Disability, Earnings, Income and Consumption

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Abstract: We study the well-being of the disabled and the economic benefits of disability insurance. Using longitudinal data for 1968-2009 for male household heads, we determine the prevalence of working-age disability, its association with a wide range of economic outcomes including, earnings, income, consumption, wealth and time-use. We disaggregate the disabled based on the persistence and severity of work-limiting conditions and find that disability is common and associated with poor economic outcomes. The outcomes differ sharply by disability group. We then provide the range of behavioral elasticities and preference parameters consistent with current disability compensation being optimal in the Baily-Chetty framework.

KEYWORDS: Disability, Disability Insurance, Optimal Benefits, Earnings, Income, Consumption.

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1. Introduction

Disability may be the most significant risk that individuals and their families face. The prevalence of disability is high, its onset and persistence is largely unpredictable, and it is often permanent. These features of disability mean that it is difficult for individuals to take measures to insure themselves against bad outcomes that often include a large decline in their living standards. Balanced against the value of insurance are the distortions and costs of insurance that are high. In 2012, Social Security Disability Insurance (SSDI) payments equaled $137 billion and the share of Supplementary Security Income (SSI) for the blind and the disabled was $36 billion. Private spending on the disabled was also high, with $60 billion spent on Workers' Compensation in 2011.[1]

This paper examines the lifetime prevalence of disability among male household heads and how they and their families fared before and after the onset of disability. 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 prevalence and persistence over an individual's lifetime. To date, however, few studies have examined the lifetime pattern of disability and the long-term economic circumstances of the disabled.[2] Our study aims to fill this gap in the literature.

The information we report is essential to design and evaluate disability policies. In the framework of Baily (1977) and Chetty (2006), optimal disability benefits depend 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).[3] This framework, which guides our analyses, also emphasizes that even though disability is endogenously a function of available benefits, the *rate* of disability and the accompanying fall in consumption are needed to assess the optimality of disability compensation.

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[1] See U.S. Social Security Administration (2013) and Sengupta et al. (2013).

[2] Important past work on this topic includes Baldwin and Chu (2006) who estimate that the probability of receiving Social Security Disability Insurance by age 67 is 38 percent for men and 31 percent for women and 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, while Bound and Waidmann (2002) look at employment rates among the disabled. Earnings, hours and wages after disability are examined in Charles (2003) with corrections in Mok et al. (2008). Stephens (2001) analyzes some of these outcomes as well as food consumption. There is also related work by Rupp and Davies (2004) and others.

[3] Important research that examines the adequacy of insurance for disability includes Chandra and Samwick (2005) and Low and Pistaferri (2010).

While there is an extensive literature on the moral hazard effects of disability,[4] we have less information on lifetime disability rates and the fall in consumption with disability. Stephens (2003) is the only published paper we are aware of that examines consumption. The question can benefit from additional evidence, as the paper discusses a single food consumption measure and focuses on married men in the first five years after onset. Maybe more importantly, the disabled as a whole are analyzed, while disaggregation turns out to be crucial here. Our study differs from the literature in several ways. First, by using 42 years of longitudinal data from the Panel Study of Income Dynamics (PSID) we are able to estimate the risk of disability over a household head's lifetime. Second, we comprehensively examine the economic circumstances of the disabled: we investigate changes in earnings, income, public transfer receipt, poverty rates, work hours, employment, food consumption, housing consumption, home production, and leisure time.[5] In taking this wider view, we obtain a better picture of the well-being of the disabled. Third, our estimates account for public transfer under-reporting, an issue that can lead researchers to overestimate the income decline 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. We then examine the lifetime prevalence of disability and the changes in economic well-being associated with different degrees of disability. 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. Fifth, going beyond theoretical discussions of benefit optimality in the literature, we quantitatively examine the implications for optimality of estimated disability rates and changes in consumption.

This study has many findings. First, disability rates are high. A male household head reaching age 50 has a 36 percent chance of having been disabled at least once during his working years. We also estimate that by age 50, about 9 percent of male household heads have begun a chronic and severe disability. By age 56, that number rises to 15 percent.

Second, disability is associated with poor economic outcomes. Ten years after disability onset, those with a chronic and severe disability condition have on average seen their earnings drop by 76 percent, their after-tax after-transfer income drop by 28 percent,

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[4] See for example, Parsons (1980, 1984, 1991), Haveman and Wolfe (1984a, b), Bound (1989, 1991), Gruber (2001), Black et al. (2002), Autor and Duggan (2003), von Wachter et al. (2011), French and Song (2012), and Maestas et al. (2013).

[5] Our companion paper, Meyer and Mok (2013), focuses on earnings, income and public benefit receipt.

their family food and housing consumption drop by 25 percent, and their consumption of food alone fall by 18 percent. We also see a less precisely estimated but noticeable decline in wealth. In addition, about two-thirds of these most disabled individuals never return to work in the long run. This pattern of findings indicates the partial but incomplete roles that family support, government and private insurance, and savings play in reducing the consumption drop that follows disability. Despite the various government programs available, the incomes of 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. 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.

Third, there are sharp outcome differences across disability groups; those with chronic and severe disabilities often experience a percentage decline in the above economic outcomes more than twice as large as those of the average disabled. The fall in consumption we find for the large chronic and severe disability group is much larger than the fall found in response to other adverse events including unemployment and retirement.[6]

Furthermore, recent research suggests that the dollar expenditures of the retired may understate their true consumption because they get more for their money through increased shopping and home food preparation (Aguiar and Hurst 2005). Related to this point, our fourth, finding is that time-use surveys do not suggest that the disabled and their spouses do more shopping and cooking. Instead of spending more time on food preparation and other home production, the disabled spend more time using medical services, watching television, relaxing, and sleeping. Together these findings suggest a true decline in material well-being after the onset of disability, especially for those who are severely disabled. We further assess our finding that consumption declines following disability, by examining food surveys and find suggestive evidence that the diet of the disabled is worse than that of the non-disabled.

Fifth, we use our estimates in the Baily-Chetty optimal benefit formula that balances insurance against moral hazard. We calculate the set of behavioral elasticities and utility function parameters consistent with the current compensation for the most disabled being optimal. While the values of the key risk preference parameters remain unsettled in the

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[6] Gruber (1997) finds a 7 percent drop in food consumption that bounces back with reemployment. Browning and Crossley (2001) find a 14 percent drop in Canadian data. Aguiar and Hurst (2005) review the evidence on the food consumption fall in the PSID for retirees and report estimates that cluster around 10 percent. Stephens (2001) finds a fall in PSID food consumption of 5-10 percent for displaced workers.

literature, our calculation suggests that there is a substantial range over which current compensation for the disabled is lower than is optimal.

The rest of the paper is organized as follows. Section 2 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 3 examines the change in earnings and employment following disability onset. Section 4 examines the fall in income following disability onset, the rise in poverty and public transfer receipt. Section 5 summarizes the changes in consumption of food and housing and in wealth. Section 6 discusses a series of robustness checks, revisits the change in food consumption and considers the time use of the disabled. Section 7 examines the optimality of current programs for the disabled, and Section 8 concludes. The online appendices include additional results concerning the impact of disability on food quantity and quality, as well as the usage of time.[7]

2. 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) of about 1,800 households.

Households were interviewed annually between 1968 and 1997, and biannually since then.[8] 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. Many authors have used this particular feature to measure the material well-being of individuals. As of 2009, the PSID had collected information on 71,285 individuals.

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[7] The appendices can be accessed online at http://harrisschool.uchicago.edu/directory/faculty/bruce_meyer

[8] Some data are available for intervening years. For example, the 1999 interviews asked about both 1998 and 1997 earnings.

In this study, we use the entire PSID panel, beginning with 1968 and continuing through the 2009 wave. Most of our analysis focuses on male household heads who are 22-61 years old in the survey year.[9] 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. 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.[10] After determining the presence of a work-limiting condition, the interviewer asks a severity question to determine the extent to which 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*." Those who respond "can do nothing," "completely," "a lot," or "severely" are classified as *Severely Disabled*, while those who respond "just a little," "somewhat," "not limiting," or "not at all" are classified as *Not Severely Disabled*.

Table 1 tabulates the unweighted and weighted disability rates for male household heads aged 22-61 during the 1968-2009 period. These rates are usually between 11-15 percent and are comparable to those found by Burkhauser et al. (2006).[11] The table also 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

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[9] 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.

[10] In the period 1973-1975, only new entrants to the survey are asked this disability question. We assume that the disability status of others does not change over this period.

[11] These authors 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).

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."[12] 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 the classification system we use, as discussed in the online Appendix.

C. Self-Reported Disability and its Validity

1) Self-Reported Disability Status

Many researchers have argued that self-reported disability status is the preferred way to define disability 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 driven by pain).[13] Other 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. Others may be unwilling to receive government benefits or if they do, they may omit reporting them in surveys. 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. SSDI and SSI benefits are unavailable to those who earn above certain amounts despite their disabilities. In 2012, a SSDI recipient could not earn more than $1,010 after a trial period ($1,690 if he was blind), 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 2013). 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

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

[13] 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).

[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).

in 1993, of the 48 percent of denied SSDI claimants who requested reconsideration, 50 percent were accepted).[16]

Past research, however, has 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.[17]

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. 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 1999-2009 surveys. In Appendix 1 of the online appendix, 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-

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[16] Bound (1989) suggests that many rejected SSDI 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.

[17] Bound (1991) argues that there are biases in both self-reported and objective measures and that the biases from the endogeneity of and measurement error in self-reported health measures tend to cancel each other out.

serious forms of these conditions, relative to the non-severe group and the non-disabled. For example, the average number of activity limitations (difficulty walking, bending, driving, etc.) is 2.74 for the Severe group, 1.15 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 1.17 for the *Severely disabled*, 0.19 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

Our focus is on disabilities that begin during the working years; accordingly, we exclude those whose onset age is under 18 or above 56.[18] In order to have sufficient information after 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. We exclude, however, individuals who are missing key demographic variables (education, age and marital status).[19]

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.[20] For those who first report having a disability after 1978, we require that such individuals report no limitations in the two consecutive survey years

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[18] Our main estimation sample includes the person-year observations prior to disability onset for those who became first disabled after age 56 as they enter disability rates and are part of the implicit comparison group for the disabled.

[19] We exclude 117 individuals (1.2 percent of the main estimation sample) because key demographic information is unavailable.

[20] 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.

immediately prior to the year in which they first report having a work limitation.[21] The application of these restrictions results in a primary sample of 6,741 male household heads, 1,937 (29 percent) of whom are classified as ever disabled.

E. Categorizing the Disabled

Besides determining how the disabled fare around disability onset, we examine how economic outcomes evolve for different types of disabilities. We divide the extent of disability along two dimensions: persistence and severity. We divide the disabled into three persistence groups, building on Charles (2003). 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 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.[22]

The severity questions were asked nearly every year, giving us multiple reports. We rely on average severity throughout the paper.[23] Specifically, 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.[24]

We combine the two disability dimensions in our main analyses by splitting the *Chronically Disabled* into two groups. Hence, this classification yields four groups of interest – *One-time, Temporary, Chronic-Not Severe* (with a severity ratio under 0.5) and

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[21] 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 interview per year, we also choose the year of onset to be the year including the midpoint in time of adjacent interviews. See the data appendix.

[22] 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.

[23] The results are similar if we use only the initial severity report.

[24] 22 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).

Chronic-Severe (with a severity ratio over 0.5) which we collectively call the *Extent of Disability groups*.[25]

To further motivate the need for a multiyear definition of disability and to summarize the dynamic nature of disability status, Table 2 reports a modified second-order Markov transition matrix for disability group. 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. The results indicate both patterns of mobility and persistence, depending on past history. We see that there is strong persistence over time in disability status for those who are non-disabled or *Severely Disabled* in two consecutive years. 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 0.95 next year. However, someone who is *Severely Disabled* the past two years has a 0.80 probability of being *Severely Disabled* this year and a 0.73 probability of being *Severely Disabled* next year. Among those becoming severely disabled who were previously non-disabled, future disability status is fairly uncertain. It is almost equally likely that they will be in any of the three states the following year.

Table 3 reports descriptive statistics for the *Extent of Disability groups*. Of the 1,937 disabled individuals, 465 (24 percent) are *One-Time* disabled, 595 (31 percent) are *Temporary* disabled, 548 (28 percent) are *Chronic-Not Severe* and 329 (17 percent) are *Chronic-Severe*. The average age at disability onset is highest for the *Chronic-Severe* group (41.7 years), followed in descending order by the *Chronic-Not Severe* group (37.0 years), the *One-Time* group (35.7 years) and the *Temporary* group (35.6 years). The *Chronic-Severe* group is also the least educated group – only 19 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 6.3 more years than the *One-Time* group. It is also encouraging to see that all four disabled groups have participated in a similar total number of interviews, 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.

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[25] In the case where exactly half of the responses indicate severe disability (a *severity ratio* of 0.5), we classify the disabled head based on the first severity report. Of the 1,937 disabled, 109 have a severity ratio of 0.5. Of the 877 chronically disabled individuals, only 43 have a severity ratio of 0.5.

In much of the paper, we focus on the *Chronic-Severe* group. While this group is defined in a restrictive way, it still includes a much larger share of a given age group than is receiving Social Security disability payments as we will see shortly. 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 6.2 years of 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 almost seven times that of the *Chronic-Not Severe* group (0.12).

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. However, the 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.[26] With data currently spanning 42 years, the PSID is ideally suited for this calculation. We define the *lifetime prevalence of disability* as the probability that an individual becomes disabled during his working years 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, ranking 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.[27]

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 (1980-1992) who have been in the survey for at least ten prior years. Using the

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[26] 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.

[27] 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.

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.[28] 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 in Table 4 for the 1980-1992 subsample.[29] Not surprisingly, the chance of experiencing disability rises with age, though the estimates do not rise monotonically given the unbalanced panel. By the time a person reaches age 50, there is a 36 percent chance that he has experienced some kind of disability during his working years. In particular, there is a 9 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 6 percent, 7 percent and 13 percent. The rise in the prevalence of *Chronic-Severe* disability with age is steep. The chance of ever experiencing a *Chronic-Severe* disability approximately triples between age 40 and age 50. Between age 50 and age 60 the probability nearly doubles again. The rates of *Chronic-Severe* disability tend to be about twice as high as the SSDI receipt rates by age indicated in SSA data. Despite a broader definition than SSDI eligibility, we will see that the *Chronic-Severe* group fares very poorly.

We also report changes in disability prevalence over time (see the Online Appendix). Our most sophisticated analyses that account for definitional and sample changes, suggest only a modest decline in disability rates over time.

H. Empirical Methodology

To measure the change in economic outcomes associated with disability, consider the following fixed effect model for person i in year t:

$$(1)\quad y_{it} = \alpha_i + \gamma_t + X_{it}\beta + \sum_g \sum_k \delta_k^g A_{kit}^g + \varepsilon_{it},$$

where y_{it} is the outcome of interest (such as hours worked) 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

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[28] Recall that the retrospective question was asked only if an individual was disabled at the time of the interview.

[29] 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. See the Appendix for further discussion.

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.[30] 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 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 inclusion of these time invariant individual fixed effects also alleviates the concern that those who begin their disability spell later in their lifetime may exhibit different patterns of outcomes compared with those who became disabled at a younger age. 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).

Specification (1) is attractive for some dependent variables, but in other cases we may be interested in percentage changes in the dependent variable and may believe proportional effects of explanatory variables are more natural that additive effects. Although one can transform specification (1) into a log-linear form, by replacing the dependent variable y_{it} by $\log(y_{it})$, this method however is not suitable if a large number of observations on the dependent variable are zero. As we will show, many disabled men have zero earnings because they do not work at all. Defining a lower cutoff (that is, $\log(y) = \log(a)$ for $y<a$) is also not ideal, as the estimates may be sensitive to this cutoff. We therefore consider the Poisson fixed effect regression model:

$$(2) \quad y_{it} = \exp(\alpha_i' + \gamma_t' + X_{it}\beta' + \sum_g \sum_k \delta_k'^{g} A_{kit}^{g} + \varepsilon_{it}')$$

where the coefficients of interest can be estimated by conditional maximum likelihood methods. Modeling outcomes in this way allows us to keep observations with a dependent

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[30] 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 and its square. 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 Appendix 3 of the Online Appendix.

variable of zero. Estimated percentage change in the outcome of a one-unit change in the dependent variable can be obtained simply as *exp(b)-1*, where *b* is the estimated coefficient of interest.

We estimate model (1) if our interest is how disability affects the *level* of the outcome (such as hours of work, receipt of public transfers), whereas we estimate model (2) if we are interested in knowing how disability affects the *percentage change* of the outcome (such as earnings, income, food and food plus housing consumption). Standard errors are clustered by person.[31]

In our analysis, all monetary values are reported in 2010 dollars, adjusting for inflation using the Consumer Price Index Research Series using Current Methods (CPI-U-RS).

3. Employment and Earnings Following Disability

We first focus on labor supply and investigate the changes in, annual hours worked, the probability of working, annual earnings and the hourly wage during the five years before and ten years after disability onset.

A. Hours of Work and Employment

We estimate model (1) for hours since the estimated coefficients represent changes in the level of annual hours which are easily interpreted. Column 1 of Table 5 shows the changes in annual hours of work of the average disabled, and Figure 1 depicts these changes. Similarly, column 2 reports the percentage of the average disabled working zero hours; these results are displayed in Figure 2. By the year of onset, annual hours of work are estimated to decline about 250 hours for the average disabled, with about 6 percent of this population not working during the year. This decline is relative to the period more than five years prior to onset (that is, $k < -5$, where $k = 0$ in the year of disability onset). By the following year, the drop increases to 370 hours with about 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.

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[31] Note that we do not impose the Poisson variance assumption.

Figures 1 and 2 also show 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 110 hours on average during disability onset and by an additional 17 hours the following year. From then on, the fall diminishes. An F-test that all estimates of the fall in hours are zero after $k = 5$ fails to reject the null hypothesis (p-value = 0.14) for our *One-Time* group. We observe a similar pattern for the *Temporary* group. By the tenth year after onset, about 7 to 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 more than 200 hours by the year of onset. By the fifth year after onset, this group's work hours are estimated to decline by about 350 with about 11 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 about 300 with about 10 percent of these household heads not doing any work during the year. Although these declines are large, they are much smaller than those of the *Chronic-Severe* group (columns 1 and 2 of Table 6), whose annual hours of work are estimated to plummet by almost 690 by the year of onset. By the following year, we estimate annual hours 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 35 percent of this group will do any work in a year in the long run. 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. It appears that many individuals' disabilities worsen over time or their skills decline, and eventually they do not do any work.

B. Earnings

With many disabled having zero earnings and zero hours of work following disability, we use Poisson regression to estimate the effect of disability on earnings is a better choice. Column 3 of Table 5 shows the results for the disabled as a whole. Here, we report the implied percentage changes and their corresponding standard errors. These percentage changes are also displayed in Figure 3. Annual earnings decline rapidly around the year of disability onset, falling about 8.4 percent on average by the year prior to onset and 13.9 percent by the year of onset. This decline continues over the next two years, reaching about

20 percent. The earnings drop remains at around this level through the ten years after onset. These results for the disabled as a whole are very similar to those of Stephens (2001).[32]

The change in average earnings for all disabled heads hides great heterogeneity across the *Extent of Disability* groups. Figure 3 also shows each disability group's implied percentage change in annual earnings (the full set of estimates are shown in Appendix Table 4). Not surprisingly, earnings drop the least after disability for the *One-Time* and *Temporary* groups. For the *One-Time* group, they fall 7.3 percent by the year of onset. By the fifth year after onset, the decline reaches about 12.3 percent. Six to ten years after disability onset, annual earnings have fallen about 10 percent. While many of the single-year differences in earnings from the base period 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 have dropped 11 percent by the year of onset and 14.5 percent by the year after onset. By the third year after onset, the earnings drop has shrunk to about 9 percent. The estimated percentage decline in later years are about 8 percent but the estimates are statistically indistinguishable from zero. For the *Chronic-Not Severe* group, earnings drop about 17.3 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 almost 30 percent.

In contrast, the decline in the earnings of the *Chronic-Severe* group is especially large. The coefficient estimates and the corresponding implied percentage changes are reported in columns 3 and 4 of Table 6 respectively. By the year of onset, earnings fall 36.5 percent. In the following year, they fall an additional 23 percentage points, resulting in a cumulative loss of about 59 percent. This downward trend continues, and by the tenth year after onset, earnings have dropped by a fairly precisely estimated 76 percent on average, with the 95 percent confidence interval being (-85.2, -66.9). Such a drop is more than triple that of the average disabled. As we saw earlier, this pronounced drop is due to the high fraction of people who work zero hours after disability.

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[32] 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. See also Mok et al. (2008) for corrections to some of the results in Charles (2003).

A closer examination of the two chronic groups suggests that they both experience a decline in earnings prior to recorded disability onset. By the year before onset, earnings of the *Chronic-Not Severe* group and the *Chronic-Severe* group drop 11.4 percent and 19.4 percent, respectively. This can be due to an illness or accident may have happened several years earlier and that a person experiencing a decline in his earnings ability would hesitate to call himself in bad health or disabled initially, but would be more willing to do so after a condition persisted.[33] With annual data there is also some rounding in the timing of onset.

C. Hourly Earnings Following Disability

The above results indicate 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 individuals who are working to be experiencing 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. We estimate model (1) with hourly earnings as the outcome and Figure 4 displays the percentage change in hourly earnings before and after disability onset for all disabled and by the *Extent of Disability* groups.[34] 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 and imprecisely measured. The *Chronic-Not Severe* and *Chronic-Severe* groups, however, experience sharp drops in hourly earnings following disability even among those who are working. By the fifth year after disability onset, hourly earnings drop 15 percent on average for the *Chronic-Not Severe* group and 13 percent for the *Chronic-Severe* group. In the long-run (six to ten years after disability onset), hourly earnings decline an estimated 18 percent for the *Chronic-Not Severe* group and about 21 percent for the *Chronic-Severe* group.

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[33] As Meyer and Mok (2013) shows, about 4.4 percent of the *Chronic-Severe* disabled received OASDI and an additional 1 percent received SSI before disability onset. The drop in earnings prior to onset is also documented in Singleton (2012) using Survey of Income and Program Participation (SIPP) data.

[34] The estimates for the change in hourly earnings are reported in Appendix Table 9.

4. 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 income tax liabilities.[35] 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.[36]

We use two income measures that are useful when examining the material well-being of the disabled. First, after-tax pre-transfer income is family income after federal income taxes but without benefits from the main types of public benefit programs.[37] 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, after-tax post-transfer income is the sum of after-tax family income, Food Stamps and the amount of any housing subsidy received.[38] In addition, we account for under-reporting in the main public benefit programs by scaling the benefits received using the program-specific reporting rates following Meyer, Mok and Sullivan (2009). 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

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[35] 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.

[36] See Meyer, Mok and Sullivan (2009) for evidence of under-reporting of public transfers in several datasets including the PSID.

[37] 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.

[38] See Appendix 3 of the Online Appendices for how we estimate the value of housing subsidies.

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. Column 4 of Table 5 reports the Poisson regression implied percentage change estimates for after-tax pre-transfer income received for the disabled as a whole and we display these estimates in Figure 5. For the disabled as a whole, after-tax pre-transfer income drops about 9 percent by the year of disability onset. The decline continues and the drop by the tenth year after onset is about 13 percent.

Before examining the changes for the other disability groups, let us consider how public transfers mitigate the income drop for the average disabled. Column 5 reports the estimates for after-tax post-transfer income, and the implied percentage changes we display in Figure 6. Including public transfers reduces the income drop for the average disabled by almost a half, to about 5 percent by the year of onset and about 8 percent by the tenth year after onset.[39]

Changes in family income vary considerably across the disabled groups (Appendix Tables 7 and 8). For the *Chronic-Not Severe* group, pre-transfer income drops an estimated 7.8 percent by the year of onset. Public transfers reduce this drop to under 3 percent. Income continues to fall through the ten years after disability. By the tenth year after onset, pre-transfer income has fallen by almost 13 percent. With public transfers, the income drop is reduced to about 7.6 percent. A similar pattern is apparent for the *Temporary* group. For the *One-Time* group, the pre-transfer income change by the tenth year after disability onset is small and statistically insignificant and the effect of moving to post-transfer income is small.

Columns 4-5 in Table 6 report the income changes for the *Chronic-Severe* group, and we also display them in Figures 5 and 6. There is significant evidence of a pre-onset fall in both income measures which, as we saw earlier, 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-transfer income is about 23 percent, but only 11 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, we estimate that pre-transfer income has dropped 52 percent, with the 95 percent confidence interval being (-61.1 , -43.4); when

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[39] 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.

public transfers are included, we estimate the income drop to be reduced to 28 percent on average.

B. Poverty

A standard indicator of well-being is the percentage of a group with family 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 definition and incorporate some of the conceptual 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.

Not surprisingly, the *Chronic-Severe* group has the highest poverty rate. Over 17 percent of the *Chronic-Severe* disabled group lives below poverty during the year of disability onset; the number reaches 23 percent by the following year. The poverty rate for this group remains above 20 percent until the tenth year after onset, when about 19 percent of the *Chronic-Severe* group has income below the poverty threshold. The rate for the *Chronic Not-Severe* group tends to rise over time and is over 10 percent in most later years. 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 Spousal Earnings

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 specification (1) 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 $7,000 by the year of onset then rise sharply in the next year. Benefits received then rise slowly, reaching about $14,000 per year ten years after onset. In contrast, members of the *Chronic-Not Severe* group receive only about $2,500 ten years out.

Given the importance of public transfer income for the disabled in the long run (six-ten years after disability onset), it is useful to disaggregate this broad category into specific social insurance programs. We focus on those disabled individuals who are in their sixth to tenth year after disability onset.[40] Not surprisingly, most of the disabled in the *Chronic-Severe* group receive benefits – 49 percent receive Social Security retirement or disability benefits (42 percent receive SSDI), 9 percent receive SSI (and about 50 percent receive SSDI or SSI), and 24 percent receive food stamps.[41] 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-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. We also calculate the share of each disability group that neither receives benefits nor works in the long run. 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 income.[42]

We have also studied the degree of spousal risk sharing by estimating the change in annual hours of work by wives of disabled heads.[43] The general pattern suggests a decline in hours worked by the wife, particularly for those with a chronically and severely disabled husband; the estimates are not precise, however.[44] 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

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[40] See Appendix Table 10 in the Online Appendices and Meyer and Mok (2013).

[41] 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.

[42] This statistic is likely overstated (and the earlier program receipt rates understated) because of the under-reporting of transfers mentioned earlier.

[43] *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.

[44] Appendix Table 6 of the Online Appendices shows these results. 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).

seriously disabled groups.[45] 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 hardships 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.

5. Consumption and Wealth Changes Surrounding Disability

In this section, we focus on consumption changes surrounding disability onset because consumption has advantages over income when measuring well-being. We will also see below in Section 7 that whether current disability compensation is optimal can be assessed using the consumption fall with disability as in Chetty (2006). 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 (2009) 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 associated with other measures of well-being for the disadvantaged (Meyer and Sullivan 2003, 2011).

The canonical model for examining the welfare implications of income shocks and consumption is the life-cycle model. In the life-cycle model, households maximize the

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[45] A study by Charles and Stephens (2004) finds no change in the divorce hazard after disability. Using the Survey of Income and Program Participation, Singleton (2012) finds an increase in divorce probability after disability for a sample of men.

present discounted value of expected utility, subject to an inter-temporal budget constraint. The life-cycle model has the clear prediction 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 (Dynan 1993, Bernheim, Skinner and Weinberg 2001).

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. 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.[46] Third, and most importantly, the disabled person is embedded in a household that has in our data on average about 4 members, falling to 3.5 ten years after disability onset. Thus, it seems reasonable to assume that the household level marginal utility of consumption does not change appreciably with the head's disability.

A. Food and Housing Consumption

We focus on the two components of consumption that can be measured well in the PSID: food and housing.[47] 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.[48] We define housing consumption as the sum of owned dwelling service flows calculated as 6 percent of current housing value, rent payments and the rental subsidy for those with free or subsidized housing.[49] Note, that consumption is

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[46] For recent empirical evidence on the effect of bad health on the marginal utility of consumption see Finkelstein, Luttmer and Notowidigdo (2013) and the discussion and references there.

[47] 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.

[48] 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.

[49] 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

measured at the household level, so in most cases a fall in consumption reflects a decline in living standards for more than the disabled head.

Columns 6 and 10 of Table 5 report the estimated percentage changes from the Poisson regressions for food consumption and food plus housing consumption, respectively, for the average disabled. We display the results in Figure 9 (food) and Figure 10 (food plus housing). For the disabled as a whole, food consumption falls 3 percent by the year of onset while food plus housing drops about 4 percent. Consumption continues to fall: our estimates imply that by the tenth year after disability onset, the average disabled man faces a decline in earnings of 22 percent, in after-tax post-transfers income of 8 percent, in food plus housing consumption of 9 percent and in food consumption of 8 percent.

Across the *Extent of Disability* groups, we again see that the decline in consumption is most dramatic for the *Chronic-Severe* group (columns 6 and 10 of Table 6).[50] By the year of onset, food consumption has fallen an estimated 9 percent and food plus housing consumption has fallen by 12 percent. Consumption continues to decline through the next ten years – by the tenth year after disability onset, food consumption has fallen by about 18 percent and food plus housing by about 25 percent.[51] These large declines are about triple those of the *Temporary* and *Chronic-Not Severe* groups, for whom food consumption drops about 7 percent. Compared with our previous estimates for the *Chronic-Severe* group, earnings fall 76 percent, after-tax post-transfers income falls 28 percent, food plus housing falls 25 percent and food falls 18 percent. These declines are close to triple those of the average disabled.[52] 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. 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.

We also note that food consumption has fallen by about 12 percent the year before onset for the *Chronic-Severe* disabled. As noted in our discussion of earnings changes, a

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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).

[50] We report the full set of estimates in Appendix Table 8 in the Online Appendices.

[51] The average decline in Food plus housing consumption in the six to ten years for the *Chronic-Severe* group is 25.6%.

[52] We have also examined food security of the disabled using data from the 1999, 2001 and 2003 PSID. While the sample sizes are small, the *Chronic-Severe* group in the long run after disability onset is about four times more likely to report problems of food security in the family than the non-disabled, and two to three times more likely than the other disability groups.

person may not immediately report he has a disability even when his productivity has fallen. During this period of decreased productivity, however, he might suspect that his future income will be lower. Consequently, such a person may adjust his consumption downwards as suggested by the Permanent Income Hypothesis.

B. Food Eaten at Home and Outside the Home

The above estimates suggest that food consumption falls after disability. If the observed fall in food consumption were due purely to a switch from high cost meals eaten outside the home to low cost meals eaten at home, then it might be premature to conclude that a fall in food consumption translates to a fall in material well-being. It could be that such a change reflects a change in preferences by the newly disabled away from eating out. To clarify this issue, we look at the change in food eaten at home and outside the home separately. We report the results in columns 7 and 8 of Table 5 (all disabled) and Table 6 (*Chronic-Severe*), and are depicted in Figure 11 (food at home) and Figure 12 (food outside the home).[53] We focus on the *Chronic-Severe* group as its members suffer the greatest drop in expenditures on food eaten at home and outside the home. Although the estimates suggest a pre-onset fall in both measures, these changes are mostly imprecisely measured.[54] The decline in consumption of food at home (11 percent) is first apparent in the second year after disability onset. While the fall is imprecisely estimated for individual years, most indicate a decline of over ten percent. Food outside the home falls more sharply, dropping by over 40 percent by the seventh year after onset and staying low. 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.[55]

C. Housing Consumption

We saw in Table 6 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. Column 9 of Table 5 and Table 6 shows the percentage

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[53] Appendix Table 12 reports the underlying estimates.

[54] An F-test that all pre-onset estimates are zero has the p-value 0.42 for food at home.

[55] We decompose the average change in food consumption using consumption shares for food at home and away. We find that, of the 18.9 percentage points decline in food consumption among the *Chronic-Severe*, 71% (13.4 percentage points) is due to decline in food eaten at home, and the remaining 29% (5.5 percentage points) is due to the decline in food eaten away from home.

decline in housing consumption for the disabled as a whole and the *Chronic-Severe* group respectively. Figure 13 shows these results. For the average disabled, it is estimated that housing consumption drops by about 4 percent by the year of disability, and by 6.9 percent by the tenth year after disability. This decline is mostly driven by the *Chronic-Severe* group, with an estimated decline in housing consumption of 12 percent by the year of onset and 26 percent by the tenth year after disability onset.

To understand the change in housing consumption, we analyzed the change in housing type (rent, public housing, private housing) and the change in housing consumption conditional on type. For brevity, we report the full results in the online Appendices. For the *Chronic-Not Severe* and the *Chronic-Severe* group, the likelihood of living in public housing increases in the long run by 2 and 4.5 percentage points, respectively, with the change for the *Chronic-Severe* group statistically significant.[56] The likelihood of these groups renting or owning a home, however, does not change significantly in the long run. For housing consumption, the *Chronic-Severe* group again displays some pronounced patterns. The estimated decline in homeowners' housing consumption in the long run is more than $3,000 a year; this corresponds to a drop in home value of more than $51,450. For those who rent private housing units, estimated annual rent paid declines about $1,400 ($116 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 retain observations after age 61 and 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

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[56] In the years prior to t= -5, 61.1% of the *Chronic-Severe* owned their home, 35.7 percent rented their home and 3.2 percent were in subsidized housing.

the age indicator variables that 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 than it was earlier, though the point estimates suggest that consumption falls slightly relative to the pre-eligibility years. The change with age is not significantly different for those who receive SSDI prior to age 62, and those who do not.

E. Wealth and How the Changes Fit Together

The last primary outcome associated with disability that we examine is changes in wealth. So far, we have seen that the changes in outcomes have the expected patterns and relationship to each other. Family income falls less than household head earnings reflecting mostly pooling of income. After we account for government transfers the fall is even lower. There is a sharp rise in transfers that accounts for this difference. The fall in food plus housing consumption is even lower than the fall in income. We have also seen that the fall in food consumption is lower than that for housing, and the fall in food at home is even lower than overall food decline. The missing connection so far is the identity connecting changes in income and consumption to changes in wealth. The change in consumption can only be smaller than the change in income if wealth is declining. In this section we examine this missing link. We might also be independently interested in changes in wealth as an indicator of the well-being of the disabled.

The wealth data available in the PSID are more limited than the income and consumption data. The wealth data are also highly skewed, complicating statistical analysis. Thus, the estimates in this section are less precise and differ more depending on the measure of wealth examined. However, these data are consistent with the decline in wealth for the *Chronic-Severe* disabled that we expect. Wealth is only available every five years beginning in 1984 and every two years beginning in 1997. We linearly interpolate between reports when possible or use a report from up to two years away. Given the skewness of the wealth data, we focus on medians and censored means that are less sensitive to outliers than ordinary means. We first look at median wealth without demographic controls or fixed effects. The median net wealth of the *Chronic-Severe* disabled starts at a level below that of the non-disabled and of the disabled with less severe or permanent impairments. It falls over time for the *Chronic-Severe* disabled approximately one thousand dollars per year, while it generally rises for the other disabled groups by roughly two thousand dollars per year (Appendix Table 10). We then estimate mean regressions with fixed effects and controls for age, education and other demographic variables, but we censor either five or ten percent of the extreme observations. Computationally we cannot estimate median regressions with so many fixed effects. Our estimates suggest a highly significant decline in net wealth on the order of four to seven thousand dollars per year for the *Chronic-Severe* relative to the non-disabled. This dissaving estimate is more than sufficient to account for the lower fall in consumption than in income that we find. Given the small number of observations and the difficulty of estimating changes in wealth, we think of this as only a rough estimate of the degree of dissaving.

6. Robustness Checks, Nutrition, and Time Use

In this section we report several additional results: a) changes in other behaviors prior to onset, b) the effects of accounting for unobserved differences between the disabled and the nondisabled through fixed effects, c) results for later disabilities and subsamples defined by program receipt and cohort, d) changes in nutrition, e) the time-use of the disabled, and f) life satisfaction and adaptation. The details of these analyses can be found in Appendix 2 of the online Appendices.

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

While our approach treats disability as endogenous, one might wonder if a period of unemployment or bad health leads a person to say he is disabled. An individual's decision on when he is disabled is likely a function of his time-varying productivity, disutility of work, and other factors. We present suggestive evidence for this view by looking at how unemployment, illness and health change prior to when an individual reports a condition that limits work. We estimate a series of regressions for the period prior to onset, controlling for demographic variables as in equation (1). We first examine the number of working days lost due to unemployment in the five years before disability onset (online Appendix Figure 1). For the average disabled, there is virtually no change over time. For the chronic groups, however, there is a dip in days of unemployment during the third and fourth years before onset, compared to earlier or later years, but no clear evidence of a prolonged rise in unemployment leading up to onset.

Next, we examine the number of workdays lost due to illness (online Appendix Figure 2). The results suggest that the number of workdays lost due to illness rises as we approach the year of onset; the changes are similar for all disabled groups. Finally, we examine health status where the dependent variable equals one if an individual is in poor or fair health (online Appendix Figure 3). Again, we see suggestive evidence that a decline in health is an important 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 over 8 percentage points just prior to disability onset. Overall, the results suggest that declining health, but not unemployment, is a key reason for reporting a disability.

B. Underlying Permanent Differences Between the Disabled and Non-Disabled[57]

We compare the association of disability with various outcomes with and without fixed effects to examine how the disabled differ in terms of unobservable permanent characteristics. These estimates indicate whether 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 in most of the outcomes. 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 those in the most disabled group are not different from the non-disabled (after accounting for observed characteristics) in terms of unobserved attributes that affect these outcomes. There is a noticeable difference for food plus housing consumption, with the estimates without fixed effects being about six percentage points higher than those with fixed effects after onset.

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[57] These results are not reported, but are available from the authors upon request.

This result implies that the *Chronic-Severe* disabled consumed more pre-onset than their characteristics imply. In terms of pre-disability estimates, the *Chronic-Severe* disabled have unobserved characteristics that lead to lower hours (about 80 hours per year) and lower earnings 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 the *Chronic-Severe* and non-disabled groups. What differences exist initially between the groups appears to be overwhelmed by the changes in sample composition during the years after onset.

For all disabled men combined, 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. These results suggest that cross-sectional methods may do a fairly good job of approximating panel data methods in some cases.

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 outcomes during these later *Chronic-Severe* disability spells are quantitatively similar to those of the original *Chronic-Severe* group presented above.

D. Social Security and Outcomes

Since Social Security disability or SSI payments are the main safety net for the permanently disabled, it is natural to ask how recipients fare relative to non-recipients. We split the *Chronic-Severe* group into those who receive SSDI or SSI benefits more than half of the time over the ten years after disability onset (SSA recipients) and those who do not (SSA non-recipients). We find that 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 (Appendix Figures 4 through 7). The results suggest that those with low pre-transfer income are more likely to be recipients, with the benefits raising these worst off recipients to the level of the other disabled.

E. Cohort Differences

We examine whether the material circumstances of the disabled have changed over time. To do so, we split the disabled into two samples: those who were 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. Results for earnings and income can be found in Meyer and Mok (2013).

F. Nutrition and Time-use Data

The results in Section 5 suggest that the disabled suffer from a sizable drop in food consumption, particularly the *Chronic-Severe* group. However, individuals with a lower relative price of time may substitute time in home production for expenditures (Becker 1965). Thus, the fall in food consumption we observe for the disabled may be a result of the disabled: 1) spending more time shopping and searching for lower prices for the goods they purchase and/or 2) spending more time on food preparation, which may turn cheaper ingredients into better food. Our findings do not support these effects being important, as 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 that the disabled have worse nutrition, with about a 10-15 percent lower intake of Vitamin A, Vitamin C and Vitamin E. To examine time use, we employ 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. Major uses of the additional non-work time of the disabled are time spent watching TV – 10.6 hours per week, obtaining medical care – 7.2 hours per week, sleeping – 6.8 hours per week, and "relaxing" – 3.2 hours per week. Given that the household production function employs time inputs of both the husband and the wife, we also investigate 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.

G. Life Satisfaction and Adaptation

Our study has examined changes in a variety of economic variables before and after the onset of disability. One variable that we have not analyzed but has attracted much attention is "life satisfaction". Some authors have suggested that the disabled may adapt (or habituate) to their new state and utility may not fall despite the consumption drop. There are three important issues here. First, the phrasing of life satisfaction questions seems to affect individual's responses. Second, whether life satisfaction is equal to utility or part of utility remains controversial in the literature.[58] Third, there are few empirical studies to date investigating how life satisfaction evolves after disability onset, especially in the United States, and they reach conflicting conclusions.[59] Data limitation may prevent us from taking on this issue here.[60]

7. Optimal Disability Benefits

We have emphasized that social insurance benefits reduce material deprivation by smoothing an individual's consumption, while past work has emphasized their labor supply distortions. Studies of optimal social insurance benefits attempt to balance the two effects. The classic reference is Baily (1977) who examines the optimality of unemployment insurance benefits under some simplifying assumption on preferences. Chetty (2006) generalizes this result by relaxing the assumptions that the third and higher order terms of the utility function are small and considering adverse events besides unemployment. Moreover, he emphasizes that the results are robust to a number of complications such as a leisure value of nonemployment, private insurance arrangements, saving and costly search. Here, we

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[58] See Stevenson and Wolfers (2008).

[59] Lucas (2007), Oswald and Powdthavee (2008), and Daly and Gardiner (2013) examine the existence of adaptation by studying how life satisfaction changes after disability. The papers come to different conclusions, though their results differ in part due to differences in methodology and data. In addition, the first two studies use British and German longitudinal data, and benefits are more generous in these countries than those in the United States. Daly and Gardiner (2013) use the U.S. Health and Retirement Study and the General Social Survey and find "*little evidence that individuals return to their pre-disability level of subjective wellbeing as measured by life satisfaction,*" though they also note that the length of their panel is short relative to the first two studies above.

[60] The PSID has data on life satisfaction in its 2009 'Disability and Use of Time' supplement but the data are only available for a small subsample of older survey respondents.

examine the optimality of the current system of compensation, based on the Chetty framework as described below.

A. The Framework

Suppose an individual lives for one unit of time and faces disability with probability p. If he is not disabled, he will receive wage w. In the event of disability, the individual chooses the fraction of time disabled D. Suppose $\delta(D)$ is a concave and increasing function capturing the net benefit of disability duration (such as the pain avoided). Let A_0 be the individual's initial asset level, and $u(c)$ be a strictly concave and state-independent utility function of the individual, where $c=\{c_e, c_d\}$ represent the consumption of the individual in the event of no disability (c_e) and disability (c_d). Thus, given the disability probability p, the benefit amount b and tax τ the individual chooses c_e, c_u and D to maximize his expected lifetime utility:

$$\max\ (1-p)u(c_e) + p(u(c_u) + \delta(D))$$

$$\text{s.t.} \quad A_0 + (w - \tau) - c_e \geq 0$$

$$A_0 + bD + w(1-D) - c_u \geq 0$$

Suppose a social planner chooses b and τ to maximize the expected utility of the individual, subject to a balanced budget constraint. Let $V(b,\tau)$ be the indirect utility function of the individual, then the social planner's problem is to choose the benefit amount and tax to maximize the utility of the individual:

$$\mathrm{Max}_{b,\tau}\ V(b,\tau) \ \text{ s.t. } (1-p)\tau = pbD$$

The first order condition for optimality is:

$$(3) \quad u'(c_e)\left[1 + \frac{b}{D}\frac{dD}{db}\right] = u'(c_d)$$

This condition simply says that the marginal benefit of providing one extra dollar of benefits is equal to the marginal cost, which is the sum of the direct cost of raising the tax ($u'(c_e)$) and a term due to the individual's behavioral response of extending duration of disability. By applying a Taylor Series expansion, and assuming the fourth and higher order derivatives of $u(.)$ are small, the optimal benefit condition can be written as:

$$(4)\quad \gamma\frac{\Delta c}{c}(b^*)\left[1+\frac{1}{2}\rho\frac{\Delta c}{c}(b^*)\right]\approx\varepsilon_{D,b}$$

where $-\frac{\Delta\bar{c}}{\bar{c}}(b^*)$ is the drop in mean consumption with disability as a function of the benefit level b, γ is $-u''c_t/u'$, the coefficient of relative risk aversion, and ρ is $-u'''c_t/u''$, the coefficient of relative prudence. D is the fraction of a lifetime spent disabled, and $\varepsilon_{D,b}$ is the elasticity of D with respect to b. In his calibration exercises, Chetty finds that assuming $u'''=0$, i.e. ignoring the term in ρ, leads to substantial bias.

Chetty (2006) also derives a similar optimality condition under a more general setting. He considers a continuous-time dynamic setting where a representative agent faces persistent risk of an adverse event, such as disability. The agent makes a vector of decisions at time t contingent on a vector of state variables at time t. With some standard assumptions, proposition 2 in his paper states that the optimal benefit level b* is implicitly defined by the equation:[61]

$$(5)\quad \left\{\left[\frac{\Delta\bar{c}}{\bar{c}}(b^*)\gamma\left[1+\frac{\rho}{2}\frac{\Delta\bar{c}}{\bar{c}}(b^*)\right]+1\right]F-1\right\}=\frac{\varepsilon_{D,b}}{1-D}$$

where $F=(1+\gamma\rho s_d^2)/(1+\gamma\rho s_n^2)$, s_d is the coefficient of variation of consumption in the disabled state and s_n is the coefficient of variation of consumption in the non-disabled state. Chetty finds in his calibration exercises given his assumed range of F that setting $F=1$ leads to little bias, while below we find that our estimate of F leads to an elasticity at the optimum that is up to 14 percent lower than it would be with $F=1$, depending on preferences.

The relationship in (5) provides a way of checking whether current benefits are optimal. If the left hand side is greater than the right hand side then benefits are too low; if the reverse is true then benefits are too high. This equation highlights the importance of knowing the consumption fall with disability when designing disability policy. Furthermore, this optimality condition is robust to a number of extensions: private insurance arrangements (spousal supply of labor), a leisure value of nonemployment, dynamic search and saving behavior, borrowing constraints, and heterogeneity in the consumption fall.[62]

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[61] See p.1889 of Chetty (2006) for the details.

[62] Interested readers can refer to pp.1895-96 in Chetty (2006).

B. Optimality of Disability Compensation

To implement the optimality rule implied by equation (5), we first take the proportional drop in consumption to be 0.256, based on the estimate of the change in food plus housing consumption for the *Chronic-Severe* group in the six to ten years after disability onset, as reported in Section 5.[63] 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 in Section 5.D. that the consumption drop for the *Chronic-Severe* group continues until at least age 75, this approach seems reasonable. To estimate *D*, the fraction of the working life spent disabled, we rely on our estimated probability of having had a disability by various ages reported in Section 2. We average these probabilities from ages 20 through the expected life span for men conditional on reaching age 20, which is age 76. Since our samples are only large enough to estimate disability probabilities precisely from age 27 through 61, we take earlier years to have the rate at age 27 and later years the rate at 61. This calculation gives us an estimate of *D* of 0.12. Given that some work disabilities occur after age 61, our estimate of *D* may be too low. On the other hand, since mortality among the disabled is higher than average, our estimate of D may be too high. The optimal level of benefits though is not very sensitive to the estimate of *D* as can be seen in equation (5) where the quantity *1-D* enters multiplicatively. To obtain the coefficient of variation of consumption in the disabled state and the non-disabled state, we split the sample into two groups: 1) The *Chronic-Severe* disabled individuals beginning in the year of onset. 2) The non-disabled, the non-*Chronic-Severe* disabled and the *Chronic-Severe* disabled observations prior to disability onset. Using their food plus housing consumption data (adjusted by family size and composition), we obtain $s_d = 0.272$ and $s_n = 0.289$.[64]

We report the optimal benefit calculation in Table 7. This table reports the elasticity of *D* with respect to benefits that would be consistent with benefits being optimal, for different values of the coefficients of relative risk aversion (γ) and relative prudence (ρ). Since the literature considers a wide range of values for these parameters, we do as well. We

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[63] One might be concerned that food plus housing might represent only a fraction of consumption and the drop of 0.256 might be an overestimate of the true consumption decline. However, both food and housing should be viewed as necessities and hence collectively should have a lower income elasticity than overall expenditure. Using the Engel curve estimates from Aguiar and Bils (2011), their Table 2, Column 2 results suggest that the income elasticity for food plus housing is 0.82, lower than the income elasticity of overall expenditure of 0.99.

[64] To adjust the food and housing consumption data, we use the equivalence scale $(A+0.7K)^{0.7}$ where *A* is the number of adults and K is the number of children in the family.

assume that the marginal utility of consumption (at a given consumption level) is the same before and after disability, though as discussed earlier, the direction of any change is uncertain. Particularly since, as mentioned earlier, it is the marginal utility of consumption for a household of 3 to 4 members on average not just one disabled individual, the assumption of constancy seems reasonable. As γ ranges from 1 to 5 and ρ ranges from 0 to 5, the elasticity consistent with optimality ranges from 0.23 to 1.63. If we focus on an estimate of γ of at least 3 as assumed typically,[65] benefits are optimal or higher than optimal if the true elasticity of time spent disabled is at least 0.68, depending on ρ, but are lower than optimal if the elasticity is lower. In the case of a CRRA utility function where $\rho = \gamma+1$, the elasticity consistent with optimality ranges from 0.26 to 1.31 as γ goes from 1 to 4 (see the bold estimates in Table 7).

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 average 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. We have also simplified the model by not considering the choice of waiting times and screening stringency (see Low and Pistafferi 2010 for an analysis that emphasizes the determinants of these other program features).

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 see how the two elasticities compare, note that they can be written as

$$(6) \quad \varepsilon_{D,j} = \frac{\partial D_j}{\partial b}\frac{b}{D_j},$$

where j equals s or np indicating a self-report or non-participation respectively. To convert one to the other, we need to compare the levels of non-participation and self-reported

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[65] 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".

disability, D_{np} and D_s respectively, and the derivatives of the two states with respect to benefits, $\partial D_{np} / \partial b$ and $\partial D_s / \partial b$ respectively. 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 benefits, but still work. Thus, we take the two derivatives to be approximately equal and conclude that $\varepsilon_{D,s} \approx \varepsilon_{D,np}$.

The elasticity of non-work with respect to workers' compensation (WC) benefits is also relevant since WC is the second largest program for the disabled. 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. The sum of the median estimates for these two elasticities in the literature is under 0.6. This WC claim elasticity likely significantly overstates the nonwork elasticity, which is probably in the range of the SSDI elasticity or lower. The combination of these numbers, suggests that current compensation for disability appears to be below the optimal amount suggested by equation (5), if we believe that the coefficient of relative risk aversion is three or higher, regardless of the coefficient of relative prudence (as long as it is zero or positive). We should emphasize that the magnitude of these preference parameters is not settled in the literature; in this framework there is a range of values that point to compensation being higher than optimal.

One might also wonder whether one could implement this type of optimal benefit formula in practice. In particular, how does the screening mechanism for disability insurance compare to the *Chronic-Severe* classification of disability emphasized in the paper? We should emphasize that we do not anticipate program eligibility being determined by the answers to the PSID questions. Rather, other screening mechanisms could approximate our disability classification. We have already noted that at each age the share of men who are on the Social Security disability program is considerably lower than the share that is in the *Chronic-Severe* disability group. Thus, we have not focused on a more select and severely disabled group than those who currently receive SSDI benefits. Our PSID classification does require examining disability over several years, but in practice SSDI does as well.[66] In general, disability screening relies on much more information than is available in the PSID, including a potential recipient's medical history and doctors' examinations, so it could be more effective. Thus, it does not appear that the screening stringency required is beyond that which could be implemented.

8. Discussion and Conclusions

This paper studies the prevalence of working-age disability, changes in household material well-being surrounding disability onset, and the optimality of current benefits for the disabled. We use longitudinal data for the period 1968-2009 from a sample of male household heads to determine the prevalence of disability and examine how it affects a comprehensive range of outcomes, including earnings, income, and consumption. This paper has several key findings. First, disability rates are high. We estimate that by age 50, about 9 percent of male household heads have begun an enduring and severe disability. By age 56, that share rises to 15 percent. An even larger proportion of men have experienced some type of disability.

Second, disability is associated with poor economic outcomes. Ten years after disability onset, those with a chronic and severe disability condition have on average experienced a 76 percent decline in earnings, a 28 percent decline in after-tax after-transfer income, a 25 percent decline in food and housing consumption and a 18 percent decline in consumption of food alone. In addition, about two-thirds of these most disabled individuals do not 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.

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. We also find a noticeable fall in earnings and income prior to the onset of a

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[66] See French and Song (2012) for data on how the SSDI allowance process is spread out over the ten years after application.

reported disability. Consumption also falls somewhat prior to reported onset, indicating that future disability is partially but incompletely predictable in the short run.

Fourth, 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.

Fifth, we employ the Baily-Chetty optimal benefit formula, which balances the consumption fall we find against the large labor supply disincentives found in past research. We find that for a substantial range of plausible parameter values current compensation for the most disabled appears to be lower than this standard model suggests is optimal. However, stronger statements require knowing preference parameters that have not been pinned down in the literature. This optimal benefit calculation accounts for the moral hazard effects of disability, but assumes that the marginal utility of consumption at the household level is not state dependent.

There are several important limitations to our research. We have not examined the prevalence and circumstances of disabled women since the lack of information on disability for women in the early years of the PSID prevents a parallel treatment. Recent evidence from other sources suggests that disability is rising for women (Baldwin and Chu 2006). We should also emphasize that we only focus on disability during the working years, not earlier or later ages. We hope that future work will address these limitations.

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

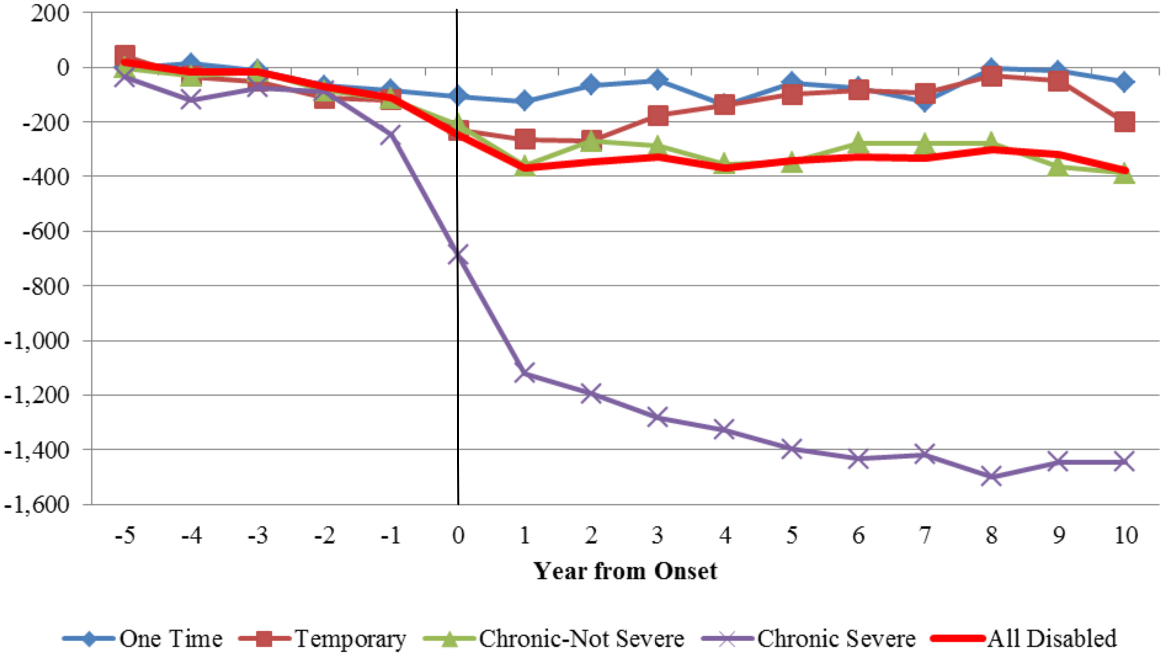

Figure 2
Percentage of Disabled with Zero Hours of Work Before and After Disability Onset, Extent of Disability Groups and All Disabled

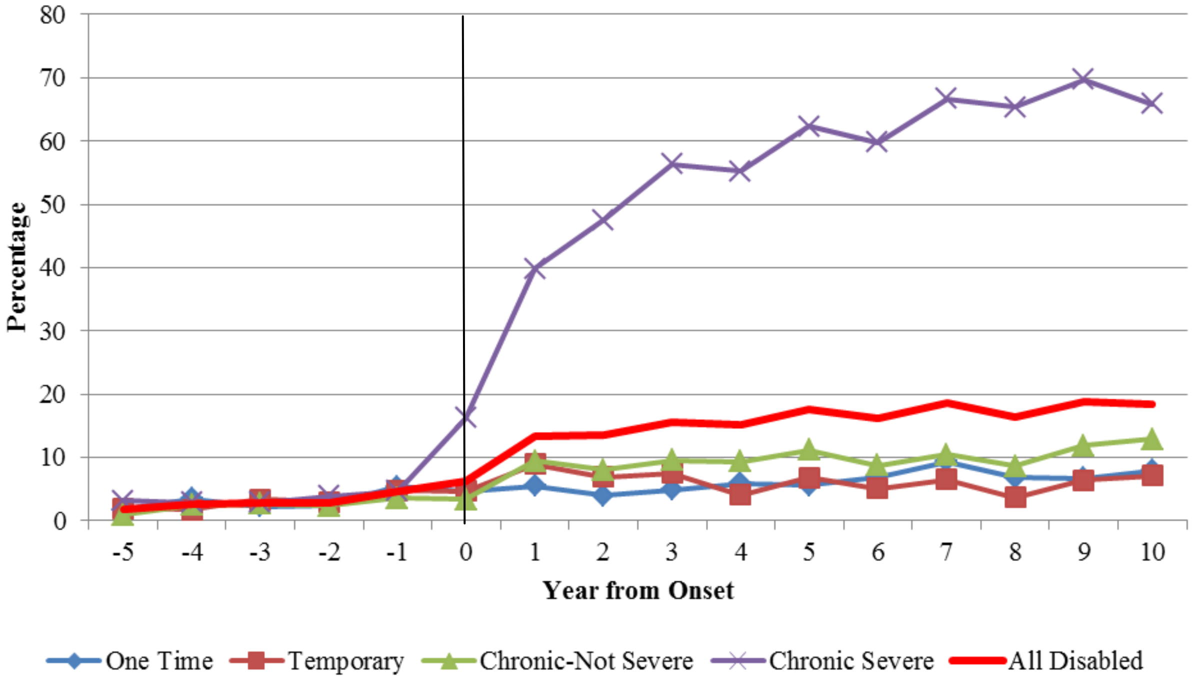

Figure 3
Percent Change in Annual Earnings Before and After Disability Onset, Extent of Disability Groups and All Disabled

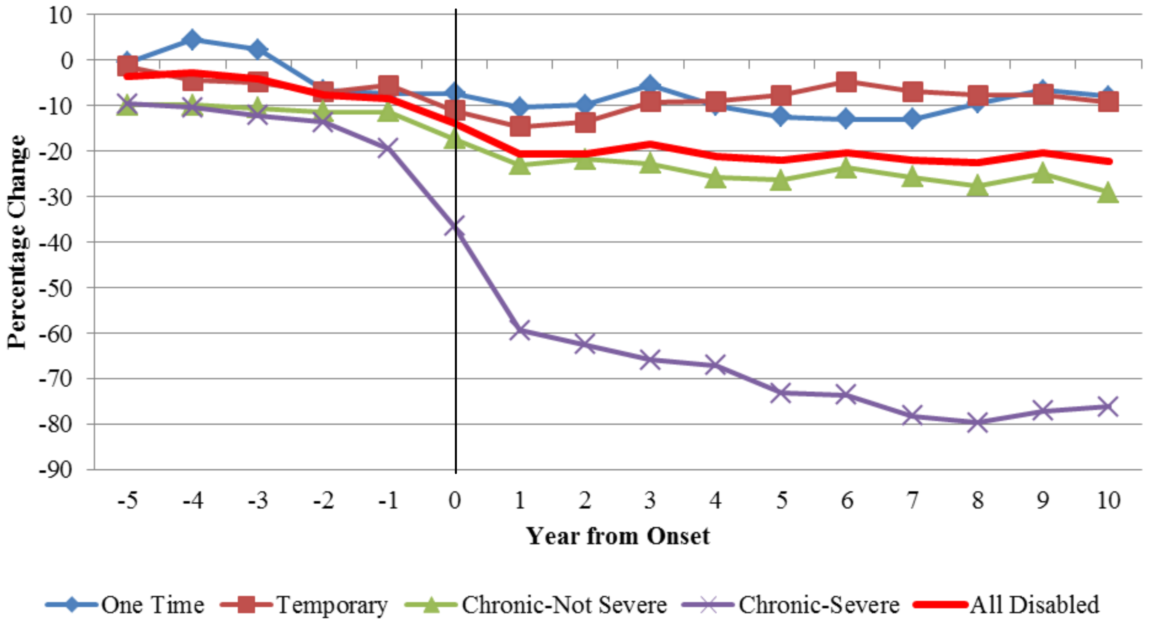

Figure 4
Percentage Change in Hourly Earnings Before and After Disability Onset, Extent of Disability Groups and All Disabled

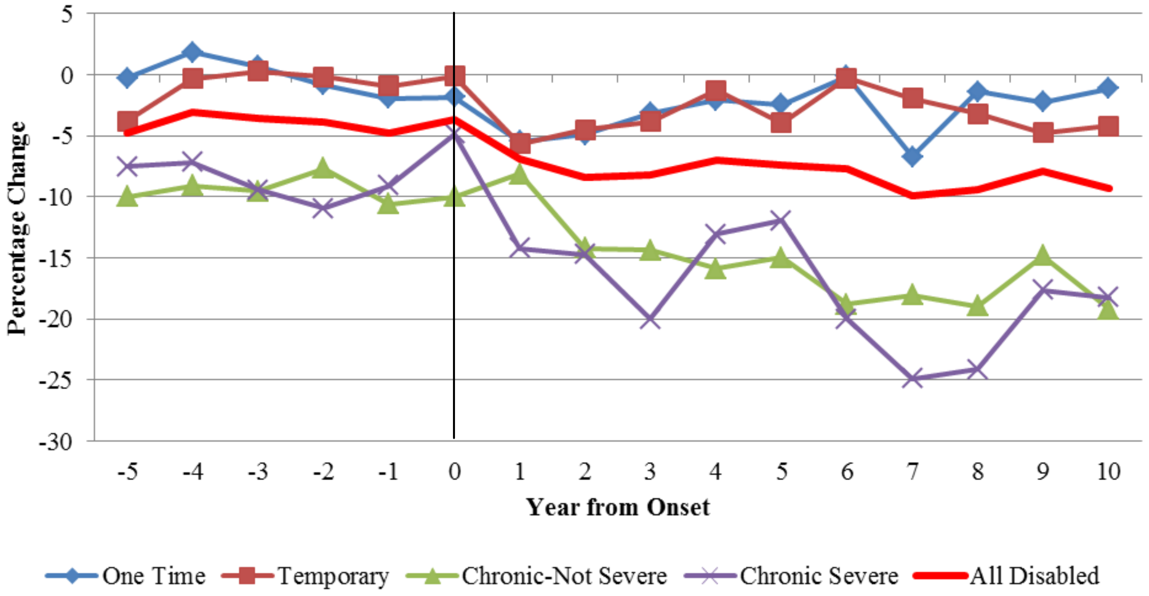

Figure 5
Percentage Change in After-Tax Pre-Public Transfer Income Before and After Disability Onset, Extent of Disability Groups and All Disabled

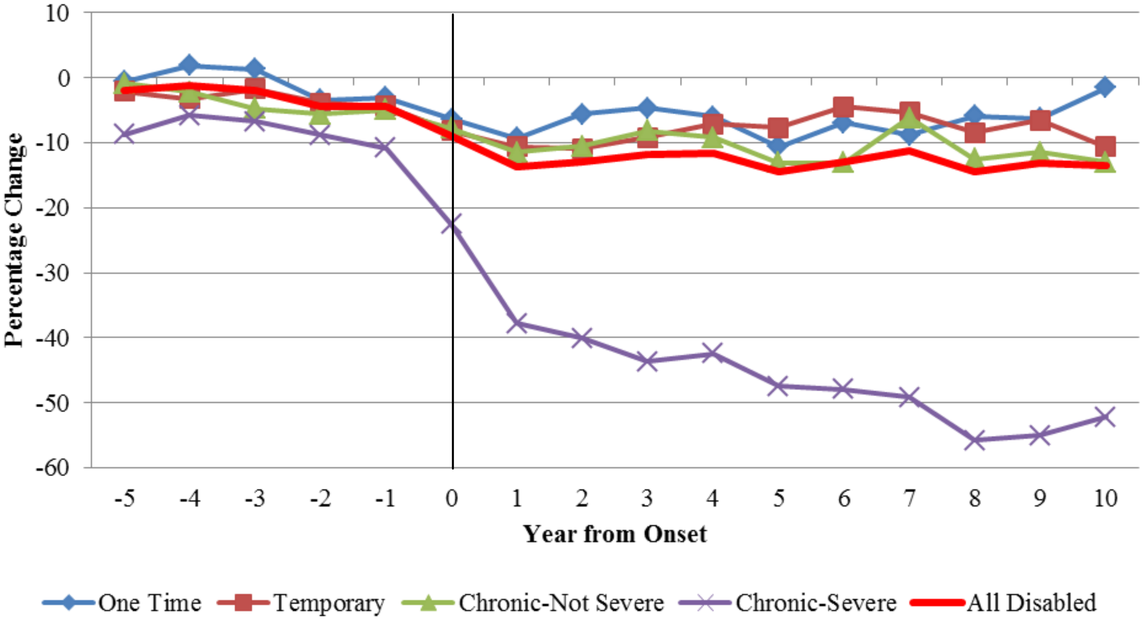

Figure 6
Percentage Change in After-Tax Post-Transfer Income Before and After Disability Onset, Extent of Disability Groups and All Disabled

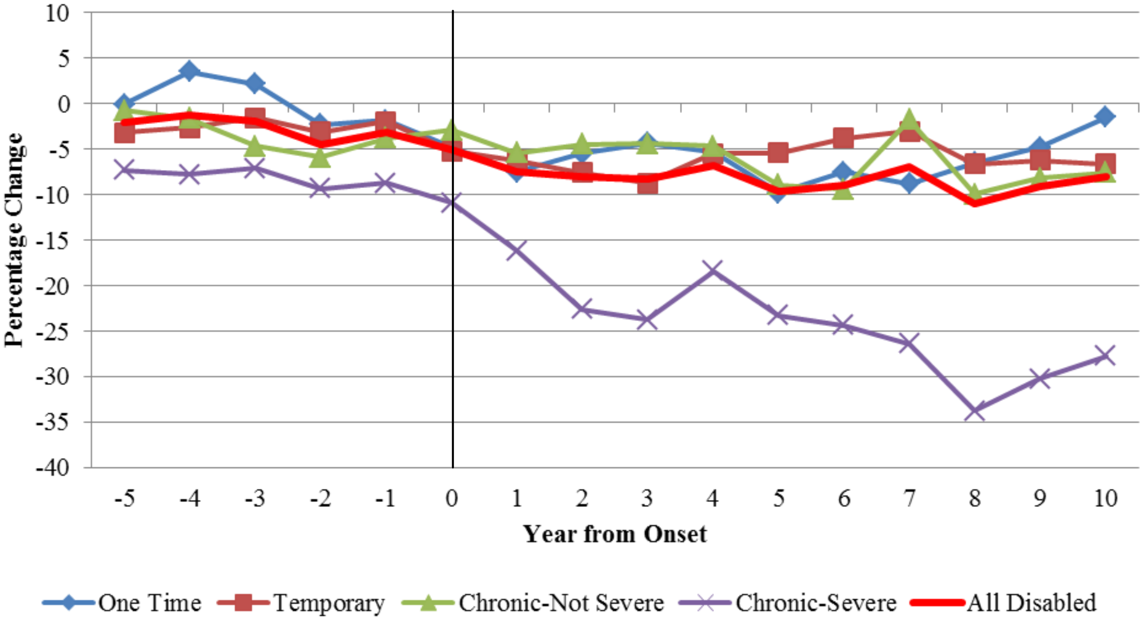

Figure 7
Percentage of Families with After-Tax Post-Transfer Income Below the Poverty Line, Extent of Disability Groups and All Disabled

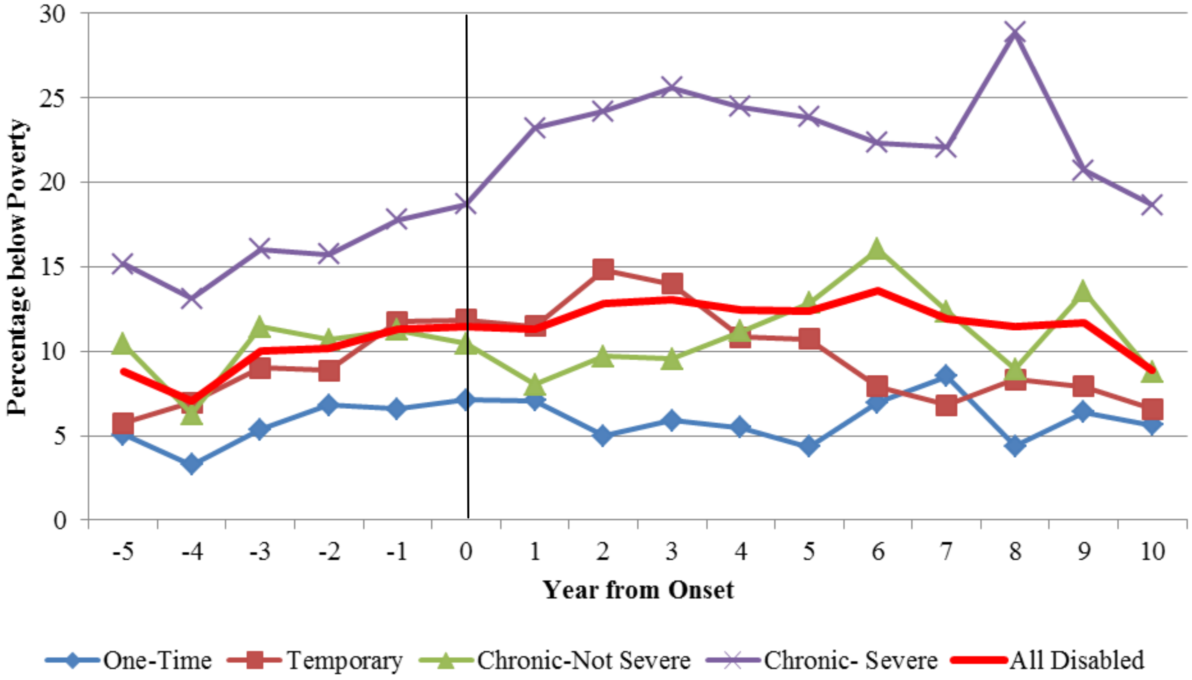

Figure 8
Change in Under-reporting Adjusted Public Transfer Income Before and After Disability Onset, Extent of Disability Groups and All Disabled

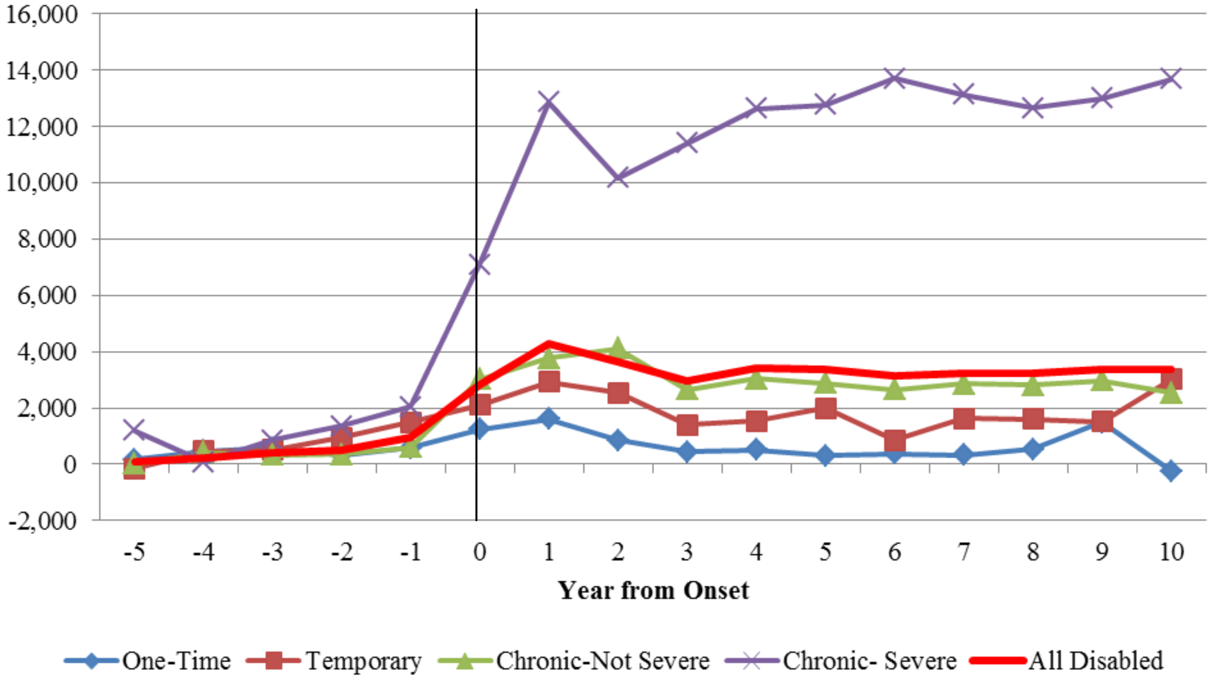

Figure 9
Percentage Change in Food Consumption Before and After Disability Onset, Extent of Disability Groups and All Disabled

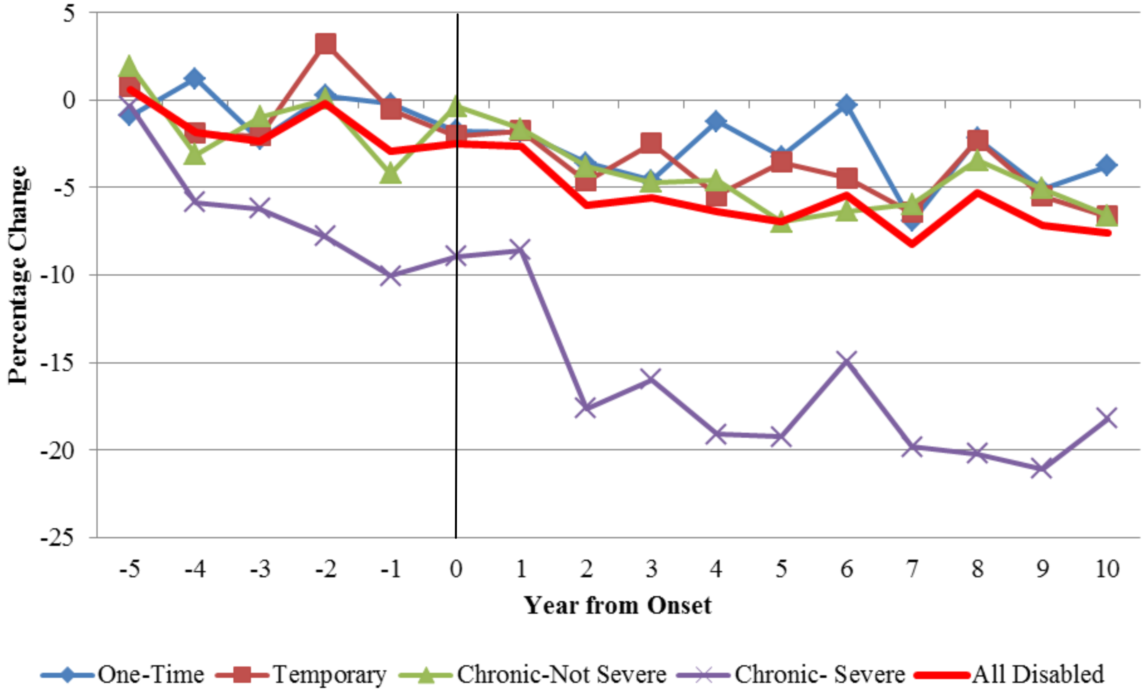

Figure 10
Percentage Change in Food plus Housing Consumption Before and After Disability Onset, Extent of Disability Groups and All Disabled

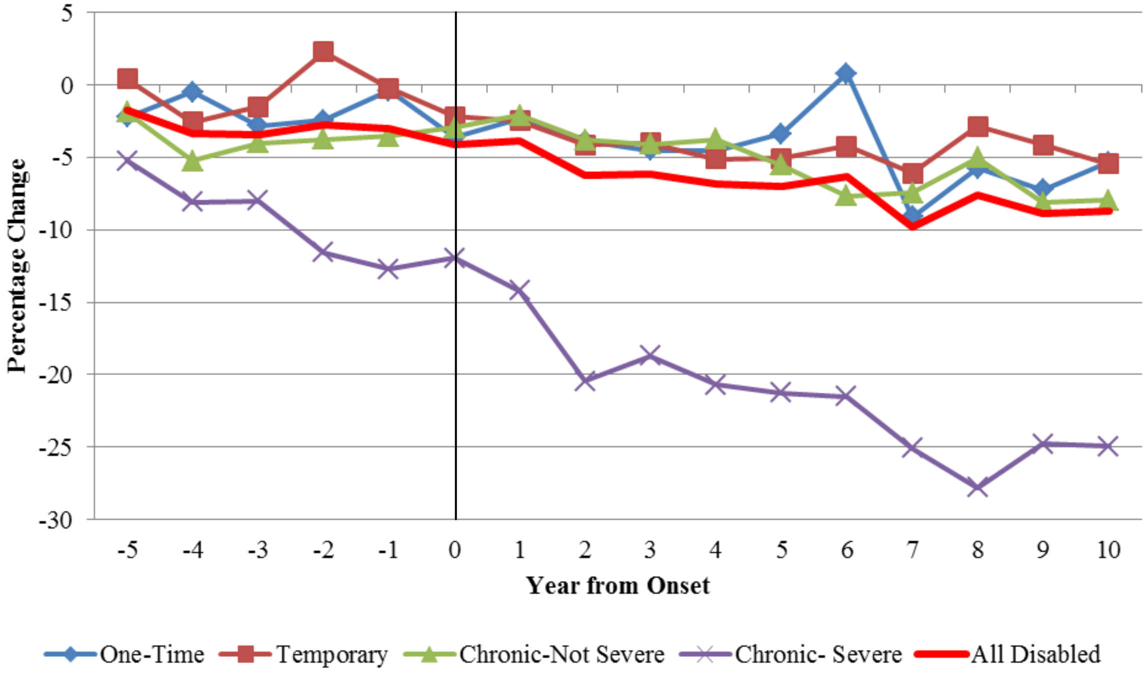

Figure 11
Percentage Change in Food Eaten at Home Before and After Disability Onset, Extent of Disability Groups and All Disabled

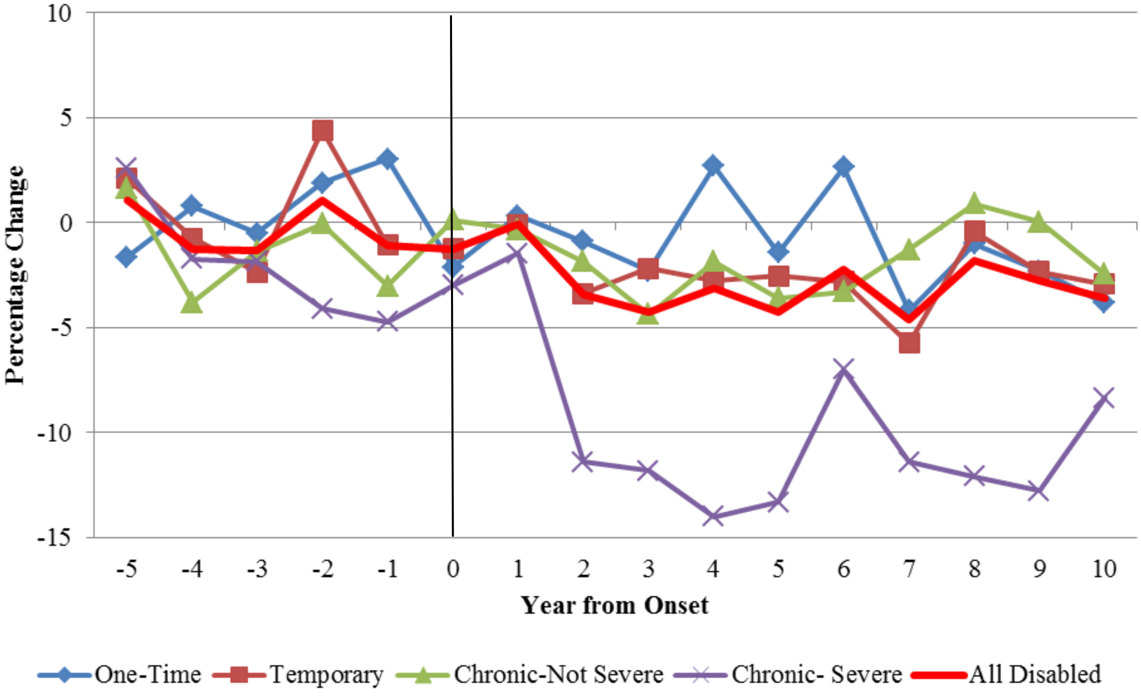

Figure 12
Percentage Change in Food Eaten Outside the Home Before and After Disability Onset, Extent of Disability Groups and All Disabled

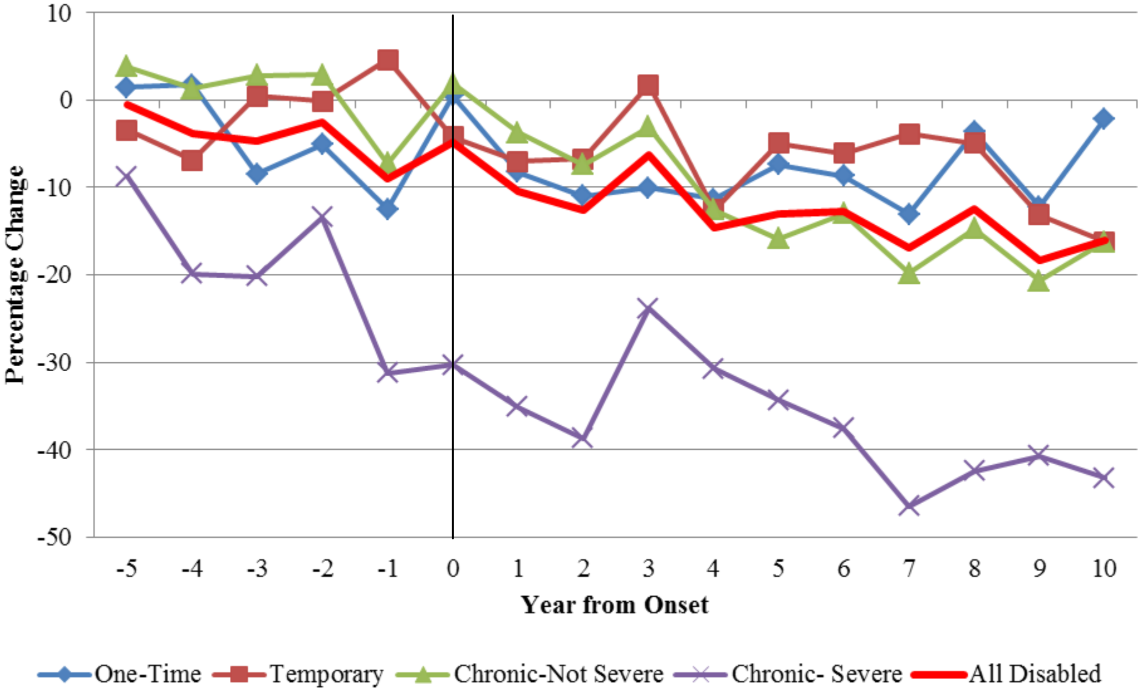

Figure 13
Percentage Change in Housing Consumption Before and After Disability Onset, Extent of Disability Groups and All Disabled

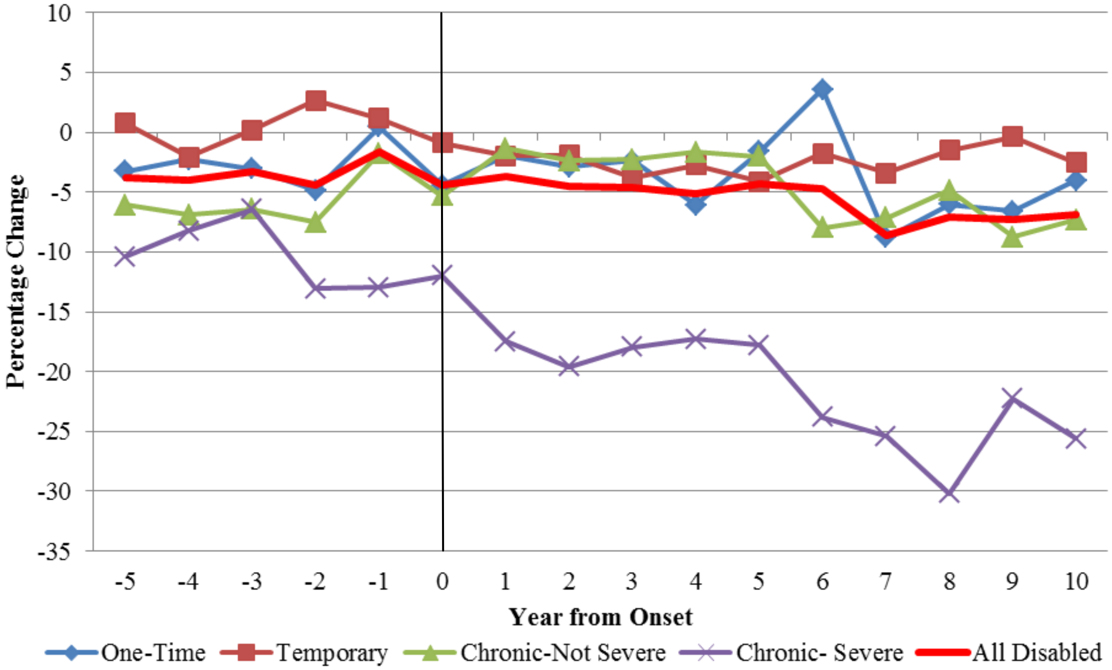

Table 1
Working Age Male Household Head Disability Rates, and Shares Severely Disabled
1968-2009

Year	N (1)	Disability Rate (Unweighted) (2)	Disability Rate (Weighted) (3)	Share of Disabled that are Severely Disabled (Weighted) (4)
1968	2,865	15.17	13.74	0.30
1969	2,659	17.84	16.25	
1970	2,730	16.40	14.76	
1971	2,809	16.87	16.01	
1972	2,901	14.03	13.16	0.33
1973	3,039	12.62	12.24	0.28
1974	3,164	11.79	11.41	0.27
1975	3,307	10.81	10.60	0.27
1976	3,418	10.89	10.43	0.35
1977	3,542	11.86	10.95	0.48
1978	3,663	12.17	11.39	0.44
1979	3,799	13.26	12.79	0.44
1980	3,905	14.09	13.60	0.42
1981	3,931	12.46	12.38	0.48
1982	3,970	11.74	11.99	0.45
1983	4,046	11.46	11.25	0.48
1984	4,093	12.38	12.86	0.37
1985	4,177	11.95	12.14	0.41
1986	4,193	10.55	11.25	0.26
1987	4,221	12.62	13.64	0.31
1988	4,262	12.86	13.71	0.28
1989	4,266	12.90	13.49	0.31
1990	5,485	13.65	14.42	0.33
1991	5,451	13.48	14.09	0.31
1992	5,716	13.50	13.99	0.28
1993	5,712	13.24	13.46	0.29
1994	6,224	13.46	12.80	0.30
1995	5,966	13.03	12.98	0.34
1996	4,946	12.78	13.19	0.34
1997	4,028	11.34	12.02	0.28
1999	4,175	12.11	12.29	0.34
2001	4,475	12.45	13.02	0.29
2003	4,718	12.13	12.35	0.32
2005	4,746	11.60	12.07	0.38
2007	4,858	12.13	13.20	0.36
2009	5,034	11.45	12.03	0.39

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

Disability Transition Matrix

t-1	t	t+1			t+2		
		Non-disabled	Not Severe	Severe	Non-disabled	Not Severe	Severe
Non-disabled	Non-disabled	0.967	0.023	0.007	0.954	0.029	0.011
Non-disabled	Not Severe	0.586	0.336	0.075	0.619	0.300	0.074
Non-disabled	Severe	0.309	0.255	0.431	0.345	0.253	0.388
Not Severe	Non-disabled	0.752	0.203	0.041	0.726	0.202	0.067
Not Severe	Not Severe	0.252	0.647	0.094	0.323	0.546	0.118
Not Severe	Severe	0.124	0.314	0.552	0.173	0.309	0.514
Severe	Non-disabled	0.647	0.196	0.145	0.609	0.211	0.165
Severe	Not Severe	0.194	0.464	0.342	0.212	0.397	0.386
Severe	Severe	0.066	0.129	0.796	0.099	0.160	0.728

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

Table 3
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		37.0	35.7	35.6	37.0	41.7
		(10.3)	(9.0)	(10.5)	(10.3)	(10.2)
Age	35.9	40.5	37.0	39.5	42.1	44.9
	(7.9)	(8.7)	(6.7)	(8.4)	(8.6)	(9.2)
White	0.667	0.670	0.716	0.657	0.752	0.489
	(0.471)	(0.470)	(0.451)	(0.475)	(0.432)	(0.501)
Married	0.802	0.799	0.786	0.797	0.816	0.792
	(0.317)	(0.312)	(0.319)	(0.307)	(0.299)	(0.331)
Number of Years In Survey	13.7 (8.0)	19.3 (8.1)	19.4 (8.0)	19.2 (8.3)	20.6 (7.9)	17.5 (8.0)
Highest Level of Educ-High School	0.347 (0.476)	0.315 (0.465)	0.347 (0.476)	0.331 (0.471)	0.336 (0.473)	0.264 (0.442)
Highest Level of Educ-College	0.461 (0.499)	0.355 (0.479)	0.462 (0.499)	0.360 (0.480)	0.358 (0.480)	0.191 (0.394)
Years in Survey after Onset		13.7 (8.6)	10.2 (6.7)	13.8 (9.3)	16.5 (8.5)	13.9 (8.2)
Number of Consecutive Positive Limitation Reports		1.919 (4.225)		0.444 (0.631)	3.339 (5.193)	4.933 (6.167)
Number of Non-missing Reports of Disability Status from Onset to the 10th Year after Onset		7.471 (2.495)	6.794 (2.599)	7.218 (2.542)	8.210 (2.196)	7.653 (2.392)
Number of Positive Limitation Reports from Onset to the 10th Year after Onset		2.993 (2.912)		1.402 (0.491)	5.363 (2.113)	6.155 (2.339)
Severity Ratio		0.277	0.129	0.207	0.121	0.837
		(0.371)	(0.336)	(0.307)	(0.164)	(0.168)
Age in the Last Interview	45.2	54.8	50.2	53.6	57.6	58.5
	(11.7)	(13.4)	(11.8)	(13.7)	(13.1)	(13.4)
Number of Observations	4,804	1,937	465	595	548	329

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. Individuals are classified by their first observed disability. See data appendix or text for sample restrictions and the text for group definitions.

Table 3 (*continued*)
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)
Economic Outcomes (in 2010 dollars) in the Years prior to the Fifth Year before Disability (Overall Average for the Non-Disabled)						
Earnings	49,067	43,019	43,419	44,484	44,259	38,125
	(38,243)	(31,308)	(25,713)	(30,353)	(38,395)	(27,235)
After-tax, After Transfer Family Income	63,536	52,656	53,012	54,183	53,825	47,831
	(38,633)	(28,777)	(24,987)	(29,199)	(33,359)	(24,775)
Consumption	17,336	15,047	14,954	15,517	14,932	14,619
	(8,534)	(6,502)	(6,087)	(6,770)	(6,241)	(7,060)

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. Individuals are classified by their first observed disability. See data appendix or text for sample restrictions and the text for group definitions.

Table 4
Prevalence of Disability by Age

Age	Number of Male Heads	Any disability (1)	Currently Disabled (2)	One-Time (3)	Temporary (4)	Chronic Not Severe (5)	Chronic Severe (6)
30	607	0.2171	0.0862	0.0428	0.0650	0.0736	0.0357
		(0.0201)	(0.0147)	(0.0089)	(0.0120)	(0.0124)	(0.0102)
32	1009	0.2160	0.0769	0.0422	0.0645	0.0772	0.0321
		(0.0156)	(0.0102)	(0.0077)	(0.0090)	(0.0101)	(0.0071)
34	1214	0.2443	0.0899	0.0570	0.0590	0.0902	0.0382
		(0.0150)	(0.0102)	(0.0079)	(0.0079)	(0.0098)	(0.0078)
36	1272	0.2448	0.0989	0.0584	0.0572	0.0964	0.0329
		(0.0143)	(0.0098)	(0.0075)	(0.0074)	(0.0102)	(0.0057)
38	1112	0.2683	0.0824	0.0635	0.0693	0.1069	0.0286
		(0.0161)	(0.0098)	(0.0084)	(0.0092)	(0.0118)	(0.0057)
40	1009	0.2658	0.0882	0.0536	0.0712	0.1118	0.0292
		(0.0167)	(0.0105)	(0.0081)	(0.0096)	(0.0121)	(0.0062)
42	902	0.2827	0.1079	0.0611	0.0710	0.1204	0.0302
		(0.0178)	(0.0126)	(0.0091)	(0.0099)	(0.0132)	(0.0067)
44	743	0.3001	0.1205	0.0484	0.0995	0.1201	0.0321
		(0.0199)	(0.0141)	(0.0088)	(0.0132)	(0.0143)	(0.0070)
46	583	0.3298	0.1317	0.0507	0.1061	0.1130	0.0599
		(0.0231)	(0.0169)	(0.0108)	(0.0152)	(0.0155)	(0.0116)
48	554	0.3411	0.1275	0.0470	0.0910	0.1394	0.0637
		(0.0237)	(0.0165)	(0.0101)	(0.0144)	(0.0175)	(0.0116)
50	542	0.3595	0.1628	0.0558	0.0790	0.1332	0.0916
		(0.0245)	(0.0191)	(0.0117)	(0.0134)	(0.0170)	(0.0151)
52	555	0.3544	0.1687	0.0606	0.0720	0.1200	0.1018
		(0.0239)	(0.0190)	(0.0119)	(0.0121)	(0.0164)	(0.0152)
54	538	0.3824	0.1909	0.0607	0.0758	0.1281	0.1178
		(0.0242)	(0.0198)	(0.0122)	(0.0126)	(0.0164)	(0.0160)
56	545	0.4140	0.2152	0.0639	0.0734	0.1312	0.1456
		(0.0243)	(0.0205)	(0.0127)	(0.0125)	(0.0165)	(0.0172)
58	383	0.6047	0.3033	0.0841	0.1041	0.2104	0.2060
		(0.0298)	(0.0281)	(0.0171)	(0.0179)	(0.0250)	(0.0244)
60	352	0.6142	0.3039	0.0808	0.1007	0.1878	0.2451
		(0.0309)	(0.0290)	(0.0180)	(0.0181)	(0.0251)	(0.0268)

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. For this table we only use data from 1980-1992. 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 Economic Outcomes Before and After Disability Onset, All Disabled

			Implied Percentage Change							
						Consumption				
Year from onset	**Hours of Work** (1)	**% working zero hours** (2)	**Earnings** (3)	**Pre-Public Transfer Income** (4)	**Post-Public Transfer Income** (5)	**Food** (6)	**Food Eaten At Home** (7)	**Food Eaten Away from Home** (8)	**Housing** (9)	**Food plus Housing** (10)
-5	22	1.84	-3.68	-1.91	-2.04	0.59	1.1	-0.51	-3.79*	-1.72
	(20)		(2.04)	(1.27)	(1.25)	(1.39)	(1.52)	(3.22)	(1.51)	(1.12)
-4	-15	2.63	-2.80	-1.20	-1.18	-1.87	-1.24	-3.82	-4.00*	-3.32**
	(23)		(2.65)	(1.51)	(1.53)	(1.23)	(1.27)	(3.32)	(1.67)	(1.14)
-3	-18	2.78	-4.21	-1.90	-1.95	-2.31	-1.34	-4.69	-3.31	-3.38**
	(23)		(2.56)	(1.77)	(1.77)	(1.31)	(1.36)	(3.27)	(1.82)	(1.22)
-2	-70**	2.81	-7.73**	-4.40**	-4.43**	-0.17	1.07	-2.55	-4.39*	-2.74*
	(25)		(2.05)	(1.47)	(1.42)	(1.38)	(1.45)	(3.20)	(1.98)	(1.32)
-1	-112**	4.59	-8.36**	-4.49**	-3.11	-2.94*	-1.07	-8.98**	-1.65	-3.00*
	(25)		(2.16)	(1.60)	(1.60)	(1.32)	(1.41)	(3.16)	(2.27)	(1.40)
0	-246**	6.21	-13.91**	-9.02**	-4.97**	-2.48	-1.27	-4.82	-4.39*	-4.10**
	(27)		(2.18)	(1.56)	(1.57)	(1.30)	(1.35)	(3.31)	(2.15)	(1.39)
1	-368**	13.30	-20.63**	-13.66**	-7.47**	-2.63	-0.07	-10.43**	-3.70	-3.88**
	(29)		(2.37)	(1.64)	(1.71)	(1.56)	(1.70)	(3.31)	(2.20)	(1.50)
2	-346**	13.52	-20.54**	-12.89**	-8.06**	-6.02**	-3.45*	-12.58**	-4.54	-6.25**
	(30)		(2.38)	(1.68)	(1.73)	(1.36)	(1.46)	(2.95)	(2.33)	(1.48)
3	-328**	15.50	-18.40**	-11.74**	-8.24**	-5.61**	-4.29**	-6.31	-4.57	-6.13**
	(30)		(2.91)	(2.15)	(2.21)	(1.43)	(1.48)	(3.53)	(2.46)	(1.58)
4	-368**	15.23	-21.13**	-11.70**	-6.75**	-6.35**	-3.15*	-14.64**	-5.18	-6.81**
	(30)		(2.55)	(2.28)	(2.34)	(1.42)	(1.59)	(2.88)	(2.68)	(1.69)
5	-343**	17.50	-21.88**	-14.56**	-9.63**	-6.95**	-4.27**	-13.00**	-4.30	-6.99**
	(32)		(3.06)	(2.00)	(2.03)	(1.43)	(1.53)	(3.15)	(2.85)	(1.76)
6	-329**	16.17	-20.22**	-12.86**	-8.97**	-5.46**	-2.22	-12.81**	-4.73	-6.30**
	(33)		(2.87)	(2.05)	(2.07)	(1.47)	(1.59)	(3.20)	(3.59)	(2.13)
7	-334**	18.55	-22.00**	-11.20**	-6.90*	-8.23**	-4.62**	-16.96**	-8.68**	-9.83**
	(33)		(3.19)	(3.01)	(3.08)	(1.44)	(1.60)	(2.98)	(2.74)	(1.74)
8	-300**	16.33	-22.50**	-14.56**	-11.02**	-5.26**	-1.80	-12.49**	-7.10*	-7.63**
	(34)		(2.89)	(2.13)	(2.10)	(1.56)	(1.67)	(3.36)	(3.26)	(2.02)
9	-320**	18.72	-20.20**	-13.05**	-9.13**	-7.18**	-2.77	-18.31**	-7.29*	-8.83**
	(36)		(3.39)	(2.35)	(2.36)	(1.57)	(1.73)	(3.16)	(3.29)	(2.01)
10	-378**	18.41	-22.28**	-13.43**	-7.97**	-7.56**	-3.59*	-16.06**	-6.86*	-8.69**
	(38)		(3.37)	(2.45)	(2.54)	(1.67)	(1.81)	(3.55)	(3.41)	(2.14)

Notes: The numbers reported are, for each variable of interest, the coefficient estimates of the time from onset indicator variables in fixed effect regressions or the implied percentage changes. 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 6 - Changes in Economic Outcomes Before and After Disability Onset, Chronic-Severe Disabled

			Implied Percentage Change							
						Consumption				
Year from onset	**Hours of Work** (1)	**% working zero hours** (2)	**Earnings** (3)	**Pre-Public Transfer Income** (4)	**Post-Public Transfer Income** (5)	**Food** (6)	**Food Eaten At Home** (7)	**Food Eaten Away from Home** (8)	**Housing** (9)	**Food plus Housing** (10)
-5	-36	3.20	-9.57*	-8.70**	-7.27*	-0.33	2.58	-8.73	-10.41**	-5.24*
	(58)		(3.89)	(3.11)	(2.91)	(2.66)	(2.94)	(7.74)	(2.88)	(2.10)
-4	-120*	2.82	-10.36**	-5.77	-7.80*	-5.85*	-1.73	-19.87	-8.25*	-8.07**
	(51)		(3.68)	(3.26)	(3.03)	(2.90)	(2.83)	(10.28)	(3.54)	(2.48)
-3	-75	2.90	-12.11**	-6.78	-7.08*	-6.20*	-1.85	-20.16**	-6.47	-7.99**
	(53)		(3.95)	(3.58)	(3.30)	(3.06)	(3.35)	(6.25)	(4.11)	(2.53)
-2	-87	3.90	-13.64**	-8.77*	-9.33**	-7.78*	-4.12	-13.37	-13.04**	-11.55**
	(63)		(4.69)	(3.63)	(3.20)	(3.14)	(3.22)	(7.24)	(4.12)	(2.81)
-1	-249**	4.67	-19.41**	-10.78**	-8.72*	-10.05**	-4.74	-31.26**	-12.96**	-12.72**
	(59)		(4.82)	(3.73)	(3.41)	(3.25)	(3.49)	(6.85)	(4.24)	(2.83)
0	-686**	16.18	-36.52**	-22.53**	-10.83**	-8.92**	-2.98	-30.29**	-11.99**	-11.90**
	(71)		(4.99)	(4.05)	(3.70)	(3.04)	(3.30)	(6.56)	(4.56)	(2.86)
1	-1,121**	39.85	-59.34**	-37.83**	-16.17**	-8.58	-1.46	-35.13**	-17.49**	-14.18**
	(69)		(4.19)	(3.75)	(4.10)	(4.50)	(5.14)	(6.59)	(4.21)	(3.33)
2	-1,195**	47.49	-62.50**	-40.10**	-22.55**	-17.61**	-11.40**	-38.72**	-19.62**	-20.50**
	(73)		(4.20)	(3.60)	(3.44)	(2.80)	(2.96)	(6.34)	(4.04)	(2.58)
3	-1,283**	56.36	-65.85**	-43.68**	-23.77**	-15.99**	-11.85**	-23.81**	-17.97**	-18.72**
	(68)		(4.30)	(3.91)	(3.68)	(3.29)	(3.33)	(8.59)	(3.82)	(2.71)
4	-1,327**	55.26	-67.08**	-42.47**	-18.37**	-19.12**	-14.05**	-30.73**	-17.33**	-20.69**
	(70)		(4.25)	(5.45)	(5.36)	(2.71)	(3.03)	(6.48)	(4.50)	(2.67)
5	-1,397**	62.28	-73.12**	-47.44**	-23.29**	-19.30**	-13.33**	-34.37**	-17.80**	-21.24**
	(66)		(3.64)	(3.65)	(3.67)	(2.94)	(3.16)	(6.21)	(4.25)	(2.67)
6	-1,434**	59.75	-73.58**	-47.97**	-24.36**	-14.92**	-7.02	-37.58**	-23.84**	-21.52**
	(72)		(3.84)	(3.76)	(3.98)	(3.29)	(3.62)	(6.42)	(4.74)	(2.93)
7	-1,417**	66.67	-78.23**	-49.15**	-26.37**	-19.80**	-11.37**	-46.45**	-25.43**	-25.12**
	(74)		(3.39)	(3.96)	(3.98)	(3.22)	(3.74)	(5.31)	(5.28)	(2.90)
8	-1,499**	65.35	-79.70**	-55.82**	-33.74**	-20.20**	-12.10**	-42.47**	-30.14**	-27.84**
	(75)		(3.74)	(3.46)	(3.54)	(2.72)	(3.07)	(5.53)	(4.59)	(2.57)
9	-1,444**	69.73	-77.10**	-55.06**	-30.25**	-21.10**	-12.81**	-40.72**	-22.26**	-24.77**
	(86)		(4.12)	(3.70)	(3.77)	(2.83)	(3.42)	(6.09)	(6.57)	(3.38)
10	-1,445**	65.82	-76.08**	-52.25**	-27.74**	-18.20**	-8.35	-43.22**	-25.63**	-24.94**
	(85)		(4.68)	(4.51)	(4.64)	(3.62)	(4.27)	(6.59)	(4.63)	(3.00)

Notes: The numbers reported are, for each variable of interest, the coefficient estimates of the time from onset indicator variables in fixed effect regressions or the implied percentage changes, for the Chronic-Severe disability group. 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 7
Estimates of $\varepsilon_{D,b}$ for Current Disability Compensation Programs to be Optimal

A. Estimated Change in Consumption

		Coefficient of Relative Risk Aversion, γ				
		1	2	3	4	5
Coefficient of Relative Prudence, ρ	0	0.2253	0.4506	0.6758	0.9011	1.1264
	1	0.2439	0.4850	0.7239	0.9610	1.1966
	2	**0.2635**	0.5236	0.7814	1.0377	1.2928
	3	0.2839	**0.5649**	0.8444	1.1228	1.4005
	4	0.3049	0.6082	**0.9107**	1.2127	1.5144
	5	0.3265	0.6529	0.9792	**1.3056**	1.6320

Notes: These table show, for a given value of γ (coefficient of relative risk aversion) and ρ (coefficient of relative prudence), 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 chronic-severe disabled are optimal. Estimates in bold refer to the case of a CRRA utility function.

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