Beyond Health: The Welfare Effects of Disability Insurance*

Manasi Deshpande Lee M. Lockwood

February 7, 2020

Preliminary and Incomplete: Comments Appreciated

Abstract

In the public debate, disability insurance (DI) is generally evaluated relative to its statutory purpose of providing assistance to workers who experience severe health conditions. We go beyond the statutory health standard to evaluate DI in a broader welfarist framework. We find that the Social Security Disability Insurance (SSDI) program is well-targeted on broader welfarist criteria. Recipients are 42% more likely to experience an adverse life event—such as job loss, involuntary move, or divorce—than non-recipients, and 17% less likely to have resources to cope with those events. Health is highly correlated with adverse life events and low resources, but DI's non-health tags and screens further improve targeting even conditional on health: Recipients who do not have a severe health condition are more disadvantaged on non-health dimensions, while non-recipients who have a severe health condition are less disadvantaged. Under a wide range of assumptions, recipients' marginal utility exceeds that of non-recipients by 50-200% on average, implying a high value of increasing benefits at the margin given other policies. Our results indicate that stricter enforcement of the health tag, while aligning the program more closely with its statutory role, could reduce social welfare by reducing the extent to which DI insures non-health risks.

*Deshpande: University of Chicago and NBER, mdeshpande@uchicago.edu; Lockwood: University of Virginia and NBER, leelockwood@virginia.edu. We are grateful to Mark Duggan, Liran Einav, Steven Haider, Magne Mogstad, Austin Nichols, Luigi Pistaferri, Joe Shapiro, Isaac Sorkin, and seminar participants at Michigan State, University of Illinois at Chicago, University of Wisconsin-Madison, Federal Reserve Board, and Stanford University for helpful comments. We thank Yalun Su and Jiada Ye for excellent research assistance.

1 Introduction

Disability insurance (DI) is a major component of the social safety net in most developed countries. In the United States, the Social Security Disability Insurance (SSDI) program provides $150 billion in benefits to nearly 9 million workers. The statutory purpose of DI programs is to provide assistance to workers who experience severe health conditions. The expansion in DI over recent decades has prompted a public debate over whether disability recipients are truly disabled or "fraudulently" collecting disability benefits without a serious health condition. Underlying much of this debate is the premise that SSDI should be evaluated according to its statutory purpose of providing benefits to individuals with severe health conditions.

In this paper, we go beyond the statutory health standard to evaluate disability insurance from a welfarist perspective, using complementary positive and normative analyses. In the positive analysis, we analyze the targeting of the SSDI program on broader welfarist criteria.[1] We use a combination of survey and administrative data to estimate the sign and magnitude of selection into SSDI with respect to adverse life events, such as job loss, involuntary moves, and divorce, and with respect to resources available to cope with these events. In addition to comparing recipients and non-recipients, we focus on errors of inclusion and exclusion relative to DI's statutory health standard: individuals who receive SSDI but do not have a severe disability and individuals who do not receive SSDI despite having a severe disability.

In the normative analysis, we use a sufficient statistics approach to estimate the marginal welfare effects of various changes in DI. We focus in particular on the DI "markup": how much larger the marginal utility of DI recipients is relative to non-recipients. In a broad class of models, the markup is the marginal welfare gain from an actuarially fair transfer from non-recipients to recipients. We use PSID consumption data in combination with a range of assumptions about utility to estimate the markup for the SSDI program. We combine our estimates of the markup with evidence from the literature on behavioral responses to changes in DI—which determine the fiscal externality cost of changing DI—to calculate the marginal welfare effects of different reforms.

We also study the mechanisms behind the welfare effects of DI. The targeting of DI—and hence its markup—is determined by the tags and screens involved in the application process and decision process. The canonical tag associated with DI is health. But DI programs involve many other tags and screens. SSDI, for example, considers an applicant's age and education in award decisions and involves a lengthy, complicated application process.

[1] Throughout this paper, we use disability insurance (DI) to refer to disability insurance programs generally and Social Security Disability Insurance (SSDI) to refer to the particular DI program in the United States that we study.

Relative to the health tag alone, these non-health tags and screens could either improve or worsen the targeting of DI, depending on their correlation with marginal utility and potential earnings. We compare the DI markup to that of a hypothetical program that targets perfectly on health. The difference between these markups reflects the combined effects of DI's non-health tags and screens.

We find in the positive analysis that DI recipients are highly selected with respect to adverse life events and resources. Recipients are 42% more likely than non-recipients to have experienced an adverse life event, such as job loss, involuntary move, or divorce, and 17% less likely to have the resources to cope with these events. Moreover, we find good selection into DI even conditional on health. Recipients without severe health conditions are 4% less and 39% more likely than severe recipients or non-recipients, respectively, to have experienced an adverse life event. In administrative data, we find that they are 20% more likely than severe recipients to have experienced a financial event such as bankruptcy, eviction, or foreclosure, and 48% more likely to have experienced a mass layoff. Conversely, non-recipients with severe health conditions are 15% less likely than severe recipients to have experienced an adverse event.

Consistent with the strong selection into DI on the basis of health and non-health shocks, we find that recipients have much lower consumption than non-recipients. Under a wide range of assumptions, the marginal utility of recipients far exceeds that of non-recipients. Our baseline estimate is that the marginal utility of recipients is about 150 percent greater than (2.5 times) that of non-recipients. This means that the markup on transfers from non-recipients to recipients—i.e., the risk premium or surplus value over the no moral hazard actuarially fair value—is 150 percent. Each dollar increase in the no moral hazard actuarially fair value of DI benefits is worth \$2.50 of non-labor income among non-recipients from behind the veil. DI's high markup is partly due to the high value of health status as a tag: health is highly correlated with marginal utility even at the margin given DI and other programs. Yet even conditional on health, DI's non-health tags and screens appear to improve targeting on marginal utility. Consistent with the positive findings, these results suggest that on net DI's non-health tags and screens improve, rather than worsen, its targeting of marginal utility.

Of course, social welfare depends not only on program benefits, as represented by the markup, but also on program costs. The fiscal externality cost of an increase in DI benefits includes the benefits paid to marginal recipients induced into applying as well as reductions in tax revenue from reductions in the earnings of recipients and their families. We use evidence from the literature on the behavioral responses to changes in DI, together with evidence on how such behavioral responses translate into net costs to the government from Bound et al. (2004), to calculate the fiscal externality cost of an increase in DI benefits. Although

there is substantial uncertainty about the key elasticities and so the fiscal externality, our point estimates suggest that government budget-neutral increases in DI benefits financed by greater taxes on non-recipients would likely increase welfare from behind the veil. In addition, the ex ante marginal value of public funds spent increasing DI benefits appears to exceed that of increasing the benefits of other important programs such as UI.

Our findings suggest that stricter enforcement of the health tag, as many reform proposals advocate, could potentially reduce social welfare. Although such reforms would more closely align DI with its statutory purpose, our results suggest that they might worsen targeting on broader welfarist criteria. Our findings highlight important tradeoffs between increasing DI's alignment with its statutory purpose and providing valuable insurance against the many non-health risks that DI currently insures.

To be sure, our findings do not imply that DI is the best way to insure non-health risks or redistribute income. Because DI requires recipients to limit their earnings, it is likely a costly way to insure risks that do not permanently eliminate work capacity. Such risks may be better addressed by other policies. Moreover, given the tradeoffs between the multiple roles DI is currently serving—insuring disability risk, insuring non-health risks, and redistributing—there could be large gains from using different policy instruments to serve these different purposes.

The primary contribution of this paper is to consider the importance of characteristics beyond health in evaluating the targeting and welfare effects of the DI program. In doing so, we build on previous work evaluating DI on the basis of health. Chandra and Samwick (2009) and Meyer and Mok (2019) measure insurance against health shocks specifically. These papers find that DI, together with other programs, provides incomplete insurance against health shocks.

Research on DI in recent decades has focused on non-health drivers of DI enrollment. The seminal work of Autor and Duggan (2003, 2006) finds that economic factors, especially stagnating median wages, are responsible for much of the recent growth in SSDI. Other papers study specific economic events. Black, Daniel and Sanders (2002) and Charles, Li and Stephens (2018) study the effects of local economic shocks in driving DI enrollment, and Rege, Telle and Votruba (2009) study the role of mass layoffs. In this paper, we ask the converse question: How many recipients, especially those without a severe health condition, have been affected by adverse life events and have limited resources to cope with those events? To the extent that such events are only incompletely insured by other means, DI could potentially have a valuable role to play beyond its statutory purpose. The positive analysis builds on papers that study selection into DI application and award, including Benıtez-Silva et al. (1999), Von Wachter, Song and Manchester (2011), and Deshpande,

Gross and Su (2019).

Our paper complements recent papers that estimate the welfare effects of DI using alternative methodological approaches. Low and Pistaferri (2015) estimate a structural life-cycle model of DI applications and awards and find that reducing the strictness of the DI health tag increases welfare despite worsening the labor distortion. Their rich model fully specifies applicant behavior, risks, and insurance mechanisms, which enables them to calculate the welfare effects of a wide range of policy counterfactuals. Our sufficient statistics approach, which aims to recover the marginal welfare effects of various changes from the status quo, complements their structural approach. The main advantage of our approach relative to more structural approaches is that it does not depend on modeling the full set of risks people face and insurance mechanisms they use, since in a broad class of models the effects of such factors are captured by the markup and fiscal externality. Cabral and Cullen (2019) use the demand for private disability insurance to bound the value of public DI. Consistent with these papers, we find that DI has a high value at the margin. We further find that DI's non-health tags and screens improve, rather than worsen, targeting on the basis of marginal utility.

Bound et al. (2004) estimate the marginal welfare effect of an increase in DI benefits and taxes. A major contribution of their paper, which we rely on in this paper, is their detailed modeling of the fiscal externality of increasing DI benefits. We build on their work in several ways. First, we consider a wider range of policy counterfactuals—including changes in award decisions and tags as well as in benefit levels, and including those that do not require different earnings groups to pay the full marginal cost of changes in their benefits. This allows us to shed light on the welfare effects of a wider range of reforms, and to quantify the value from behind the veil of DI's redistribution across different earnings groups as well as its insurance within groups. Second, we use household-level consumption data directly, without imputations, which allows us to capture the effects of DI on the full distribution of consumption, including the left tail. Third, we investigate the key mechanisms underlying DI's welfare effects. In the positive analysis, we document strong selection into DI on the basis of health, non-health shocks, and resources with which to self-insure shocks. In the normative analysis, we decompose the value of DI into that from insurance against health versus non-health risk, and from insurance within permanent income groups versus redistribution across groups.

The paper proceeds as follows. In Section 2, we present a conceptual framework of the targeting of DI benefits that guides our positive and normative analyses. Section 3 provides institutional background and describes the data. In Section 4, we present the positive analysis of the targeting of DI on proxies for well-being, including adverse life events and resources. In Section 5, we use a sufficient statistics approach to estimate the marginal welfare effects

of DI. Section 6 concludes.

2 Conceptual Framework

Our objective is to evaluate DI from a welfarist framework that goes beyond the statutory health standard. In a neoclassical framework, the marginal utility of income of recipients is a sufficient statistic for estimating the marginal welfare gain to recipients from the program. By definition, the marginal utility of income gives the increase in recipient utility from an additional dollar transferred. Similarly, the difference in marginal utilities between recipients and non-recipients gives the net marginal welfare gain across society, before accounting for the behavioral effects of the policy. Note that the marginal utility of income is sufficient for the program's treatment effects. Although many studies on social programs estimate treatment effects, the treatment effects of the program are important for marginal welfare analysis only to the extent that they predict the marginal utility of income.

Because marginal utility is a sufficient statistic for marginal welfare analysis, we want to determine the extent to which DI targets individuals on the basis of marginal utility. In practice, we measure the extent to which DI targets on predictors of marginal utility (in the positive analysis) and on estimates of marginal utility given certain assumptions (in the normative analysis). Like all non-universal social programs, the targeting of DI benefits is determined by two types of instruments: 1) tags, or observable characteristics on which benefits are conditioned, and 2) screens or restrictions on behavior, in which program design features encourage or discourage enrollment. Health is the canonical tag associated with DI, and the SSDI decision process is charged with deciding whether an applicant meets the medical eligibility criteria of the program. But DI also includes non-health tags—for example, the vocational grid takes into consideration an applicant's age, education, and work experience in addition to health. It also includes screens or restrictions on behavior. Some screens are intentional, such as the requirement that applicants be out of the labor force for at least five months before collecting benefits. Others, such as the complicated application process, are unintentional byproducts of program administration. Even for the health tag itself, measurement error can lead adjudicators to make mistakes in determining an individual's true health status.

How well DI targets on marginal utility depends on 1) the correlation between marginal utility and health, and 2) the correlation between marginal utility and the remaining non-health tags, screens, and mistakes conditional on the health tag. For (1), we expect better health to be associated with lower marginal utility, and we can estimate this parameter by comparing the marginal utilities of individuals with and without severe health conditions.

In contrast, the sign of the correlation in (2) is ambiguous ex ante. It depends on the correlations of several different DI instruments with marginal utility (Akerlof (1978), Nichols and Zeckhauser (1982)). For example, Deshpande and Li (2019) find, using variation from Social Security field office closings, that higher application costs worsen targeting on broader welfarist criteria. But this is only one screen among DI's many non-health tags and screens. Since finding variation in all DI tags and screens is infeasible, we instead estimate (2) by comparing the targeting of actual DI and a hypothetical "health DI" (HDI) that perfectly enforces the health tag. If we find that actual DI recipients have a higher average marginal utility than individuals with severe conditions (who would be recipients in the HDI program), we would conclude that the non-health tags, screens, and mistakes improve targeting on marginal utility conditional on the health tag. If we find instead that actual DI recipients have a lower marginal utility than HDI recipients, then we would conclude that these non-health instruments worsen targeting relative to a health tag alone. In the positive analysis, we compare characteristics that are likely to predict marginal utility for the recipients and non-recipients of the actual DI program and the HDI program. In the normative analysis, we use a sufficient statistics approach to estimate marginal utility for these groups.

3 Institutional Setting and Data

3.1 Background on Social Security Disability Insurance

Like DI programs throughout the developed world, the U.S. Social Security Disability Insurance (SSDI) program is intended to insure against health-related shocks to earnings capacity. To qualify for SSDI, individuals must have worked for a certain number of quarters. Workers who become disabled between the ages of 30 and 42 must have 20 quarters of earnings to qualify for SSDI. The requirement increases by one quarter for every year above 42. Younger workers qualify with fewer credits. Individuals who do not meet the work history requirements for SSDI may be eligible for Supplemental Security Income (SSI), a means-tested program that has the same medical eligibility requirements as SSDI but does not require a work history.

The SSDI benefit is increasing in past earnings, at a decreasing rate. The average annual SSDI benefit is around \$15,000[2], and beneficiaries qualify for Medicare after a two-year waiting period. There is no household income or asset test, but disabled workers are not permitted to earn more than the substantial gainful activity (SGA) level, which was \$1,260 per month in 2020.

[2]Annual Statistical Report on the Social Security Disability Insurance Program, 2018

Since our paper estimates the welfare effects of SSDI in the context of the broader social safety net, it is important to understand its interactions with other programs. In principle, unemployment insurance (UI) and SSDI are mutually exclusive since the former is conditioned on remaining in the labor force and the latter is conditioned on being out of the labor force. In practice it is possible that individuals receive both types of benefits, though this is uncommon[3]. As mentioned above, the Social Security Administration also administers SSI, which has the same medical eligibility requirements and SSA decision process as SSDI, but different non-medical requirements. SSI requires low income and assets but has no work history requirements, while SSDI is not means-tested but requires a work history. Individuals who have a sufficient work history as well as low income and assets can qualify for both SSDI and SSI.

3.2 Data

In the positive analysis in Section 4, we use a combination of survey data and administrative data. The main data source for this section is the Panel Study of Income Dynamics (PSID), a panel survey of between 5,000 and 8,000 households. The PSID was annual from 1968 to 1997, has been administered every two years since then. The main advantage of the PSID for our context is the long panel structure, which allows us to go back in time to measure events and characteristics of households at the time of SSDI entry or disability onset. For nearly all measures in the positive analysis, we classify individuals by their SSDI status and health status in 2016 (measured in the 2017 wave), the latest available year, and then track them back to their entry onto DI and the onset of a severe health condition.

We use the PSID to measure the following characteristics, with the exact questions and responses presented in Appendix Table A3 - A7:

- **SSDI status.** We use the self-reported SSDI question.
- **Severity of health condition.** We classify individuals as "severe" if they report that their health condition limits "a lot" the amount of work they can do or if they "can do nothing." We classify individuals as "non-severe" if it limits "somewhat," "just a little," or "not at all," or if they report no health condition (see Appendix Table A3).
- **Medical bills.** We use questions on out-of-pocket costs (nursing homes, doctor and hospital bills, prescriptions, in-home medical care, and other services) and amount covered by health insurance.

[3]Concurrent Receipt of Social Security Disability Insurance (SSDI) and Unemployment Insurance (UI): Background and Legislative Proposals(Morton (2015), https://fas.org/sgp/crs/misc/R43471.pdf)

- **Adverse life events.** We measure head and spouse job loss, involuntary moves, and divorce. Our goal is to limit these measures to external events or shocks, rather than choices. For head and spouse job loss, we limit the measure to job separations that the worker reports as involuntary, namely layoffs or firings, firm closings or moves, and strikes. For moves, we limit the measure to "involuntary reasons" (eviction, health reasons, divorce, etc.), "purposive consumptive reasons" (less space, less rent); and ambiguous or other reasons (e.g., need to save money). The PSID does not include any information about the reasons for divorce, so we include all divorces.

- **Resources.** We use marriage, banking relationship, and homeownership as our primary measures of resources in the PSID. We also use health insurance coverage (public, private, or any); help from relatives and non-relatives; and other public transfer programs, including food stamps, TANF, SSI, UI, and workers compensation.

The PSID has important limitations: a relatively small sample size, self-reported DI status, and no information about applications for SSDI or SSI. To address these shortcomings, we supplement the positive analysis with the Survey of Income and Program Participation (SIPP) linked to SSA administrative data. We use SIPP-SSA linked data to verify our main cross-section results and to observe SSDI and SSI applications. We use the 1996, 2001, 2004, 2008, and 2014 panels from the SIPP; each panel of the SIPP has a sample of around 20,000 to 37,000 households, and we combine panels to further increase precision. The SIPP-SSA linked data also allows us to observe applications in the SSA administrative data, which is particularly important for studying mechanisms in Section 4.3. For example, we use the SSA application data to determine how many individuals who have severe conditions but do not receive SSDI applied for SSDI or SSI. The main disadvantage of the SIPP is that each panel lasts only a few years, so it is not useful for following the same household for an extended period.

The positive analysis also uses SSA administrative data for two additional measures of adverse events: financial events (bankruptcies, evictions, and foreclosures) and mass layoffs. First, we use the Master Beneficiary Record linked to nationwide financial records from Deshpande, Gross and Su (2019) to measure financial events such as bankruptcies, evictions, and foreclosures for SSDI recipients and applicants. Second, we use the Continuous Work History Sample to identify firms where mass layoffs occur, and link SSDI applicants and recipients to these mass layoff events. We follow the literature and define mass layoffs as events in which the number of workers at a firm that had at least 150 workers declines by at least 30 percent.[4]

[4]Von Wachter, Song and Manchester (2011) use a threshold of 50 workers, but we use a higher threshold since we have only a 10 percent sample of US workers.

In normative analysis in Section 5, we use consumption data from the PSID. Before 1998, the PSID collected consumption data only for food and housing. Since then, it has added more comprehensive measures of consumption, including transportation, education, child care, and health. We use total consumption excluding health care expenditures in the normative calculations, since including health care spending could artificially inflate the consumption of individuals with severe health conditions.

4 Positive Analysis: DI Targeting on Adverse Events and Resources

From the statutory health standard, the value of DI depends on the extent to which it enrolls individuals with severe health conditions. From a broader welfarist standard that goes beyond health, the value of DI depends on the extent to which it enrolls individuals with a high marginal utility of income, regardless of the reasons for that high marginal utility. In this section, we study characteristics of individuals that are likely to be predictive of marginal utility, including adverse life events and resources available to cope with those events.

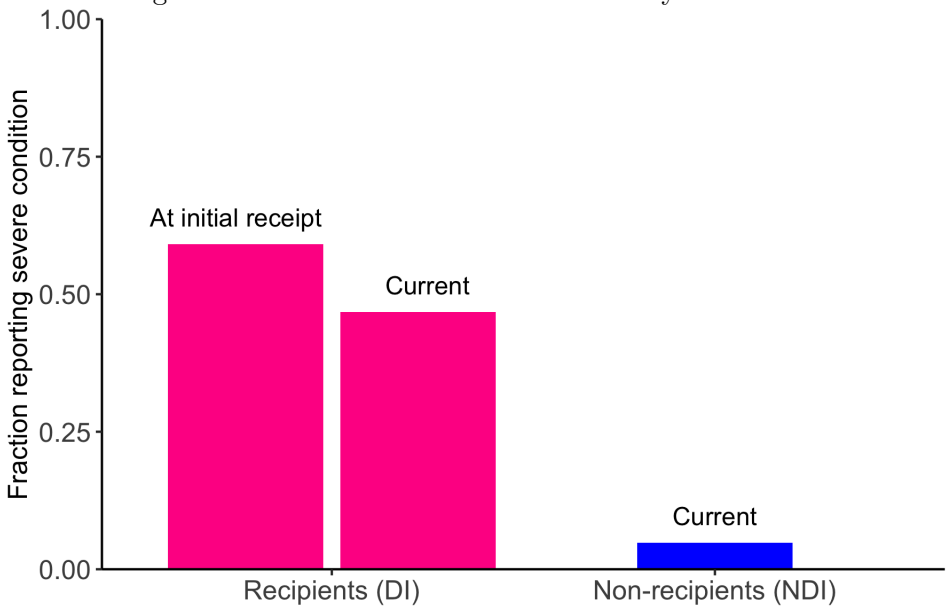
Our goal is to the determine the sign and magnitude of selection into DI on broad welfarist measures. We categorize individuals into DI recipients (DI, for short) and DI non-recipients (NDI), and individuals with severe conditions (S) and without severe conditions (NS). Of particular interest are the two groups that are "misclassified" with respect to the health tag. The first is individuals who receive DI benefits but do not have a severe condition (DI-NS). We study how DI-NS are selected with respect to adverse life events and resources in comparison to DI recipients with severe conditions (DI-S) and non-recipients without severe conditions (NDI-NS). The second group is individuals who do not receive benefits but have a severe condition (NDI-S). We study how the NDI-S are selected on these measures in comparison to DI recipients with severe conditions (DI-S).

We start by classifying individuals as recipients versus non-recipients, and severe versus non-severe, in 2016, which is the latest available year in the PSID. We classify individuals as "severe" if they report that their health condition limits "a lot" the amount of work they can do or if they "can do nothing;" we classify them as "non-severe" if it limits "somewhat," "just a little," or "not at all," or if they report no health condition (see Appendix Table A3). As shown in Figure 1, 47% of DI recipients currently have a severe condition, down from 59% at the time they entered DI. In contrast, just 5% of non-recipients have a severe condition. In the SSA administrative data, we use the adjudicator's judgment of the likelihood of

medical improvement to classify recipients: we classify recipients as "severe" if they receive a "medical improvement not expected" designation and as "non-severe" if they receive a "medical improvement expected" or "medical improvement possible" designation. These medical improvement judgments are used to determine the frequency of continuing disability reviews for a new recipient. Of course, we are unable to observe or classify the severity of non-recipients in SSA administrative data.

We verify that medical costs vary with SSDI status and health status as expected. Indeed, recipients with severe conditions are more likely to have high out-of-pocket medical expenses and high total medical expenses than recipients without severe conditions. Severe recipients are much more likely to have high medical bills than non-recipients, including non-recipients with severe conditions (see Appendix Figures A1 and A2).

Figure 1: PSID: Severe health condition by SSDI status



Notes: Figure presents fraction of households in 2016 PSID reporting at least one adult with a severe health condition, for households currently receiving SSDI (572) and households not currently receiving SSDI (7,162). For households currently receiving SSDI who can be observed in the year of initial SSDI receipt (505), the figure also shows the fraction with a severe health condition in the first year of SSDI receipt. The sample includes all households in the 2016 PSID with heads between the ages of 25 and 65. We define the first year of SSDI as the first year in which the household is observed receiving SSDI and head age is below 35, or the first year in which the household receives SSDI and did not receive SSDI the previous year.

4.1 Selection of non-severe individuals into SSDI

We compare adverse life events and resources of four key groups:

- DI recipients with severe conditions (DI-S), who are 3.3% of the sample

- DI recipients without severe conditions (DI-NS), who are 4.1% of the sample
- Non-recipients with severe conditions (NDI-S), who are 4.3% of the sample
- Non-recipients without severe conditions (NDI-NS), who are 88% of the sample

In terms of adverse life events, we observe job loss, involuntary moves, and divorce in the PSID and SIPP; mass layoffs in SSA administrative data; and measures of financial distress in SSA administrative data linked to nationwide financial records. In terms of resources, we observe in the PSID marriage, banking relationship, homeownership, health insurance coverage, formal assistance from public programs, and informal assistance from relatives and non-relatives.

We start by studying the selection of individuals who do not have a severe condition but still receive DI (DI-NS). Figure 2 shows that DI-S and DI-NS have similarly high rates of adverse life events in the PSID in the four years prior to receiving SSDI, including job loss, involuntary moves, and divorce.[5] For job loss, we are careful to include only separations that respondents report being involuntary, namely layoffs or firings. About 20% of DI-NS have experienced a head job loss and 16% a spouse job loss, compared to 15% and 8.2% for DI-S. Involuntary moves, which include evictions and foreclosures as well as moves undertaken for financial reasons, are more common: 38% for DI-NS and 34% for DI-S in the four years before DI entry. Divorce rates are also similar between the two: 5.9% for DI-NS and 6.4% for DI-S. Overall, the likelihood of experiencing any of these events is 51% for DI-NS and 46% for DI-S.

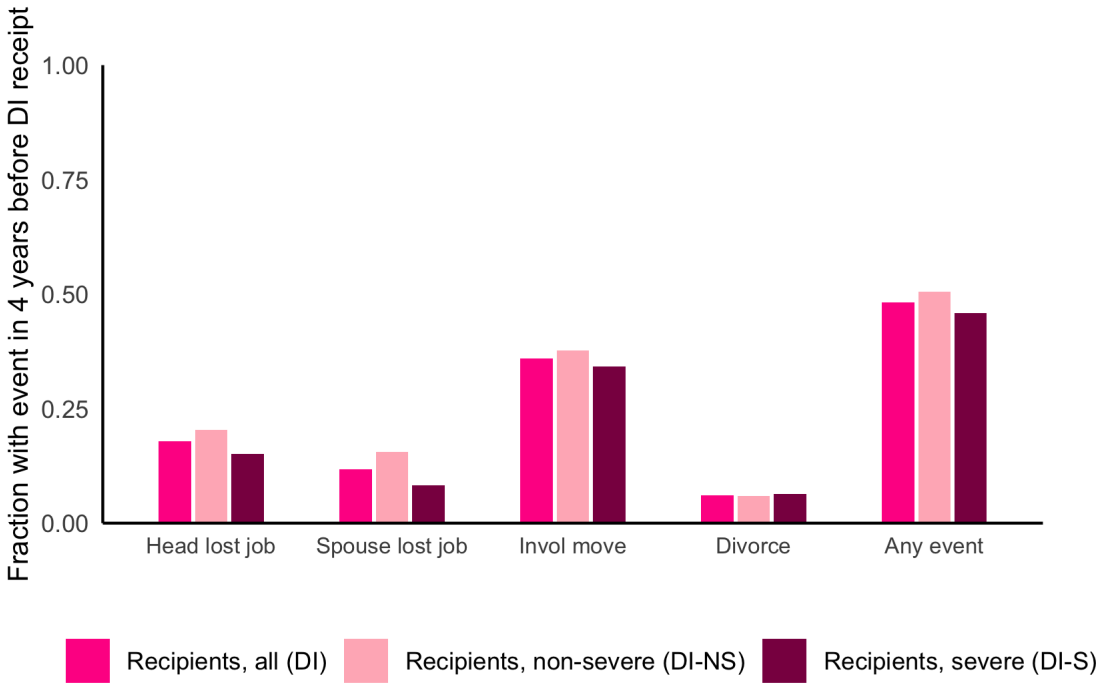
We can also compare adverse life events for DI-S and DI-NS in the SSA administrative data. From the Continuous Work History Sample, we find in Figure 3 that DI-NS are more likely than DI-S to have experienced a mass layoff prior to entering SSDI. The mass layoff rate is 5.8% for DI-NS and 3.9% for DI-S in the three years before entry, and this difference remains even after conditioning on working. The same figure shows that we find a similar pattern for financial events from SSA administrative data linked to nationwide financial records. DI-NS are more likely than DI-S to have experienced bankruptcy (4.3% vs. 3.5%), foreclosure (3.8% vs. 3.1%), and eviction (4.5% vs. 3.8%) in the years prior to receiving DI.[6]

In addition to adverse life events, we also analyze how DI-NS are selected on resources available to cope with adverse events. As shown in Figure 4, we find that DI-NS are less likely than DI-S to be married, to have a banking relationship, or to own a home. Of course, these outcomes might reflect the effects of SSDI itself, which would be problematic

[5] explain why 4 years

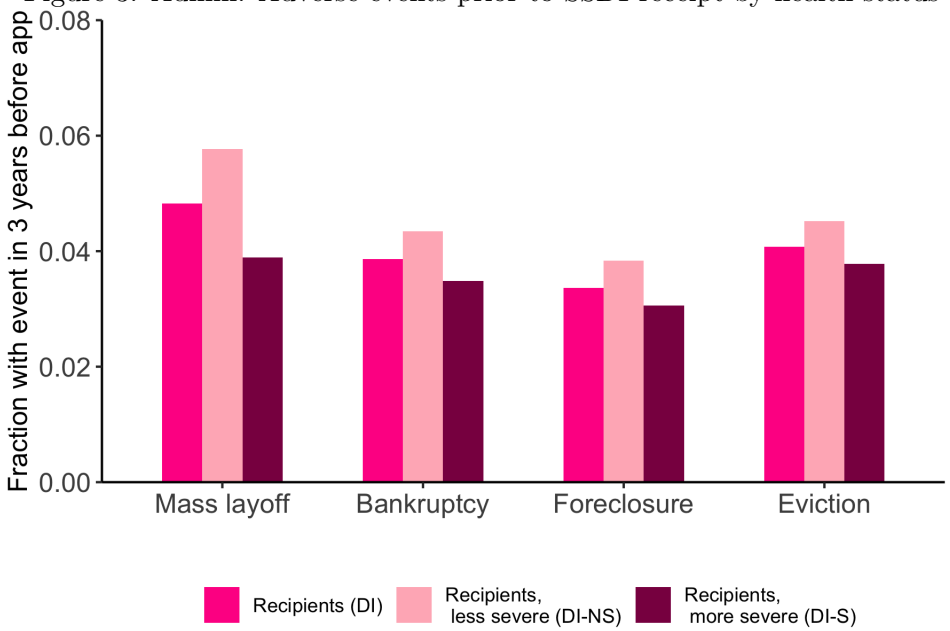
[6] Appendix Figure A6 shows financial measures and mass layoffs, respectively, for rejected applicants compared to approved applicants.

Figure 2: PSID: Adverse events prior to SSDI receipt by health status



Notes: Figure presents rates of various adverse life events in the four years before the first year of SSDI receipt for households receiving SSDI in the 2016 PSID, by severe and non-severe. Head and spouse job loss are defined as strike/lockout, laid off/fired, or company going out of business or leaving town (see Appendix Table A4). The sample for head job loss is households currently receiving SSDI who can be observed in the four years before initial DI receipt (169 severe, 207 non-severe). The sample for spouse job loss is married households currently receiving SSDI who can be observed in the four years before initial DI receipt (78 severe, 89 non-severe). Involuntary move is defined as response to outside events (including eviction), contraction of housing (less space/less rent), and ambiguous reasons such as saving money (see Appendix Table A5). The sample for involuntary move is households currently receiving SSDI who can be observed in the four years before initial DI receipt (156 severe, 186 non-severe). Divorce is defined as being married in a previous survey year but not in this survey year. The divorce sample is households currently receiving SSDI who can be observed in the four years before initial DI receipt (154 severe, 175 non-severe). "Any event" is experiencing head or spouse job loss, involuntary move, or divorce. The any event sample is households currently receiving SSDI who can be observed in the four years before initial DI receipt (137 severe, 161 non-severe).

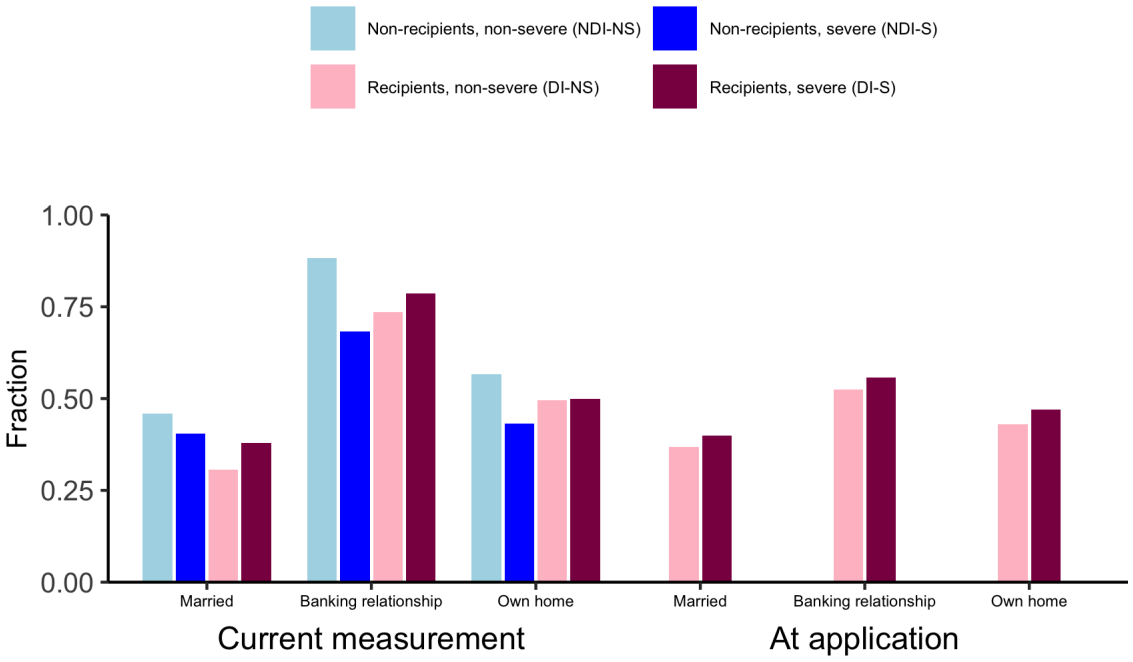
Figure 3: Admin: Adverse events prior to SSDI receipt by health status



Notes: Figure presents rates of adverse financial events prior to SSDI receipt for individuals who apply for and receive SSDI benefits in SSA administrative data, by more-severe and less-severe. "Mass layoff" indicates being part of a mass layoff in the five years prior to SSDI application. The mass layoff sample is SSDI recipients in the CWHS-linked Master Beneficiary Record (MBR) who were allowed onto SSDI between 1985 and 2016 (850,000 less-severe, 920,000 more-severe). We determine rates of mass layoff using the Continuous Work History Sample (CWHS), which is a 10% sample of US workers. In the CWHS, we identify EINs that experience a drop in employees of at least 30 percent from a base of at least 150 employees. From the MBR, we label an SSDI recipient as experiencing a mass layoff in the three years prior to application if they experienced a separation from a mass-layoff EIN in the same year as the mass layoff event. "Bankruptcy," "foreclosure," and "eviction" indicate experiencing these events in the three years prior to SSDI application. We link SSDI applicants in the 831 files to nationwide financial records using the methods described in Deshpande, Gross and Su (2019). The bankruptcy sample is SSDI recipients in the 831 files between 1995 and 2009 (3.0M less-severe, 3.7M more-severe). The foreclosure sample is approved SSDI applicants in the 831 files between 2005 and 2014 who are homeowners (780,000 less-severe, 1.2M more-severe). The eviction sample is approved SSDI applicants in the 831 files between 2005 and 2014 who are not homeowners (560,000 less-severe, 840,000 more-severe). "More severe" indicates a medical diary of "medical improvement not expected" or "medical improvement possible," and "less severe" indicates a medical diary of "medical improvement expected."

for studying selection into SSDI. For this reason, we go back to the year before each recipient entered SSDI and find a similar pattern: DI-NS are less likely than DI-S to have outside resources even prior to receiving SSDI. Marriage rates are 37% for DI-NS and 40% for DI-S, the likelihood of having a banking relationship is 53% for DI-NS and 56% for DI-S, and the likelihood of homeownership is 43% for DI-NS and 47% for DI-S. DI-NS are also less likely before DI to have either private insurance (41% vs. 53%, from Appendix Figure A3), less likely to receive public transfers (34% vs. 38% for food stamps, from Appendix Figure A4), and less likely to receive help from relatives (21% vs. 25%, from Appendix Figure A5).

Figure 4: PSID: Available resources by SSDI and health status



Notes: Figure presents rates of marriage, banking relationship, and homeownership for four types of households in the 2016 PSID: households not currently receiving SSDI without a severe health condition (6,831 NDI-NS), households not currently receiving SSDI with a severe health condition (330 NDI-S), households currently receiving SSDI with a severe health condition (256 DI-S), and households currently receiving SSDI without a severe health condition (316 DI-NS). For DI-S and DI-NS who can be observed one year prior to the year of initial DI receipt (221 and 285, respectively), figure also presents rates of marriage, banking relationship, and homeownership one year prior to the year of initial DI receipt ("at application"). Appendix Table A6 presents the PSID questions for banking relationship and homeownership.

4.2 Selection of severe individuals out of SSDI

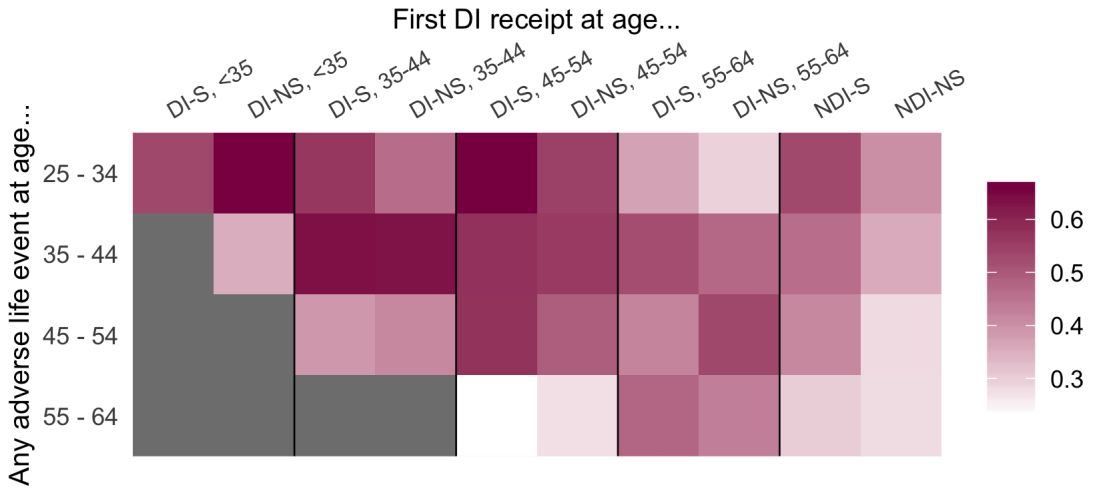
The second group of interest is individuals who have a severe health condition but do not receive DI (NDI-S). Since NDI-S never receive SSDI, we cannot measure life events with

respect to the year of SSDI entry. Instead, the grid in Figure 5 shows the rate of adverse life events (including job loss, involuntary move, and divorce) at different ages for different groups of recipients and non-recipients. The recipient groups are classified by their severity and age at entry (e.g., "DI-S, < 35" represents SSDI recipients who currently who have a severe condition and who entered SSDI under the age of 35). The non-recipient groups on the right-hand-side of the grid are classified by their severity (e.g., "NDI-S" represents non-recipients with severe conditions). For recipients, the grid has a strong diagonal pattern, with the likelihood of an adverse life event peaking at the time of DI entry around 66%. Non-recipients are less likely to have experienced an adverse life event at any given age. For NDI-S, the likelihood of an adverse life event peaks at 53% at ages 25-34, which is lower than either DI-NS or DI-S (though higher than NDI-NS). Appendix Figures A7–A10 show results for head and spouse job loss, involuntary move, and divorce separately.

Turning to outside resources, we find that NDI-S are on average more advantaged than DI recipients, but this average masks important heterogeneity. To avoid measuring the causal effects of DI, we go back to the year of disability onset for NDI-S and DI-S. At onset, NDI-S are more likely than DI-S to be married (44% vs. 38%) and to have a banking relationship (63% vs. 61%), though they are less likely to own a home (42% vs. 50%) (Appendix Figure A11). But further investigation reveals that NDI-S actually comprises two distinct groups: those who qualify for DI based on work history (about two-thirds) and those who have an insufficient work history to qualify (about one-third). When we separate these two groups in Figure 6, we find that the qualified NDI-S are much more likely to be married, more likely to have a banking relationship, and almost as likely to own a home. In contrast, the unqualified severe non-recipients are much *less* likely than DI-S to have these outside resources. In fact, about 42% of unqualified NDI-S receive SSI, just 16% of qualified NDI-S and 11% of DI-S receive SSI benefits. Since SSI has the same medical eligibility requirements as SSDI but does not have a work history requirement, we can infer that a large fraction of the unqualified NDI-S would receive SSDI were it not for the work history requirement.

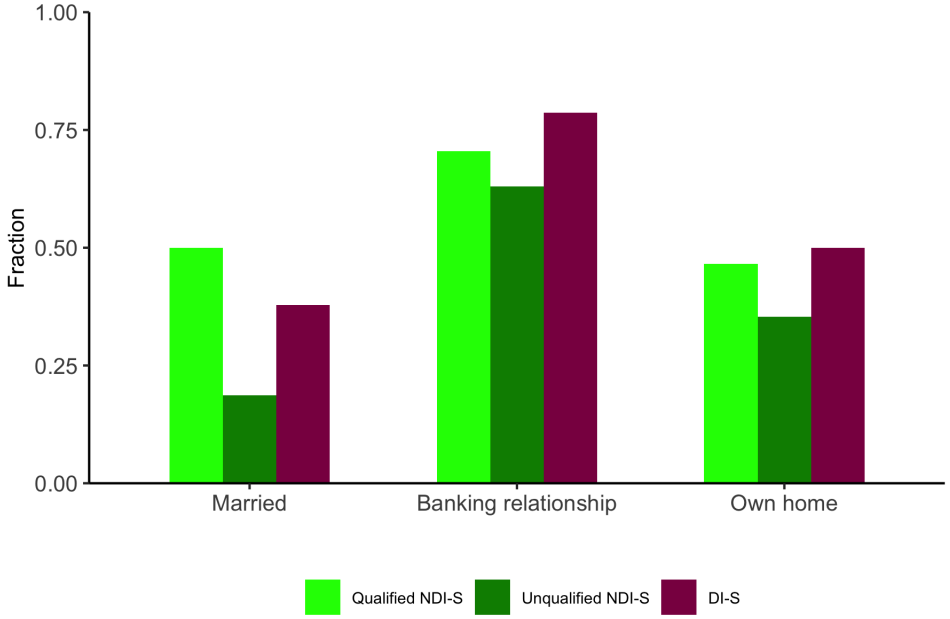
Overall, we find mostly good selection into and out of SSDI conditional on health. Individuals who do not have a severe health condition but receive SSDI (DI-NS) are highly selected on economic distress, having high rates of adverse life events and limited resource to cope with those events. In contrast, most individuals who have a severe health condition but do not receive DI (NDI-S) have fewer adverse life events and substantial resources than recipients, though about one-third of NDI-S are actually more disadvantaged than recipients and do not qualify for SSDI because of insufficient work history.

Figure 5: PSID: Any adverse life event by SSDI and health status



Notes: Figure presents rates of experiencing an "adverse life event"—head or spouse job loss, involuntary move, or divorce—at various ages for households in the PSID, by SSDI status, health status, and age at SSDI entry. Households are first categorized by their SSDI status: whether they ever received DI (DI) or never received DI (NDI). DI are further classified by their health status at DI entry (severe DI-S, or non-severe DI-NS), and NDI are further classified by whether they ever had a severe health condition (ever severe NDI-S, never severe NDI-NS). The DI-S and DI-NS groups are further categorized by their age at SSDI entry: <35, 35–44, 45–54, 55–64. We organize these groups along the horizontal axis and then plot the rate of experiencing any adverse event at the following ages along the vertical axis: 25–34, 35–44, 45–54, and 55–64. Darker shades indicate higher rates, as shown in the legend. Gray squares indicate that the sample size is less than 50. The sample of each cell is households in SSDI/age category indicated in the horizontal axis that are observed in the PSID during the age range indicated in the vertical axis. See Appendix Figures A7–A10 for each particular life event.

Figure 6: PSID: Available resources by SSDI status and SSDI eligibility



Notes: Figure presents rates of marriage, banking relationship, and homeownership for three types of households in the 2016 PSID: households that receive SSDI with a severe health condition (256 DI-S), households do not receive SSDI with a severe health condition that qualify for SSDI on the basis of work history (196 qualified NDI-S), and households that do not receive SSDI with a severe health condition that do no qualify for SSDI on the basis of work history (134 unqualified NDI-S). We determine whether households are "qualified" and "unqualified" by calculating approximate Social Security credits based on their earnings history in the PSID.

4.3 Selection mechanisms

Why do NDI-S and DI-S end up in the "wrong" category based on the health tag? We use a combination of the PSID and SIPP-SSA linked data to investigate the mechanisms behind selection into SSDI. First, we investigate why NDI-S do not receive SSDI benefits. One important question is whether these individuals never apply, or whether they apply and get rejected. We find that about one-quarter of these cases can be explained by either measurement error or mistakes in the decision process: individuals with severe conditions who applied but were rejected by SSA on medical grounds. Another one-quarter can be explained by ineligibility on the basis of work history. In fact, 41.6% of NDI-S with an insufficient work history receive SSI. The remaining one-half of NDI-S cases appear to reflect good self-selection out of SSDI: those who did not apply but had a sufficient work history and substantial other resources.

We next study the converse question of why DI-NS receive DI. Since all recipients apply for and are awarded benefits, in a broad sense all DI-NS cases reflect either measurement error, mistakes in the decision process, or mistakes in the subsequent review process. However, we find that about one-quarter of DI-NS had a severe condition when they applied, even though they do not currently have a severe condition. About one-quarter of DI-NS have experienced a shock and previously received UI but no longer do, suggesting that they turned to SSDI as a form of permanent insurance against a non-health shock. Another one-sixth of DI-NS experienced a shock but never received UI. Finally, about one-third of DI-NS have no observable shock prior to applying for SSDI but have low resources.

5 Normative Analysis: The Marginal Welfare Effects of DI

We find in the previous section that enrollment into SSDI reflects mostly good selection. Not only is the health tag strongly correlated with welfare-relevant characteristics, but even conditional on the health tag, SSDI's additional tags, screens, and "mistakes" are together correlated with these characteristics. These descriptive results suggest that DI has good targeting properties and high value at the margin of the existing social safety net. In this section, we formally estimate the marginal welfare effects of SSDI using a sufficient statistics approach combined with consumption data from the PSID.

5.1 Marginal welfare effects of increasing DI benefits: Theory

The marginal value from behind the veil of a uniform increase in DI benefits, in terms of non-labor income in non-recipient states of the world, is

$$MWTP = \frac{P(DI)E(\lambda|DI)}{P(NDI)E(\lambda|NDI)} = \frac{P(DI)}{P(NDI)} \times \left(1 + \frac{E(\lambda|DI) - E(\lambda|NDI)}{E(\lambda|NDI)}\right) \equiv \pi \times (1+M),$$

where $P(DI)$ is the probability of receiving DI benefits (the population share of DI recipients), $P(NDI) = 1 - P(DI)$ is the probability of not receiving DI benefits, λ is marginal utility, $\pi \equiv \frac{P(DI)}{P(NDI)}$ is the no-moral-hazard-actuarially-fair price of non-labor income in recipient states in terms of non-labor income in non-recipient states, and $M \equiv \frac{E(\lambda|DI)-E(\lambda|NDI)}{E(\lambda|NDI)}$ is the markup over the no moral hazard actuarially fair price that someone behind the veil is willing to pay to transfer non-labor income from non-recipient to recipient states. The numerator is the marginal benefit (in utils) of increasing resources in recipient states, and the denominator is the marginal cost of reducing resources in non-recipient states. So the ratio is marginal willingness to pay out of non-labor income in non-recipient states for a uniform increase in DI benefits, from behind the veil.

The key term in the marginal value equation is the markup, M. The markup is the marginal insurance value—i.e., the surplus or risk premium value over the no-moral-hazard-actuarially-fair value—of transferring resources from non-recipient to recipients states. The markup is positive if marginal utility in recipient states exceeds marginal utility in non-recipient states on average. In that case, the ex ante value of an increase in DI benefits exceeds the no-moral-hazard-actuarially-fair value because the increase in DI provides a valuable insurance benefit from behind the veil.

The markup is a gross value, not a net value, so a high markup does not imply that increasing DI benefits would increase social welfare. That depends on the costs of such an increase and how they are paid. Such costs include not only the direct, mechanical increase in benefits paid to inframarginal recipients but also fiscal externality costs from more people applying for and receiving DI and associated reductions in the labor supply of—and so net taxes paid by—new and existing applicants and recipients and their families. The expected net marginal cost to the government of increasing DI benefits can be written

$$GMC = P(DI)(1 + FE),$$

where the fiscal externality, FE, is the proportional excess of the government's marginal cost over the transfers received by inframarginal beneficiaries. The fiscal externality arises from behavioral responses and any displacement of other net government transfers caused

by the change in benefits. Absent such effects (i.e., if $FE = 0$), the government's expected marginal cost is $P(DI)$, the no moral hazard actuarially fair price. But if the increase in benefits causes more people to apply for and receive DI or causes inframarginal recipients to earn less and so pay less in net taxes, then the marginal cost to the government exceeds the no moral hazard actuarially fair price, $P(DI)(1 + \text{FE}) > P(DI)$.

Under certain assumptions, the markup and fiscal externality, along with the fraction of recipients, are sufficient to recover the slope of social welfare with respect to the benefit level, at the current benefit level. The markup is the marginal insurance benefit of transferring resources from non-recipients to recipients, and the fiscal externality is the marginal efficiency cost of making this transfer by increasing DI benefits. Although being allowed onto DI triggers a large change in a recipient's constraints, the marginal benefit of increasing the benefit level is simply the marginal benefit of increasing the non-labor income of inframarginal recipients, the marginal value of which for any recipient is simply their marginal utility. The marginal value of the large changes in the constraints of marginal recipients just indifferent between applying or not at the current benefit level is zero by the envelope theorem. This is much the same as the marginal benefit of increasing the UI benefit level. Although increasing the UI benefit presumably leads more people to receive UI—and so to discrete jumps in their non-labor income—the marginal benefit to these marginal recipients is zero by the envelope theorem.

There are two key assumptions for the sufficiency of the markup and fiscal externality. The first is that people optimize. This is why marginal recipients, who apply for DI in response to the increase in benefits, do not contribute to the (gross) marginal value. (They do contribute to the net value, by affecting the marginal cost.) Optimizing marginal applicants are indifferent about whether to apply, so, by the envelope theorem, their net marginal gain from the increase in benefits is zero. The second assumption is that the only efficiency effects of changes in benefits are insurance effects and fiscal externalities.

Aiming to recover the slope of social welfare rather than its level facilitates much greater flexibility in incorporating the effects of different types of risks and insurance mechanisms than would be possible in a fully specified model, at the expense of narrowing the scope of policy counterfactuals that can be evaluated (Chetty, 2006). The markup and fiscal externality are sufficient statistics for the marginal welfare effects of policy changes in a broad class of models, including models with costly self-insurance, disutility of labor, and liquidity constraints. That such factors do not appear directly in the formulas for the markup and fiscal externality does not mean they are unimportant or that their effects are missed by the analysis. On the contrary, such factors likely play a major role in determining the value of changes in DI, and the ability to flexibly incorporate their likely importance is perhaps

the greatest strength of this approach. The theory—especially the assumption that people optimize—tells us that the effects of such factors on the marginal welfare effects of changes in DI is captured by their effects on the size of the markup and fiscal externality. That is, such factors likely play a crucial role in determining the values of the key parameters, despite not affecting the mapping from the parameters to marginal welfare effects.

Consider costly self-insurance. The better the available self-insurance mechanisms, the smaller the gap in marginal utility between recipient and non-recipient states will be. That gap is a revealed-preference measure of the marginal cost of insuring that risk through any and all available means, including self-insurance. The welfare gain from transferring another dollar from non-recipient states to recipient states is smaller if self-insurance technologies are better because people take advantage of better technologies to insure themselves, thereby shrinking the gap in marginal utilities across states. In response to an increase in DI benefits, people might consume more, reduce costly self-insurance efforts, or spend the gain in any number of other ways. The particular way in which they choose to spend the gains is second-order—and so has no effect on the marginal welfare effect—since at a private optimum spending the gains along any margin at an interior optimum has the same first-order effect on private welfare.

5.2 Marginal welfare effects of increasing DI benefits: Estimation approach

Our main goal is to estimate the DI markup introduced in Section 5.1,

$$\mathrm{M} \equiv \frac{E(\lambda|\mathrm{DI}=1) - E(\lambda|\mathrm{DI}=0)}{E(\lambda|\mathrm{DI}=0)}. \tag{1}$$

As a baseline, we assume that marginal utility is a power function of consumption, $\lambda = c^{-\gamma}$, where γ is the coefficient of relative risk aversion. The assumption that marginal utility of consumption is state-independent does not require that utility itself is state-independent. For example, marginal utility of income takes the same form, $\lambda = c^{-\gamma}$, in models with state-dependent disutility of labor of the form $U = u(c) - h(h;\theta)$, as in Diamond and Sheshinski (1995), where the state θ may include health status, for example. We also test the robustness of our results to state-dependent marginal utility. Finkelstein, Luttmer and Notowidigdo (2013) estimate that marginal utility is 10 to 25 percent lower for unhealthy individuals relative to healthy individuals. Lillard and Weiss (1997) and Brown, Goda and McGarry (2016) find state dependence in the opposite direction. We consider both directions in our

robustness calculations. We also vary the risk aversion parameter γ.[7]

We estimate the markup using measures of household consumption from the PSID. Starting in 1998, the PSID includes detailed consumption information on food, housing and utilities, transportation, education, child care, and health. We use total household consumption excluding health care in the marginal utility calculation, since including health care consumption could artificially inflate the consumption level of individuals with severe health conditions. Following standard empirical methods, we adjust for household size by dividing household consumption by the square root of household size. We also impose an annual consumption floor at the 10th percentile of the consumption distribution.

In addition to estimating the markup, we use evidence from the literature to quantify the fiscal externality cost of increasing DI benefits. The fiscal externality costs include SSDI payments and Medicare coverage to marginal recipients, which depend on the elasticity of DI applications and awards with respect to the DI benefit. Fiscal externality costs also include foregone tax revenue from decreases in earnings from both marginal and inframarginal recipients.

We follow Bound et al.'s (2004) thorough procedure for mapping key behavioral elasticities into the marginal cost to the government of increasing DI benefits. This mapping includes all of the main channels through which changes in DI affect net government spending. For the key behavioral elasticities, we combine estimates from several sources. Our baseline fiscal externality calculation is based on estimates of the elasticity of DI applications and receipt with respect to local earnings based on local economic booms and busts from Black, Daniel and Sanders (2002) and Charles, Li and Stephens (2018). Both papers estimate an elasticity of DI receipt with respect to the benefit level of around 0.2. Details about how we map these elasticity estimates into the fiscal externality of changes in DI benefits are available in the Appendix. It is important to emphasize the substantial uncertainty about the fiscal externality costs of different changes in DI. Producing additional evidence on these key parameters is a high priority for future research.

Before turning to the results, we emphasize that the flexibility of our approach comes with important limitations. One set of limitations is the assumptions on which the analysis depends. The key assumptions are that people optimize, that the only efficiency effects of changing DI are its insurance effects and fiscal externalities, and that marginal utility takes a particular form. If people did not optimize, marginal applicants might experience first-order welfare ef-

[7]To calculate the average markup for a group, we first calculate marginal utility λ for each individual in the group based on the assumed utility function and consumption data from the PSID. We then calculate average marginal utility for recipients in that group (i.e., $E(\lambda|\text{DI} = 1)$) and average marginal utility for non-recipients in that group (i.e., $E(\lambda|\text{DI} = 1)$). Finally, we calculate the difference in marginal utilities according to equation (1).

fects from changes in DI. If there were other externalities beyond fiscal externalities, changes in DI might have first-order welfare effects on parties other than inframarginal recipients. One type of externality that might be relevant in the case of DI is non-welfarist preferences about the desirability of certain types of people receiving benefits. Such departures from our assumptions would affect the set of ingredients necessary to calculate the marginal welfare effect of changing DI.

The assumptions about marginal utility play a crucial role in determining the value of transferring resources from some groups to others and so in the welfare effects of changes in DI. The level of risk aversion determines the magnitude of the gap in marginal utilities—and so the estimated markup—for any given gap in consumption levels. We report results based on several different levels of risk aversion. Any state dependence in utility might also affect the markup. In our context, state dependence based on health or work hours could be especially important. We use state-independent utility as the baseline and test robustness to state dependence based on evidence from the literature.

Another set of limitations is the scope of the questions that can be addressed by the analysis. Our approach aims to estimate the slope of social welfare with respect to various policy changes *from the status quo*. The markup and fiscal externality are the marginal insurance value and marginal efficiency cost of increasing DI *given* other aspects of policy and features of the economy, such as the existing tax and transfer system and UI. Moreover, on their own the markup and fiscal externality say nothing about the underlying mechanisms. Understanding such mechanisms can be useful for policy. For example, increasing DI might be valuable because of credit markets imperfections or because few programs insure temporary shocks. The marginal welfare effects of DI alone are uninformative about how changes in credit markets or temporary insurance programs would affect social welfare or the value of DI.

5.3 Marginal welfare effects of increasing DI benefits: Results

Table 1 presents our estimates of the markup for a range of coefficients of relative risk aversion. For ease of exposition, we focus our discussion on the case of $\gamma = 3$. The markup on DI is 150 percent; average marginal utility among DI recipients is 150 percent greater than (2.5 times) that of non-recipients. At the margin, an increase in DI is worth \$2.50 $(1 + 1.5)$ per dollar of no moral hazard actuarially fair value to someone behind the veil. This large markup comes from the fact that DI recipients have much lower consumption than non-recipients, both on average and, importantly, in the left tail of the consumption distribution. This large consumption gap is consistent with the strong associations between

Table 1: Estimates of markup by group

	Risk aversion parameter			
	$\gamma = 1$	$\gamma = 2$	$\gamma = 3$	$\gamma = 4$
Markup by education				
All	0.47	1.02	1.49	1.84
Less than HS	0.26	0.49	0.66	0.78
HS grad	0.35	0.71	1.00	1.19
Some college	0.45	1.03	1.64	2.15
College	0.21	0.50	0.79	1.00
Markup by program				
DI	0.47	1.02	1.49	1.84
UI	0.20	0.41	0.57	0.68
"Health DI"	0.40	0.84	1.23	1.51
Inclusion error	0.48	1.05	1.53	1.87
Exclusion error	0.36	0.76	1.10	1.35
Markup using "health-only" standard (versus utilitarian)				
DI	-0.36	-0.15	0.04	0.18
"Health DI"	0.50	1.03	1.52	1.89
Inclusion error	-0.99	-0.99	-0.98	-0.97
Exclusion error	0.45	0.93	1.35	1.67
Markup with state dependence (adjust λ for severe)				
DI				
-25%	0.33	0.84	1.29	1.62
-10%	0.42	0.95	1.42	1.76
+10%	0.53	1.09	1.57	1.93
+25%	0.61	1.19	1.69	2.05
Health DI				
-25%	0.05	0.38	0.67	0.88
-10%	0.26	0.66	1.00	1.26
+10%	0.54	1.03	1.45	1.76
+25%	0.75	1.31	1.78	2.14

Notes: Table presents the "markup" for all SSDI recipients and SSDI recipients within certain groups, using equation 1. We calculate marginal utility (λ) using CRRA utility with coefficient of relative risk aversion γ from 1 to 4. The sample is households in the 2016 PSID with heads between 25 and 65 years. We classify households based on current self-reported SSDI status and education level. Consumption includes food, housing, transportation, education, and child care, and excludes health care spending. Under "markup by education," the markup is calculated within education group. Under "markup by program," the markup is calculated for SSDI recipients, UI recipients, individuals with severe health conditions (who would be recipients under a hypothetical "health DI" program), SSDI recipients without a severe health condition (who represent errors of "inclusion" relative to "health DI"), and non-recipients with a severe health condition (who represent errors of "exclusion" relative to "health DI.") Under "markup using 'health-only' standard," the markup is calculated setting λ to 0 for non-severe SSDI recipients. Under "markup with state dependence," the markup is calculated with the λ for individuals with severe conditions decreased by 25% or 10% or increased by 10% or 25%.

DI receipt and various health and non-health related shocks documented in the positive analysis. The large markup indicates that the various risks in the economy correlated with

DI receipt are only very incompletely insured, and, viewed in terms of revealed preferences, it suggests that alternative, non-DI means of insuring these risks have high marginal costs.

Our preferred estimate of the marginal cost to the government of increasing DI benefits is \$1.34 per dollar of no moral hazard actuarially fair value, corresponding to a fiscal externality of 0.34. The major components of DI's fiscal externality are DI benefits to successful new applicants (\$0.21 per dollar of no moral hazard actuarially fair value) and lost tax revenue from new applicants (\$0.12 per dollar of no moral hazard actuarially fair value). Given the substantial uncertainty about the key behavioral elasticity (of DI applications with respect to award) underlying this estimate, we also assess the robustness of our key conclusions to using a wide range of elasticity estimates. Recall that our baseline elasticity estimate of 0.2 comes from evidence on the response of DI applications to local economic conditions from Black, Daniel and Sanders (2002) and Charles, Li and Stephens (2018). We probe the robustness of the fiscal externality calculations to an elasticity of 0.5, Bound et al.'s (2004) preferred estimate based on time series evidence from the 1960s and 1970s. This greater fiscal externality is 0.84.

What do the markup and fiscal externality estimates imply about the welfare effect of increasing DI benefits?

One policy counterfactual of interest is a government budget constraint (GBC)-neutral reform package that pairs an increase in DI benefits with an increase in taxes on non-recipients, the total net cost of which to the government is zero. Marginal willingness to pay, from behind the veil, out of non-labor income in non-recipient states for a GBC-neutral reform package that combines an increase in DI benefit levels with an increase in the level of taxes on non-recipients is

$$WTP = \pi(M - FE), \tag{2}$$

where $\pi = \frac{P(DI)}{P(NDI)}$ is the no-moral-hazard-actuarially-fair-value, M is the markup on transfers from non-recipients to recipients, and FE is the fiscal externality associated with this reform package, including the fiscal externality costs of both the increase in benefits and the increase in taxes used to fund the increase in benefits. Such a GBC-neutral reform increases welfare from behind the veil if and only if $M > FE$. Our estimates suggest that this condition holds. The estimated markup on DI of 1.50 far exceeds not only our preferred fiscal externality estimate of 0.34 but also our "conservative" fiscal externality estimate of 0.84. These results suggest that this reform package would increase expected utility from behind the veil. Intuitively, from behind the veil, people are willing to pay more in non-recipient states for the increase in DI benefits than they lose from the GBC-neutral increase in taxes. Although increasing DI benefits has a substantial fiscal externality cost, its markup—from the gap in marginal utility between recipients and non-recipients—is sufficiently large to make this cost

worth paying from the perspective of someone behind the veil or, equivalently, a utilitarian social planner.

Of course, the government can finance an increase in DI benefits in any of a wide number of ways, including raising other, non-DI taxes or cutting other spending. Moreover, the behind-the-veil perspective or utilitarian social welfare function are normative positions that not everyone shares. For both of these reasons, it is also useful to consider non-government budget neutral increases in DI benefits alone, with no paired increase in any net taxes. In order to do so, we consider several relevant comparisons using the marginal value of public funds (MVPF):

$$MVPF = \frac{WTP}{1 + FE}, \tag{3}$$

where WTP is the marginal willingness to pay for the reform by those affected and FE is the fiscal externality of the reform (Mayshar, 1990; Hendren, 2015). The MVPF is the marginal value of the reform to those affected by it per dollar of net marginal cost to the government. Analyzing non-GBC-neutral reforms with the MVPF is useful because it allow one to abstract from how a particular reform is financed and to instead compare any reforms with others with the same net cost to the government. Comparisons of the MVPFs of different policy changes reveal the opportunity cost of helping the beneficiaries of one policy in terms of helping the beneficiaries of other policies.

We highlight the distinction between ex ante and ex post MVPFs. The ex post MVPF of an increase in DI benefits is the marginal value of increasing DI benefits to inframarginal recipients, after all uncertainty has been realized, per dollar of net marginal cost to the government. It does not include any ex ante insurance value such a change would produce. Under standard assumptions, inframarginal recipients value an increase in DI benefits one-for-one: $WTP = 1$, so the ex post MVPF is

$$MVPF_{ex\ post} = \frac{1}{1 + FE}.$$

In contrast, the ex ante, behind the veil, MVPF of an increase in DI benefits is the marginal value to someone behind the veil, *before* uncertainty about health and non-health risk is realized, of increasing DI benefits, per dollar of net marginal cost to the government. Marginal willingness to pay from behind the veil is $WTP = (1 + M)$, where M is the markup, i.e., marginal insurance value, of an increase in DI benefits, so the ex ante MVPF is

$$MVPF_{ex\ ante} = \frac{1 + M}{1 + FE}.$$

Our baseline fiscal externality implies an ex post marginal value of public funds spent in-

creasing the DI benefit of 0.75. This means that for each dollar of net marginal cost to the government from increasing the DI benefit, inframarginal DI recipients gain $0.75. The ex post MVPF based on our larger fiscal externality estimate is 0.54.

For comparison, Hendren and Sprung-Keyser (2019) estimate an ex post MVPF of increasing UI benefits of 0.51, of increasing EITC benefits of 1.16, and of cutting the top income tax rate of 3.03.[8] These marginal values of public funds reveal the marginal opportunity costs of helping the beneficiaries of one policy in terms of helping the beneficiaries of other policies. Taking the point estimates at face value, that the ex post MVPF of DI is smaller than that of UI means that it costs the government more to help DI beneficiaries than to help UI beneficiaries. If the average marginal social welfare weights of DI and UI recipients were equal, this would imply that a government budget-neutral reform package that combined a reduction in DI benefits and an increase in UI benefits would increase social welfare. Of course, the substantial uncertainty in these estimates makes it premature to draw strong policy conclusions.

Given the centrality of DI's insurance function to its role, it is also useful to consider the ex ante MVPF of increasing DI benefits, accounting for DI's insurance value. Our baseline estimates of the markup imply an ex ante, behind the veil, marginal value of public funds spent increasing the DI benefit level of 1.87 based on our baseline fiscal externality and 1.36 based on our high fiscal externality. This means that for each dollar of net marginal cost to the government of increasing the DI benefit, someone behind the veil gains $1.87 or $1.36.

For comparison, we estimate a corresponding ex ante MVPF for UI as well. We estimate UI's ex ante markup using the same methodology and social welfare weights (equivalent to a utilitarian social welfare function) that we use for DI, and we use Hendren and Sprung-Keyser's (2019) estimates of UI's fiscal externality of 0.95. The results imply that UI's ex ante markup is 0.57, and that its ex ante MVPF is 0.81 (1+0.57)/(1+0.95). These ex ante, behind the veil, marginal values of public funds reveal the marginal opportunity cost of helping someone behind the veil via one policy versus another. Taking the point estimates at face value, that the ex ante, behind the veil, MVPF of DI (1.87, or 1.36 with the higher fiscal externality) far exceeds that of UI (0.81) means that it is cheaper for the government to help someone behind the veil by increasing DI than by increasing UI.

[8]Our ex post marginal value of public funds spent increasing DI benefits is not directly comparable to the ex post marginal value of funds "spent on DI" reported by Hendren and Sprung-Keyser (2019) (of 0.85). Hendren and Sprung-Keyser (2019) construct the ex post marginal value of public funds spent increasing DI not by increasing the benefit levels of all recipients (our counterfactual) but by awarding benefits to applicants on the margin of program entry. We consider that counterfactual in Section 5.5.

5.4 Understanding the mechanisms underlying DI's high markup

DI's high markup—i.e., the large gap between the marginal utility of recipients and non-recipients—indicates that status quo policies involve highly incomplete insurance against various risks that are correlated with DI receipt. As a result, DI targets marginal utility extremely well at the margin, giving it a high gross marginal value. Yet while the marginal approach of estimating the markup has many advantages, a disadvantage is that it is a black box—it does not reveal anything about the underlying drivers of value.

This section investigates the extent to which DI's high markup is driven by its insurance of disability versus non-disability risks, including the risk from behind the veil of having low earning ability. A better understanding of the determinants of DI's value is important for evaluating policy reforms. For example, the greater DI's value from insuring non-disability risk, the greater the potential loss from reforms that increase its focus on disability. The greater DI's value from redistribution across earning ability groups, the greater the potential of the income tax and transfer system to achieve similar redistribution, potentially at a lower cost.

First, decompose DI into two subsets of DI benefits: those received by people with severe disabilities and those received by people without severe disabilities. The overall DI markup is a probability-weighted average of the markups on these two subsets of DI benefits, where the weights are the shares of DI recipients with versus without severe disabilities, respectively:

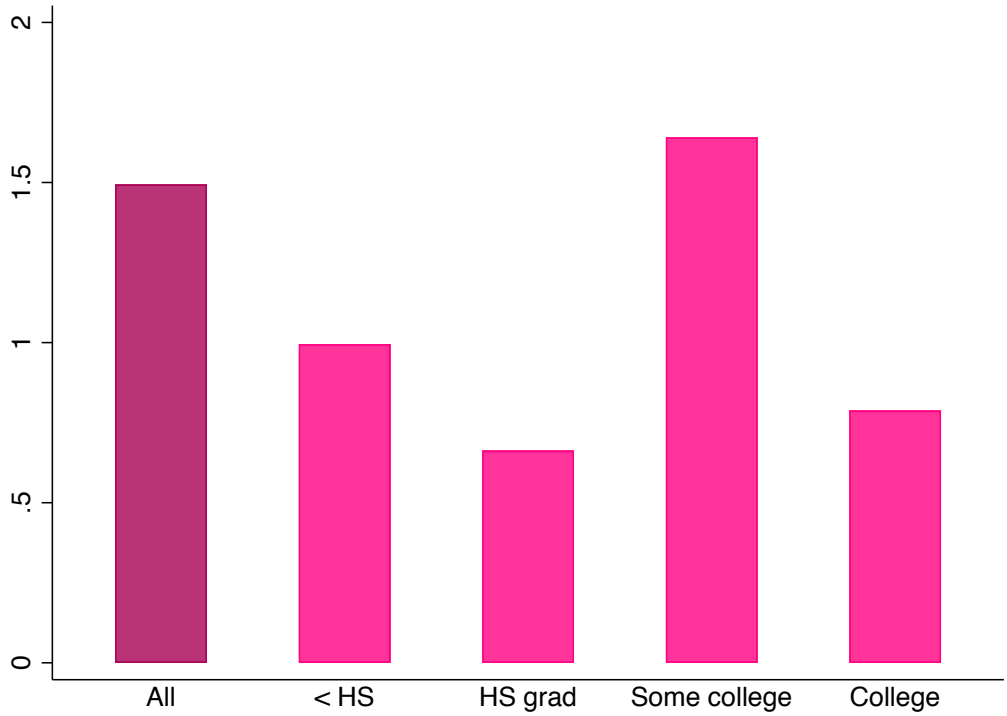
$$\begin{aligned} MV_{DI} &= \pi_{DI \cdot S}(1 + M_{DI \cdot S}) + \pi_{DI \cdot NS}(1 + M_{DI \cdot NS}) \\ &= \pi_{DI} \left[1 + \underbrace{P(DI \cdot S|DI) M_{DI \cdot S} + P(DI \cdot NS|DI) M_{DI \cdot NS}}_{M_{DI}} \right], \end{aligned}$$

where $\pi_X = P(X)$ is the no moral hazard actuarially fair price of benefit X in terms of non-labor income in all states. The results show, consistent with the positive analysis, that people without severe disabilities make up a large fraction of DI recipients (53 percent), that the markup on these benefits is quite high—higher even than that on benefits to received by people with severe disabilities (153 vs. 117 percent)—and, as a result, that these benefits account for large shares of DI's overall marginal value (57 percent) and of DI's marginal insurance value (i.e., risk premium or markup over the expected value of benefits) (60 percent).

The substantial value of DI's insurance against non-disability risk raises the question of where this value is coming from: Which non-disability risks is DI insuring, and how valuable is DI's insurance against each? One risk of particular intellectual and policy interest is the risk from

behind the veil of having low earning ability. Ability risk is one of the largest risks people face. It is also a risk that can be addressed—at some cost, of course—by the income tax and transfer system. The extent to which DI's value comes from insurance against ability risk is therefore informative about the extent to which DI's insurance gains could be achieved by the income tax and transfer system. For that part of DI's value that comes from insurance against ability risk, a key question is the relative costs and benefits of achieving this with DI vs. the income tax and transfer system.[9]

Figure 7: Estimated markups for SSDI program by education



Notes: Figure presents the "markup" for all SSDI recipients and within education group, using equation 1. We calculate marginal utility (λ) using CRRA utility with coefficient of relative risk aversion (γ) of 3. The sample is households in the 2016 PSID with heads between 25 and 65 years. We classify households based on current self-reported SSDI status and education level. Consumption includes food, housing, transportation, education, and child care, and it excludes health care spending.

Figure 7 shows within-education group markups on transfers from non-recipients to recipients, $M_e = \frac{E(\lambda|e \ \& \ DI=1) - E(\lambda|e \ \& \ DI=0)}{E(\lambda|e \ \& \ DI=0)}$, the weighted average of the within-education markups based on the shares of each education group in the population as a whole (not among DI recipients), $E_e(M_e) = \sum_e P(e)M_e$, and the overall markup on DI benefits,

[9]Although there is a strong theoretical presumption against using differential commodity taxation for redistribution when a flexible income tax and transfer system is available (the well-known Atkinson-Stiglitz theorem; Atkinson and Stiglitz (1976)), there is no similar presumption against using tagged benefit programs like DI for redistribution (see, e.g., Akerlof (1978) and Mankiw and Weinzierl (2010)). In such a case, the appropriate roles of the different policies is an empirical question about the relative sizes of the costs and benefits of the different options.

$M_{DI} = \frac{E(\lambda|DI=1)-E(\lambda|DI=0)}{E(\lambda|DI=0)} = \sum_e P(e|DI = 1)M_e$. There is significant heterogeneity in the markup across education groups, ranging from 1.0 among high school graduates to 1.64 among people with some college. That the markup is non-monotonic in education may reflect the competing factors of more highly educated people having more earnings to lose but perhaps also having better technologies for insuring earnings losses (e.g., private DI through their employers).

Although the heterogeneity is interesting, the key results for understanding DI's different roles concern the levels of different markups. The weighted average of the within-education markups, $E_e(M_e)$, is large (100 percent), though significantly smaller than the overall markup on DI benefits, M_{DI} (150 percent). Together, these findings suggest that much of the insurance value of DI comes from insurance within education groups but that a non-negligible share comes from its redistribution across education groups.[10] Although the marginal utility gaps between education groups are substantial and DI redistributes from higher- to lower-education groups, the marginal utility gaps between recipients and non-recipients within each education group are far greater, so most of DI's insurance value comes from its within- rather than across-education group transfers.

5.5 Implications for optimal DI eligibility rules

In this section, we consider the question at the heart of the public debate about DI: how stringently should DI enforce its health tag, given that about one-half of DI recipients do not report having a severe health condition? From a statutory perspective that considers only health, the answer is clear: DI should focus exclusively on the health tag. From a welfarist

[10]These two different "aggregate" markups correspond to different policy counterfactuals. The average education group-specific markup, $E_e(M_e)$, is the insurance value of a reform in which each education group pays for its own benefits. This is similar to the policy counterfactual envisioned by much of the literature on DI (e.g., MM19, kind of Bound et al 04, LP15?, Cabral-Cullen, etc.) and UI (e.g., Gruber (1997), Hendren (2017), etc.). By contrast, the overall markup, M_{DI}, is the insurance value of a reform in which an increase in DI benefits is financed equally by non-recipients as a whole. This reform does not force each education group to pay for its own benefits but rather involves redistribution from education groups with lower-recipiency to those with higher-recipiency. Because education groups with greater recipiency also tend to have greater marginal utility, this redistribution provides valuable insurance against ability risk (viewing education as a proxy for ability) from behind the veil. The mathematical relationship between these markups is:

$$M_{DI} = E_e(M_e) + Cov_e\left(\frac{P(DI|e)}{P(DI)}, M_e\right) + Cov_e\left(M_{\Omega\to e}, \frac{P(DI|e)}{P(DI)}(1+M_e)\right),$$

where $M_{\Omega\to e}$ is the markup on transfers from all states (Ω) to those with education level e. The overall DI markup is the by-education average, $E_e(M_e)$, plus "correction terms" for (i) the extent to which higher-recipiency groups enjoy higher markups on within-group transfers from non-recipients to recipients and (ii) the extent to which higher-marginal utility groups (as measured by mean marginal utility among non-recipients) enjoy a greater recipiency rate-weighted gross markup on within-group transfers from non-recipients to recipients.

perspective, however, the answer depends on the relative markups and fiscal externalities associated with awards to people with vs. without severe health conditions.

We first compare the markup on DI to that on a hypothetical, infeasible program that perfectly targeted people with severe health conditions. Note that this compares an increase in actual DI benefits from their observed, status quo levels to an increase in hypothetical benefits whose observed, status quo level is zero. Our analysis is guided by the insight that the benefits of the actual DI program can be broken into three parts: (i) the benefits of a hypothetical program that is perfectly targeted on health (health DI, or HDI), which are received by someone if and only if they have a severe health condition; plus (ii) DI's errors of inclusion relative to that program, EI, i.e., DI benefits received by people without a severe health condition; minus (iii) DI's errors of exclusion relative to that program, EE, i.e., DI benefits that are *not* received by people with a severe health condition:

$$DI = HDI + EI - EE.$$

As shown in Table 1, we find that the actual DI program has a higher markup than the hypothetical HDI program, meaning that increasing transfers to the average DI recipient has a higher (gross) marginal insurance value than increasing transfers to the average person with a severe health condition.[11] Mechanically, this is due to the combined effects of two reinforcing factors. First, the "inclusion error" markup exceeds the HDI markup. The positive analysis showed that recipients without severe health conditions are highly disadvantaged on non-health dimensions. Here, we find that the net effect of these disadvantages is to make their average marginal utility even greater than that of people with severe health conditions as a whole. Second, the "exclusion error" markup, although also high, is lower than the HDI markup. This result is again consistent with the positive finding that non-recipients with severe health conditions are relatively advantaged on non-health dimensions and appear to self-select out of the program.[12] This analysis suggests that even an infeasible program that perfectly targeted people with severe health conditions would have a lower markup than DI's, which is suggestive that reforms to enforce the health tag more stringently could potentially reduce social welfare.

It is important to emphasize, of course, that these markup calculations reflect the marginal

[11]The difference between actual DI and HDI reflects the combined effects of the non-health tags, screens, and mistakes involved in actual DI. Deshpande and Li (2019) find that one such instrument, higher application costs resulting from field office closings, likely worsens the targeting of SSDI on broad welfarist criteria. The comparison of markups between actual DI and HDI, by contrast, is suggestive that, *considered as a whole*, these non-health tags, screens, and mistakes improve targeting of marginal utility, even if some individual instruments worsen targeting.

[12]To be sure, the exclusion error markup is high enough that a welfarist planner would wish to increase transfers to these individuals if doing so could be accomplished at not too great a cost.

value of transferring an additional dollar to these groups, on top of the existing tax-and-transfer system, including the current DI program. They do not tell us whether replacing the entire SSDI program with HDI (if that were feasible) or whether implementing particular reforms to SSDI would increase social welfare. The analysis also ignores the fiscal externality costs of increasing the benefits of different groups. It seems likely that the fiscal externality cost of awarding benefits to people without severe health conditions exceeds that of awarding benefits to people with severe health conditions, given their presumably greater counterfactual earnings were they not to receive DI. Moreover, the calculations are based on a welfarist perspective that does not reflect non-welfarist considerations. From a non-welfarist perspective, consistent with DI's statutory purpose, in which the Social Planner values only the DI benefits going to individuals with severe health conditions, DI is much less valuable. From such a perspective, as shown in Table 1, the HDI markup vastly exceeds the markup of actual DI. The actual DI markup is so low in this case because its many inclusion errors are extremely costly.

In the analysis above, we approach the question of how strictly to enforce DI's health tag by comparing the marginal value of increasing benefits in the status quo versus in a counterfactual with widely different recipiency patterns corresponding to perfect enforcement of the health tag. We can also approach this question by considering the converse: a marginal change in eligibility rules that creates a large change in the benefit amount for individuals at the margin of program entry. This alternative approach has the advantage of distinguishing between current and marginal recipients. It also distinguishes between the marginal value of increasing a DI recipient's cash benefit and the full value of awarding DI to an applicant at the margin of program entry. Being awarded DI triggers large changes in non-labor income, in-kind benefits and costs, and implicit labor taxes, the total value of which might differ significantly from a first-order approximation to the value of a change in benefits alone. Not only do DI benefits increase discretely upon allowance, DI also imposes various restrictions—most notably the earnings test—that likely reduce the value of the program to recipients relative to its cash value.

We consider a hypothetical reform that marginally decreases the stringency of DI's health tag by decreasing the award thresholds of all examiners. Maestas, Mullen and Strand (2013) document variation across SSA examiners in their propensities to make awards. They estimate that the examiner to which an applicant is assigned affects the ultimate award of 23 percent of applicants, those between the 20th and 43rd percentiles of the distribution in terms of disability severity. In our counterfactual, the 23 percent of applicants on the margin of program entry all become marginally more likely to be awarded DI, while the award decisions on the 77 percent of inframarginal applicants are unchanged. We use the evidence from Maestas, Mullen and Strand (2013) on the labor supply effects of DI awards to help

quantify the marginal welfare effect of reducing DI's award threshold, i.e., we aim to recover the slope of social welfare with respect to the award threshold.

The value from behind the veil, in terms of non-labor income in all states, of a marginal reduction in the award threshold is

$$WTP = \frac{p_a E\left(\frac{\Delta U}{\Delta DI}\middle| a\right)}{E\left(\lambda\right)},$$

where p_a is the probability of being an applicant on the margin of program entry, $E\left(\frac{\Delta U}{\Delta DI}\middle| a\right)$ is the average increase in utility from receiving DI for an applicant on the margin of program entry (accounting for both the discrete nature of a DI award to a recipient and possible costs to recipients of meeting DI's restrictions), and $E\left(\lambda\right)$ is mean marginal utility in the population. The expected net cost to the government of a marginal reduction in the award threshold is

$$GMC = p_a b(1 + FE),$$

where this cost has been expressed in terms of the expected increase in direct spending on DI benefits holding behavior fixed, $p_a b$, plus fiscal externality costs from the induced changes in the government budget above and beyond the mechanical increase in DI spending, FE.

Together, the value to potential recipients and costs to the government can be used to form the marginal value of public funds spent on reducing the DI award threshold,

$$MVPF = \frac{WTP}{GMC} = \frac{\frac{p_a E\left(\frac{\Delta U}{\Delta DI}\middle| a\right)}{E(\lambda)}}{p_a b(1 + FE)} = \frac{\frac{E\left(\frac{\Delta U}{\Delta DI}\middle| a\right)}{E(\lambda)}}{b(1 + FE)}.$$

This is the usual marginal value of public funds, though along the margin of increasing allowances rather than increasing benefits and so adjusted to reflect that changing allowances triggers a discrete rather than marginal change in the constraints and so utility of applicants on the margin of program entry due to the indivisible nature of being on DI.

Define an implicit "discount" on the DI benefit, δ, such that the expected utility gain from DI equals the gain from a counterfactual cash benefit of size $b(1 - \delta)$, i.e., $E\left(\frac{\Delta U}{\Delta DI}\middle| a\right) = E(\lambda|a)b(1 - \delta)$. The MVPF can then be written

$$MVPF = \frac{\frac{E\left(\frac{\Delta U}{\Delta DI}\middle| a\right)}{E(\lambda)}}{b(1 + FE)} = \frac{\frac{E(\lambda|a)b(1-\delta)}{E(\lambda)}}{b(1 + FE)} = \frac{\frac{E(\lambda|a)}{E(\lambda)}}{1 + FE}(1 - \delta) = \frac{1 + M_a}{1 + FE}(1 - \delta),$$

where $M_a = \frac{E(\lambda|a)-E(\lambda)}{E(\lambda)}$ is the markup on transfers from the population as a whole to applicants on the margin of program entry. This formulation is an ex ante version of the usual

marginal value of public funds multiplied by an adjustment term, $(1 - \delta)$, which reflects that DI recipients might value their benefits less than one-for-one. Intuitively, the earnings test, stigma or hassle costs of being on DI, or other factors might reduce the value of DI to recipients below the benefit amount. This formulation makes it easy to quantify how changes in the value of DI to recipients or in the value a non-welfarist planner would place on DI awards to certain recipients would affect the marginal value of public funds spent reducing the DI award threshold.

As a baseline, we assume that average marginal utility of applicants on the margin of program entry, of which direct measures do not exist, matches that of non-severely-disabled DI recipients, $E(\lambda|a) = E(\lambda|DI \cdot NS)$. This assumption is based on the idea that applicants on the margin of program entry are similar to non-severe recipients on average. This assumption understates the average marginal utility of applicants on the margin of program entry (and so the markup on transfers to them, M_a) to the extent that applicants on the margin of program entry are similar to non-severely-disabled DI recipients on average and that being awarded DI tends to reduce marginal utility (by increasing benefits by more than it decreases earnings, as is true for the average applicant on the margin of program entry). It overstates their true marginal utility if applicants on the margin of program entry have lower marginal utility than non-severely-disabled DI recipients on average. We also assume that the fiscal externality of reducing the DI award threshold is the same as that of increasing the DI benefit. In principle, these could differ, but there is little evidence on this important point.

Under these assumptions, if the average applicant on the margin of program entry values DI one-for-one (i.e., $\delta = 0$), the ex ante MVPF is 1.87. If the average applicant on the margin of program entry values DI at the change in net income (the DI benefit less reduced earnings, ignoring any value of leisure; $\delta = 0.28$), then the ex ante MVPF is 1.35.[13] The discount that makes the marginal value of public funds equal one—i.e., that equalizes willingness to pay from behind the veil and the marginal cost to the government—is 0.47.

Although far from definitive, these analyses suggest that, under status quo policies, reforms to increase DI's award threshold are likely to reduce social welfare. This conclusion is driven primarily by two empirical facts. One is the strong selection into applying for DI on the basis of health and non-health shocks—and so on marginal utility—the central finding of this paper. The other is the low counterfactual earnings that applicants on the margin

[13]We calculate the change in net income as the benefit less the average reduction in earnings from being awarded DI among applicants on the margin of program entry, which is about $3,800 per year, or about 28 percent of the average annual DI benefit. Alternatively, if applicants on the margin of program entry value DI one-for-one if they would earn less than the SGA in the absence of DI (81 percent of applicants on the margin of program entry) and do not value DI at all if they would earn more than the SGA in the absence of DI (19 percent of applicants on the margin of program entry), the discount is 0.19 and the MVPF is 1.51.

of program entry earn in the absence of DI (from Maestas, Mullen and Strand (2013) and related studies), which suggests that the earnings test aspect of DI is unlikely to significantly reduce the value of DI for most applicants on the margin of program entry. In the Appendix, we consider the gross marginal welfare effects of several other potential SSDI reforms that have been proposed to reduce SSDI spending. We find that those that focus on removing or reducing benefits to recipients based on health status have the largest negative gross marginal welfare effects, while reforms that focus on removing or reducing benefits based on non-health factors have positive gross marginal welfare effects.

6 Conclusion

In the public debate, DI is largely evaluated relative to its statutory purpose: providing assistance to workers who experience severe health conditions. Relative to this purpose, providing benefits to people without severe disabilities is a major concern, one that has dominated the public debate over the program. In this paper, we go beyond health to evaluate the DI program from a broader welfarist perspective. From this perspective, we find that DI provides valuable insurance against many non-health as well as health risks, and we find suggestive evidence that reforms to increase the emphasis on DI's statutory purpose might reduce social welfare.

The key empirical findings underlying these results are that, on average, non-severe recipients are more likely than non-recipients to have experienced adverse life events, are less likely than non-recipients to have the resources to insure those events, and are much more likely to have very low earnings even in the absence of DI. As a result, non-severe recipients tend to have much lower consumption than non-recipients, which creates a large value to someone behind the veil of expanding DI.

These findings highlight important trade-offs of reforms to increase the emphasis on DI's statutory purpose. Given the strong selection into DI applications on the basis of health- and non-health-related determinants of low consumption, such reforms could potentially reduce social welfare by reducing consumption among people experiencing severe shocks, whether health related or not.

Is SSDI the best way to achieve these goals? Almost certainly not. SSDI is likely best-suited to insuring risks that cause permanently very low "optimal earnings" and is likely a costly way to insure risks that do not permanently eliminate work capacity, since it requires that individuals remain out of the labor force in order to receive benefits. Although there's clearly important heterogeneity, our analyses and others' suggest that the majority of DI recipients

would have low earnings even without DI. For the others, it seems likely that different policies could help them at lower cost than SSDI does. For example, a wage insurance program might more efficiently insure temporary productivity shocks, and the income tax system might more efficiently accomplish some of the redistribution across permanent income groups currently accomplished by DI. Introducing multiple instruments to serve the multiple roles that DI currently serves would likely increase the efficiency of the social safety net.

References

Akerlof, George A. 1978. "The economics of" tagging" as applied to the optimal income tax, welfare programs, and manpower planning." *The American economic review*, 68(1): 8–19.

Atkinson, Anthony Barnes, and Joseph E Stiglitz. 1976. "The design of tax structure: direct versus indirect taxation." *Journal of public Economics*, 6(1-2): 55–75.

Autor, David, and Mark Duggan. 2006. "The Growth in the Social Security Disability Rolls: A Fiscal Crisis Unfolding." National Bureau of Economic Research Working Paper 12436.

Autor, David H, and Mark G Duggan. 2003. "The rise in the disability rolls and the decline in unemployment." *The Quarterly Journal of Economics*, 118(1): 157–206.

Benıtez-Silva, Hugo, Moshe Buchinsky, Hiu Man Chan, John Rust, and Sofia Sheidvasser. 1999. "An empirical analysis of the social security disability application, appeal, and award process." *Labour Economics*, 6(2): 147–178.

Black, Dan, Kermit Daniel, and Seth Sanders. 2002. "The impact of economic conditions on participation in disability programs: Evidence from the coal boom and bust." *American Economic Review*, 92(1): 27–50.

Bound, John, Julie Berry Cullen, Austin Nichols, and Lucie Schmidt. 2004. "The welfare implications of increasing disability insurance benefit generosity." *Journal of Public Economics*, 88(12): 2487–2514.

Brown, Jeffrey R, Gopi Shah Goda, and Kathleen McGarry. 2016. "Heterogeneity in State-Dependent Utility: Evidence from Strategic Surveys." *Economic Inquiry*, 54(2): 847–861.

Cabral, Marika, and Mark R Cullen. 2019. "Estimating the Value of Public Insurance Using Complementary Private Insurance." *American Economic Journal: Economic Policy*, 11(3): 88–129.

Chandra, Amitabh, and Andrew A Samwick. 2009. "Disability risk and the value of disability insurance." In *Health at Older Ages: The Causes and Consequences of Declining Disability among the Elderly*. 295–336. University of Chicago Press.

Charles, Kerwin Kofi, Yiming Li, and Melvin Jr Stephens. 2018. "Disability benefit take-up and local labor market conditions." *Review of Economics and Statistics*, 100(3): 416–423.

Chetty, Raj. 2006. "A general formula for the optimal level of social insurance." *Journal of Public Economics*, 90(10–11): 1879–1901.

Deshpande, Manasi, and Yue Li. 2019. "Who is screened out? application costs and the targeting of disability programs." *American Economic Journal: Economic Policy*, 11(4): 213–48.

Deshpande, Manasi, Tal Gross, and Yalun Su. 2019. "Disability and Distress: The Effect of Disability Programs on Financial Outcomes." National Bureau of Economic Research.

Diamond, Peter, and Eytan Sheshinski. 1995. "Economic aspects of optimal disability benefits." *Journal of Public Economics*, 57(1): 1–23.

Finkelstein, Amy, Erzo FP Luttmer, and Matthew J Notowidigdo. 2013. "What good is wealth without health? The effect of health on the marginal utility of consumption." *Journal of the European Economic Association*, 11(suppl_1): 221–258.

Gruber, Jonathan. 1997. "The consumption smoothing benefits of unemployment insurance." *The American Economic Review*, 87(1): 192.

Hendren, Nathaniel. 2015. "The Policy Elasticity." *Tax Policy and the Economy, Volume 30*. University of Chicago Press.

Hendren, Nathaniel. 2017. "Knowledge of future job loss and implications for unemployment insurance." *American Economic Review*, 107(7): 1778–1823.

Hendren, Nathaniel, and Ben Sprung-Keyser. 2019. "A Unified Welfare Analysis of Government Policies." National Bureau of Economic Research, Inc NBER Working Papers 26144.

Lillard, Lee A, and Yoram Weiss. 1997. "Uncertain health and survival: Effects on end-of-life consumption." *Journal of Business & Economic Statistics*, 15(2): 254–268.

Low, Hamish, and Luigi Pistaferri. 2015. "Disability insurance and the dynamics of the incentive insurance trade-off." *American Economic Review*, 105(10): 2986–3029.

Maestas, Nicole, Kathleen J. Mullen, and Alexander Strand. 2013. "Does Disability Insurance receipt discourage work? Using examiner assignment to estimate causal effects of SSDI receipt." *American Economic Review*, 103(5): 1797–1829.

Mankiw, N Gregory, and Matthew Weinzierl. 2010. "The optimal taxation of height: A case study of utilitarian income redistribution." *American Economic Journal: Economic Policy*, 2(1): 155–76.

Mayshar, Joram. 1990. "On measures of excess burden and their application." *Journal of Public Economics*, 43(3): 263–289.

Meyer, Bruce D, and Wallace KC Mok. 2019. "Disability, earnings, income and consumption." *Journal of Public Economics*, 171: 51–69.

Morton, William R. 2015. "Concurrent Receipt of Social Security Disability Insurance (SSDI) and Unemployment Insurance (UI): Background and Legislative Proposals."

Nichols, Albert L, and Richard J Zeckhauser. 1982. "Targeting transfers through restrictions on recipients." *The American Economic Review*, 72(2): 372–377.

Rege, Mari, Kjetil Telle, and Mark Votruba. 2009. "The effect of plant downsizing on disability pension utilization." *Journal of the European Economic Association*, 7(4): 754–785.

Von Wachter, Till, Jae Song, and Joyce Manchester. 2011. "Trends in employment and earnings of allowed and rejected applicants to the social security disability insurance program." *American economic review*, 101(7): 3308–29.

Appendix (not for publication)

A The fiscal externality of changes in DI

We follow Bound et al.'s (2004) thorough procedure for mapping key behavioral elasticities into the marginal cost to the government of increasing DI benefits. Bound et al. (2004) combine evidence from a wide range of sources into a microsimulation model to estimate the net marginal cost to the government of a one percent increase in DI benefits. This model quantifies the effects of the increase in DI benefits in terms of: (i) reducing SSI and Food Stamp benefits received by current beneficiaries, (ii) increasing federal and state taxes paid by current beneficiaries, (iii) increasing DI benefits due to successful new applicants, (iv) decreasing taxes paid by recipients and new applicants and their families, and (v) increasing transfers from SSI, Food Stamps, and AFDC to new applicants. In magnitude, (iii) DI benefits paid to new applicants is by far the largest, followed by (iv) reduced taxes paid by recipients and new applicants and their families. See Bound et al.'s (2004) Table 1 (page 2500).

We depart from Bound et al. (2004) in two main ways. First, our main counterfactual is an increase in DI benefits to non-elderly beneficiaries, whereas Bound et al. (2004) consider an increase in DI benefits to all beneficiaries, including elderly ones on Social Security Retirement. Since the behavioral responses to changes in DI benefits are driven by younger people, focusing on an increase in the DI benefits of younger people tends to increase the fiscal externality as a fraction of the mechanical increase in benefits.

Second, we take advantage of more recent evidence on the key behavioral elasticity. The key elasticity determining the size of the fiscal externality is the elasticity of applications with respect to benefits. Unfortunately, the evidence on this key elasticity is sparse. Bound et al.'s (2004) preferred estimates are based on time series evidence from the 1960s and 1970s, which suggest elasticities around 0.5. More recently, Black, Daniel and Sanders (2002) and Charles, Li and Stephens (2018) have taken advantage of local economic booms and busts to estimate an elasticity of DI receipt with respect to earnings, of around $-.3$. We follow Meyer and Mok (2019) in translating this elasticity with respect to earnings into an elasticity with respect to DI benefits, based on the assumption that what determines applications is the replacement rate. This suggests an elasticity of around 0.2. We scale the subset of cost estimates in Bound et al. (2004) that should scale in this key elasticity (i.e., the ones driven by new applications and awards) by the ratio of our preferred estimate of 0.2 to Bound et al.'s (2004) preferred estimate of 0.5, i.e., by $0.2/0.5 = 0.4$. This tends to reduce the fiscal externality relative to Bound et al.'s (2004) preferred estimate.

Based on this evidence, we estimate a fiscal externality per \$1 of greater net transfers to inframarginal recipients—increased DI benefits less decreased means-tested transfers received and increased tax payments made—of \$0.34. Increasing net transfer to inframarginal DI recipients by \$1 costs the government \$1.34. This is somewhat smaller than Bound et al.'s (2004) baseline estimate of \$1.50 because the effect of using a smaller elasticity dominates the effect of not increasing the benefits of elderly recipients. We also assess the robustness of our key results and conclusions to using a fiscal externality estimate based on Bound et al.'s

(2004) preferred elasticity. When we use their preferred elasticity of 0.5, we estimate a fiscal externality per $1 of greater net transfers to inframarginal recipients of $0.84.

It is important to emphasize the substantial uncertainty about the fiscal externality costs of different changes in DI. Producing additional evidence on these key parameters is a high priority for future research.

B Evaluating other proposed reforms

Several reforms have been proposed to reduce SSDI spending. McCrery and Pomeroy (SSDI Solutions, CRFB) list the following:

- Stricter medical eligibility criteria: eliminate mental and back pain allowances
- Temporary disability insurance: time-limit benefits of individuals with less severe conditions
- Full funding of continuing disability reviews: remove recipients who have medically improved
- Means testing: impose household earnings and asset tests
- Higher work requirements: increase required quarters of coverage

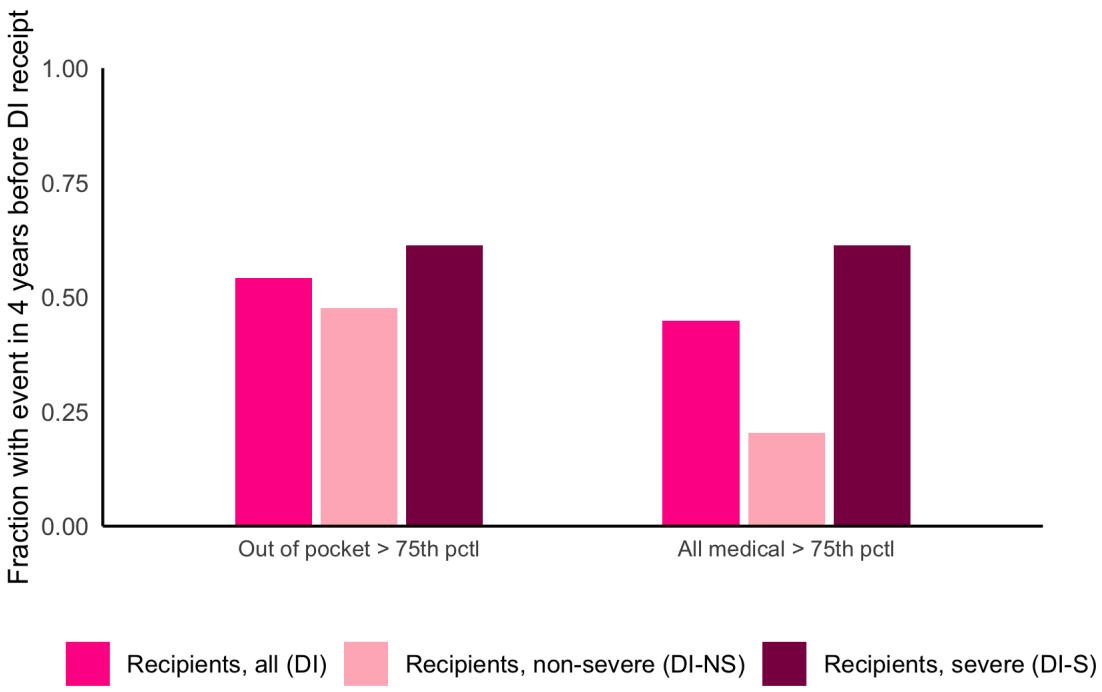
For each reform, we calculate the markup from behind the veil on transfers from non-recipients to the group whose DI benefits would be reduced or eliminated by the reform. These markups measure the marginal cost in terms of reduced insurance from behind the veil of reducing transfers to these groups, a key determinant of the welfare effect of these reforms. Reforms that reduce the benefits of groups with greater markups have greater marginal costs in terms of foregone insurance from behind the veil.

Table **??** shows the results. The temporary disability and higher work requirement reforms have the greatest marginal costs in terms of reduced insurance from behind the veil, with markups on transfers to the excluded groups of 174 percent and 178 percent, respectively (using a coefficient of relative risk aversion of three). Excluding people with mental health problems and back pain forgoes transfers with a markup of 115 percent. Removing recipients who have medically improved forgoes transfers with a markup of 96 percent. By contrast, removing recipients who do not meet an asset test slightly *improves* insurance from behind the veil, with a markup of -6 percent on transfers to such recipients, and removing recipients with high household earnings improves insurance from behind the veil substantially, with a markup of -73 percent on transfers to such recipients.

The value of transferring resources to groups whose benefits would be cut or eliminated by different reforms is just one ingredient in an overall welfare analysis of these reforms. Moreover, the marginal cost of reducing a particular group's benefits might differ substantially from the cost of excluding them from DI entirely, given the relatively high level of DI benefits and the many non-cash aspects of being on DI. Investigating these issues in more depth is an important subject for future research.

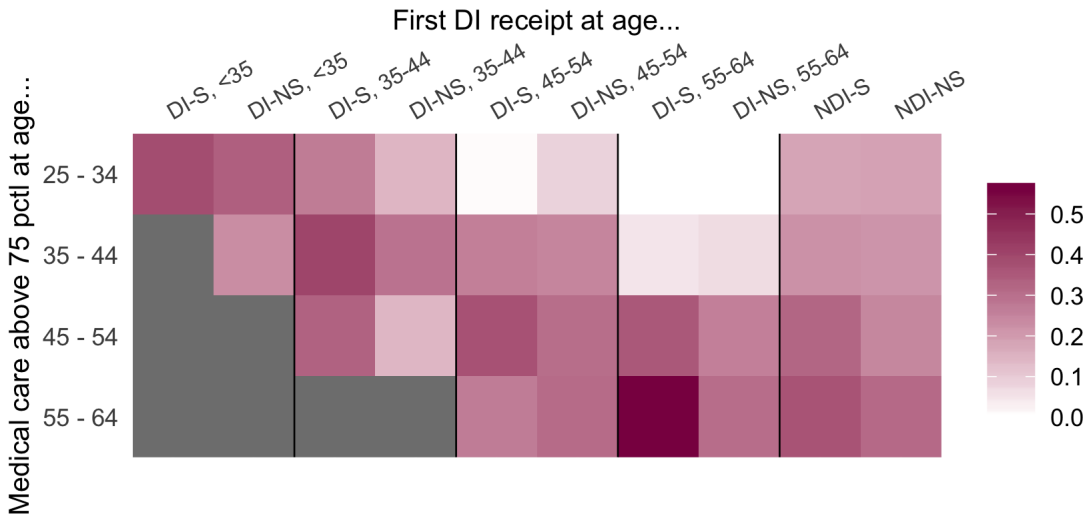
Appendix Figures and Tables (not for publication)

Figure A1: PSID: Medical shock in 4 years before DI receipt



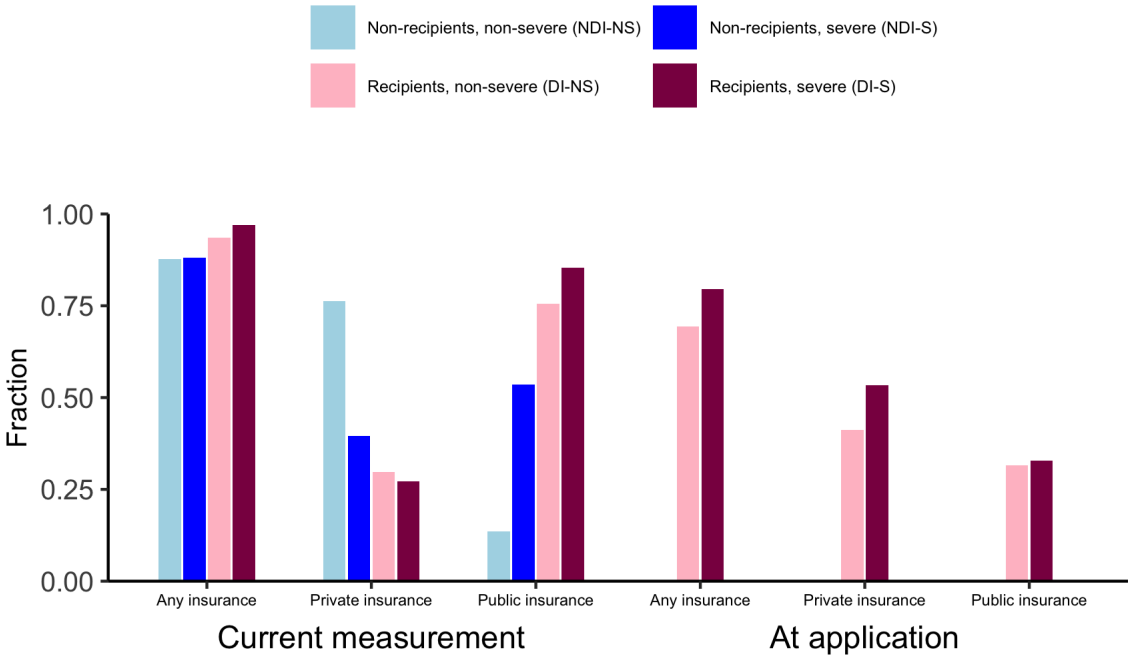
Notes: Figure presents rates of two adverse life events regarding medical bill in the four years before the first year of SSDI receipt for households receiving SSDI in the 2016 PSID, by severe and non-severe. "Out of pocket > 75th pctl" is defined as the medical bill paid from out of pocket being higher than 75th percentile. The sample for out of pocket > 75th pctl is households currently receiving SSDI who can be observed in the four years before initial DI receipt (158 severe, 191 non-severe). "All medical > 75th pctl" is defined as all medical paid being higher than 75th percentile. The sample for all medical > 75th pctl is households currently receiving SSDI who can be observed in the four years before initial DI receipt (20 severe, 13 non-severe).

Figure A2: PSID: Medical care



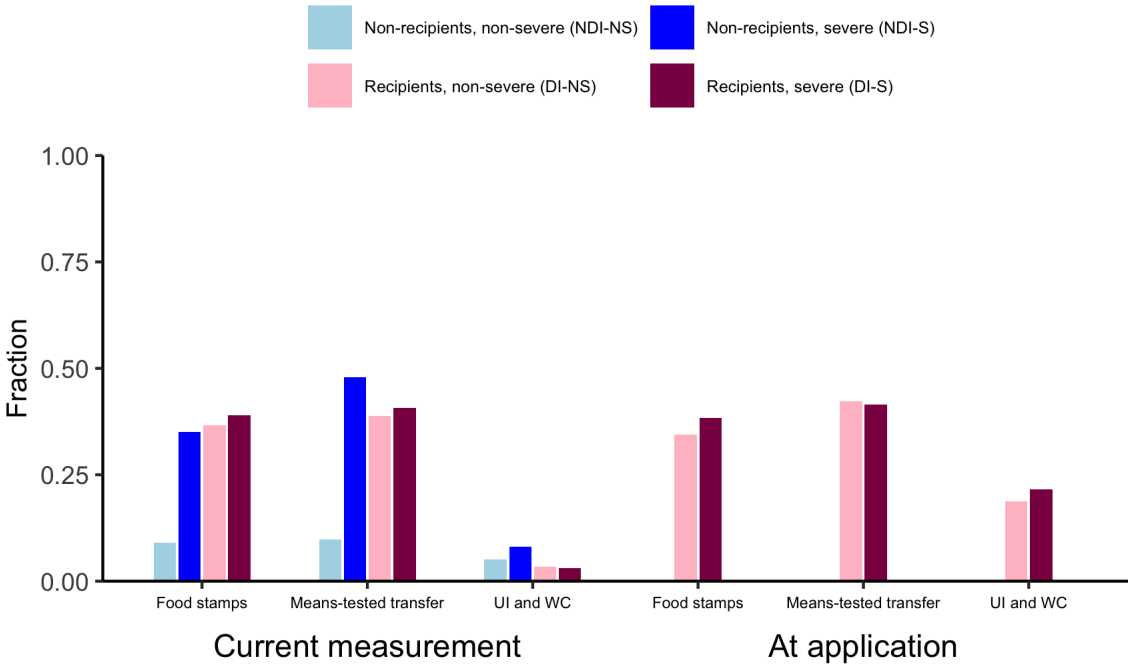
Notes: Figure presents rates of paying medical care bill higher than the 75th percentile at various ages for households in the PSID, by SSDI status, health status, and age at SSDI entry. Households are first categorized by their SSDI status: whether they ever received DI (DI) or never received DI (NDI). DI are further classified by their health status at DI entry (severe DI-S, or non-severe DI-NS), and NDI are further classified by whether they ever had a severe health condition (ever severe NDI-S, never severe NDI-NS). The DI-S and DI-NS groups are further categorized by their age at SSDI entry: <35, 35–44, 45–54, 55–64. We organize these groups along the horizontal axis and then plot the rate of experiencing any adverse event at the following ages along the vertical axis: 25–34, 35–44, 45–54, and 55–64. Darker shades indicate higher rates, as shown in the legend. Gray squares indicate that the sample size is less than 50. The sample of each cell is households in SSDI/age category indicated in the horizontal axis that are observed in the PSID during the age range indicated in the vertical axis.

Figure A3: PSID: Insurance Coverage (Head)



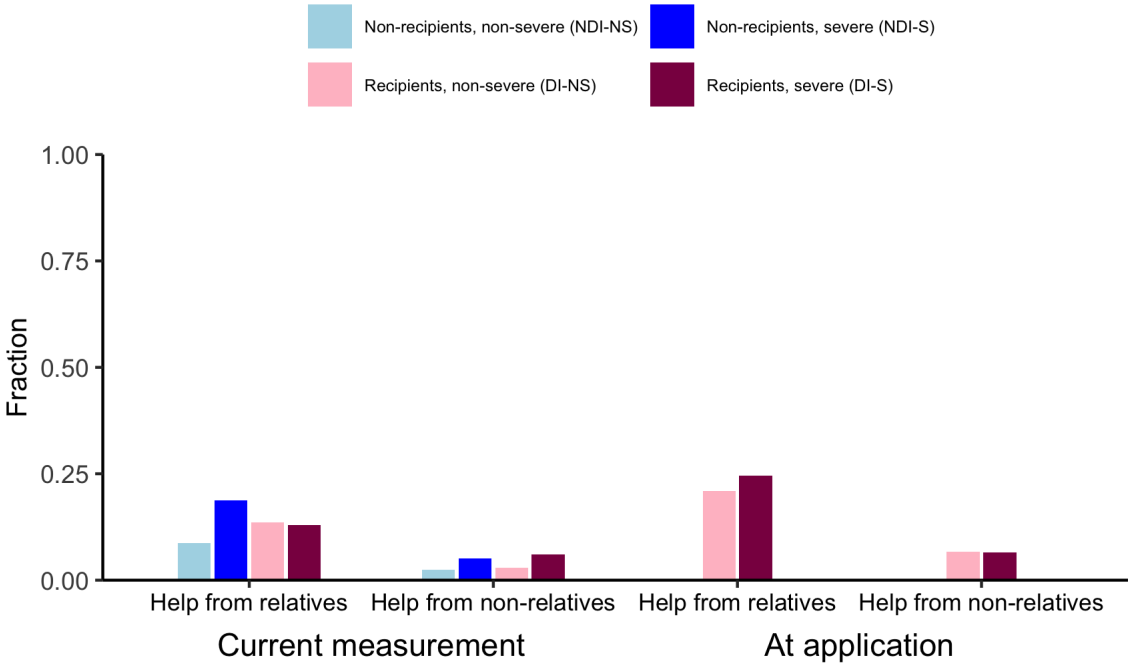
Notes: Figure presents rates of any insurance, private insurance, and public insurance for four types of households in the 2016 PSID: households not currently receiving SSDI without a severe health condition (6,831 NDI-NS), households not currently receiving SSDI with a severe health condition (330 NDI-S), households currently receiving SSDI with a severe health condition (256 DI-S), and households currently receiving SSDI without a severe health condition (316 DI-NS). For DI-S and DI-NS who can be observed one year prior to the year of initial DI receipt (221 and 285, respectively), figure also presents rates of any insurance, private insurance, and public insurance one year prior to the year of initial DI receipt ("at application"). Appendix Table A7 presents the PSID questions for private and public insurance.

Figure A4: PSID: Transfers



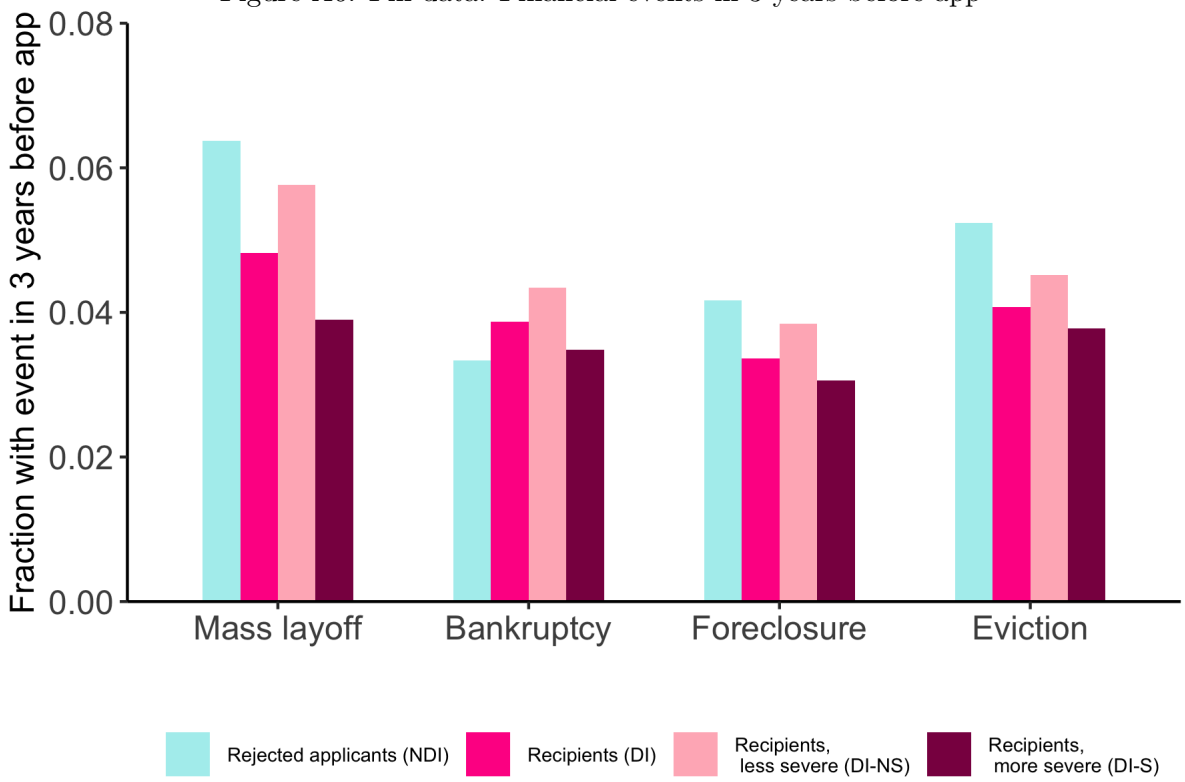
Notes: Figure presents rates of food stamp, means-tested transfer, and unemployment insurance (UI) and worker compensation (WC) for four types of households in the 2016 PSID: households not currently receiving SSDI without a severe health condition (6,831 NDI-NS), households not currently receiving SSDI with a severe health condition (330 NDI-S), households currently receiving SSDI with a severe health condition (256 DI-S), and households currently receiving SSDI without a severe health condition (316 DI-NS). For DI-S and DI-NS who can be observed one year prior to the year of initial DI receipt (221 and 285, respectively), figure also presents rates of food stamp, means-tested transfer, and UI and WC one year prior to the year of initial DI receipt ("at application").Appendix Table A6 presents the PSID questions for SSI, ADC/AFDC, food stamp, UI, and WC.

Figure A5: PSID: Cash assistance



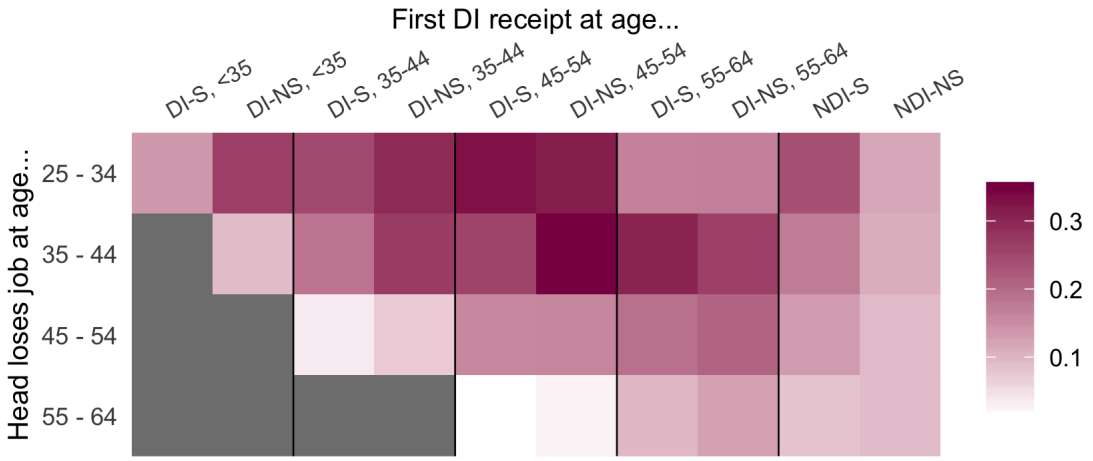
Notes: Figure presents rates of cash assistance from relatives and non-relatives for four types of groups in the 2016 PSID: households not currently receiving SSDI without a severe health condition (6,831 NDI-NS), households not currently receiving SSDI with a severe health condition (330 NDI-S), households currently receiving SSDI with a severe health condition (256 DI-S), and households currently receiving SSDI without a severe health condition (316 DI-NS). For DI-S and DI-NS who can be observed one year prior to the year of initial DI receipt (221 and 285, respectively), figure also presents rates of cash assistance from relatives and non-relatives one year prior to the year of initial DI receipt ("at application"). Appendix Table A6 presents the PSID questions for cash assistance from relatives and non-relatives.

Figure A6: Fin data: Financial events in 3 years before app



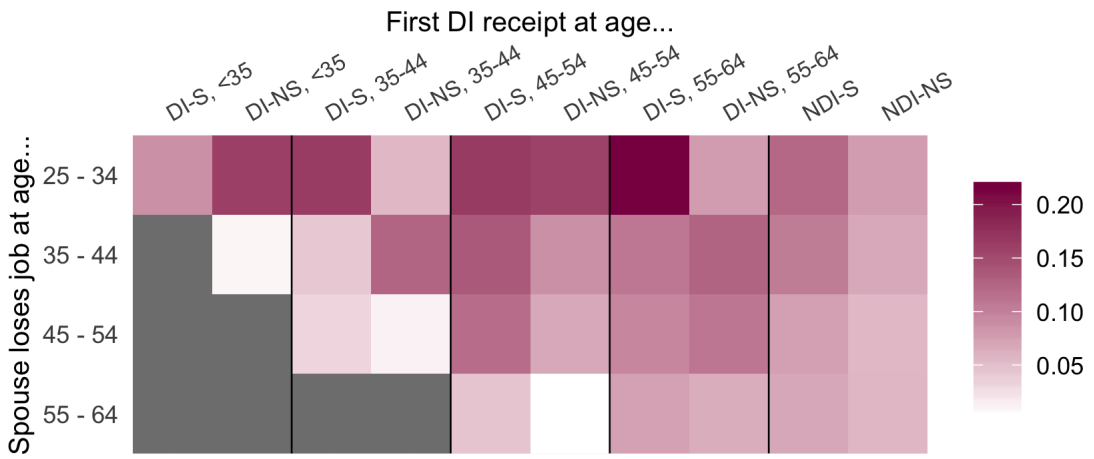
Notes: Figure presents rates of adverse financial events prior to SSDI receipt for individuals who apply for but are rejected and receive SSDI benefits in SSA administrative data, by more-severe and less-severe. "Mass layoff" indicates being part of a mass layoff in the five years prior to SSDI application. The mass layoff sample is SSDI recipients in the CWHS-linked Master Beneficiary Record (MBR) who were allowed onto SSDI between 1985 and 2016 (850,000 less-severe, 920,000 more-severe). We determine rates of mass layoff using the Continuous Work History Sample (CWHS), which is a 10% sample of US workers. In the CWHS, we identify EINs that experience a drop in employees of at least 30 percent from a base of at least 150 employees. From the MBR, we label an SSDI recipient as experiencing a mass layoff in the three years prior to application if they experienced a separation from a mass-layoff EIN in the same year as the mass layoff event. "Bankruptcy," "foreclosure," and "eviction" indicate experiencing these events in the three years prior to SSDI application. We link SSDI applicants in the 831 files to nationwide financial records using the methods described in Deshpande, Gross and Su (2019). The bankruptcy sample is SSDI recipients in the 831 files between 1995 and 2009 (3.0M less-severe, 3.7M more-severe). The foreclosure sample is approved SSDI applicants in the 831 files between 2005 and 2014 who are homeowners (780,000 less-severe, 1.2M more-severe). The eviction sample is approved SSDI applicants in the 831 files between 2005 and 2014 who are not homeowners (560,000 less-severe, 840,000 more-severe). "More severe" indicates a medical diary of "medical improvement not expected" or "medical improvement possible," and "less severe" indicates a medical diary of "medical improvement expected."

Figure A7: PSID: Head job loss



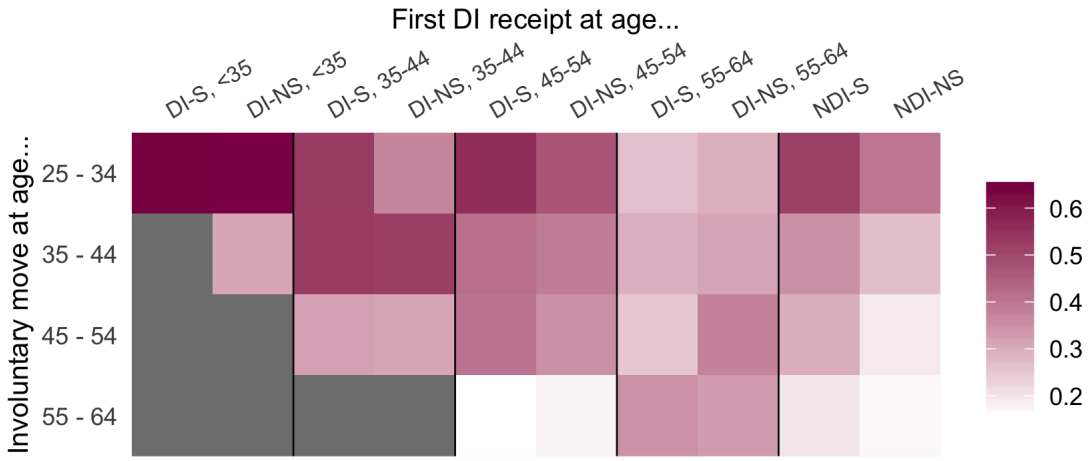
Notes: Figure presents rates of head job loss at various ages for households in the PSID, by SSDI status, health status, and age at SSDI entry. Households are first categorized by their SSDI status: whether they ever received DI (DI) or never received DI (NDI). DI are further classified by their health status at DI entry (severe DI-S, or non-severe DI-NS), and NDI are further classified by whether they ever had a severe health condition (ever severe NDI-S, never severe NDI-NS). The DI-S and DI-NS groups are further categorized by their age at SSDI entry: <35, 35–44, 45–54, 55–64. We organize these groups along the horizontal axis and then plot the rate of experiencing any adverse event at the following ages along the vertical axis: 25–34, 35–44, 45–54, and 55–64. Darker shades indicate higher rates, as shown in the legend. Gray squares indicate that the sample size is less than 50. The sample of each cell is households in SSDI/age category indicated in the horizontal axis that are observed in the PSID during the age range indicated in the vertical axis.

Figure A8: PSID: Spouse job loss



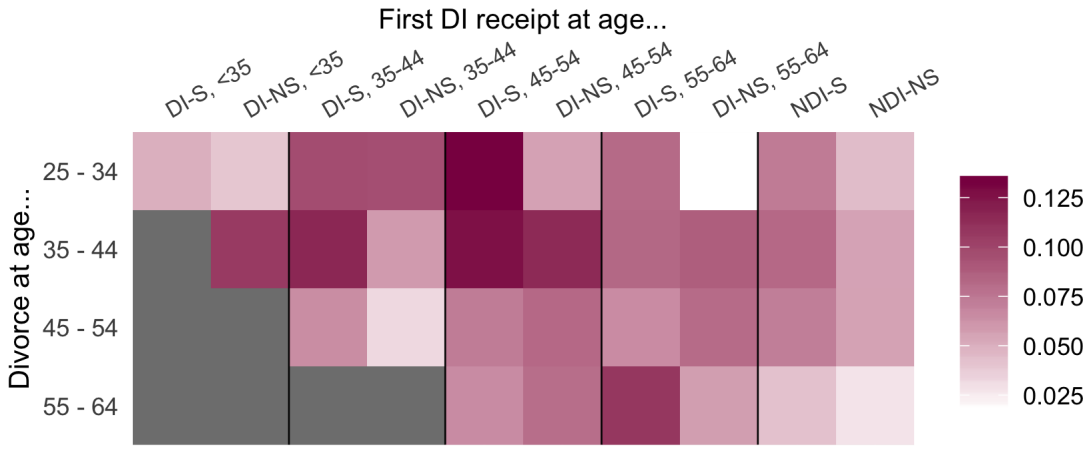
Notes: Figure presents rates of experiencing spouse job loss at various ages for households in the PSID, by SSDI status, health status, and age at SSDI entry. Households are first categorized by their SSDI status: whether they ever received DI (DI) or never received DI (NDI). DI are further classified by their health status at DI entry (severe DI-S, or non-severe DI-NS), and NDI are further classified by whether they ever had a severe health condition (ever severe NDI-S, never severe NDI-NS). The DI-S and DI-NS groups are further categorized by their age at SSDI entry: <35, 35–44, 45–54, 55–64. We organize these groups along the horizontal axis and then plot the rate of experiencing any adverse event at the following ages along the vertical axis: 25–34, 35–44, 45–54, and 55–64. Darker shades indicate higher rates, as shown in the legend. Gray squares indicate that the sample size is less than 50. The sample of each cell is households in SSDI/age category indicated in the horizontal axis that are observed in the PSID during the age range indicated in the vertical axis.

Figure A9: PSID: Involuntary move



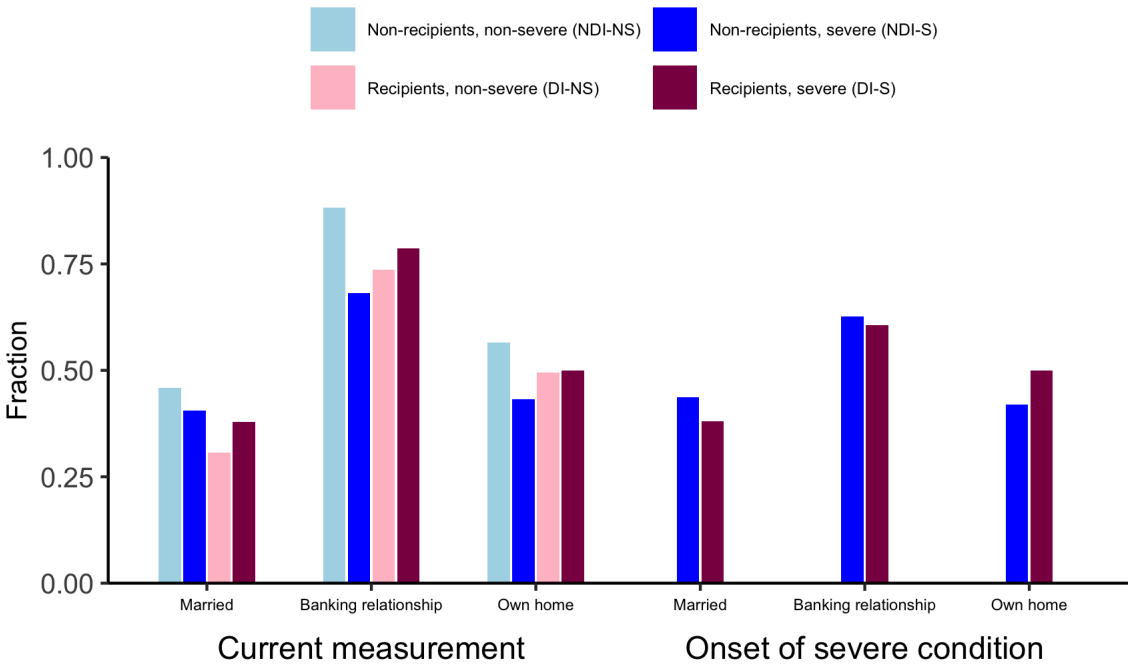
Notes: Figure presents rates of experiencing involuntary move at various ages for households in the PSID, by SSDI status, health status, and age at SSDI entry. Households are first categorized by their SSDI status: whether they ever received DI (DI) or never received DI (NDI). DI are further classified by their health status at DI entry (severe DI-S, or non-severe DI-NS), and NDI are further classified by whether they ever had a severe health condition (ever severe NDI-S, never severe NDI-NS). The DI-S and DI-NS groups are further categorized by their age at SSDI entry: <35, 35–44, 45–54, 55–64. We organize these groups along the horizontal axis and then plot the rate of experiencing any adverse event at the following ages along the vertical axis: 25–34, 35–44, 45–54, and 55–64. Darker shades indicate higher rates, as shown in the legend. Gray squares indicate that the sample size is less than 50. The sample of each cell is households in SSDI/age category indicated in the horizontal axis that are observed in the PSID during the age range indicated in the vertical axis.

Figure A10: PSID: Divorce



Notes: Figure presents rates of experiencing divorce at various ages for households in the PSID, by SSDI status, health status, and age at SSDI entry. Households are first categorized by their SSDI status: whether they ever received DI (DI) or never received DI (NDI). DI are further classified by their health status at DI entry (severe DI-S, or non-severe DI-NS), and NDI are further classified by whether they ever had a severe health condition (ever severe NDI-S, never severe NDI-NS). The DI-S and DI-NS groups are further categorized by their age at SSDI entry: <35, 35–44, 45–54, 55–64. We organize these groups along the horizontal axis and then plot the rate of experiencing any adverse event at the following ages along the vertical axis: 25–34, 35–44, 45–54, and 55–64. Darker shades indicate higher rates, as shown in the legend. Gray squares indicate that the sample size is less than 50. The sample of each cell is households in SSDI/age category indicated in the horizontal axis that are observed in the PSID during the age range indicated in the vertical axis.

Figure A11: PSID: Outside Resources



Notes: Figure presents rates of marriage, banking relationship, and homeownership for four types of households in the 2016 PSID: households not currently receiving SSDI without a severe health condition (6,831 NDI-NS), households not currently receiving SSDI with a severe health condition (330 NDI-S), households currently receiving SSDI with a severe health condition (256 DI-S), and households currently receiving SSDI without a severe health condition (316 DI-NS). For DI-S and NDI-S who can be observed one year prior to the year of severe condition onset (344 and 677, respectively), figure also presents rates of marriage, banking relationship, and homeownership one year prior to the year of severe condition onset ("Onset of severe condition"). Appendix Table A6 presents the PSID questions for banking relationship and homeownership.

Table A1: Selection mechanism for NDI-S

SIPP 2008 (SIPP 2014)	NDI-S applied and rejected	24% (31%)
	Severe applicants rejected	53% (56%)
	at step 2	18% (13%)
	at step 4	24% (13%)
	at step 5	36% (45%)
	other	6% (6%)
	Work credits up to reference year	
	NDI-S	66 credits (63 credits)
	NDI-S-notapply	59 credits (54 credits)
	NDI-S-apply	88 credits (83 credits)
	DI-S	97 credits (95 credits)
	Qualified to apply for DI	
	NDI-S	75% (75%)
	NDI-S-notapply	68% (65%)
	NDI-S-apply	97% (97%)
	DI-S	97% (97%)
PSID	Ineligible for DI among NDI-S	38%
	Receiving SSI	42%

Notes: This table presents the numbers that potentially explain why people with severe condition do not receive DI. The numbers in parentheses are calculated from the 2014 SIPP panel. In the process of determining denial of DI, applicants are denied at step 1, 2, 4, and 5. At step 1, applicants are denied based on their financial eligibility. However, in both the 2008 and 2014 SIPP panels, no one is denied at step 1, so it is not included in the table. At step 2, the rejection decision is mainly based on severe impairments. At step 4, the rejection decision is mainly based on capacity for past work. Finally, at step 5, which is the last step, applicants are announced their decision based on capacity for any other work. To calculate the rejection rates for severe applicants and at which steps, all severe applicants in the panel are included. Other numbers calculated from the SIPP use the specific group in 2009 for the 2008 panel (2013 for the 2014 panel) considered. For the social security credit, the SIPP-SSA linked data allows us to calculate the sum of social security credits up to any reference years (up to 2018). The qualification to apply for DI here is based on the social security credits earned up to the reference year.

Table A2: Selection mechanism for DI-NS

SIPP 2008 (SIPP 2014)	Non-severe applicants allowed		62% (53%)
		at step 3	34% (34%)
		at step 5	52% (52%)
		appeal	20% (14%)
	Receiving UI before applying for DI		
		NS-app	10% (2%)
		DI-NS-app	11% (4%)
PSID	DI-NS		
	Severe when they apply for DI		26%
	Experienced adverse life events & receiving UI previously		15%
	Experienced adverse life events & not receiving UI previously		51%
	No observable adverse life events but have low resources		24%

Notes: This table presents the numbers that potentially explain why people without severe condition receive DI. The numbers in parentheses are calculated from the 2014 SIPP panel. In the process of determining allowance of DI, applicants are allowed at step 3 and 5, and after a sequences of appeals. At step3, applicants face a medical screen, and they are allowed without further evaluation if they pass the screening. At step 5, which is the last step, applicants are announced their decision based on capacity for any other work. Finally, applicants can request appealing even though they are not allowed after the initial determination. To calculate the allowance rates for severe applicants and at which steps, all non-severe applicants in the panel are included. The rates of receiving UI before applying DI is calculated using DI-NS or NS who applied in last two years of the SIPP panel because the period of UI receipt might be too short to observe before DI application. More applicants receiving UI before receiving DI in the 2008 panel than 2014 panel could be explained by Great Recession.

Table A3: Severity and medical bill questions

Severity	
(1)	Do you have any physical or nervous condition that limits the type of work or the amount of work you can do? - Yes - No - Can do nothing
(2)	For work you can do, how much does it limit the amount of work you can do – a lot, somewhat, or just a little? - A lot - Somewhat - Just a little - Not at all
Severe	if "Yes" in (1) and "A lot" in (2), or "Can do nothing" in (1)
Non-severe	if others
Out-of-pocket	
(1)	About how much did you pay out-of-pocket for nursing home and hospital bills in 2015 and 2016 combined?
(2)	About how much did you pay out-of-pocket for doctor, outpatient surgery, dental bills in 2015 and 2016 combined?
(3)	About how much did you pay out-of-pocket for prescriptions, in-home medical care, special facilities, and other services in 2015 and 2016 combined?

Notes: Out-of-pocket for medical care that is used is the sum of out-of-pocket variables above.

Table A4: Job loss and divorce/marriage questions

Job loss	Why did you stop working for (Name of employer)? – Did the company go out of business, were you laid off, did you quit, or what? – Most recent main job
✓	1. Company folded/changed hands/moved out of town; employer died/went out of business
✓	2. Strike; lockout
✓	3. Laid off; fired
	4. Quit; resigned; retired; pregnant; needed more money; just wanted a change
	5. Other; transfer; any mention of armed services
	6. Job was completed; seasonal work; was a temporary job
Divorce/marriage	Are you (Head) married, widowed, separated, or have you never been married?
	1. Married
	2. Never married
	3. Widowed
	4. Divorced, annulled
	5. Separated
Divorced	if married in the previous observation but not married in this observation

Notes: We consider an individual experienced job loss if one of the choices with a check mark is chosen, and consider divorce if an individual is not married in an observation but is married in the previous observation.

Table A5: Involuntary move question

Moving	Why did you move?	
	1.	Purposive productive reasons: to take another job; transfer: stopped going to school
	2.	To get nearer to work
	3.	Purposive consumptive reasons – expansion of housing: more space; more rent; better place
✓	4.	Purposive consumptive reasons – contraction of housing: less space; less rent
	5.	Purposive consumptive – other house-related: get own home/place; got married; physial conditions of the previous housing unit
	6.	Purposive consumptive – neighborhood-related: better neighborhood; go to school; to be closer to friends and/or relatives
✓	7.	Response to outside events (involuntary reasons): HU coming down; being evicted; armed services, etc.; health reasons; divorce; retiring because of health
✓	8.	Ambiguous, mixed, or other reasons, including reasons such as to save money, all my old neighbors moved away, retiring
	9.	Homeless

Notes: We consider each individual involuntarily move if one of the choices with a check mark is chosen.

Table A6: Resource, cash assistance, and other transfer questions

Home own	Do you (or anyone else in your family living there) own the (home/apartment), pay rent, or what? 1. Owns or is buying home, either fully or jontly;mobile home ownders who rent lots are included here 2. Pays rent 3. Neither owns nor rents
Banking relationship	If you added up all such accounts (for all of your family living there) about how mch would they amount to right now?
Help from relatives	Did you receive any help from relatives? [THIS MUCT BE FROM NON-FU MEMBERS.]
Help from non-relatives	Did anyone (else) not living with you help you and your family out by giving you money?
SSI	Did you have any (other) income, such as pensions, welfare, interest, gifts, or anything else, last year? How much from SSI?
ADC/AFDC	Did you receive any income from TANF (Temporary Assistance for Needy Families) or (NAME OF STATE PROGRAM) formerly called ADC or AFDC?
Food stamp	Did you (or anyone else in your family) receive food stamp benefits (that is, either food stamps or a food stamp benefit card,) at any time last year?
UI	Did you receie any income from unemployment compensation?
Workers compensation	Did you receive any income from workers compensation?

Table A7: Insurance question

Insurance		What type of health insurance plan or health insurance coverage did you have in 2015 and 2016? If you had more than one type of plan or coverage please tell me about each of them.
Private	Public	
✓		1. Employer provided health insurance
✓		2. Private health insurance purchased directly
	✓	3. Medicare
	✓	4. Medi-Gap/Supplemental
	✓	5. Medicaid/Medical Assistance/[STATE PROGRAM]
	✓	6. Military health care/TRICARE (Active)
	✓	7. CHAMPUS/TRICARE/CHAMP-VA (Dependents, Veterans)
	✓	8. Indian Health Insurance
	✓	9. Oher state-sponsored plan (not Medicaid)
✓		10. Other government program
✓		11. Other

Notes: We classify types of insurance to two categories, private and public. Private insurances are those choices with a check mark on the left hand side, and public insurances are those choices with a check mark on the right hand side.

Table A8: Number of credits needed for disability benefits

Became Disabled at Age	Number of Credits You Need
Before age 24	Qualify if you have 6 credits earned in the 3-year period ending when your disbility starts
Age 24 to 31	Qualify if you have credit for working half the time between age 21 and the time you become disabled.
Age 31 to 42	Qualify if you have 20 credits
Age 43 to 61	Qualify if you have the number of credits that are equal to your age - 22
Age 62 or older	Qualify if you have 40 credits

Notes: