Preliminary
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The Welfare Implications of Increasing DI Benefit Generosity*

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Abstract

The empirical literature on DI has primarily focused on the impact of program parameters on caseload growth or reduced labor force attachment. The focus on the efficiency costs of DI provides a misleading view of the social desirability of the program itself and of the adequacy of benefit levels. In order to provide a more comprehensive view, we develop a framework that allows us to simulate the benefits as well as the costs associated with a marginal increase in benefit generosity using a representative cross-sectional sample of the population. Using the 1991 March CPS, we estimate the total cost of providing an additional $1 of income to current DI recipients to be $1.38. While the load factor due to moral hazard is fairly high, we demonstrate that it is moderate enough that representative workers should be willing to "buy" additional insurance through reduced take-home pay at this price. The reform looks less attractive, however, once the financial benefits and costs are distributed across individuals in the sample. First, the average implicit price of an additional dollar of insurance is actually much higher than 1.38 for all but the least educated category of workers due to the redistributive nature of the program. We predict that the reform leads to a net welfare loss for these more highly educated groups, regardless of the level of risk aversion. Second, despite an average implicit price of less than $1, the expected utility gain also turns negative for high school dropouts under high levels of risk aversion. This counterintuitive finding arises since the utility calculation weights low income individuals more heavily as risk aversion increases and individuals with income below the floor provided to current DI recipients help to finance the benefit increase.

1. Introduction

Disability status is increasingly used as a means for targeting resources in the United States. In 1999, 5.6 million disabled individuals and 1.6 million spouses and dependent children received Disability Insurance (DI) benefits for a total outlay of $4.2 billion, representing over one-eighth of the Social Security budget for benefit payments. Given its importance and continuing growth, an evaluation of whether the DI program provides adequate insurance against the income losses associated with the onset of severe limitations is overdue. In this paper, we address this issue by evaluating the welfare implications of marginal changes in the level of benefit generosity.

The empirical literature on DI has primarily focused on the impact of program parameters on the direct and indirect costs of the program either in terms of caseload growth or reduced labor force attachment. The focus on the efficiency costs of DI provides a misleading view of the social desirability of the program itself and of the adequacy of benefit levels. The effectiveness of the program depends on how the costs relate to the social benefits. What is striking is that there has not been any explicit valuation of the benefits associated with providing DI.

A literature on the economic disadvantage of the disabled, particularly the "doubly disabled" who are black, women, or have low levels of education does exist (e.g., Haveman and Wolfe, 1990; Burkhauser, Haveman, and Wolfe, 1993). This research also shows that publicly provided transfers are an increasingly important source of income for people with disabilities. However, these descriptive facts do not adequately capture the value of disability insurance for potential beneficiaries. This value depends on answers to counterfactual questions about what the income and work effort (leisure) of disabled individuals would be in the absence of DI or under different DI regimes.

In order to provide a more comprehensive view, we account for the benefits as well as the costs associated with a marginal change in benefit generosity in our analysis. Like other social insurance programs, the social value of DI derives from its dual role as a program that redistributes resources across individuals as well as insures individuals against adverse events. Thus, for example, DI redistributes from the more to the less well educated both because benefits are relatively more generous for lower earners (replacement rates are higher) and because the less well educated are substantially more likely to become DI beneficiaries. At the same time, for both the well and less well educated, DI acts as publicly provided insurance against the reduction in earnings capacity associated with the onset of disability. While both the redistributive and the insurance aspects of DI confer social benefits, we would ideally like to separate the insurance from the redistributive value because it is easier to provide a rigorous justification for mandatory insurance than for redistributive transfers.[1] Our analysis highlights the degree to which the two aspects are entangled within the DI program.

From an individual worker's perspective, the insurance value of expanding disability insurance is based on the expected change in lifetime utility. This expectation depends on the impact on the path of family income and work effort both in the case where the worker becomes disabled and applies for DI and in the case where the worker never applies, and on the likelihood of each of these outcomes. Our approach is based on the intuition that if the population is in steady state, a representative sample of individuals can be thought of as capturing the distribution of these potential life-cycle paths for a representative individual. Using observed earnings patterns, we can simulate the impact of increasing DI benefits on family income for current recipients, potential new applicants, and workers in the sample. Combining the 1991 March Current Population Survey (CPS) with plausible assumptions about behavioral responses, we calculate the expected financial benefits accruing to and financial costs borne by each individual in the sample given a one percent increase in DI benefit generosity.[2]

We then first aggregate the financial benefits and costs across the population to calculate the average implicit price of providing an additional dollar of DI benefits. The total costs include both the direct costs of providing increased benefits to current beneficiaries and the indirect tax and transfer costs associated with the behavioral responses of individuals induced to apply. The ratio of total costs to direct benefit payments provides an estimate of the average degree of actuarial unfairness in this insurance market. The amount by which this ratio exceeds one reflects the load factor that can be attributed to moral hazard. We estimate that overall it costs $1.38 in order to provide $1 of increased benefits to current beneficiaries. Based on assumptions about the marginal value of income for representative workers, we find that purchasing additional insurance through reduced take-home pay should generally be individually attractive despite the fairly high load factor.

[1] Much of the theoretical work relies on static one-period models, with variation across individuals in the degree to which they suffer a disability (modeled as the disutility of work). Productivity differences across individuals are assumed away. In this context the equity/insurance distinction disappears since everyone is identical.

[2] Gruber's (1996) attempt to calculate the welfare implications of increases in disability insurance payments following a reform in Canada foreshadows our analysis. His back-of-the-envelope calculations quantify the net utility benefits to current beneficiaries, marginal applicants, and workers of the discrete change in benefit generosity.

We also calculate the ratio of benefits to costs for identifiable subgroups in order to illustrate variation in the implicit price that arises from the redistributive nature of the DI program. Because of the way that benefits and costs are distributed across individuals in the sample, the average implicit price increases dramatically with the level of education. The average price ranges from $0.27 for high school dropouts to $7.04 for individuals with a college degree.

We next postulate a utilitarian social welfare function in order to value the expected changes in incomes. The sign of the sum of the change in utility across all individuals answers whether a representative individual would favor a benefit increase without knowing his own but knowing the social distribution of disability and life-cycle earnings. From this perspective of the "veil of ignorance" (Buchanan and Tullock, 1962; Oates, 1972; Rawls, 1972), redistribution and insurance are not separate concepts. The sum can also be thought of as simply describing whether or not individuals benefit on average, where the average is a weighted average which puts more weight on changes in income for individuals at the low end of the income distribution. As we do above, we disaggregate this analysis by broad education categories to explore to what extent high and low income subgroups gain or lose.

Given our assumptions about the form of utility, the reform is consistently predicted to reduce net social welfare regardless of the level of risk aversion. While this also holds among more highly educated subgroups, individuals with less than a high school degree are predicted to witness utility gains for modest levels of risk aversion. Counterintuitive to the expectation that increased insurance provides greater benefits the more risk averse individuals are, the net benefit to these individuals turns negative at higher levels of risk aversion. The explanation is that at higher levels of risk aversion individuals who have income below that of current DI beneficiaries and who are taxed to finance the program are weighted more heavily. Therefore, while redistribution across broad education categories combined with moderate moral hazard costs lead to a favorable price of additional insurance for the less educated, implicit redistribution among the less educated (or across states of the world for less educated individuals) means that the reform is not expected to be always welfare enhancing even for these individuals.

The remainder of the paper proceeds as follows. The next section provides background on DI and develops the conceptual framework we use to evaluate the welfare impact of increasing DI benefit generosity. Section 3 describes the implementation using the 1991 March CPS and additional details on the assumptions that we make. Section 4 presents and discusses the results, and Section 5 concludes.

2. Background and Conceptual Framework

DI is currently the most important disability program in terms of its scope and the magnitude of expenditures involved. The program provides benefits to disabled workers (and their spouses and children) in amounts related to the disabled worker's former earnings in covered employment. DI benefit payments are calculated in essentially the same way as are retirement benefits. Monthly benefits rise as a function of past earnings, but less than proportionately. Funding is provided through a Social Security payroll tax, a portion of which is allocated to the separate DI trust fund.

To be eligible for DI benefits, a worker must have worked a sufficient number of quarters in Social Security covered employment.[3] In addition, he or she must not be gainfully employed and must pass a medical screening. The determination of whether an applicant meets the medical requirements for disability involves a sequential process under which about half are turned down. Generally, the worker must be found incapable of gainful employment, taking into account age, education and work experience. The person must be disabled for a five-month waiting period before he or she can receive benefits. Given continuing restrictions on work, the vast majority of recipients refrain from working at all. Successful applicants can expect to continue to receive benefits for the remainder of their lives. At the age of 65, beneficiaries are transferred from the DI to the retirement program, but with no change in benefits.

The fact that DI is targeted to eligible workers distinguishes DI from the second most prominent disability program—Supplemental Security Income (SSI). While DI is essentially an early retirement program, SSI is a means-tested program providing benefits to needy disabled and blind as well as needy aged individuals regardless of work history. The two programs serve quite different populations. The typical DI beneficiary tends to be older and is less likely to be female, a high school graduate, or white than is a typical member of the working aged population. The typical SSI recipient tends to be

[3] Roughly speaking, an individual has to have worked in covered employment for 5 of the 10 years prior to the point in time the worker becomes disabled.

somewhat younger than the DI population and is even less well educated and more likely to be female. We focus our attention on the DI program because it functions more directly as an insurance program.

The experiment that we consider is a 1% increase in DI benefits. Our task of determining whether representative individuals would benefit from this increase is greatly simplified by steady state assumptions. We assume that the overall population and the fraction receiving DI are not growing, that the age distributions of both the overall population and of DI recipients are not changing, and that there is no productivity growth. Given these strong steady state assumptions, we can measure the costs and benefits from a random sample of the population.

Imagine that the 1% increase in benefits induces an x% increase in awards that is neutral with respect to age groups. In the new steady state, the age distribution of those on DI would be the same as before, but the overall size of the DI population would be x% larger. Consider the difficulties that arise with valuing even the direct benefits. The direct benefits are the increases in income for those already on DI. Individuals who enter the program when they are 35 will continue to receive benefits from then on. We would, therefore, need to project benefits forward to determine the full cost. However, as long as the population is in steady state, each individual observed in the cross-section can be conceptualized as depicting the circumstances at one age within a possible life cycle path for an individual (See Figure 1). Then, benefits to 45-year olds on the program today can be thought of as picking up future benefits to 35-year olds. While DI transfers resources from younger to older individuals and from able-bodied to disabled individuals in the cross-section, from this alternative perspective DI transfers resources from earlier to later years and across different states of the world. If the cross-sectional distribution captures the full distribution of potential life-cycle paths, then the net benefits to the random sample measure the average life-cycle incidence.

Adopting the above steady-state framework, we use observed earnings patterns to simulate the impact of increasing DI benefits on family income for current beneficiaries, potential new applicants, and workers. The pattern of changes in family income depends on the distribution of direct and indirect benefits and costs. While the direct benefits accrue to those already on DI through the increase in transfer income, indirect benefits accrue to the individuals induced to apply for DI benefits. However, since these individuals are at the margin, revealed preference suggests that they will gain relatively little from the increase.[4] In our calculations, we ignore these gains. Thus, there are no indirect benefits to measure.

The costs include both the direct costs of financing the increase for current beneficiaries and the costs associated with the behavioral responses of these and other individuals to the benefit increase. We focus on the indirect costs that have been emphasized in the prior literature—those associated with new applications. The magnitude of these indirect costs will depend on how many more individuals apply for DI and how many of these new applicants pass the medical screening. Further, changes in the income and labor supply of successful and unsuccessful applicants and their families may lead to increased participation in other transfer programs as well as lower income tax payments. Workers not only have to pay for the DI benefit payments to new successful applicants, but must also pay for the higher public transfers and reduced tax revenue associated with successful and unsuccessful applications.

We rely on evidence from prior literature to predict how many new applicants and beneficiaries will result from the policy reform. Estimates of the elasticity of applications with respect to benefit generosity vary considerably (Bound and Burkhauser, 1999), however plausible bounds exist. The estimates we find the most credible are based on time series evidence from the 1960s and 1970s, a period of time when replacement ratios rose appreciably (Halpern, 1979; Lando, Coate and Kraus, 1979). These estimates suggest elasticities in the neighborhood of 0.5. Thus, our baseline assumption is that a 1% increase in benefits leads to a 0.5% increase in applications. To link the application elasticity to the size of the current pool of recipients, we assume that half of applicants are accepted.[5] The steady state number of applicants is then twice as large as the recipiency base and the elasticity of beneficiaries with respect to benefits is the same as the application elasticity. We describe in the next section how we identify these new unsuccessful and successful applicants in our sample.

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[4] For applicants truly at the margin it is reasonable to think they gain nothing from a marginal increase in benefits. Think of the demand curve for DI benefits. As the cost of applying goes down, more and more individuals apply for benefits, with the demand for benefits curve tracing out the distribution of individuals' willingness to pay. As long as the aggregate demand curve for benefits is smooth and continuous, the marginal applicant will be indifferent between applying and not applying.

[5] Historically, roughly half of those who apply for DI are awarded benefits (Bound and Burkhauser, 1999). It seems likely that those induced to apply by an increase in benefits would tend to be less severely impaired than the typical applicant. In this case, they would be less likely to pass the screening. Since unsuccessful applicants cost less in terms of taxes and transfers than do successful applicants, our assumption should lead to an overestimate of the

We make extreme assumptions about the behavioral responses of marginal applicants and their families to determine indirect costs other than benefit payments to new successful applicants. Marginal applicants, whether successful or unsuccessful, are assumed to permanently withdraw from the labor force. Other family members' labor supply is assumed to remain unchanged. Changes in federal and state income tax payments can then be calculated mechanically from the predicted changes in income. We also calculate changes in eligibility for AFDC and food stamps following both successful and unsuccessful applications, using actual take-up pre-reform and assuming 100% take-up following the reform. Our assumptions, such as complete withdrawal from the labor force, no family adjustments, and 100% take-up of benefits are intended to err on the side of overstating the indirect costs associated with application.[6]

By considering only the indirect costs associated with the labor supply of marginal applicants, we ignore several classes of behavioral responses—some of which we expect to have a negligible impact on our calculation and others that are potentially important but about which we can do little. First, we ignore responses of current beneficiaries and their families to the lump sum increase in income following the reform. Own labor supply would have little room to respond given the restriction on gainful work imposed by DI, though family labor supply responses could potentially be sizeable (Cullen and Gruber, 2000). Second, we ignore the deadweight burden associated with raising taxes to pay for the increased benefits. Empirical evidence (Gruber, 1994; Anderson and Meyer, 1995) suggests that payroll taxes that support programs that are restricted to workers are essentially benefit taxes so that the deadweight burden of the tax increase will be negligible. However, as we demonstrate, DI is far from a pure benefit tax since it involves substantial redistribution across worker types. Though we ignore the deadweight burden in our calculations, scaling the tax costs upward according to high-end estimates of deadweight loss provides bounds on the importance of this omission.

Finally, we ignore a variety of general equilibrium responses to changes in DI benefit generosity,

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costs of a benefit increase.

[6] DI beneficiaries are eligible for Medicare after two years on the program. We ignore the associated costs since valuing medical insurance for marginal applicants would require valuing medical insurance for the working population as well in order to determine baseline utility. The insurance value would not be the mean dollar value of benefits but the insurance value, which would add substantial complications. For reference, however, average Medicare payments per DI beneficiary in 1996 were $4741. Given the rate of growth in overall Medicare expenditures, the average payment would have been approximately $2892 in 1990.

such as changes in savings or marriage rates or participation in private disability insurance programs. We suspect that none of these effects is likely to be large. The occurrence of a long-term disability during a person's working years is a relatively rare event, but is likely to represent a reasonably permanent state. Because of this, schemes such as saving or marrying to self-insure against that eventuality are not very effective, and are therefore unlikely to be heavily used and unlikely to respond to changes in benefit levels. Moreover, applicants for DI typically have little savings and are typically not covered by any type of private disability program, leaving little room for crowd-out along these margins.[7]

Given our estimates of the direct and indirect costs, how these costs are distributed across workers determines the incidence of the policy change and, implicitly, the degree of actuarial unfairness associated with marginal changes to DI benefit generosity. We distribute the costs according to current funding patterns. That is, the direct costs of additional DI benefit payments are shared across workers in proportion to earnings below the Social Security maximum. Net tax costs due to lost tax revenue and other transfers are distributed according to workers' shares of federal and state income taxes paid. In this case, a representative worker's view of the desirability of increasing DI generosity from the perspective of own expected outcomes includes the effect of the progressivity of DI replacement rates and of the tax code on the worker's relative share of these new costs.[8]

Once the benefits and costs are allocated across the observed population, we can calculate whether representative individuals would benefit from the reform. In order to determine whether a representative individual would be willing to purchase additional insurance given the degree of actuarial unfairness, we first estimate the total cost of transferring an additional $1 to current DI recipients. The average implicit price of insurance is equal to the ratio of total direct and indirect costs to total direct benefit payments. Note that this price differs from one only to the extent that behavioral distortions are

[7] Our calculations from the March 1991 CPS suggest that 0.4% of all individuals report receiving private disability insurance. Among working aged individuals who report a limitation that prevents them from working, 6.7% report receiving private disability insurance.

[8] While the above method of distributing costs is the most immediately policy-relevant approach, a second method would instead distribute the net costs across workers in proportion to expected net benefits. Expected net benefits would be based on a worker's age-adjusted position in the earnings distribution and would require information on the pre-application position of DI applicants. This would have the advantage of more effectively isolating the insurance value of increased benefit generosity because the degree to which the policy change is actuarially unfair (e.g. expected financial payments exceed expected benefit receipts) reflects only the relative magnitude of the costs arising

important, reflecting the impact that moral hazard has on the cost of insurance.[9] When the price is calculated for specific education categories, as the ratio of costs borne by the group to benefits received by the group, the price reflects the additional impact of redistribution on the degree of actuarial unfairness.

In order to determine willingness to "buy" more insurance at these prices, we need to determine the relative value of income to an individual across able-bodied and disabled states of the world. We assume a utility function that exhibits constant relative risk aversion, and is separable in consumption and leisure:

(1) $U(c) = c^{1-\theta}/(1-\theta) - f(H)$,

where H represents hours worked and θ is the coefficient of relative risk aversion. Given this utility function, the marginal utility of income is $c^{-\theta}$. The relative value of $1 across the two states of the world can be expressed as $(c_d/c_{nd})^{-\theta}$, where c_d represents consumption when disabled and c_{nd} represents consumption when able-bodied. We rely on outside studies to approximate the relative consumption levels. Then, we compare willingness to pay calculated at varying levels of risk aversion to the relevant implicit price of insurance.

We then add additional structure to analyze the welfare implications of increasing DI benefit generosity from a different angle. For this approach, we estimate the impact of changes in patterns of income before and after the regime change on utility. The price, or degree to which the increased insurance is actuarially fair, is folded into the analysis since the predicted shifts in family income absorb the tax increases due to direct and indirect financial costs. We assume that utility takes the same form as described above. Given our assumptions, we focus on the financial component. The only changes in leisure that we consider are among families of marginal applicants, whom we assume have no net change in utility since these families are just on the margin.[10] Our goal is to assign a utility value to the changes in income.

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from moral hazard.

[9] The theoretical literature on disability insurance has been explicit about viewing disability insurance as a form of mandatory income insurance where benefit generosity is limited by moral hazard (e.g. Diamond and Sheshinski, 1995).

[10] For the benefit to marginal applicants to be equal to zero requires additional assumptions on the distribution of preferences across individuals such that the "demand" for applying to DI is smooth in the level of benefit generosity. To the extent this does not hold, we ignore a non-zero gain to this group and thus underestimate the benefits associated with increasing DI benefit generosity.

First, we identify the changes in income experienced by each of four different family types: families with a current beneficiary (b), with a successful applicant (s), with an unsuccessful applicant (u), and with only able-bodied individuals (w). The changes in income are calculated as follows:

Family Type:	Change in Income:
Current beneficiary	$\Delta y^b = .01{*}b^b - t^b$
Successful applicant	$\Delta y^s = -\, y_{0a}{}^s + \Delta T^s + b^s - t^s$
Unsuccessful Applicant	$\Delta y^u = -\, y_{0a}{}^u + \Delta T^u - t^u$
Able-bodied	$\Delta y_1{}^w = -\, t^w$

Families of current beneficiaries witness a 1% increase in benefits (b) and pay a share of the direct and indirect costs (t). Families of successful applicants lose earnings of the applicant (y_{0a}), are eligible for a different amount of non-DI transfers (T), receive DI payments (b), and pay their share of direct and indirect costs. Families of unsuccessful applicants experience the same sources of changes in income, except they do not receive DI benefits. Finally, families with all able-bodied individuals simply pay their share of the costs of the reform.

In order to value these changes in income across individuals, we need to translate family income into individual consumption. One alternative is to simply proxy for consumption using per capita family income. However, there is evidence that families are capable of buffering themselves against short-term fluctuations in income. Therefore, we also use an alternative proxy to account explicitly for divergence between income and consumption due to saving. We use data from the Consumer Expenditure Survey (CEX) to calculate the relationship between concurrent family income and consumption, and then adjust family income accordingly.[11] In addition, in both the case where family income is adjusted and unadjusted, we calculate individual-level measures using a per capita equivalency in addition to a strict per capita measure. Family income is divided by a factor that accounts for both differences in consumption between children and adults and economies of scale.[12]

The estimated changes in consumption are then fed through the utility function and summed over

[11] We estimate the following relationship using individuals in the CEX in 1990: ln(family consumption) = 5.12 + .483 × ln(after-tax family income bounded below by \$1) + 5.17 × (indicator for after-tax family income less than \$1). We then adjust smoothed family income by a factor to ensure that aggregate income remains constant.

[12] We use the adjustment factor suggested by the National Research Council: $(N_a + .8{*}N_c) \times .7$, where N_a is the number of adults and N_c is the number of children.

individuals to determine the net welfare impact. Again, the change in utility is set to 0 for individuals in families with a member that is induced to apply on the margin. The sum of the net benefits to individuals determines the social value of increasing net benefits. The same calculation for workers with given characteristics determines the value of the policy change to subsets of individuals. Estimates of the utility gain from reducing the potential income loss from the onset of disability depend on the level of risk aversion. We present results both low and high levels of risk aversion in order to test the sensitivity our findings.

Though determining the welfare impact of a marginal change in policy is apparently an easier task than determining optimal policy design, there are extensive calculations involved. The specific implementation in the CPS of the methodology outlined above is described in the next section.

3. Implementation

The random sample of the population that serves as the basis for our analysis comes from the March 1991 Current Population Survey (with income data for calendar year 1990). We take both the size of the disability population and the implementation of the program (e.g. screening stringency) as given when evaluating the desirability of increasing benefit generosity. [13] Our sample consists of 158,318 individuals residing in 73,638 tax-filing units.[14]

An issue immediately arises with our assumption that the population is in steady state. The hump-shaped distribution we observe in the CPS is not consistent with a feasible steady state (See Figure 2). That is, the fraction of the population that falls within each age category has to be monotonically declining, or at least non-increasing. We plan to re-weight our sample assuming constant fertility and mortality rates to approximate a feasible steady state distribution.

Identifying Recipients and Potential Applicants

Among the families in the CPS, we identify three categories that will be treated differently in the calculations: families with current DI beneficiaries, with potential applicants, and families with neither. In

[13] 1990 predates the recent surge in program growth. See Stapleton et al (1998) for a discussion of the various factors behind this recent growth.

[14] Our definition of tax-filing units essentially matches the CPS definitions of subfamilies, except that adult unmarried children residing with their parents are considered to be their own tax-filing units.

order to identify DI beneficiaries and potential applicants, a further distinction is made between "working aged" (aged 21-61) and "elderly" (aged 62 and older) individuals. While it is clear that both beneficiaries and applicants should be found among the working aged population, understanding why both are among the elderly requires explanation. Recall that our conceptual framework views an elderly person as the aged version of a working aged individual. Therefore, following the reform, the status of a 75-year old individual may change if the individual either received DI benefits or was induced to apply for DI at an earlier age. In order to simulate the full impact of the reform, we need to identify which elderly individuals would have been DI beneficiaries and applicants in their working years. We refer to such individuals as elderly DI beneficiaries or marginal applicants, though technically they are elderly individuals who had fit into these categories at younger ages.

Since the CPS does not explicitly identify which individuals are DI recipients, we first need to impute DI beneficiary status. This is fairly straightforward for the working aged population. The CPS includes self-reports of whether or not an individual has a condition that limits his/her ability to work. In addition, it includes information on individual receipt of Social Security income. We assume that individuals aged 21 to 61 who report having a limitation and receive Social Security benefits are receiving those benefits on the basis of their disability. This imputation appears to be fairly accurate, capturing over 96% of the number of recipients reported in the Social Security Bulletin administrative data for 1990.[15] Table 1 summarizes the characteristics of DI beneficiaries relative to working aged individuals for both males and females. For both men and women, DI beneficiaries are over 50% more likely to be black than other working aged individuals. They also tend to be older and less highly educated. These types of demographic differences drive the redistribution within the DI program.

The process of identifying current beneficiaries is more difficult for individuals over the age of 61. We would like to identify those who were receiving DI benefits during their working years, before the disability and retirement programs merge. However, for those over 61, it is impossible to distinguish Social Security Disability Income from Social Security retirement income. This is further complicated by the fact that self-reported disability rates increase with age. Rather than identify a subset of elderly individuals as DI beneficiaries with certainty, we impute the probability that each elderly individual would

[15] The Social Security Bulletin documents 2,479,270 worker beneficiaries between the ages of 21 and 61 in 1990. Weighting the count of imputed beneficiaries by the CPS person weight yields an estimate of 2,387,258 worker

have been a DI beneficiary by assuming that elderly DI beneficiaries are similar to the older working aged beneficiaries already identified.

In order to calculate this probability, we first relate whether individuals aged 51-61 are worker beneficiaries to their individual characteristics, using a logit specification run separately by gender. Results from these regressions can be found in Appendix Table A1. We then use the coefficients from this regression to predict the probability that individuals aged 62 and over are DI recipients, calculated by setting their age to 61. Then, any individual who does not report Social Security income is assumed to have a zero probability of DI receipt.[16] Assuming similar mortality rates across disabled and non-disabled individuals, the probabilities are rescaled proportionately so that the fraction of the population imputed to be DI recipients at any age over 61 is the same as the fraction at age 61 (7.6% for males and 6.5% for females).[17] Of the 22,966 individuals in our sample over the age of 61, 14,842 are assigned a non-zero probability of being a DI beneficiary. Summary statistics for the elderly population as a whole and for imputed beneficiaries are found in Table 2.

Once we have identified current DI beneficiaries, the next step is to identify those who would be marginal applicants under the new regime. To this end, we have had to rely on extreme assumptions about who would be induced to apply. Among working aged individuals, we assume that the pool of potential applicants consists of all persons who self-report having disability-related work limitations but who are not identified as current DI beneficiaries.[18] The last column for both men and women in Table 1 presents summary statistics for these individuals. Among elderly individuals, we assume that the pool of potential applicants is the same as the pool of individuals imputed to have a non-zero probability of having been DI beneficiaries.

Following the regime change, each potential applicant may follow one of three paths. They may

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beneficiaries.

[16] If a family has more than one elderly individual, we assume that only the individual with the highest predicted probability has a non-zero probability of being a DI recipient. We assign the probability that either is a DI recipient to this individual.

[17] In fact, mortality rates among DI beneficiaries tend to be higher than mortality rates among the newly retired. Thus, our assumption is likely to exaggerate the fraction of the elderly who would have been DI recipients. Calculations we have done using existing estimates of the mortality rate among DI beneficiaries suggests the magnitude of this effect is small.

[18] We exclude limited individuals who report receipt of Supplemental Security Income since these individuals would have had to have passed the same screening used for DI recipients and must have been determined to be ineligible for DI due to inadequate work history. While true in general, this ignores the possibility that some SSI recipients are

choose not to apply for DI, they may apply and be accepted to the program, or they may apply but be rejected. Each of these scenarios involves different indirect costs associated with changes in benefit outlays, labor supply, transfers, and tax payments. Rather than attribute a specific path to each individual within the potential applicant pool, we assign individuals a probability of each of these three outcomes.

In order to predict the likelihood of each of these three scenarios for working aged limited individuals, we first simulate the likelihood that each non-beneficiary would be induced to apply for DI benefits given estimates of the elasticity of application and awards with respect to benefit generosity from the literature. The simplest way to calculate the likelihood that any given limited individual applies would be to assume that each potential applicant is equally likely to apply. Our assumption that one-half of applicants are successful implies that the size of the applicant pool is twice the size of the pool of current beneficiaries. With the additional assumption that the elasticity of applications with respect to benefits is .5, the probability that a given limited individual applies in response to a 1% increase in benefits is $.01 \times .5 \times (2 \times D)/L$, where D is the number of current beneficiaries and L is the number of limited non-beneficiaries.

However, it is unlikely that each limited person is equally likely to apply. To account for individual differences in this proclivity for working aged individuals, we adjust the above probability using information on the likelihood that limited individuals with differing observable characteristics are on DI. The results of logit regressions predicting DI receipt among limited individuals separately by gender are reported in Appendix Table A2. The predicted probability that any given individual applies is as shown above, weighted by a term that is equal to that individual's predicted likelihood of being on DI relative to the average probability among the limited non-recipient population. While the resulting estimates of the probability of applying are more realistic, they rely on the assumption that marginal applicants are observably similar to current recipients.

For elderly individuals, the probability of applying is derived directly from the imputed likelihood that the individual is a current DI beneficiary. We scale the probability that an elderly individual is a current DI beneficiary by $.01 \times .5 \times 2$ to take into account the magnitude of the benefit increase, the application elasticity, and the likelihood of acceptance.

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in the process of applying for DI.

With estimates of the likelihood that an individual is induced to apply on hand, we derive the likelihood of each outcome for a potential applicant. If we define the probability that an applicant applies as a_i, then, given our assumption that half are accepted, the probabilities of applying and being accepted and of applying and being rejected are both equal to $.5\times a_i$. The likelihood of not applying is simply $(1-a_i)$.

Our final category of individuals are those who are not limited.[19] These individuals are affected only indirectly by the reform.

Calculating Direct and Indirect Costs and Benefits

The increase in DI benefit generosity involves a set of direct and indirect costs. The direct costs result from the increased benefits paid to current beneficiaries. Indirect benefit costs are generated by the payment of benefits to those individuals who were induced to apply by the policy change and were successful. Another set of indirect costs is generated by the labor supply responses from those induced to apply. Applicants who reduce their labor supply pay fewer federal and state income taxes and receive a differential level of public transfers.

The direct costs are calculated by scaling family benefits for current working aged and elderly DI beneficiaries to reflect the 1% increase in benefit generosity. We first impute family benefits for both worker and elderly beneficiaries. Since all of the working aged beneficiaries in our sample receive DI benefits on their own account (that is, due to their own disability and work history), we impute family benefits for our working aged beneficiaries based on the reported level of worker benefits and the rules followed by the Social Security system. The baseline level of worker benefits associated with the working aged population is estimated by our methodology to total $13.8 billion, as compared with the value of $17.3 billion determined from the administrative data reported by the Social Security Bulletin. To fully account for the costs associated with the benefit increase despite apparent underreporting of DI benefits in the CPS, we scale all reported SS benefits by a factor of 1.25.[20] The 1% increase,

[19] We assume that those who do not report a limitation in the baseline are not in the pool of potential applicants. This ignores the possibility that self-reported disability might respond to changes in the parameters of DI. Previous work has suggested that the fraction of the working aged population identifying themselves as unable to work is quite sensitive to the availability and generosity of disability benefits, but that the fraction identifying themselves as in some way limited in their capacity for work is much less sensitive to such factors (Waidmann et al, 1995).

[20] The undercount of Social Security benefits in the CPS appears to affect all age levels. An equivalent scaling factor

therefore, generates direct benefits costs among working aged individuals of $191.0 million.

For the elderly, all of the individuals assigned some positive probability of being a DI beneficiary report receiving Social Security income. However, in the scenario under which these individuals are treated as having been worker beneficiaries, an increase in DI benefit generosity will only affect family income if these individuals are receiving benefits due to their own work history. If the individual currently receives a Social Security benefit amount determined by a retired or deceased spouse's benefit eligibility, the reform will have no impact on benefit payments.

To identify which are receiving Social Security on their own account, we first group elderly beneficiaries into two subsets: those in families with only one elderly Social Security recipient and those in families with more than one. Among those in families with only one (70% of elderly beneficiaries), we assume that female elderly beneficiaries receive benefits on their own account only if they were never married, or if they are currently married to a man reporting no Social Security income. We assume that male beneficiaries in families with only one recipient are all receiving benefits on their own account. For the 30 percent of elderly beneficiaries in families with two Social Security recipients, we look at the ratio of their own benefits to the highest benefit level within the family. We assume that they are receiving benefits on their own account if this ratio is greater than 0.5, since spouses are eligible for the maximum of the benefit amount determined based on their own work history and half of their spouse's benefit payment. Then, we impute family DI benefits for those who receive benefits on their own account based on their reported Social Security benefits.[21] The direct benefit costs for elderly beneficiaries are equal to 1% of current family DI benefits multiplied by the probability the individual had been a working aged recipient. Total costs of increased benefits paid to elderly beneficiaries are estimated to be $135.9 million.

The indirect benefit costs of the regime change are new benefits paid to individuals who are induced to apply for benefits and are successful. Ideally we would like to measure the Social Security

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derived for the population aged 62 and over is equal to 1.21. Due to the similarity of the implied scaling factors, we apply the working aged scaling factor to all Social Security benefits for consistency.

[21] For those elderly who were awarded DI benefits, the DI benefit formula is used to calculate their benefit level instead of the retirement formula. However, without detailed work histories for these individuals, we are unable to use these formulas to calculate a true level of benefits under each program. Instead, we assume both DI and retirement benefits to be equal to reported Social Security benefits for those determined to be receiving benefits on their own account.

benefits to which a given individual would be entitled based on their work history. However, since the CPS does not include earnings histories, we instead predict the benefits that working aged potential applicants would receive if successful by returning to our sample of current working aged DI beneficiaries. We regress their actual log benefits on their individual characteristics (by gender; results from these regressions can be found in the Appendix Table A3), then use the resulting coefficients to predict individual benefits for our marginal applicants. For elderly potential beneficiaries, we simply use their reported Social Security income. We ignore changes in benefit payments that would result from altered work histories. We then calculate family benefits from individual level benefits, again using the program eligibility rules. The total simulated indirect benefit cost is $89.7 million, which is about one-fourth as large as the total direct benefit cost.[22]

Next, we estimate the additional indirect tax and transfer costs associated with the increase in income for current recipients and behavioral changes resulting from inducing individuals to apply for DI. As described in the previous section, we assume no own or spousal labor supply responses and no changes in private or public transfers for current beneficiaries. The net income tax cost for this group is negative since higher DI benefits mean that they owe more taxes. We determine the net tax savings by first using actual family non-DI income and DI benefits to calculate baseline federal and state income taxes owed, and then recalculating taxes owed adding the increase in family benefits. We rely on the National Bureau of Economic Research's TAXSIM program for this and all following income tax calculations.

Among marginal applicants, we allow own labor supply to change and account for changes in public transfers and taxes based on the corresponding changes in family income. As described in the previous section, we make the extreme assumption that both accepted and rejected marginal DI applicants stop working and never work again. We consider changes in two transfer programs—AFDC and food stamps. Under the scenario where applicants are rejected, we remove the individual's wage and salary and self-employment earnings. We then use the new income to calculate AFDC and food

[22] As a plausibility test, we compare the indirect benefit cost for working aged individuals to an alternative crude calculation. Indirect benefit costs should be approximately equal to total benefits paid to current working aged beneficiaries multiplied by .05 (the 1% benefit increase times the application elasticity). The ratio between the amount resulting from the more involved calculation detailed in the text and this amount is 0.94.

stamp benefit levels, assuming 100% take-up rates.[23] The change in transfer payments is calculated as the difference between baseline amounts and the imputed post-reform amounts. The 100% take-up assumption for both programs post-reform is likely to lead to overstatements of the indirect transfer costs associated with unsuccessful applications. The indirect tax costs are the reduction in income tax payments associated with the change in family income.

The scenario where marginal applicants are accepted is similar, except that we add predicted family DI benefits to family income. We again calculate the new level of public transfers to which the family is entitled and use the new family income calculate the federal and state tax implications.

The costs associated with the behavioral responses of the potential marginal applicants depend on how likely successful and unsuccessful applications are. As a result, the *expected* cost of the increase in benefit generosity due to the marginal applicants is based on the predicted likelihood of being in a given scenario. We weight the costs for the respective scenarios by the probability that the marginal applicant applies and is rejected ($.5 \times a_i$) and is accepted ($.5 \times a_i$). These total expected indirect costs of the reform are summarized along with the total direct and indirect costs in Table 3. The total state and federal tax costs are $30.2 million. We actually predict savings on AFDC benefit payments, since few marginal applicants receive AFDC in the base case, few become eligible as unsuccessful applicants, and most become ineligible as successful applicants. Federal savings and state savings are each less than 0.1 million, with the shares to each level of government determined by the 1990 AFDC cost sharing formulas. The federal food stamp cost is sizeable at $5.0 million, driven by the 100% take-up assumption and less restrictive income limits for disabled individuals.

Distributing Costs to Determine Impact on Family Income

Once we have estimated the direct and indirect costs associated with the benefit increase, we distribute these costs to families in a way that attempts to mimic the current (as of 1990) financing of the relevant programs. Since the costs are based on the post-regime-change income, for probabilistic cases we distribute costs based on expected income. The direct and indirect costs associated with the increase in DI benefits paid are distributed to families in proportion to their share of earnings below the

[23] We attribute AFDC benefits only to eligible single parent families and ignore the AFDC-UP program, which represented only 5.3% of total AFDC caseloads in 1990.

Social Security cap ($51,300 per individual in 1990). The indirect tax and transfer costs due to the labor supply responses of the marginal applicants are distributed to families based on their shares of the federal and state income tax payments to capture both their share of the tax bases and tax code progressivity.

4. Results and Discussion

Back-of-the-envelope calculations of willingness-to-pay

Our calculations of total direct and indirect costs yield an estimate of the average degree of actuarial unfairness associated with the "purchase" of an additional dollar of DI benefits through reduced income for non-recipients. Figure 3 depicts visually the relative magnitude of direct and indirect costs. The ratio between the two is equal to 1.38. For every $1 of increased benefits to current recipients, an additional 38 cents is incurred in indirect costs. The only reason that this number differs from one is due to behavioral responses to the reform, or due to moral hazard. Given the focus in the empirical literature on these types of distortions, it is surprising that our estimates suggest that these distortions do not lead to a greater load factor.[24]

We use our estimate of the average implicit price to calculate whether individuals should be willing to pay for increased benefits. For example consider a typical working aged man with positive earnings, whose share of household earnings is 2/3 and average replacement rate is 0.5.[25] If we assume that when he becomes disabled, he loses his own earnings and they are replaced by DI benefits, the income drop suffered by the household when he moves to DI is 1/3. As discussed in the prior section, given a separable constant relative risk aversion utility function, the relative value of a dollar in the two states can be expressed by the ratio of income in the two states raised to the power of the negative relative risk aversion parameter. The relative value of $1 in the disabled state relative to the able-bodied state is $1.50, $2.25, and $5.07 for levels of risk aversion equal to 1, 2, and 4 respectively. The average working aged man would be willing to "buy" more insurance at a price of $1.38.

Consider the same calculation for the typical working aged woman who has positive wage and salary income. She contributes 1/3 of household income when working so that household income

[24] Remember, however, that this figure has not been scaled to account for deadweight loss incurred.
[25] These numbers are based on the CPS and from published data on Social Security benefits and average earnings.

would fall by 1/6 if the replacement rate is also 1/2. The relative value of $1 across a state where income is only five-sixths as high as another is equal to $1.2, $1.4, and $2.1 for levels of relative risk aversion of 1, 2, and 4. Because the fall in income is less severe, additional insurance only looks attractive at the individual level when risk aversion is moderately high.

Next, we consider a typical applicant. The typical applicant not only tends to earn less than the typical worker, but also tends to face higher replacement rates. Calculations using the SIPP imply that a typical male beneficiary will have household income of about 5/6 of the level experienced a year prior to the application for benefits. This matches the case for typical working aged women outlined above. For female applicants, household income appears to fall by about 12%. The relative value of $1 across the two states would be $1.14, $1.29, and $1.66 for our three levels of risk aversion. Again, the relatively small fall in income means that only relatively higher levels of risk aversion are associated with additional insurance being individually attractive.

Now, we consider the fact that different individuals must pay different prices for increased insurance given the redistribution within the program. Rather than relating overall direct costs to total costs, we consider how these costs are distributed across individuals with higher and lower levels of education. Table 4 shows the average share of costs borne by families according to years of education of the family head. The majority of costs are distributed in proportion to earnings under the payroll tax cap. The distribution of costs is highly progressive in terms dollar amounts, as the least-educated families pay $1.56 in direct and indirect costs and the most educated pay $6.35 on average through reduced take-home pay. However, the distribution of costs is much less progressive from the perspective of income shares, as shown in the fourth column in Table 4. Those with low levels of education, who are likely to have the highest marginal value of income, face income drops that are small in terms of dollars but large as a proportion of income.

Comparing these average costs to the expected benefits by level of education provides a crude sense of variation in actuarial unfairness. The expected increase in DI benefit receipts is much higher for less educated families due to a likelihood of receipt that is nearly eight times as great as for the most educated families. The benefit increase provides an additional dollar to these families at a price of only 27 cents. All other families pay more than one dollar, with the college-educated paying over $7. Applying these "prices" to the cases above suggests that only certain subgroups of workers would find increasing DI benefit generosity financially attractive.

Welfare analysis

In this section, we convert the changes in family income to changes in individual utility to evaluate the net welfare impact of the increase in DI benefits. Before converting the dollar values to utils, we first summarize the changes in family income in Table 5. The first three columns of Table 5 present average pre-reform income for individuals classified by family type. We identify three types of families: families with no DI beneficiary, families with a working aged DI beneficiary, and families with an elderly DI beneficiary. The six rows are based on three concepts of income: family income, per capita income, and adjusted per capita income. Each of these three measures are presented unadjusted and adjusted (smoothed) to account for the relationship between concurrent family income and consumption.

Baseline unadjusted family after-tax income is larger for individuals in families with no DI beneficiary ($30,844) than for those in families with either a worker beneficiary ($22,548) or an elderly beneficiary ($22,269). However, the gap narrows when family income is smoothed. The difference between families with and without beneficiaries becomes even smaller when income is expressed in per capita terms. In fact, the average income for individuals in families with an elderly DI beneficiary is larger than that for families with no limited individuals for three of the four per capita measures. The next three columns of Table 5 show the post-reform change in the various measures of income for individuals in the three types of families. As expected, individuals in families with no beneficiary face income losses while individuals in families with either a working aged or elderly beneficiary experience increases in income. The initial level of income and the change in income determine the measured impact on the financial component of utility for each individual.

Tables 6a and 6b show the average change in social welfare and the average change by family type for different levels of risk aversion and different measures of individual income. Recall that social welfare is calculated using a utility function that exhibits constant relative risk aversion of the form shown in equation (1), where θ is the coefficient of relative risk aversion. If individuals are risk neutral (θ equal to zero), utility is simply measured by individual income. Since our reform throws away 38 cents for every dollar transferred to beneficiaries, there must be a net loss in welfare under risk neutrality. What becomes clear from the results shown in Tables 6a and 6b is that the policy reform leads to a net welfare loss for most larger values of θ as well.

The pattern of net welfare impacts (as normalized by the relevant average pre-reform utility) across levels of risk aversion in Tables 6a and 6b is surprising. The net welfare loss at first shrinks and then becomes larger as the level of risk aversion increases. It appears that a representative individual from behind the "veil of ignorance" would be less willing to pay for higher disability benefits when very risk averse. This is counterintuitive since the insurance motive should become more important and we would expect the policy reform to become more attractive. However, the DI program combines insurance with substantial redistribution. The program redistributes from low, moderate, and high income populations toward a moderate income population. At the bottom end of the distribution, non-beneficiaries have lower baseline income than beneficiaries since they are not guaranteed an income floor like the one provided by DI benefits. As the level of risk aversion increases, this population is weighted disproportionately in the welfare calculation.

Table 7 shows how the net welfare impact varies for more and less well-educated individuals at different levels of risk aversion. These results again stress the redistributive component of the DI program. For all individuals with education of a high school diploma or greater, the policy change causes a loss in net welfare. For individuals with less than a high school diploma, there is a net welfare gain for all but the highest levels of risk aversion. Given the favorable implicit price of insurance found for this group in the last section, this finding merits explanation. While the price is favorable on average for individuals with low education due to low moral hazard costs and redistribution from the more highly educated, the gain turns negative at high levels of risk aversion due to redistribution from low to modest income individuals within the low education category.

5. Conclusion

This paper has developed two basic insights into the desirability of increasing DI benefits. First, indirect costs appear smaller than the emphasis in the prior empirical literature would lead one to believe. We estimate a ratio of total costs to direct costs of 1.38, suggesting that the implicit degree of actuarial unfairness due to moral hazard is not very substantial. Second, while the moral hazard costs appear to be relatively low, the implicit price of additional insurance can be quite large for some subgroups of the population due to redistribution. The implicit price of an additional dollar varies from less than $1 for individuals with less than a high school degree to more than $7 for individuals with a college degree. While the importance of redistribution across broad education categories has not been previously quantified, this pattern in implicit prices is not surprising given differences in the incidence of disability. What is less acknowledged is that an increase in benefits leads to transfers from low income individuals to individuals with more moderate income, such that these transfers lead to net welfare losses at high levels of risk aversion. These results highlight that DI treats the certifiably disabled as more "deserving" than able-bodied individuals who may be financially worse off. From an individual insurance perspective, a marginal increase in DI benefits is less attractive because of this potential redistribution to bad states of the world from worse states of the world.

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Table 1: Summary Statistics: Working-Aged Population (21-61 years)

	Males			Females		
	Non-Limited Individuals	DI Beneficiaries	Potential Applicants	Non-Limited Individuals	DI Beneficiaries	Potential Applicants
Black	.105	.174	.160	.122	.225	.151
American Indian	.005	.010	.010	.006	.015	.010
Asian	.028	.010	.018	.031	.013	.019
Hispanic	.086	.061	.095	.082	.058	.068
Age	37.9	46.3	43.1	38.2	48.4	42.5
	(10.9)	(10.9)	(11.2)	(11.0)	(10.7)	(11.0)
Years of Education	13.3	10.4	11.9	13.1	10.6	12.3
	(2.9)	(3.9)	(3.1)	(2.7)	(3.8)	(2.9)
Married	.631	.465	.566	.643	.332	.513
Never Married	.257	.340	.237	.186	.223	.161
Number of Children	0.77	0.33	0.62	0.91	0.32	0.68
	(1.12)	(0.88)	(1.09)	(1.17)	(0.76)	(1.08)
Individual DI Benefits	-	6363	7383	-	4991	5708
		(3076)	(1521)		(2465)	(1003)
Family DI Benefits	-	9016	8624	-	7448	6787
		(5097)	(2622)		(4640)	(1713)
Probability Induced to Apply	-	-	.005†	-	-	.004†
			(.002)			(.002)
Number of observations	38561	816	1776	41946	618	1651

Notes to Table 1: The mean and standard deviation are shown for key characteristics of the working-aged population, broken down by gender and DI status. The second column reports statistics for individuals who are imputed to be current DI worker beneficiaries. The third column reports statistics for individuals who report a limitation but are not currently receiving Social Security income, individuals who we assume are within the pool of potential applicants. The first column presents statistics for all other working-aged individuals. †These are predicted values, using the methods described in the text.

Table 2: Summary Statistics: Elderly Population (62+ years)

	Males			Females		
	Non-DI Beneficiaries	DI Beneficiary, Own Benefits	DI Beneficiary, Spouse Benefits	Non-DI Beneficiaries	DI Beneficiary, Own Benefits	DI Beneficiary, Spouse Benefits
Black	.089	.078	.012	.071	.084	.099
American Indian	.005	.003	.015	.004	.006	.004
Asian	.032	.009	0	.021	.017	.013
Hispanic	.047	.036	.017	.050	.040	.032
Age	69.8	71.8	71.5	69.4	70.8	74.4
	(6.8)	(6.8)	(6.9)	(6.4)	(6.7)	(7.5)
Years of Education	12.8	10.5	10.9	11.5	11.6	10.8
	(3.7)	(3.7)	(3.2)	(3.4)	(3.2)	(3.2)
Married	.893	.685	1	.810	.692	.158
Never Married	.034	.053	0	.032	.308	0
Number of Children under 18	0.04	0.03	0	0.02	.019	.017
	(0.26)	(0.25)		(0.18)	(.170)	(.180)
Probability is a DI Beneficiary	-	.120	.125	-	.132	.090
		(.078)	(.061)		(.098)	(.070)
Individual DI Benefits	-	7036	0	-	5049	0
		(2829)			(2618)	
Family DI Benefits	-	10204	0	-	6832	0
		(5004)			(3795)	
Probability Induced to Apply	-	.0012	.0012	-	.0013	.0009
		(.0008)	(.0006)		(.0010)	(.0007)
Number of observations	3559	6023	66	4565	1649	7104

Notes to Table 2: The mean and standard deviation are shown for key characteristics of the elderly population, broken down by gender and DI status. The second and third columns report statistics for individuals who are imputed to be current DI worker beneficiaries. Individuals included in the sample for the second column generate Social Security, or what we term DI benefits, on their own account. Individuals included in the third column receive Social Security benefits due to another family member. The first column presents statistics for all other elderly individuals who are assigned a zero probability of having been a working-aged DI recipient.

Table 3: Summary of Costs of Policy Reform

		Costs in Millions of Dollars
Direct benefit costs		327.0
Increased benefits to worker beneficiaries	*191.1*	
Increased benefits to elderly beneficiaries	*136.0*	
Expected indirect benefit costs (successful marginal applicants)		89.7
Expected indirect tax costs due to changes in taxes paid		30.2
Federal tax cost	*24.4*	
State tax cost	*5.8*	
Expected indirect transfer costs (marginal applicants)		4.9
Federal AFDC cost	*- 0.10*	
State AFDC cost	*- 0.06*	
Federal Food Stamp Cost	*5.0*	

Table 4: Implicit Price of an Additional $1 of Insurance by Education Category

	Direct Cost	Indirect Cost	Total Cost	Total Cost/ Income (*1000)	Pr(DI Recipient)	Benefit Increase	Implicit Price
Less than High School	1.16	0.40	1.56	0.081	.093	62.6	0.27
	(0.01)	(0.01)	(0.02)	(0.001)	(.002)	(0.6)	
High School Degree	2.58	0.94	3.52	0.134	.036	71.5	1.89
	(0.02)	(0.01)	(0.02)	(0.001)	(.001)	(0.8)	
Some College	3.28	1.22	4.51	0.149	.024	73.0	2.57
	(0.02)	(0.01)	(0.03)	(0.001)	(.001)	(1.3)	
Finished College	4.50	1.85	6.35	0.158	.012	75.2	7.04
	(0.03)	(0.01)	(0.04)	(0.001)	(.001)	(1.5)	

Notes to Table 4: The unit of observation is the family. The first two columns show the average direct and indirect costs born by families without current working-aged or elderly DI beneficiaries, for all families and then separately for families broken down by the education level of the head. The third column presents the average total cost (sum of the direct and indirect costs) for families in each educational category. The fourth column reports the average of the total cost as a fraction of pre-regime change income for families (these values are multiplied by 1000 for ease of viewing). The next two columns show the probability that a family has a worker or elderly beneficiary and the average increase in family benefits. The last column is calculated by summing the direct and indirect costs and dividing by the expected benefits (the probability the family has a current beneficiary multiplied by the expected increase in benefits). Standard errors are in parentheses.

Table 5: Pre-reform and Post-reform Income

	Individuals in families with:			Individuals in families with:		
	No DI beneficiary	DI worker beneficiary	Elderly DI beneficiary	No DI beneficiary	DI worker beneficiary	Elderly DI beneficiary
	In the base period (pre-reform):			Change in income following the reform:		
Family after-tax income	30844	22548	22269	-4.97	90.8	59.7
	(21714)	(16449)	(15858)	(4.25)	(54.5)	(59.2)
Smoothed family after-tax	28002	23729	23792	-3.32	52.9	32.7
income	(9683)	(8391)	(7776)	(1.68)	(25.4)	(31.9)
Per capita after-tax income	12171	9712	12339	-1.87	43.4	32.6
	(9667)	(7109)	(8171)	(1.80)	(28.4)	(33.4)
Per capita smoothed after-tax	12106	11384	13901	-1.37	28.9	18.6
income	(7133)	(5370)	(4958)	(0.95)	(22.1)	(20.7)
Per capita equivalent after-tax	18047	14216	17667	-2.78	63.6	46.7
income	(13780)	(10136)	(11656)	(2.60)	(40.7)	(47.7)
Per capita equivalent	17948	16616	19904	-2.03	42.1	26.7
smoothed after-tax income	(10003)	(7439)	(7029)	(1.34)	(31.3)	(29.6)
Number of Observations	155633	2685	21929	155633	2685	21929
Weighted Number of Obs	240.2 million	4.3 million	4.1 million	240.2 million	4.3 million	4.1 million

Notes to Table 5: The first three columns present mean income pre-reform for individuals classified by family type. The last three columns show the average change in income following the reform. The rows correspond to different measures of income. Rows 1, 3, and 5 are based on income measures that have not been smoothed using the relationship between income and consumption in the CEX, while rows 2, 4, and 6 are based on smoothed versions. Rows 1 and 2 use family income, rows 3 and 4 use per capita family income, and rows 5 and 6 use adjusted (for economies of scale and number of adults relative to children) per capita family income. All cells are weighted using the March CPS person weight.

Table 6a: Welfare Analysis (Per capita income)

θ	Average Utility Pre-reform	Normalized Change in Utility for Individuals in Families w/:			Net Welfare Impact
		No DI Beneficiary [N=155633]	DI Worker Beneficiary [N=2685]	DI Elderly Beneficiary [N=21929]	
1) Individual income = per capita family income, not smoothed					
0	12131	-.0002 (.0001) [-36958]	.0036 (.0023) [15407]	.0027 (.0028) [10942]	-10610
1	8.99	-.00002 (.00001) [-3740]	.00060 (.00034) [2613]	.00035 (.00051) [1428]	301
2	.00017	-.0004 (.0258) [-99865]	.0063 (.0104) [27147]	.0034 (.1174) [13875]	-58843
4	.00077	-.00013 (.01396) [-30963]	8.19×10^{-10} (1.19×10^{-8}) [.004]	5.92×10^{-9} (9.00×10^{-7}) [.024]	-30963
2) Individual income = per capita family income, smoothed					
0	12123	-.0001 (.0001) [-27136]	.0024 (.0018) [10263]	.0015 (.0017) [6253]	-10620
1	9.24	-.00001 (3.97×10^{-6}) [-2939]	.00028 (.00016) [1207]	.00016 (.00024) [651]	-1081
2	.00012	-.00011 (.00019) [-26693]	.00260 (.00252) [11211]	.00117 (.00596) [4764]	-10719
4	5.06×10^{-11}	-.00038 (.04936) [-91411]	.00024 (.00122) [1044]	.00005 (.00235) [223]	-90144

Notes to Table 6a: The top panel shows the welfare analysis based on unsmoothed per capita family income, while the bottom panel is based on per capita family income that is smoothed according to the relationship between after-tax income and consumption in the CEX. Each row presents results using a different parameter of relative risk aversion (θ). The second column shows average utility in the base period, the next three columns show the average change in utility before and after the reform (normalized by average base utility) by family type, and the final column shows the aggregate change in utility (also normalized by average base utility). Standard deviations are in parentheses. The total welfare impact by family type is shown in brackets.

Table 6b: Welfare Analysis (Adjusted per capita income)

θ	Average Utility Pre-reform	Normalized Change in Utility for Individuals in Families w/: No DI Beneficiary [N=155633]	DI Worker Beneficiary [N=2685]	DI Elderly Beneficiary [N=21929]	Net Welfare Impact
1) Individual income = adjusted per capita family income, not smoothed					
0	17973	-.0002 (.0001) [-37111]	.0035 (.0023) [15252]	.0026 (.0027) [10579]	-11280
1	9.39	-.00002 (.00001) [-3579]	.00058 (.00033) [2501]	.00034 (.00049) [1366]	288
2	.00012	-.0004 (.0227) [-91474]	.0060 (.0096) [25704]	.0034 (.1171) [13761]	-52010
4	.00017	-.00017 (.01780) [-39762]	1.01×10^{-9} (1.48×10^{-8}) [.004]	9.12×10^{-9} (1.39×10^{-6}) [.037]	-39762
2) Individual income = adjusted per capita family income, smoothed					
0	17956	-.0001 (.0001) [-27185]	.0023 (.0017) [10111]	.0015 (.0016) [6047]	-11027
1	9.65	-.00001 (3.80×10^{-6}) [-2821]	.00027 (.00015) [1155]	.00015 (.00023) [623]	-1043
2	.00008	-.00011 (.00018) [-26666]	.00265 (.00243) [11437]	.00125 (.00644) [5111]	-10118
4	1.29×10^{-11}	-.00038 (.04836) [-90650]	.00023 (.00111) [1012]	.00007 (.00314) [283]	-89356

Notes to Table 6b: See notes to Table 6a. Per capita family income is now adjusted for economies of scale and the number of adults and children as described in the text.

Table 7: Net Welfare Impact by Education Level

θ	Less than high school	High school degree	Some college	Completed college
	Level of Educational Attainment			
	Using per capita income, smoothed			
0	5363	-4092	-4316	-6027
1	530	-485	-462	-644
2	2817	-5030	-4264	-6143
4	-18074	-33005	-18951	-11300
	Using adjusted per capita income, smoothed			
0	5098	-4246	-4354	-6052
1	506	-467	-444	-619
2	3138	-4833	-4223	-6103
4	-18058	-30321	-18764	-11132

Notes to Table 7: Positive values indicate that the net welfare impact of a 1% increase in DI benefit generosity is positive for the subgroup and level of risk aversion (θ) indicated, while negative values indicate a net welfare loss. The top panel calculates individual utility using per capita family income smoothed using the relationship between consumption and income in the CEX. The bottom panel uses smoothed per capita income adjusted for economies of scale and the number of adults and children.

Table A1: Predicting the Likelihood Elderly Individuals are DI Beneficiaries

	Male	Female
Constant	-4.62	-6.55
	(1.08)	(1.11)
Black	--	.617
		(.167)
American Indian	.604	1.31
	(.414)	(0.47)
Asian	-1.84	--
	(0.80)	
Hispanic	-.853	-.553
	(.232)	(.262)
Age	.062	.081
	(.018)	(.018)
Years of Education	-.071	-.010
	(.067)	(.070)
Years of Education Squared	-.007	-.008
	(.003)	(.004)
Never Married	.547	.542
	(.204)	(.229)
Number of Observations	7990	8741

Notes to Table A1: The two columns are based on separate regressions for males and females aged 51-61 in our March 1991 CPS sample. In both cases, the dependent variable is equal to 1 if the individual is a worker beneficiary and the coefficient estimates are based on a logistic model. Each observation is weighted by the CPS person weight and the standard errors are corrected using White's generalized method. Observable characteristics that did not enter significantly were dropped from the regression since the goal is to use the above relationship to predict which individuals aged 62 and over had been DI beneficiaries.

Table A2: Predicting the Likelihood a Limited Working-Aged Individual is a DI Recipient

	Males	Females
Constant	-3.48	-1.84
	(0.83)	(0.38)
Black	-.246	--
	(.152)	
Asian	-.751	--
	(.465)	
Hispanic	-.701	-.475
	(.159)	(.192)
Age	.128	.041
	(.038)	(.006)
Age Squared	-.0011	--
	(.0004)	
Years of Education	-.080	-.087
	(.014)	(.015)
Married	--	-.757
		(.122)
Never Married	.570	.267
	(.140)	(.151)
Number of children under 18	-.145	-.157
	(.066)	(.070)
Number of Observations	2872	2871

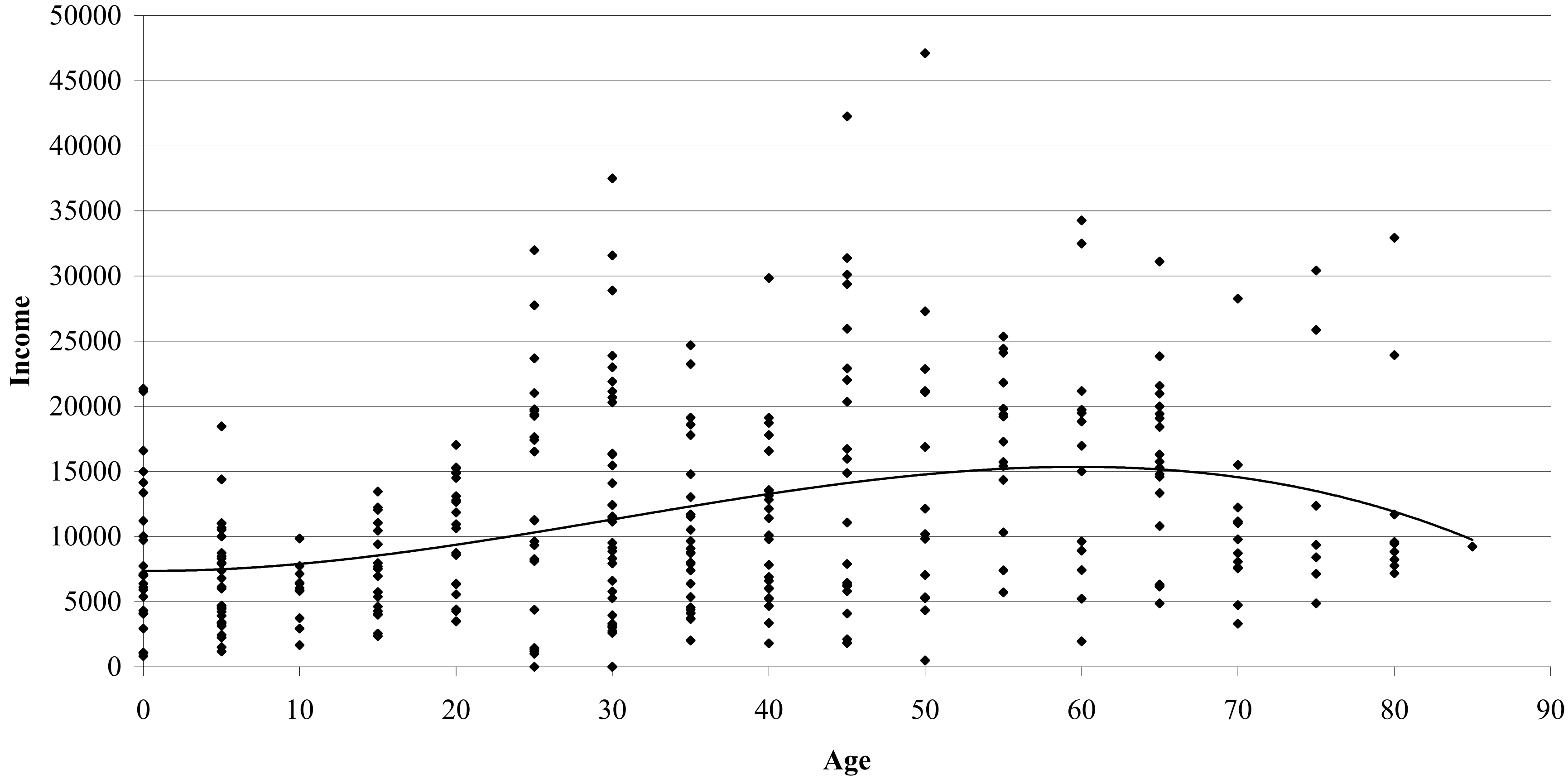
Notes to Table A2: The two columns are based on separate regressions for males and females aged 21-61 in our March 1991 CPS sample. In both cases, the dependent variable is equal to 1 if the individual is a worker beneficiary and the coefficient estimates are based on a logistic regression. Each observation is weighted by the CPS person weight and the standard errors are corrected using White's generalized method. Observable characteristics that did not enter significantly were dropped from the regression.

Table A3: Predicting Individual DI Benefits for Marginal Working-Aged Applicants

	Males	Females
Constant	8.35	7.08
	(0.15)	(0.55)
Black	-.116	--
	(.058)	
Asian	.390	--
	(.112)	
Age	.006	.051
	(.002)	(.023)
Age Squared (coefficient × 100)	--	-.054
		(.025)
Years of Education	-.014	-.012
	(.016)	(.025)
Years of Education Squared	.002	.003
	(.001)	(.001)
Married	--	-.077
		(.059)
Never Married	-.311	-.117
	(.059)	(.080)
Number of Observations	816	618

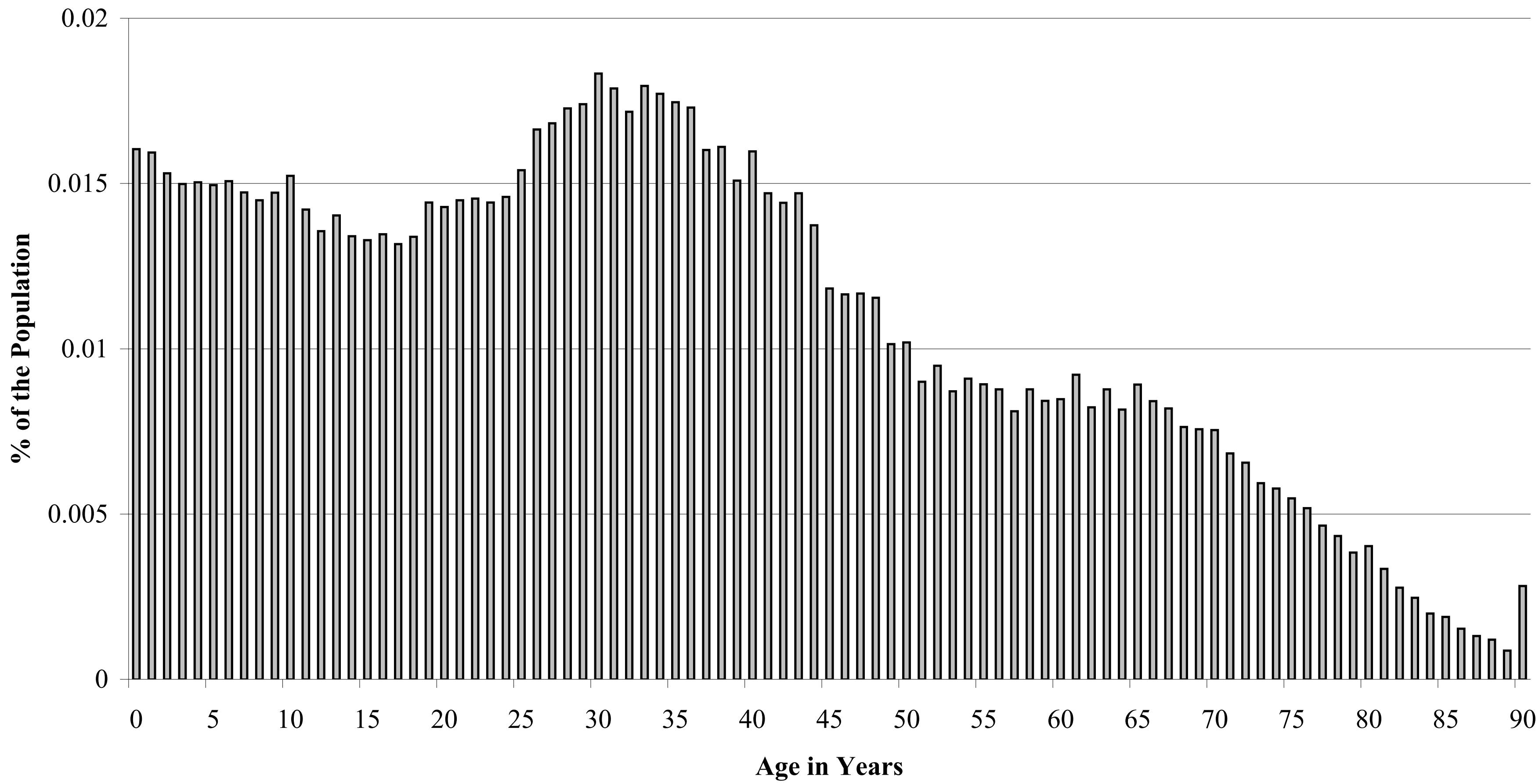
Notes to Table A3: The two columns are based on separate regressions for male and female DI beneficiaries aged 21-61 in our March 1991 CPS sample. In both cases, the dependent variable is the logarithm of reported individual Social Security benefits and the model is estimated by ordinary least squares. Each observation is weighted by the CPS person weight and the standard errors are corrected using White's generalized method. Observable characteristics that did not enter significantly were dropped from the regression.

Figure 1: Cross-sectional Distribution of Income by Age in March 1991 CPS



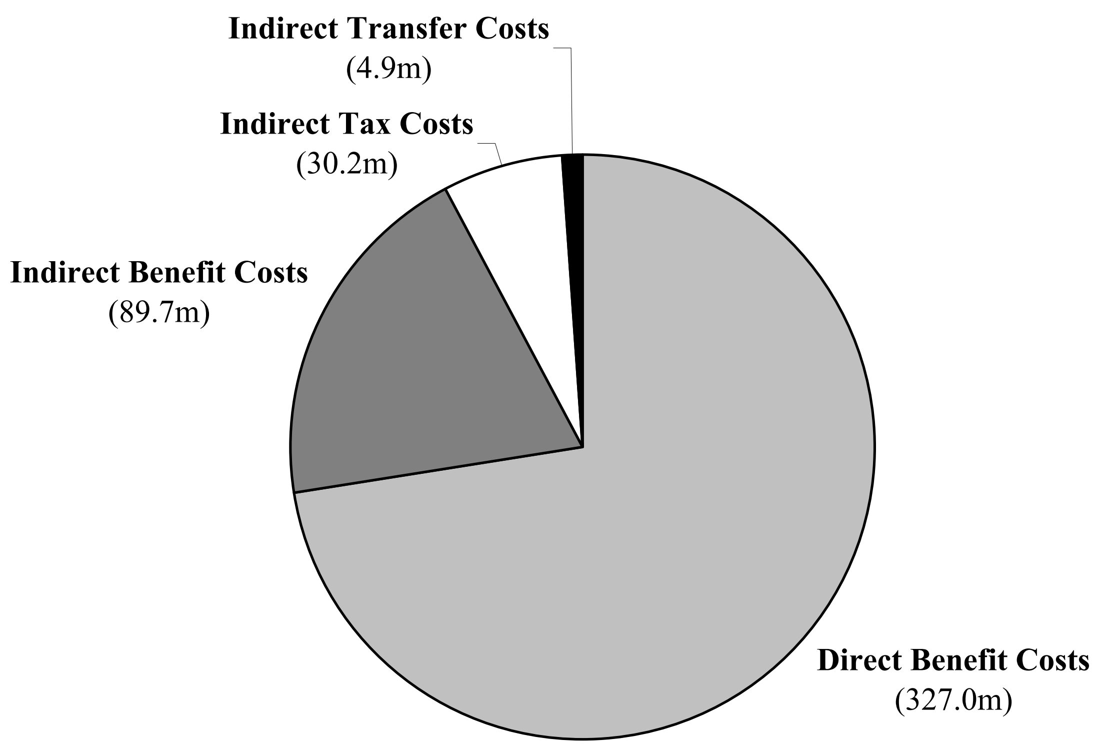
sample of the March 1991 CPS. The trend line shows the hypothetical average income profile when the cross-sectional distribution is conceptualized as capturing the full distribution of life cycle paths for an individual.

Figure 2: Age Distribution in the 1991 March CPS



1991 March CPS sample. The spike at 90 years reflects top-coding at that age.

Figure 3: Direct and Indirect Costs of Increasing DI Benefit Generosity



Age	Income
40	1792.465
20	10631.75
10	5832
35	11523.5
20	12655.5
50	21185
30	20316
0	6116
0	7020.8
15	12058
20	14860.8
45	15975.33
70	7571.687
50	22860.5
25	1179
65	10812.95
10	3744.825
0	5388
40	19119
0	4306
5	10511.5
75	30416.11
35	8718
65	15287.19
0	14981.67
35	10516
75	9359.205
35	4557.667
35	8001.25
65	20964
20	3497
65	23842.78
45	20346
45	1816.25
0	7732.5
25	4379.333
65	6166.12
40	6027.2
20	6393
45	4092.6
45	1846.886
45	42265
40	12138.5
60	8913.957
55	19395
25	8264
55	19820
20	14494.73
30	3204.42
25	17647.5
5	2443.387

5	6147.25
45	6441
15	11045.67
60	21179
20	8576
55	14351.67
30	12417
60	18831
70	3304.481
45	2116
40	6019.6
15	4027
45	6275.221
55	25360
55	24414
70	15501.29
20	13110
15	12232.25
10	5866.6
80	9582.45
20	15312.75
15	6953.75
25	21014.5
40	17791
75	7147.668
15	7523.8
35	11701
30	9131
40	18738
20	12794.4
45	6198.75
30	28883
25	16523
20	4276.333
30	9526.485
80	7764.215
30	11430
55	17285
50	16881.71
0	11213.5
5	4691.4
65	14797.5
70	8725.221
25	31986
80	8239.326
5	4701.333
40	16564
70	8070.463
60	19488.5
60	5217
30	16370.75
35	8794.602

60	16973.81
5	8324.6
5	10012.17
75	4869.313
0	1036
35	13027
15	4025
5	11009.75
35	4392.34
0	6382.8
80	11693.42
35	2028.15
55	5710.474
55	15718.5
40	29852.5
10	9843.6
5	7920
30	6599
15	5744.5
55	15414
70	4740.938
0	5907
40	9776.5
5	7374.4
40	6596
45	22025.5
5	8731.333
20	15233.5
40	7821.25
15	5384.167
25	23680
30	5784.2
50	12140.5
85	9236.074
40	4660.4
0	7056
25	1010.667
30	3088.8
45	7896.333
45	22910
65	19997
45	25961.67
10	2933
0	1083.5
20	14926.25
20	10932.41
0	21343
40	5280
40	6015.8
30	2760
25	0
5	3313

5	11041.5
70	11176.48
45	29380.5
80	9451.92
20	6334.5
50	480
0	4063.6
50	7057
5	6007
5	4547.6
35	7907
70	7618.728
20	3500
5	10673
30	2600.5
5	1178.167
60	32505.5
60	19739
65	16304.05
40	6894.5
30	8878
75	25874.88
20	11853
15	10454.6
35	3706
65	4877.5
30	5270.2
70	12242.51
5	18458.33
30	23007
80	23940
75	8397.325
40	3368.17
35	7413.333
40	13155.33
45	16728
35	4142.667
25	9633.5
30	11133
50	21074.5
75	12359.19
5	4222.4
5	1512
15	4011.455
80	32947.68
55	19224
10	7748.25
65	19422.54
0	7012.6
5	3916.6
0	13375
35	14784.5

0	10025.5
15	4623.75
20	8730
25	19267
35	9660.75
25	9348
35	19138.5
20	4411
15	7955.167
30	23897.33
65	6320.758
50	4339.559
0	829
25	11223
30	8324.5
60	34281
15	13453.75
65	21583.6
10	7146.667
45	14881.33
30	7941.667
5	7988.2
5	6796.25
35	9075.2
55	10311.67
65	19082.03
0	21160
30	15468
30	21912.5
55	21827
35	6373.25
30	3023.4
25	1440
35	4116.6
30	0
70	11033.38
45	6237
50	27291
60	15013.05
35	17801
45	5805
60	9627.5
25	1319
0	14153
40	13569.25
30	31578
45	30112
10	1658.7
30	0
5	3432.15
25	17415
15	7705.5

30	3313
0	9717.5
55	24103.5
20	5571.2
30	12434
50	9841.446
30	37500.5
50	5263.964
40	10093
30	20693
80	7177.23
10	6444.167
5	2239.25
30	3965.6
35	18593
5	14386
70	9786.986
25	27748
40	13522
0	4096.75
45	11069.67
5	8494.4
80	8841.177
5	4437.4
0	16591.5
10	6051
35	5364
30	11551
15	2565.576
35	23242
0	7108.333
50	10187.5
60	7428
60	1955.36
15	9408.25
0	2929.45
25	8114
70	28266.98
15	2350.5
50	47119
25	11282
65	14581.71
65	13346.86
25	19372.5
25	19643
45	31384
50	5328.11
25	19778
15	4262.667
40	12838.33
10	6382.6
65	18425.96

65	15745.38
30	14101
5	3416
35	3663.162
65	6260.594
5	3133.333
55	7398
20	17028
30	16303
35	24687
40	5235
40	11421
30	21146
65	31113
5	13672
5	2562.572
30	6151.6
20	7123
75	2812.004
75	4017.149

Comparing Age Distribution to Feasible Steady State
Data from CPS (disab_2a.do)

Age	% of Population
0	0.016037
1	0.015933
2	0.015312
3	0.014985
4	0.015034
5	0.01495
6	0.015069
7	0.014729
8	0.01449
9	0.014721
10	0.015229
11	0.014213
12	0.013558
13	0.014036
14	0.013406
15	0.013286
16	0.013462
17	0.013164
18	0.013387
19	0.014424
20	0.014286
21	0.014493
22	0.014546
23	0.014421
24	0.014592
25	0.015401
26	0.016635
27	0.016819
28	0.017271
29	0.017396
30	0.018324
31	0.017872
32	0.017167
33	0.017953
34	0.017718
35	0.017458
36	0.017298
37	0.016018
38	0.016104
39	0.015083
40	0.015975
41	0.014706
42	0.014419
43	0.014706
44	0.013738
45	0.011821
46	0.011648

47	0.011674
48	0.011544
49	0.010138
50	0.010189
51	0.009
52	0.009488
53	0.008709
54	0.009095
55	0.008921
56	0.008772
57	0.008113
58	0.008769
59	0.008425
60	0.008473
61	0.009214
62	0.008228
63	0.008769
64	0.008163
65	0.008918
66	0.008413
67	0.008191
68	0.007629
69	0.007564
70	0.007541
71	0.006836
72	0.006557
73	0.005933
74	0.005767
75	0.005476
76	0.005175
77	0.004649
78	0.004336
79	0.003834
80	0.004026
81	0.003341
82	0.002774
83	0.002464
84	0.001991
85	0.001888
86	0.001532
87	0.001311
88	0.001198
89	0.000867
90	0.002819

Direct and Indirect Costs

Direct Benefit Costs	327
Indirect Benefit Costs	89.7
Indirect Tax Costs	30.2
Indirect Transfer Costs	4.9
	451.8