long run.

Next, we examine the change in housing consumption within each type of housing. We estimate models similar to equation (6), but the amount of consumption of a particular type of housing becomes the dependent variable. We split the sample into three parts according to the type of housing chosen and estimate the fixed effect regressions in each subsample. Again, the coefficients of interest are the θ^g , which represent the estimated long-term change in the amount of housing consumption, conditional on the individual being in Extent of Disability group g and consuming a particular housing type j .

Panel B of Table 10 shows the results. The Chronic-Severe group again displays some pronounced patterns. The estimated decline in homeowners' housing consumption in the long run is more than \$2,600 a year; this corresponds to a drop in home value of more than \$43,900. For those who rent private housing units, estimated annual rent paid declines about \$1,220 (\$101 per month) in the long run. Both results suggest that members of the Chronic-Severe group who do not receive public housing decrease their housing consumption to accommodate an overall decline in resources by moving to less costly dwelling units.

D. Consumption After Social Security Eligibility

Up to now, we have investigated how the working age disabled fare after their disability onset. However, after a disabled person becomes eligible for social security retirement benefits, his income and consequently consumption may rise. To examine this issue, we regress consumption on age indicator variables. Specifically, we regress consumption (food plus housing) on a set of age indicator variables (62-64, 65-69, 70-74), year indicator variables, individual fixed effects and a set of non-age demographic variables (indicator for being married, number of family members, number of children in the family

and years of education of the head). We estimate these regressions using only members of the Chronic-Severe group. The coefficients of interest are those on the age indicator variables which measure changes in consumption for the average Chronic-Severe disabled as he reaches 62-64, 65-69 and 70-74 relative to his pre-retirement consumption. We find that food and housing consumption for the average Chronic-Severe disabled is not significantly different during all periods after social security eligibility, though the point estimates suggest that consumption falls slightly relative to the pre-retirement years.⁶¹ We do not find a significant difference in this change with age between those who receive SSDI prior to age 62, and those who do not.

7. Robustness Checks and Additional Results

In this section we examine alternative explanations for our results and the effects of accounting for unobserved differences between the disabled and the nondisabled through fixed effects. We also examine the time-use of the disabled both because it is another indicator of well-being and because time can potentially be substituted for the lower incomes of the disabled. The details of these analyses are in the Additional Results appendix (Appendix 2), but we summarize our main findings here.

A. Differences in Unemployment, Illness and Health Prior to the Onset of Disability

One might wonder if a period of unemployment or other bad employment outcomes lead a person to say he is disabled. While conceptually it may be difficult to observe what leads to bad employment outcomes, i.e. whether it is bad health, a declining industry, or a string of bad luck, we can compare the pattern of unemployment and health prior to disability onset. Our conceptual framework suggests that an individual will decide when he is disabled as a function of his time-varying productivity, disutility of work, and other factors. Here we present suggestive evidence for our framework by looking at how unemployment, illness and health change prior to when an individual reports a condition that limits work. Appendix Figure 1 shows the estimated change in the number of working days lost due to

⁶¹ When we further control for time after disability onset (by including a set of 13 indicator variables A_{kit} , where k is the year from onset for individual i in year t for $k=\{0,1,\dots,10, 11-20, 21 \text{ and above}\}$), we obtain very similar estimates, that are not significantly different from zero, that again suggest small declines in consumption after the earliest eligibility age for social security retirement benefits.

unemployment in each of the five years before disability onset. For the average disabled, there is virtually no change. For the chronic groups, however, there is a dip in days of unemployment during the third and fourth year before onset, contrasted with similar days of unemployment in the other years.

Next, we look at changes in the number of workdays lost due to illness; Appendix Figure 2 shows the results. The figure suggests that the number of workdays lost due to illness rises as we approach the year of onset; changes are similar for all disabled groups. Finally, we look at the change in health status. Appendix Figure 3 shows the estimates of equation (3) with a dependent variable that equals one if the individual is in fair or poor health. Here again we see some suggestive evidence that changes in health or illness are a reason for reporting a disability. This change is particularly noticeable for our Chronic-Severe group; the fraction of those reporting fair or poor health increases about 9 percentage points just prior to disability onset. Overall, these results suggest that worsening health is a reason that a person eventually reports a disability.

B. Underlying Permanent Differences Between the Disabled and Non-Disabled

We compare the estimated effect of disability on various outcomes with and without fixed effects to examine how the disabled differ in terms of unobservable permanent characteristics. These estimates indicate the extent to which it is important to estimate fixed effects models, which account for these unobserved differences, rather than OLS models of disability outcomes. In both sets of specifications we include the non-disabled. When we include fixed effects, the estimates for outcomes are relative to those for the disabled more than five years before onset. When we do not include fixed effects, the estimates for outcomes are relative to the disabled more than five years before onset *and the non-disabled* with similar age, education, etc. Thus, a comparison of the estimates with and without fixed effects tells us how the unobserved characteristics of the disabled that affect the outcome in question compare to those of the non-disabled with similar observed characteristics.

In the case of the Chronic-Severe group, we notice a number of patterns. The most striking pattern is a lack of difference between the estimates with and without fixed effects after onset. After-onset earnings, hours, after-tax post-transfer income, and food consumption are all very similar with and without fixed effects. This result suggests that the disabled (after accounting for observable characteristics) are not different from the non-

disabled in terms of attributes that affect these outcomes. There is a noticeable difference for food plus housing consumption, with the estimates without fixed effects being about five percentage points higher after onset. This result implies that the Chronic-Severe disabled consumed more pre-onset than their characteristics imply. In terms of pre-disability estimates, the disabled have unobserved characteristics that lead to lower hours (about 75 hours per year) and lower earnings (about 6 percent) in the five years before disability onset, but these differences disappear after onset. This pattern is also true for post-tax, post-transfer income. Thus, there appears to be little pronounced difference between Chronic-Severe and non-disabled groups. What change there is appears to be overwhelmed by the changes in sample composition during the years after onset.

For the group of all disabled, the patterns are mostly similar. The differences after onset tend to be fairly small, with almost no difference for consumption. Before onset, the estimates with fixed effects are slightly higher for most outcomes, indicating that the disabled in the sample for those years have worse unobserved characteristics than the non-disabled.

C. Later Disabilities

We base our disability classification throughout the paper only on the first observed disability. Here we examine whether those non-Chronic-Severe disabled individuals whose disability classification subsequently changes to Chronic-Severe over time (using a rolling ten-year-ahead window) exhibit outcomes similar to those of the original Chronic-Severe group. We find that the long-term changes in various outcomes based on these Chronic-Severe disability spells that begin after other spells are quantitatively similar to those of the original Chronic-Severe group presented above. Thus, our post-onset outcome estimates for the Chronic-Severe group also apply to those who experience such disability after a less serious condition.

D. Social Security and Outcomes

A natural question to ask is how the Chronic-Severe disabled who receive Social Security fare relative to their non-receiving counterparts. To examine this issue, we split the Chronic-Severe group into those who receive Social Security benefits more than half of the time within the ten years after disability onset (SSA recipients) and those who do not (SSA non-recipients). We find that those who receive Social Security payments stop working

earlier than those who do not. Nonetheless, the fall in income and consumption is very similar for the two groups.

E. Cohort Differences

We have also examined whether the material consequences of disability have changed over time. To do so, we split the disabled into two samples: those who are first disabled before 1985, and those disabled later. We estimate the outcome regressions on these two samples separately and find that the two sets of results for the Chronic-Severe group are very similar.

F. Detailed Consumption and Time-use Data

The results in Section 6 above suggest that the disabled suffer from a sizable drop in food consumption, particularly so for the Chronic-Severe group. We should interpret these estimates with care, however, because the PSID records only food expenditure. As Becker (1965) notes, consumption is the result of home production that uses both expenditure and time as ingredients. Individuals with a lower relative price of time may time spent in home production for expenditures. Thus, the fall in food consumption we observe for the disabled may be a result of: 1) the disabled spending more time shopping and searching for bargains, thus getting lower prices for the same quantity of goods and/or 2) the disabled spending more time on food preparation, which may turn cheaper ingredients into better food.

We find further evidence that the drop in consumption reflects a lower living standard. Using data from the 1989-1991 Continuing Survey of Food Intake of Individuals (CSFII) we find a decline in the nutrition of the disabled individual himself, with about a 10-15 percent drop in intake of Vitamin A, Vitamin C and Vitamin E. In terms of time use, we use the American Time Use Survey (ATUS) and find that currently disabled male heads spend 0.66 hours per week (5.7 minutes per day) more on food preparation. Relative to the mean for the non-disabled, this represents a 34 percent increase in the time spent on food preparation, but the amount of time is small. In fact, this increase takes up only a small fraction of their extra 24.3 hours of leisure hours per week. Most of this extra leisure time is spent watching TV – 10.6 hours per week, obtaining medical care – 7.2 hours per week, sleeping – 6.8 hours per week and an additional 3.2 hours per week spent “relaxing.” There are increases in other time-use categories as well, but they are small in general. We have also investigated the time use of wives of the disabled. On average, wives of the disabled do not spend more time

working than those whose husbands are not disabled; this is consistent with the PSID results discussed earlier. Wives of disabled men also do not spend more time on food preparation. Maybe surprisingly, there is also no conclusive evidence that wives of disabled husbands spend more time on caring for adult family members. Taken together, these results do consistently suggest that the disabled suffer from a real decline in material well-being.

8. Optimal Disability Benefit Calculations

In this paper we have calculated some of the key quantities to determine if current disability benefits are optimal. Returning to the optimal benefit formula from Section 2, we first simplify the formula by assuming that the coefficient of relative prudence is zero.⁶² The formula can now be written as

$$(7) \quad \frac{\Delta \bar{c}}{\bar{c}} (b^*) \gamma (1 - D) \approx \varepsilon_{D,b}.$$

We take the proportional drop in consumption to be 0.22, which was our estimate of the percentage change in food plus housing consumption for the Chronic-Severe group ten years after disability onset, as reported in Section 6. We assume that this estimate is a reasonable average for the entire post-onset period, including the period more than ten years after onset. Given our finding that the consumption drop for the Chronic-Severe group continues until at least age 75, this approach seems reasonable. In Section 3, we estimated the probability of having had a disability by various ages. We found that by age 56, there was about a 0.19 probability of having experienced a Chronic-Severe disability, with the median age of onset just under 50. If we take the adult lifetime to run from age 20 to age 80, then D , the fraction of the life disabled is approximately 0.19 times 0.5 or 0.095. There are some conflicting refinements we could make to this estimate. Given that some disabilities occur after age 56, our estimate of D should be adjusted upward. On the other hand, since mortality among the disabled is higher than average, our estimate of D should be adjusted downward. For the remaining calculations, we stick with $D=0.095$.

We report the optimal benefit calculation in Table 11. This table reports the elasticity of D with respect to benefits that would be consistent with benefits being optimal. We assume that the marginal utility of consumption (at a given consumption level) is the same

⁶² If the coefficient of relative prudence is not zero, benefits should be higher than suggested by the formula.

before and after disability, though as discussed earlier, the direction of any change is uncertain. We should emphasize that what is relevant is the marginal utility of consumption at the family level, and the disabled head is only one of over 3.5 family members on average during the first ten years after onset. Thus, any effect of disability on marginal utility is generally muted by the presence of other family members. We report estimates for several possible values of the coefficient of relative risk aversion, γ , since a wide range of estimates is found in the literature. As γ ranges from 1 to 5, the elasticity consistent with optimality ranges from 0.20 to 1.00. If we focus on an estimate of γ of 3, since it is a commonly assumed value,⁶³ benefits are optimal if the true elasticity of time spent disabled is 0.60.

It is a simplification to summarize policy as a single benefit and a single elasticity, since compensation for disability comes from many programs: SSDI, workers' compensation, SSI and private disability insurance. Thus, the benefit and elasticity should be thought of as averages across programs. We focus on SSDI and workers' compensation, as they are the largest programs available to the disabled, and because little is known about benefit elasticities for the other programs.

To determine the elasticity of D with respect to the disability insurance benefit, we turn to estimates in the literature for SSDI. The literature has tended to focus on the elasticity of the non-participation probability with respect to the benefit. Bound and Burkhauser (1999) report estimates that range from 0.21 to 0.93 in their survey, with a median estimate of 0.49. They argue that most of the estimates are likely to be biased upward. The question still remains as to how to convert elasticities of non-participation into elasticities of self-reported disability. To convert one to the other, we need to know two things: what are the relative levels of non-participation and self-reported disability, and how the derivatives of the two states with respect to benefits compare. The former comparison can be directly obtained from our PSID data. We find that in the prime years for work disability (ages 35 to 55), the nonparticipation rate is only about ten percent higher than the fraction of men who are currently severely disabled, and slightly lower than the fraction of those who have experienced a Chronic-Severe disability by that age. To examine the latter comparison, we note that an individual induced by higher disability benefits to not participate in the labor market is extremely likely to indicate that he is disabled. It also seems unlikely that a large number of individuals would be induced to call themselves disabled because of higher

⁶³ See Chandra and Samwick (2005) who also take γ to be 3, or Cohen and Einav (2007) who suggest that a widely used estimate is "a low single-digit coefficient".

benefits, but still work. Thus, we take the two derivatives to be equal. The combination of these numbers, suggests that current compensation for disability is below the optimal amount suggested by equation (7).

We also examine the elasticity of non-work with respect to workers' compensation benefits. Meyer (2002) reports a wide range of claim incidence and duration elasticities. The elasticity of time receiving benefits is the sum of these two elasticities.⁶⁴ The sum of the median estimates for these two elasticities in the literature is under 0.6. Given that the claim elasticity certainly understates the nonwork elasticity, the evidence again suggests that our compensation for disability may be lower than optimal, if we believe that the coefficient of relative risk aversion is three or higher.

9. Discussion and Conclusions

This paper studies the prevalence of disability prior to retirement, changes in household material well-being surrounding disability onset, and the optimality of current benefits for the disabled.

Using longitudinal data for the period 1968-2005 from a sample of male household heads, we determine the prevalence of disability and examine how it affects a range of outcomes, including earnings, income, and consumption. This paper makes several key findings. First, disability rates are high. We estimate that by age 50, about 11 percent of male household heads have begun an enduring and severe disability. By age 56, that number rises to 19 percent. An even larger share of men have experienced some type of disability. A man reaching age 56 has a 53 percent chance of having been disabled at least once during his working years and about a 37 percent chance of experiencing a chronic disability that lasted at least four years.

Second, disability is associated with worsened economic outcomes. Ten years after disability onset, those with a chronic and severe disability condition have experienced a 68 percent decline in earnings, a 32 percent decline in after-tax income, a 22 percent decline in food and housing consumption and a 21 percent decline in consumption of food alone. In addition, about two-thirds of these most disabled individuals never return to work in the long run.

⁶⁴ To see this, consider average benefit duration as the product of claim incidence and disability duration. Then log differentiate this product.

Third, there are sharp outcome differences across disability groups; the outcome declines for those with chronic and severe disabilities are often more than twice those for the average disabled. Fourth, our findings indicate the partial but incomplete roles that individual savings, family support, and government and private insurance play in reducing the consumption drop that follows disability. Despite the various government programs available, the incomes of about one-sixth of families with a chronically and severely disabled head drop below the poverty line in the long term – even after accounting for in-kind transfers and the under-reporting of benefits.

Fifth, we find a noticeable fall in earnings and income prior to the onset of a reported disability. Consumption also falls somewhat prior to reported onset, indicating that future disability is partially but incompletely predictable in the short run. Sixth, evidence from time-use surveys does not suggest that the disabled do more shopping, which might enable them to enjoy lower prices through greater search effort. We also find that instead of working more on home and food production, the disabled spend more time watching television, relaxing, sleeping and using medical services. Together these findings indicate a real decline in material well-being after the onset of disability, especially for those who are more disabled. To further substantiate our claim that consumption declines following disability, we examine food surveys and find that the diet of the disabled is worse than that of the non-disabled in many dimensions.

Seventh, based on our estimates, others from the literature, and reasonable assumptions on parameter values, we find that the current compensation for the most disabled appears to be lower than is optimal. This calculation accounts for the moral hazard effects of disability, but assumes that the marginal utility of consumption at the household level does not change with disability of the head. We believe these findings will be useful for future research on the disabled as well as policy discussions.

There are unanswered questions raised by our research. We are unable to examine disabled women given the lack of information on disability for women in the early years of the PSID. Recent evidence from other sources suggests that disability during the working years is rising for women (Baldwin and Chu 2006). Furthermore, we only focus on disability during the working years. We find that consumption does not rebound once a disabled head reaches the Social Security eligibility age. However, we do not examine disabilities that begin at later ages. Finally, we would like to supplement the rich economic data we use with detailed health information, which would allow us to refine our disability definition and

potentially focus on specific health conditions. However, small samples and lack of generality might limit such an approach.

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Figure 1
Percent Change in Annual Earnings Before and After Disability Onset, Extent of Disability Groups and All Disabled

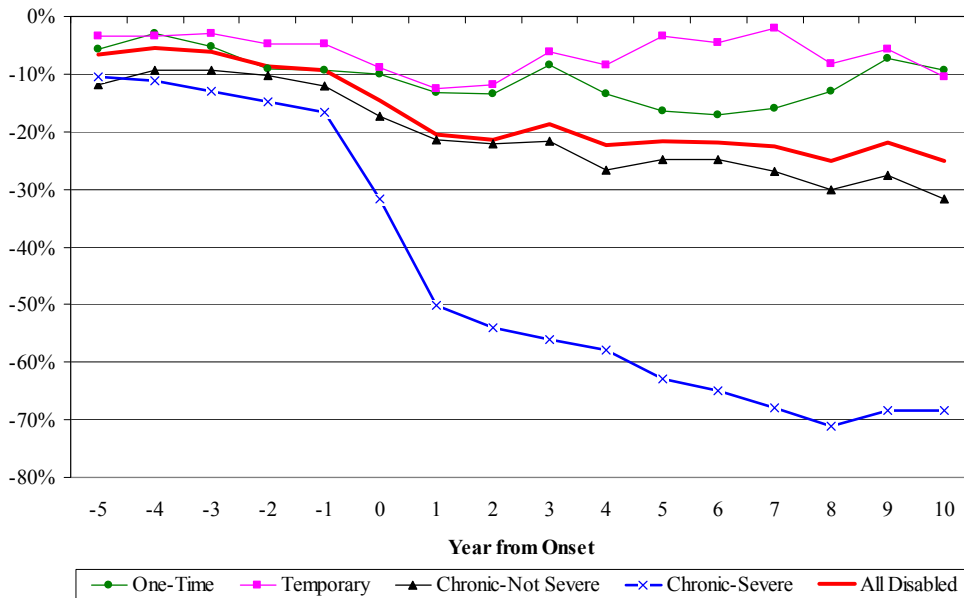


Figure 2
Change in Annual Hours of Work Before and After Disability Onset, Extent of Disability Groups and All Disabled

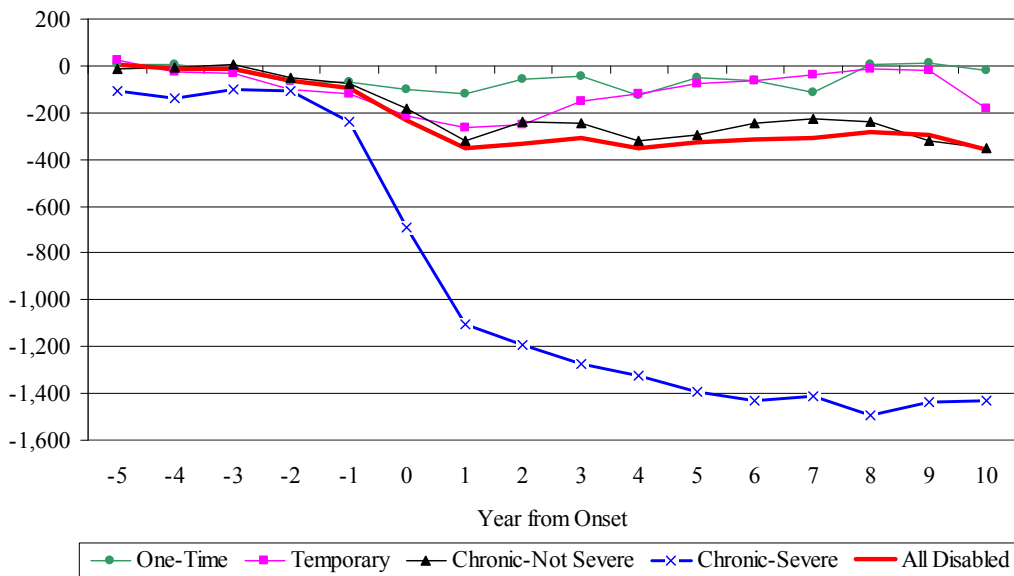


Figure 3
Percentage of Disabled with Zero Hours of Work
Before and After Disability Onset,
Extent of Disability Groups and All Disabled

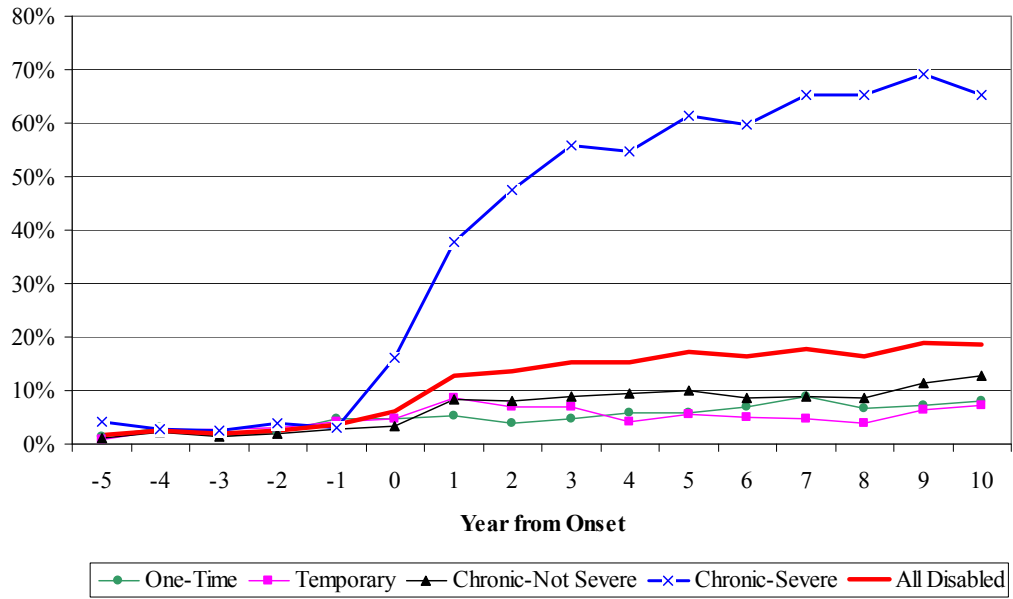


Figure 4
Change in Log Hourly Earnings Before and After Disability Onset,
Extent of Disability Groups and All Disabled

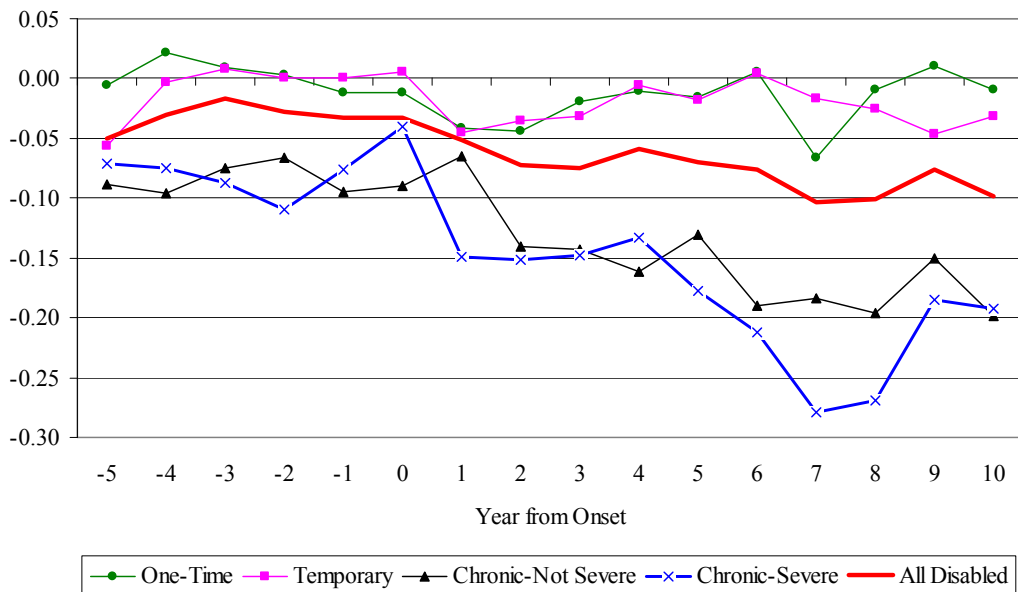


Figure 5
Change in After-Tax Pre-Public Transfer Income
Before and After Disability Onset,
Extent of Disability Groups and All Disabled

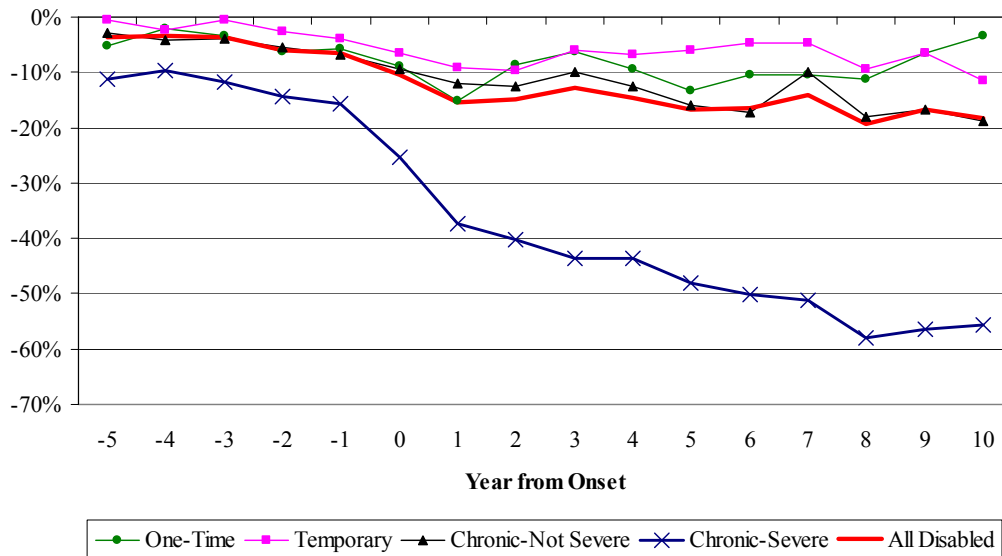


Figure 6
Change in After-Tax Post-Transfer Income
Before and After Disability Onset,
Extent of Disability Groups and All Disabled

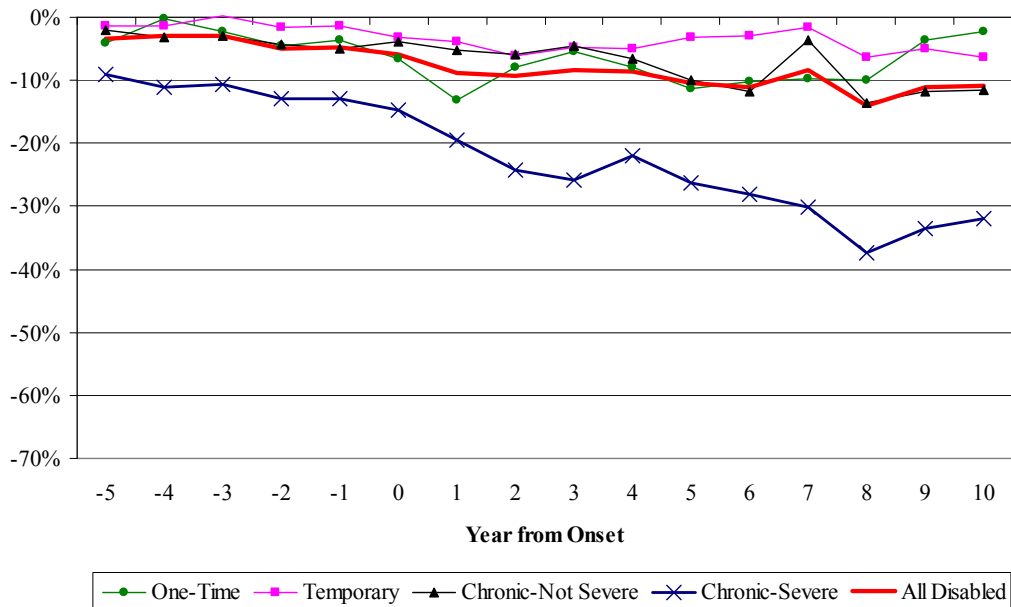


Figure 7
Fraction of Families with After-Tax Post-Transfer Income
Below the Poverty Line,
Extent of Disability Groups and All Disabled

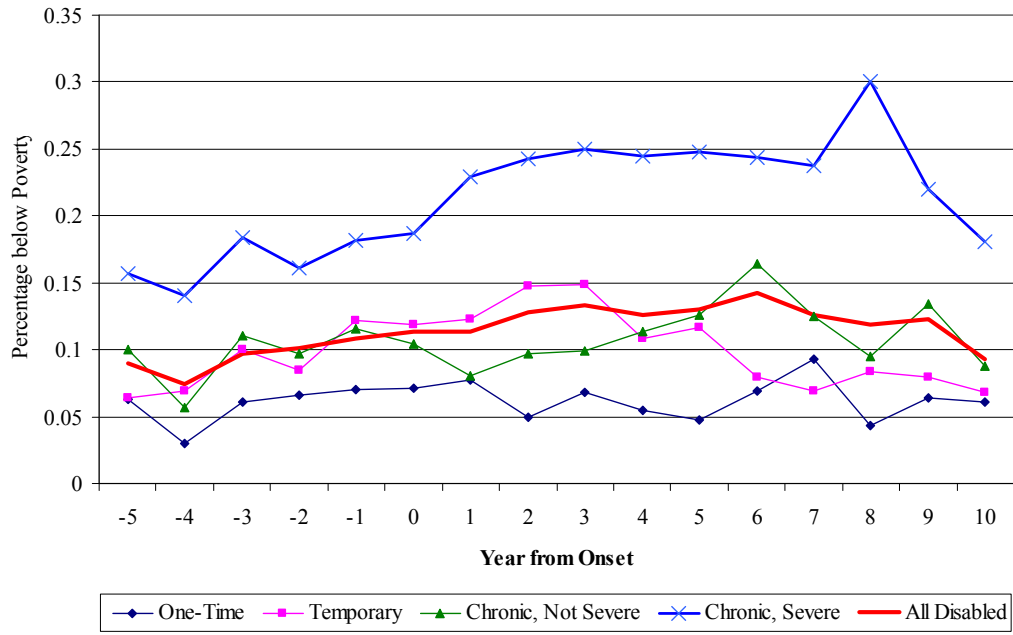


Figure 8
Change in Under-reporting Adjusted Public Transfer Income
Before and After Disability Onset,
Extent of Disability Groups and All Disabled

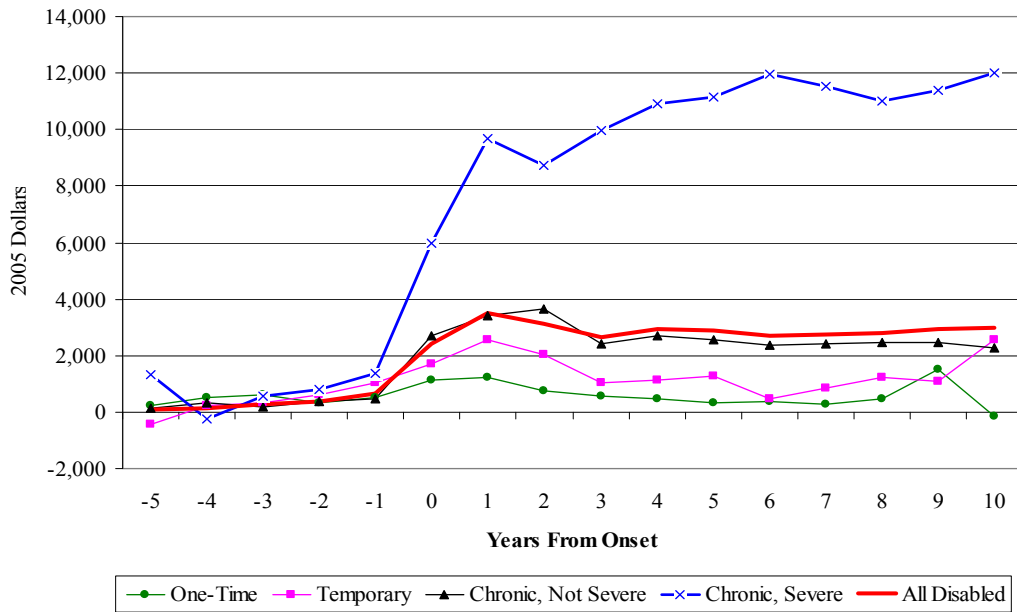


Figure 9
Change in Log Food Consumption Before and After Disability Onset,
Extent of Disability Groups and All Disabled

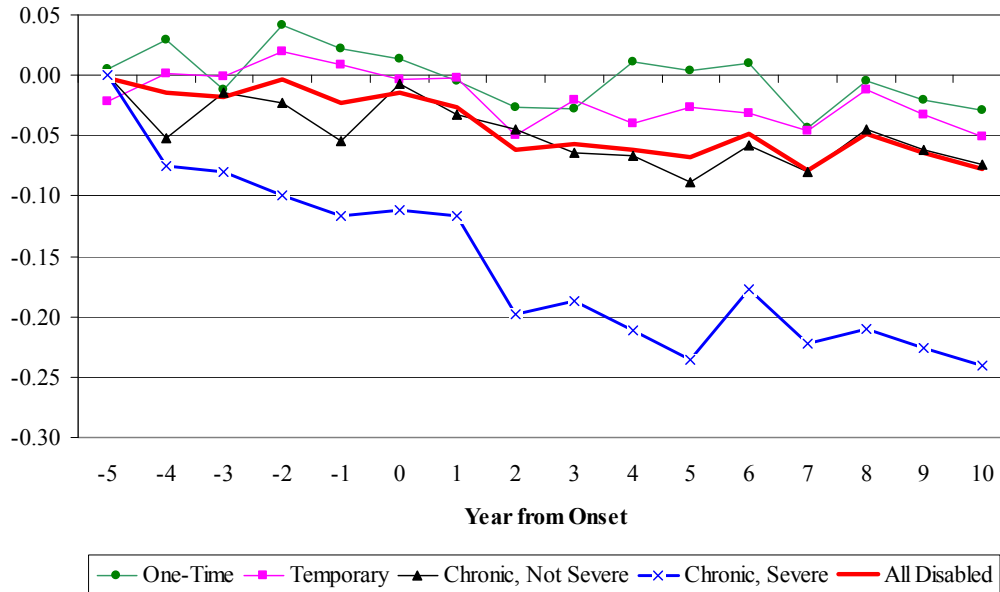


Figure 10
Change in Log of Food plus Housing Consumption
Before and After Disability Onset,
Extent of Disability Groups and All Disabled

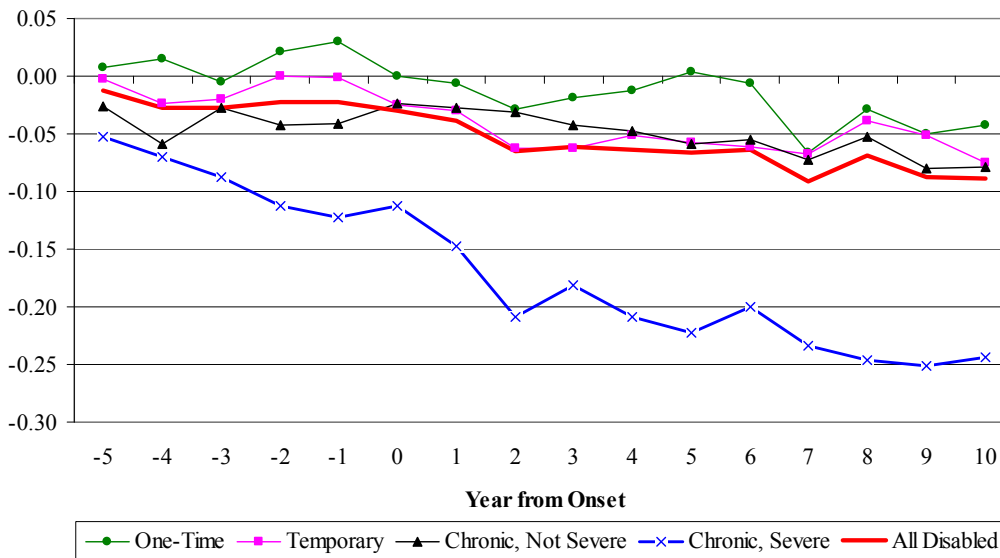


Figure 11
Change in Log of Food Eaten at Home Before and After Disability Onset,
Extent of Disability Groups and All Disabled

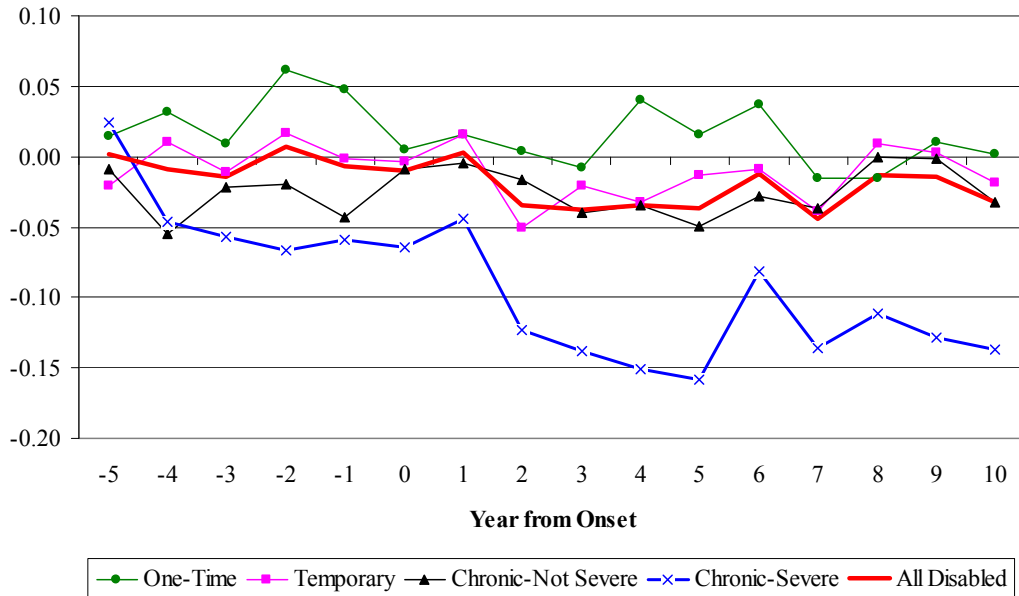


Figure 12
Change in Log of Food Eaten Outside Home Before and After Disability Onset,
Extent of Disability Groups and All Disabled

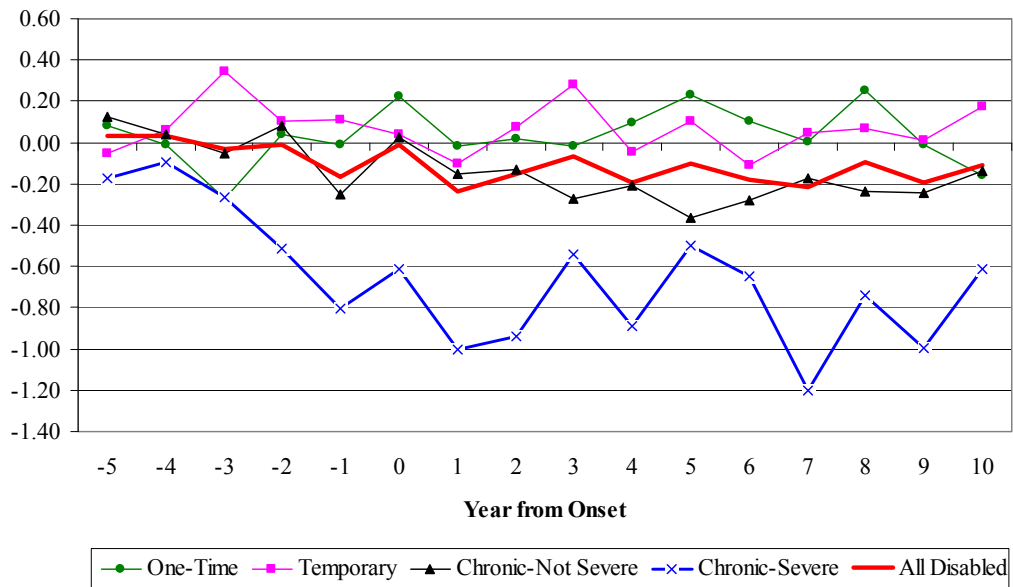


Table 1
Working Age Male Household Head Disability Rates, and Shares Severely Disabled
1968-2005

Year	N (1)	Disability Rate (Unweighted) (2)	Disability Rate (Weighted) (3)	Share of Disabled that are Severely Disabled (Weighted) (4)
1968	2,865	15.01	13.94	0.31
1969	2,659	17.79	16.50	
1970	2,730	16.37	15.11	
1971	2,809	16.84	16.39	
1972	2,901	14.03	13.38	0.34
1973	3,039	12.57	12.38	0.30
1974	3,164	11.73	11.63	0.28
1975	3,307	10.73	10.73	0.28
1976	3,418	10.83	10.66	0.35
1977	3,542	11.86	11.19	0.48
1978	3,664	12.15	11.64	0.45
1979	3,799	13.21	12.97	0.45
1980	3,905	14.06	13.79	0.43
1981	3,931	12.44	12.58	0.47
1982	3,970	11.71	12.04	0.45
1983	4,046	11.44	11.16	0.48
1984	4,093	12.36	12.68	0.37
1985	4,177	11.95	12.36	0.42
1986	4,193	10.54	11.18	0.26
1987	4,221	12.60	13.67	0.31
1988	4,262	12.86	13.59	0.29
1989	4,266	12.89	13.41	0.32
1990	5,485	13.64	14.71	0.33
1991	5,451	13.45	14.15	0.32
1992	5,716	13.45	13.91	0.29
1993	5,712	13.20	13.61	0.31
1994	6,224	13.43	13.54	0.32
1995	5,966	13.01	13.35	0.33
1996	4,946	12.72	13.29	0.35
1997	4,028	11.27	11.64	0.29
1999	4,175	12.02	11.59	0.35
2001	4,475	12.27	12.86	0.31
2003	4,718	12.04	12.16	0.32
2005	4,745	11.55	11.97	0.37

Notes: The sample is male household heads ages 22-61 years in the PSID full sample. The disabled in a survey year are those who answer yes to the question: "Do you have a physical or nervous limitation that limits the amount or type of work you can do?" Severely disabled family heads are those who report "Can do nothing," "Completely," "A Lot" or "Severely" in response to the follow-up severity question.

Table 2
Sample Means and Standard Deviations,
Non-disabled and the Extent of Disability Groups

	Extent of Disability Groups					
	Non-Disabled (1)	All Disabled (2)	One-Time (3)	Temporary (4)	Chronic Not Severe (5)	Chronic Severe (6)
Age at Disability Onset		36.7 (10.3)	35.0 (8.9)	35.2 (10.4)	36.7 (10.3)	41.6 (10.3)
Age	35.4 (7.9)	40.4 (8.9)	36.3 (6.7)	39.3 (8.7)	41.9 (8.8)	45.1 (9.4)
White	0.669 (0.471)	0.669 (0.471)	0.718 (0.451)	0.652 (0.477)	0.751 (0.433)	0.495 (0.501)
Married	0.806 (0.315)	0.806 (0.308)	0.795 (0.318)	0.799 (0.305)	0.822 (0.295)	0.805 (0.321)
Number of Years In Survey	14.1 (7.8)	19.1 (7.9)	19.2 (7.8)	18.9 (8.1)	20.2 (7.6)	17.3 (7.8)
Highest Level of Educ- High School	0.356 (0.479)	0.314 (0.464)	0.356 (0.479)	0.323 (0.468)	0.337 (0.473)	0.260 (0.440)
Highest Level of Educ- College	0.456 (0.498)	0.344 (0.475)	0.455 (0.499)	0.348 (0.477)	0.352 (0.478)	0.175 (0.380)
Years in Survey after Onset		13.7 (8.3)	10.0 (6.3)	13.8 (9.0)	16.2 (8.1)	14.0 (8.0)
Number of Consecutive Positive Limitation Reports		2.043 (4.331)		0.476 (0.642)	3.446 (5.240)	5.152 (6.212)
Number of Non-missing Reports of Disability Status from Onset to the 10th Year after Onset		7.666 (2.444)	7.050 (2.609)	7.420 (2.507)	8.324 (2.134)	7.806 (2.322)
Number of Positive Limitation Reports from Onset to the 10th Year after Onset		3.090 (2.952)		1.393 (0.489)	5.418 (2.121)	6.254 (2.332)
Severity Ratio		0.280 (0.373)	0.137 (0.344)	0.202 (0.307)	0.121 (0.164)	0.840 (0.168)
Age in the Last Interview	44.3 (11.4)	53.6 (13.3)	48.4 (11.3)	52.4 (13.5)	56.3 (12.9)	58.0 (13.3)
Number of Observations	4,482	1,819	418	555	531	315

Notes: Standard deviations are in parentheses. The variables Age and Married are averages over the sample years during which the individual is the head and ages 22-61. See data appendix or text for sample restrictions and the text for group definitions.

Table 3**Disability Transition Matrix**

t-1	t	t+1			t+2		
		Non-disabled	Not Severe	Severe	Non-disabled	Not Severe	Severe
Non-disabled	Non-disabled	0.969	0.023	0.007	0.960	0.029	0.011
Non-disabled	Not Severe	0.591	0.332	0.077	0.640	0.289	0.071
Non-disabled	Severe	0.316	0.250	0.434	0.378	0.245	0.376
Not Severe	Non-disabled	0.754	0.204	0.042	0.741	0.195	0.065
Not Severe	Not Severe	0.301	0.595	0.105	0.360	0.526	0.113
Not Severe	Severe	0.136	0.314	0.550	0.213	0.296	0.492
Severe	Non-disabled	0.650	0.204	0.146	0.637	0.204	0.159
Severe	Not Severe	0.190	0.468	0.343	0.248	0.381	0.371
Severe	Severe	0.089	0.144	0.767	0.132	0.157	0.711

Notes: The sample is male household heads ages 22-61. See the text for further details.

Table 4
Prevalence of Disability by Age

Age	N	Any disability (1)	Currently Disabled (2)	One-Time (3)	Temporary (4)	Chronic Not Severe (5)	Chronic Severe (6)
30	532	0.2156 (0.0217)	0.0879 (0.0163)	0.0396 (0.0087)	0.0627 (0.0124)	0.0773 (0.0140)	0.0360 (0.0115)
32	879	0.2245 (0.0169)	0.0793 (0.0110)	0.0441 (0.0086)	0.0673 (0.0100)	0.0798 (0.0110)	0.0334 (0.0073)
34	1052	0.2380 (0.0161)	0.0872 (0.0109)	0.0533 (0.0084)	0.0591 (0.0084)	0.0853 (0.0101)	0.0402 (0.0089)
36	1009	0.2309 (0.0158)	0.0872 (0.0104)	0.0515 (0.0080)	0.0492 (0.0078)	0.1004 (0.0117)	0.0297 (0.0061)
38	891	0.2444 (0.0175)	0.0739 (0.0102)	0.0520 (0.0086)	0.0643 (0.0099)	0.1018 (0.0129)	0.0264 (0.0061)
40	815	0.2628 (0.0183)	0.0849 (0.0111)	0.0501 (0.0087)	0.0683 (0.0104)	0.1201 (0.0138)	0.0243 (0.0058)
42	702	0.2660 (0.0199)	0.1095 (0.0145)	0.0493 (0.0094)	0.0771 (0.0116)	0.1129 (0.0147)	0.0266 (0.0071)
44	541	0.3149 (0.0237)	0.1307 (0.0173)	0.0459 (0.0103)	0.1099 (0.0162)	0.1277 (0.0172)	0.0314 (0.0078)
46	461	0.3026 (0.0256)	0.1032 (0.0170)	0.0419 (0.0111)	0.1113 (0.0178)	0.0952 (0.0158)	0.0543 (0.0127)
48	442	0.3383 (0.0267)	0.1339 (0.0192)	0.0439 (0.0113)	0.0822 (0.0152)	0.1482 (0.0204)	0.0640 (0.0130)
50	406	0.3704 (0.0290)	0.1653 (0.0226)	0.0727 (0.0158)	0.0756 (0.0150)	0.1116 (0.0180)	0.1105 (0.0194)
52	417	0.4133 (0.0287)	0.1987 (0.0236)	0.0729 (0.0152)	0.0770 (0.0148)	0.1490 (0.0211)	0.1144 (0.0184)
54	392	0.4457 (0.0298)	0.2392 (0.0257)	0.0581 (0.0140)	0.0782 (0.0157)	0.1489 (0.0205)	0.1606 (0.0224)
56	384	0.5306 (0.0303)	0.2814 (0.0275)	0.0782 (0.0176)	0.0835 (0.0161)	0.1792 (0.0231)	0.1897 (0.0236)
58	329	0.5831 (0.0327)	0.2817 (0.0297)	0.0854 (0.0187)	0.1065 (0.0191)	0.1995 (0.0265)	0.1917 (0.0254)
60	299	0.5904 (0.0335)	0.2853 (0.0301)	0.0792 (0.0193)	0.0968 (0.0186)	0.1838 (0.0268)	0.2306 (0.0277)

Notes: This table reports for each age the fraction of the sample members who have had a disability by the specified age, the fraction of individuals who are currently disabled, and the fraction for whom a given disability type is their most severe disability to date. The fractions are weighted. Standard errors are in parentheses. We restrict the sample to individuals with at least 10 years of data prior to the specified age. See text for details.

Table 5
Changes in Annual Earnings Before and After Disability Onset,
All Disabled and Extent of Disability Groups

Year from onset	A. All Disabled		B. Extent of Disability Groups							
	Annual Earning	Implied % change	One-Time	Implied % Change	Temporary	Implied % Change	Chronic Not Severe	Implied % Change	Chronic Severe	Implied % Change
-5	-2,906** (777)	-6.71	-2,498* (1,191)	-5.77	-1,466 (1,261)	-3.38	-5,105** (1,514)	-11.79	-4,492** (1,490)	-10.37
-4	-2,342* (948)	-5.41	-1,281 (1,377)	-2.96	-1,519 (1,470)	-3.51	-4,037 (2,133)	-9.32	-4,857** (1,387)	-11.21
-3	-2,714** (942)	-6.27	-2,231 (1,352)	-5.15	-1,328 (1,606)	-3.07	-4,033* (1,650)	-9.31	-5,581** (1,566)	-12.89
-2	-3,735** (1,081)	-8.62	-3,986** (1,508)	-9.20	-2,108 (1,890)	-4.87	-4,489* (1,833)	-10.36	-6,460** (1,705)	-14.92
-1	-4,054** (1,118)	-9.36	-4,092** (1,555)	-9.45	-2,073 (1,988)	-4.79	-5,256** (1,858)	-12.14	-7,233** (1,696)	-16.70
0	-6,356** (1,228)	-14.68	-4,322** (1,546)	-9.98	-3,830 (2,246)	-8.84	-7,542** (1,983)	-17.41	-13,751** (1,947)	-31.75
1	-8,921** (1,343)	-20.60	-5,755** (1,794)	-13.29	-5,405* (2,522)	-12.48	-9,265** (2,032)	-21.39	-21,699** (1,998)	-50.10
2	-9,280** (1,403)	-21.43	-5,809** (1,944)	-13.41	-5,125* (2,551)	-11.83	-9,605** (2,072)	-22.18	-23,368** (2,040)	-53.96
3	-8,051** (1,609)	-18.59	-3,629 (2,373)	-8.38	-2,661 (3,160)	-6.14	-9,343** (2,171)	-21.57	-24,266** (2,019)	-56.03
4	-9,679** (1,546)	-22.35	-5,846* (2,456)	-13.50	-3,682 (2,709)	-8.50	-11,566** (2,117)	-26.71	-25,103** (2,044)	-57.96
5	-9,367** (1,853)	-21.63	-7,112** (2,008)	-16.42	-1,452 (4,036)	-3.35	-10,789** (2,315)	-24.91	-27,215** (2,067)	-62.84
6	-9,523** (1,753)	-21.99	-7,361** (2,218)	-17.00	-1,993 (3,185)	-4.60	-10,802** (2,470)	-24.94	-28,127** (2,173)	-64.94
7	-9,760** (2,044)	-22.54	-6,908** (2,301)	-15.95	-853 (4,334)	-1.97	-11,668** (2,635)	-26.94	-29,389** (2,184)	-67.86
8	-10,881** (1,874)	-25.12	-5,601* (2,449)	-12.93	-3,566 (3,277)	-8.23	-13,038** (2,571)	-30.10	-30,835** (2,365)	-71.20
9	-9,504** (2,197)	-21.94	-3,129 (3,015)	-7.22	-2,461 (4,417)	-5.68	-11,911** (2,868)	-27.50	-29,595** (2,320)	-68.33
10	-10,825** (2,150)	-24.99	-4,071 (4,286)	-9.40	-4,568 (3,453)	-10.55	-13,701** (2,837)	-31.64	-29,652** (2,502)	-68.47

Notes: This table reports the coefficient estimates of the time from onset indicator variables in fixed effect regressions. The omitted period is more than 5 years before onset. The implied percentage changes are obtained by dividing the estimated coefficient by the average earnings of the disabled before the fifth year before disability onset (\$43,309). Columns 1 and 2 report these estimates for the disabled as a whole, while columns 3-10 report these estimates for the extent of disability groups. Standard errors clustered by person are in parentheses. Statistical significance of each estimate is denoted as follows: **Significant at 1 percent level, *Significant at 5 percent level. See text for details.

Table 6
Changes in Annual Hours of Work, and Percentage Working Zero Hours Before and After Disability Onset,
All Disabled and Extent of Disability Groups

Year from onset	A. All Disabled		B. Extent of Disability Groups							
	Hours (1)	% working zero hours (2)	One-Time (3)	% working zero hours (4)	Temporary (5)	% working zero hours (6)	Chronic Not Severe (7)	% working zero hours (8)	Chronic Severe (9)	% working zero hours (10)
-5	6 (22)	1.69	4 (35)	1.46	26 (36)	0.81	-13 (44)	1.14	-105 (64)	4.27
-4	-11 (24)	2.61	8 (42)	3.00	-26 (47)	2.55	-8 (46)	2.10	-136* (57)	2.86
-3	-14 (24)	2.01	-19 (38)	1.49	-34 (45)	2.72	3 (47)	1.52	-103 (60)	2.53
-2	-64* (26)	2.62	-69 (39)	2.24	-100* (50)	3.01	-54 (46)	1.92	-108 (69)	3.77
-1	-95** (26)	3.70	-72 (42)	4.59	-118* (47)	4.09	-78 (50)	2.81	-238** (63)	2.99
0	-235** (28)	6.21	-102* (43)	4.70	-215** (51)	4.73	-182** (51)	3.35	-688** (75)	16.18
1	-355** (30)	12.65	-117* (48)	5.41	-263** (53)	8.60	-319** (52)	8.35	-1,104** (74)	37.74
2	-333** (31)	13.51	-60 (51)	3.93	-251** (51)	6.90	-239** (53)	8.07	-1,194** (76)	47.49
3	-310** (31)	15.28	-45 (51)	4.75	-149** (51)	6.82	-245** (53)	8.80	-1,274** (72)	55.85
4	-351** (32)	15.23	-128* (51)	5.81	-121* (51)	4.12	-319** (52)	9.36	-1,322** (73)	54.81
5	-326** (33)	17.09	-48 (56)	5.83	-79 (53)	5.63	-298** (57)	10.06	-1,395** (71)	61.40
6	-315** (34)	16.32	-63 (54)	6.81	-63 (55)	5.11	-245** (57)	8.71	-1,428** (75)	59.68
7	-305** (35)	17.67	-114* (58)	8.90	-40 (55)	4.72	-228** (59)	8.92	-1,411** (80)	65.33
8	-282** (36)	16.52	8 (57)	6.78	-12 (55)	3.98	-240** (58)	8.61	-1,491** (78)	65.37
9	-298** (38)	18.77	9 (66)	7.29	-20 (58)	6.34	-321** (62)	11.49	-1,435** (91)	69.06
10	-357** (39)	18.57	-22 (69)	7.98	-181** (59)	7.29	-350** (64)	12.91	-1,432** (88)	65.38

Notes: This table reports the coefficient estimates of the time from onset indicator variables in fixed effect regressions, followed by the percentage of the disabled reported working zero hours. The omitted period is more than 5 years before onset. Columns 1 and 2 report these estimates for the disabled as a whole, while columns 3-10 report these estimates for the extent of disability groups. Standard errors clustered by person are in parentheses. Statistical significance of each estimate is denoted as follows: **Significant at 1 percent level, *Significant at 5 percent level. See text for details.

Table 7

Changes in After-Tax Pre-Public Transfer Income Before and After Disability Onset, All Disabled and Extent of Disability Groups

Year from onset	A. All Disabled		B. Extent of Disability Groups							
	All Disabled	Percentage Change	One-Time	Percentage Change	Temporary	Percentage Change	Chronic Not Severe	Percentage Change	Chronic Severe	Percentage Change
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
-5	-2,076** (758)	-3.78	-2,932** (1,113)	-5.34	-253 (1,340)	-0.46	-1,562 (1,351)	-2.84	-6,100** (1,681)	-11.11
-4	-1,901* (881)	-3.46	-1,125 (1,441)	-2.05	-1,279 (1,411)	-2.33	-2,334 (1,670)	-4.25	-5,265** (1,697)	-9.58
-3	-2,019* (977)	-3.68	-1,875 (1,561)	-3.41	-303 (1,661)	-0.55	-2,122 (1,729)	-3.86	-6,477** (1,836)	-11.79
-2	-3,251** (1,023)	-5.92	-3,421* (1,468)	-6.23	-1,471 (1,757)	-2.68	-2,998 (1,748)	-5.46	-7,851** (1,863)	-14.29
-1	-3,650** (1,074)	-6.64	-3,128 (1,621)	-5.69	-2,149 (1,775)	-3.91	-3,770* (1,809)	-6.86	-8,565** (1,854)	-15.59
0	-5,808** (1,146)	-10.57	-4,821** (1,583)	-8.78	-3,559 (1,932)	-6.48	-5,154** (1,887)	-9.38	-13,918** (2,084)	-25.34
1	-8,505** (1,270)	-15.48	-8,269** (2,244)	-15.05	-4,998* (2,164)	-9.10	-6,635** (1,874)	-12.08	-20,483** (2,015)	-37.29
2	-8,116** (1,289)	-14.78	-4,754* (1,897)	-8.65	-5,274* (2,082)	-9.60	-6,958** (2,009)	-12.67	-22,031** (2,124)	-40.11
3	-7,074** (1,510)	-12.88	-3,439 (2,123)	-6.26	-3,293 (2,514)	-5.99	-5,385* (2,669)	-9.80	-24,008** (2,199)	-43.71
4	-7,986** (1,612)	-14.54	-5,159* (2,251)	-9.39	-3,747 (2,475)	-6.82	-6,888* (2,917)	-12.54	-23,889** (2,853)	-43.49
5	-9,163** (1,623)	-16.68	-7,317** (2,135)	-13.32	-3,322 (3,172)	-6.05	-8,749** (2,100)	-15.93	-26,383** (2,296)	-48.03
6	-9,005** (1,633)	-16.39	-5,779* (2,601)	-10.52	-2,580 (2,801)	-4.70	-9,402** (2,163)	-17.12	-27,527** (2,396)	-50.11
7	-7,755** (2,187)	-14.12	-5,721* (2,839)	-10.42	-2,534 (3,431)	-4.61	-5,433 (4,334)	-9.89	-28,107** (2,381)	-51.17
8	-10,638** (1,775)	-19.37	-6,113* (2,674)	-11.13	-5,137 (2,985)	-9.35	-9,838** (2,441)	-17.91	-31,835** (2,418)	-57.96
9	-9,186** (1,971)	-16.72	-3,542 (3,011)	-6.45	-3,527 (3,462)	-6.42	-9,168** (2,767)	-16.69	-30,993** (2,459)	-56.42
10	-10,014** (2,008)	-18.23	-1,812 (4,061)	-3.30	-6,353* (2,957)	-11.57	-10,368** (2,698)	-18.87	-30,507** (2,709)	-55.54

Notes: This table reports the coefficient estimates of the time from onset indicator variables in fixed effect regression. The omitted period is more than 5 years before onset. The implied percentage changes are obtained by dividing the estimated coefficient by the average after-tax pre-public transfer income of the disabled before the fifth year before disability onset (\$54,930). Columns 3-10 show these estimates and implied percentage changes for the extent of disability groups. Standard errors clustered by person are in parentheses. Statistical significance of each estimate is denoted as follows: **Significant at 1 percent level, *Significant at 5 percent level. See the data appendix for variable definitions and the text for further details.

Table 8
Changes in After-Tax Post-Transfer Income Before and After Disability Onset, All Disabled and Extent of Disability Groups

Year from onset	A. All Disabled		B. Extent of Disability Groups							
	All Disabled (1)	Percentage Change (2)	One-Time (3)	Percentage Change (4)	Temporary (5)	Percentage Change (6)	Chronic Not Severe (7)	Percentage Change (8)	Chronic Severe (9)	Percentage Change (10)
-5	-1,898* (738)	-3.35	-2,348* (1,058)	-4.14	-772 (1,302)	-1.36	-1,184 (1,392)	-2.09	-5,081** (1,641)	-8.96
-4	-1,632 (890)	-2.88	-97 (1,464)	-0.17	-724 (1,459)	-1.28	-1,840 (1,773)	-3.25	-6,281** (1,634)	-11.08
-3	-1,719 (943)	-3.03	-1,322 (1,483)	-2.33	121 (1,674)	0.21	-1,729 (1,700)	-3.05	-5,985** (1,774)	-10.56
-2	-2,816** (1,002)	-4.97	-2,605 (1,471)	-4.60	-944 (1,763)	-1.67	-2,462 (1,751)	-4.34	-7,371** (1,800)	-13.00
-1	-2,669* (1,070)	-4.71	-2,104 (1,660)	-3.71	-715 (1,792)	-1.26	-2,844 (1,847)	-5.02	-7,359** (1,807)	-12.98
0	-3,364** (1,150)	-5.93	-3,670* (1,627)	-6.47	-1,806 (1,984)	-3.19	-2,202 (1,947)	-3.88	-8,377** (2,013)	-14.78
1	-5,017** (1,289)	-8.85	-7,510** (2,432)	-13.25	-2,228 (2,168)	-3.93	-2,893 (2,007)	-5.10	-11,096** (2,085)	-19.58
2	-5,265** (1,297)	-9.29	-4,473* (1,924)	-7.89	-3,408 (2,128)	-6.01	-3,334 (2,174)	-5.88	-13,710** (2,048)	-24.19
3	-4,693** (1,515)	-8.28	-3,041 (2,124)	-5.36	-2,694 (2,509)	-4.75	-2,610 (2,863)	-4.60	-14,642** (2,105)	-25.83
4	-4,913** (1,635)	-8.67	-4,435 (2,263)	-7.82	-2,768 (2,494)	-4.88	-3,770 (3,132)	-6.65	-12,422** (2,865)	-21.91
5	-5,943** (1,623)	-10.48	-6,431** (2,164)	-11.35	-1,753 (3,235)	-3.09	-5,676** (2,198)	-10.01	-14,941** (2,228)	-26.36
6	-6,290** (1,650)	-11.10	-5,824* (2,689)	-10.27	-1,687 (2,890)	-2.98	-6,672** (2,262)	-11.77	-15,910** (2,477)	-28.07
7	-4,730* (2,277)	-8.34	-5,535 (2,945)	-9.76	-941 (3,517)	-1.66	-2,044 (4,727)	-3.61	-17,087** (2,464)	-30.14
8	-8,002** (1,750)	-14.12	-5,705* (2,570)	-10.06	-3,572 (3,039)	-6.30	-7,677** (2,365)	-13.54	-21,246** (2,495)	-37.48
9	-6,346** (1,992)	-11.20	-2,000 (3,241)	-3.53	-2,863 (3,498)	-5.05	-6,735* (2,843)	-11.88	-19,029** (2,468)	-33.57
10	-6,153** (2,066)	-10.85	-1,247 (4,279)	-2.20	-3,543 (3,054)	-6.25	-6,568* (2,840)	-11.59	-18,144** (2,783)	-32.01

Notes: This table reports the coefficient estimates of the time from onset indicator variables in fixed effect regression. The omitted period is more than 5 years before onset. The implied percentage changes are obtained by dividing the estimated coefficient by the average after-tax post-transfer income of the disabled before the fifth year before disability onset (\$56,684). Columns 3-10 show these estimates and implied percentage changes for the extent of disability groups. Standard errors clustered by person are in parentheses. Statistical significance of each estimate is denoted as follows: **Significant at 1 percent level, *Significant at 5 percent level. See the data appendix for variable definitions and the text for further details.

Table 9
Changes in Log Food and Food plus Housing Consumption Before and After Disability Onset, All Disabled and Extent of Disability Groups

Year from onset	A. Log Food Consumption					B. Log Food plus Housing Consumption				
	All Disabled (1)	One-Time (2)	Temporary (3)	Chronic Not Severe (4)	Chronic Severe (5)	All Disabled (6)	One-Time (7)	Temporary (8)	Chronic Not Severe (9)	Chronic Severe (10)
-5	-0.002 (0.014)	0.005 (0.026)	-0.022 (0.033)	0.000 (0.023)	0.000 (0.031)	-0.013 (0.012)	0.007 (0.020)	-0.002 (0.026)	-0.026 (0.020)	-0.053* (0.024)
-4	-0.015 (0.014)	0.029 (0.026)	0.001 (0.026)	-0.052* (0.026)	-0.075* (0.035)	-0.027* (0.013)	0.015 (0.022)	-0.024 (0.024)	-0.059* (0.024)	-0.070* (0.029)
-3	-0.018 (0.015)	-0.012 (0.025)	-0.001 (0.028)	-0.015 (0.029)	-0.080* (0.037)	-0.027* (0.013)	-0.005 (0.022)	-0.020 (0.025)	-0.028 (0.024)	-0.087** (0.032)
-2	-0.003 (0.015)	0.041 (0.025)	0.020 (0.029)	-0.023 (0.029)	-0.099** (0.038)	-0.023 (0.014)	0.021 (0.022)	0.000 (0.026)	-0.043 (0.026)	-0.113** (0.036)
-1	-0.023 (0.015)	0.022 (0.024)	0.009 (0.026)	-0.054 (0.030)	-0.116** (0.039)	-0.022 (0.013)	0.030 (0.022)	-0.001 (0.023)	-0.041 (0.027)	-0.123** (0.033)
0	-0.015 (0.014)	0.014 (0.024)	-0.004 (0.026)	-0.007 (0.026)	-0.112** (0.038)	-0.030* (0.013)	0.000 (0.022)	-0.025 (0.024)	-0.024 (0.025)	-0.112** (0.033)
1	-0.027 (0.015)	-0.005 (0.027)	-0.002 (0.027)	-0.033 (0.029)	-0.117** (0.039)	-0.039** (0.014)	-0.006 (0.024)	-0.030 (0.025)	-0.028 (0.026)	-0.147** (0.033)
2	-0.062** (0.015)	-0.027 (0.027)	-0.050 (0.028)	-0.045 (0.027)	-0.198** (0.038)	-0.065** (0.014)	-0.029 (0.024)	-0.062* (0.025)	-0.031 (0.026)	-0.209** (0.033)
3	-0.057** (0.016)	-0.028 (0.027)	-0.020 (0.028)	-0.064* (0.028)	-0.187** (0.043)	-0.061** (0.015)	-0.019 (0.024)	-0.063* (0.027)	-0.043 (0.027)	-0.181** (0.035)
4	-0.062** (0.016)	0.011 (0.030)	-0.040 (0.029)	-0.067* (0.028)	-0.211** (0.037)	-0.064** (0.015)	-0.012 (0.024)	-0.051 (0.027)	-0.047 (0.028)	-0.209** (0.033)
5	-0.068** (0.017)	0.004 (0.027)	-0.026 (0.031)	-0.089** (0.031)	-0.236** (0.040)	-0.066** (0.016)	0.004 (0.024)	-0.057* (0.028)	-0.059 (0.031)	-0.222** (0.034)
6	-0.049** (0.016)	0.010 (0.027)	-0.032 (0.030)	-0.058 (0.030)	-0.177** (0.039)	-0.064** (0.016)	-0.006 (0.027)	-0.061* (0.027)	-0.055 (0.029)	-0.200** (0.036)
7	-0.079** (0.017)	-0.044 (0.028)	-0.046 (0.029)	-0.080** (0.030)	-0.222** (0.040)	-0.091** (0.016)	-0.066* (0.028)	-0.068* (0.028)	-0.072* (0.029)	-0.234** (0.035)
8	-0.048** (0.017)	-0.005 (0.028)	-0.012 (0.030)	-0.045 (0.030)	-0.210** (0.041)	-0.069** (0.017)	-0.029 (0.028)	-0.039 (0.028)	-0.053 (0.031)	-0.246** (0.035)
9	-0.064** (0.017)	-0.021 (0.029)	-0.033 (0.030)	-0.062* (0.031)	-0.226** (0.040)	-0.087** (0.017)	-0.050 (0.029)	-0.051 (0.029)	-0.080** (0.031)	-0.251** (0.038)
10	-0.078** (0.019)	-0.029 (0.034)	-0.051 (0.033)	-0.074* (0.032)	-0.241** (0.051)	-0.089** (0.019)	-0.042 (0.034)	-0.075* (0.031)	-0.079* (0.032)	-0.244** (0.041)

Notes: The numbers reported are, for each variable of interest, the coefficient estimates of the time from onset indicator variables in fixed effect regressions, for the disabled as a whole and for the extent of disability groups. The omitted period is more than 5 years before onset. Standard errors clustered by person are in parentheses. Statistical significance of each estimate is denoted as follows: **Significant at 1 percent level, *Significant at 5 percent level. See the data appendix for variable definitions and the text for further details.

Table 10
Decomposition of Change in Housing Consumption

	One-Time (1)	Temporary (2)	Chronic Not Severe (3)	Chronic Severe (4)
A. Housing Type				
Homeowner	-0.023 (0.028)	-0.074* (0.029)	-0.004 (0.028)	-0.075 (0.039)
Publicly Subsidized	0.025* (0.010)	0.016 (0.009)	0.018 (0.011)	0.057* (0.024)
Rental	-0.002 (0.028)	0.058* (0.029)	-0.014 (0.028)	0.018 (0.044)
B. Housing Consumption Given Type				
Homeowner	-878.15 (527.49)	-703.35 (650.19)	-331.3 (686.39)	-2,635.54** (540.94)
Publicly Subsidized	-6601.21** (1,906.53)	1684.1 (1,225.55)	1414.93 (745.02)	344.79 (766.72)
Rental	-1032.89** (368.07)	-1083.06** (367.90)	-540.82 (433.44)	-1224.87** (382.18)

Notes: The table reports the coefficient estimates on the interaction of each disability group with being after the 6th year after onset ($t \in \{6,10\}$). Standard errors clustered by person are in parentheses. Statistical significance of each estimate is denoted as follows: **Significant at 1 percent level, *Significant at 5 percent level. For the upper panel, the dependent variable is a dichotomous variable that equals one if the specified housing type is chosen. For the bottom panel, the dependent variable is the amount of housing consumption, conditional on the housing type chosen. See the text for details.

Table 11
Estimates of $\varepsilon_{D,b}$ for Current Disability Compensation Programs to be Optimal

	Coefficient of Relative Risk Aversion, γ				
	1	2	3	4	5
$\varepsilon_{D,b}$ such that current compensation for the Chronic-Severe group is optimal	0.1991	0.3982	0.5973	0.7964	0.9955

Notes: This table shows, for a given value of γ (coefficient of relative risk aversion), what $\varepsilon_{D,b}$ (elasticity of the fraction of a lifetime spent disabled with respect to the disability benefit level) would be if the current compensation programs for the disabled are optimal. Optimality condition is based on Chetty (2007) when we assume that the coefficient of relative prudence is zero.