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Abstract

As the Social Security full retirement age rises, the relative generosity of Social Security retirement benefits compared to disability benefits is declining, raising the incentive for insured people to apply for disability benefits. After controlling for other differences in observable characteristics, such as life-time earnings, we find that an average four month increase in the FRA slightly increases the two-year DI application rate by 0.04-0.30 percentage points. The effect is greater among those with a work limiting health problem (0.22-0.89 percentage points).

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1. Introduction

The rise in the Social Security full retirement age (FRA)—from age 65 for individuals born before 1938 to age 67 for those born in 1960 or later—is equivalent to a universal benefit cut for retirees. For example, those who claim at the earliest eligibility age (EEA), currently set at 62, receive 80 percent of their full benefit when the FRA is at age 65, 75 percent when the FRA is set at age 66, and just 70 percent when the FRA is set at age 67. While some retirees might choose to work longer to compensate for the reduction in expected lifetime wealth, for those who cannot work, the increase in the FRA could impose risks on their financial wellbeing.

The FRA increase creates an incentive for retirees with work-limiting health problems to switch from Social Security's Old Age (OA) insurance program to the Social Security Disability Insurance (DI) program. Because the DI benefit equals the full OA retirement benefit and is not reduced when claimed early, the generosity of the DI benefit is rising relative to the OA benefit. Policymakers must identify the magnitude of any such "spillover" effect from the OA system to the DI system in order to estimate accurately the financial and welfare consequences of the rise in the FRA and to forecast the potential effects of policy proposals that seek to accelerate or extend the rise. If many retirees alternatively secure the DI benefit, planned savings associated with the FRA increase might be offset to a certain degree. On the other hand, the financial wellbeing of early retirees who cannot work might be protected by the alternative DI system.

In this paper, we investigate the potential substitution between these two retirement channels—OA versus DI. Based on a sample of wave-to-wave transitions by older

individuals born between 1931 and 1940 in the longitudinal Health and Retirement Study (HRS), we find that those born after 1937 (i.e., those with higher FRAs) are more likely to apply for DI, even after we control for other covariates that are correlated with individual propensities to apply for DI (e.g., age, calendar year, life-time earnings (measured by Average Indexed Monthly Earnings (AIME)), and the presence of a work-limiting health problem). We find that the average 0.33-year rise in the full retirement age for people born between 1938 and 1940 has resulted in a 0.04-0.30 percentage points increase in the DI application rate. The increase is even higher among individuals at or above age 62 and among individuals with health problems that limit their ability to work.

We begin with an explanation of the potential causes of the spillover effect and a summary of results from previous studies on this subject in Sections 2 and 3. In Section 4, we describe our data and analytical approach. Section 5 presents our results, and Section 6 concludes the paper.

2. The Relationship between OA System Characteristics and DI Applications

An older worker must work 40 quarters in covered employment in order to be fully insured for OA benefits. If 20 of those quarters were worked within the last 10 years, he or she is also insured for DI benefits. As a consequence of this recency requirement, DI insured status is less universal than OA insured status (Mitchell and Phillips, 2001). Any possible spillover between the two Social Security programs can only happen among people who are dually insured for both programs.

In principle, three policy parameters of the OA system could affect a DI-insured person's decision to apply for DI: their full retirement age, the earliest eligibility age, and the Social Security earnings test. Raising the FRA reduces the expected payment period and increases the reduction in benefit amount at early claiming ages necessary for actuarial balance. Because the DI benefit is not actuarially reduced with claiming age, it becomes relatively more generous compared to the OA benefit when the FRA rises; this change in relative generosity could cause some individuals to substitute toward DI. In addition, because DI benefits automatically convert to OA benefits when DI beneficiaries reach their FRA, a rise in the FRA also means that people gain the option to apply for DI during the period between the original FRA and the new FRA. This might lead to an increase in DI enrollment.

Proposals to raise the FRA above age 67 usually also recommend that the EEA be raised above age 62. A rise in the EEA would likely have a substantial impact on the spillover effect because many retirees might only consider the choice between OA and DI once OA becomes available at the EEA. A GAO report (1999) suggests that the relatively easier option of claiming OA benefits (compared to the lengthy and complex DI application process, which includes medical screening) might prevent people from applying for DI after they reach EEA. The report shows that new DI awards as a percentage of the DI-covered population steadily grow with age but sharply drop at age 62, which implies that the upward trend might continue past age 62 if the EEA were raised.

Both OA and DI benefits are associated with restrictions on labor supply. DI requires a five-month period prior to application during which applicants may not work.

If approved, they may experiment with work while continuing their DI benefits for up to nine months, but in the tenth month benefits are abruptly terminated for any earnings above a low threshold ($940/month in 2008 for non-blind DI recipients). The milder labor supply restriction in the OA program comes through the earnings test, which amounts to a 50 percent implicit tax on earnings (above a threshold) and which applies to people between the age at which they claim OA benefits and age 70 before the year 2000 or only until their full retirement age in 2000 or later. Although the abolition of the earnings test above the FRA in 2000 partially relaxes this restriction, it does not change the relative generosity between OA and DI benefits, because DI benefits are automatically converted to OA benefits at the FRA. However, the relative strength of the work disincentives in the two programs may impact the desirability of the OA channel versus the DI channel, and any future reform aimed at altering the labor supply disincentives embodied in either program, could potentially affect the choice between the two retirement channels.

DI beneficiaries become eligible for Medicare after they have received DI benefits for two years; thus, a DI award before age 63 is linked to additional value for people who need health insurance coverage. If the Medicare eligibility age were raised along with the FRA, older people with the option to do so would have an even greater incentive to switch to DI (GAO, 1999).

Policymakers expect that raising the Social Security retirement ages will increase labor supply at older ages. This increase could lead to some secondary effects on DI applications. For instance, an increase in labor supply would mean that more people will

be insured for DI. It could also either improve or worsen individual health,[1] either of which effects could later affect DI eligibility.

Although there are multiple direct and indirect links between the OA program and the DI program, this paper examines how increasing the FRA affects DI applications through the most direct channel: decreasing the relative generosity of OA benefits compared to DI benefits by widening the gap between the monthly OA and DI benefit amounts.

3. Previous Research

The disability retirement channel has been frequently omitted in studies of the retirement behavior of elderly Americans (see, for example, French, 2005; Coile and Gruber, 2007), perhaps because the fraction of people retiring through this channel is much lower in the United States than in some European countries. Among the studies that do mention the possible interaction between the two Social Security programs, some provide only rough estimates or upper and lower bounds on the size of the effect. In many cases, these estimates are based on aggregate statistics; these statistics include the proportion of people who claimed OA benefits at the EEA who also had work-limiting health problems (Panis et al., 2002) and the new DI award rate at or after the EEA (Gustman and Steinmeier, 2005). To our knowledge, only three groups of researchers (Mitchell and Phillips, 2000; Duggan et al., 2005 and 2007; Bound et al., 2008) have provided model-based estimates of this effect.

[1] There has been no conclusive evidence in the literature on the health effect of delaying retirement. See Dave et al. (2006), Bound and Waidmann (2007) for studies on this topic.

Mitchell and Phillips (2000) used waves 1-4 of the HRS to estimate a conditional logit model of the choice between three retirement paths: retirement with DI, retirement with reduced OA benefits, and retirement with full OA benefits. They simulate the consequence of reducing the present value associated with the early OA retirement path by $25,000 (an experiment not exactly equivalent to the two-year rise in the FRA, which makes their results hard to compare with the others) and find that the fraction of people who choose the DI path would increase by 0.6 percentage points. Mitchell and Phillips provide a complete picture of the retirement path choice set based on careful estimates of DI insured status. However, they assume that the probability of receiving a DI award conditional on application is constant (at 49 percent) for everyone, so their estimates cannot be interpreted as the effect of a potential OA benefit cut on the DI *application* rate.

Also using the first four waves of the HRS, Bound, Stinebrickner, and Waidmann (2008) developed a dynamic programming model that includes detailed modeling of the DI application decision for single men. In their model, a simulated increase in the FRA to age 67 has a smaller effect on the one-year labor force exit rate through the DI application channel (0.2 percentage points) because, as they say, "most people in their 60s have pretty good health."

Duggan, Singleton, and Song (2007) critique the two papers described above for not using actual behavioral responses to the ongoing policy change represented by the FRA increase. Using Social Security administrative data, they created a large sample of potential beneficiaries who were between ages 45 and 64 sometime during 1984 through 2005. They estimate a linear regression model of age/year-specific DI enrollment rates,

with identification coming from policy-induced reductions in the present value of OA benefits across birth cohorts and age. Controlling for calendar year and age, they find a larger spillover effect than that reported in the Bound et al. (2008) study: a 0.6 percentage points increase in the DI enrollment rate among male beneficiaries above age 45 during the 22 years since 1984 as a result of the two-year increase in the FRA. In an earlier version of the paper (Duggan et al., 2005), they used the ratio of OA benefits to DI benefits to calculate the relative generosity of the two programs. They found that the effect of the ratio is highest at ages 63 and 64 for men (an increase of 0.6 percentage points in response to the two-year rise in the FRA), which suggests that people are more responsive to the policy change as they grow older and approach retirement. One limitation of their papers is that their dependent variable is the DI enrollment rate (the fraction of people on DI), which captures not only the flow of new awards, but the stock of past awards, as well as SSA's subjective decision of whether or not to approve the application. A cleaner measure of the individual behavioral response to the policy change is the individual decision to newly apply for DI. Another limitation is that their 2007 paper does not distinguish people who are insured for DI or not when computing the denominator of the DI enrollment rate.

To sum up, current estimates of the size of the spillover effect vary across these studies, but differences in methodology, especially with respect to the definition of the outcome variable, make comparisons across studies difficult. None has examined actual changes in the decision to apply for DI in response to the rise in the FRA. This paper tries to fill this gap.

4. Data and Sample

We use the Health and Retirement Study (HRS) to conduct a cohort comparison of DI application rates as illustrated in Table 1. The HRS currently has up to eight biennial interview waves (from 1992 to 2006) for a nationally representative sample of individuals born between 1931 and 1941 (so-called age-eligible respondents in the original HRS cohort). Among this sample, those born between 1931 and 1937 are the "control" cohorts, because their FRA remains unaffected at age 65; those born between 1938 and 1940 are the "treatment" cohorts because their FRA has been raised above age 65 by 2 months (if born in 1938), 4 months (if born in 1939) or 6 months (if born in 1940). We exclude from the sample people born in 1941 (most of them would not reach the FRA by Wave 8 in 2006) and those born between 1931 and 1940 who attrited from the HRS before reaching their FRA. This sample restriction leaves a total of 6,748 individuals – 4,772 of them in the "control" cohort born before 1938 and 1,976 of them in the "treatment" cohort born in or after 1938. We apply an additional sample restriction in which we drop everyone without matched SSA earnings records[2] because insured status for DI benefits (which is not universal) can only be derived using the historical records on annual earnings before the HRS baseline wave in 1992. The SSA match rates are similar across the two cohorts in our sample: 85 percent in the "control" cohort and 84 percent in the "treatment" cohort, leaving altogether 4,061 respondents unaffected by the FRA rise and 1,666 affected respondents.

The fourth through sixth columns of Table 1 illustrate how the difference in the FRA across the two cohorts leads to a difference in the relative generosity of OA and DI

[2] Kapteyn et al. (2006) and Michaud and van Soest (2008) find that the matching of Social Security earnings records does not lead to a biased sample for the original HRS cohort.

benefits. The OA/DI benefit ratio at age 62 drops from 80 percent for the control cohort to 77.5 percent for the youngest members of the treatment cohort, those born in 1940. The age 62 OA/DI benefit ratio is also a valid approximate measure of relative generosity for individuals who apply for DI before age 62, if we assume that most potential DI applicants would claim OA benefits at the earliest eligibility age (Duggan et al., 2005). Compared to age 62, the cross-cohort difference in the OA/DI benefit ratio is even higher at ages 63 and 64 (3.3 percent vs. 2.5 percent as the difference between the control cohort and those born in 1940).

We next compare age-specific DI application rates across the treatment and control cohorts. In the first panel of Figure 1, we plot the percentage of people who ever applied for DI[3] by age separately according to whether their FRA is 65 or greater than 65. Interestingly, the "treatment" cohort has a significantly higher chance of ever being a DI applicant. The average probability of having ever applied for DI from ages 55 to 63 is 13.6 percent for the control cohort and 17.3 percent for the treatment cohort.[4] This large difference in the *stock* of past DI applications suggests that a significant part of the recent rapid growth in the DI caseload (Autor and Duggan, 2006) might be generated by individuals who apply (and receive awards) well before their mid 50s. In that sense, we argue that the outcome variable used by Duggan et al. (2005, 2007) (the stock of beneficiaries as a percent of the insured population) might capture changes in behavior

[3] The HRS did not ask separate survey questions regarding DI and SSI application before Wave 5. SSI is generally considered a disability program for people who are not insured for DI and younger than 65. Since our outcome measure (DI application rate, described later) is conditional on being insured by DI, we rule out the possibility that any of the applications in our sample are associated with SSI.

[4] The respondents in the treatment cohort enter the HRS at younger ages (52-54) and are likely to be more "experienced" with the interviews when reporting previous DI applications at ages above mid 50s. One might worry about potential bias caused by this cohort difference; however, Weir and Smith (2005) argue that the so-called panel-conditioning effect is small in the context of the HRS.

among prime-age workers in addition to those approaching retirement. It is certainly possible that the treatment cohort might have responded to the FRA rise by increasing DI applications well before their mid 50s; however, as explained in Duggan et al. (2005), individuals should be less willing to forego their expected labor income in exchange for higher retirement benefits when they are farther away from retirement. An alternative explanation for the rise in DI applications among middle-aged Americans is the rising prevalence of disability due to obesity and associated health problems (Lakdawalla et al., 2004; Goldman et al., 2005).

The large cohort difference in the stock of previous DI applications does not necessarily imply a large difference in the flow of new DI applications – which is the key outcome variable in this paper. Since the HRS is a biennial survey, we define the DI application rate as the fraction of people who applied for DI between time *t* (or wave *w*) and time *t+2* (or wave *w+1*) conditional on having the option of applying for DI at time *t*. To choose the correct pool of people who can apply for DI in the interval between two waves, people who are not insured for DI (due to insufficient numbers of total or recent quarters of coverage) at the earlier wave are excluded from the denominator. In the second panel of Figure 1, we plot the age profile of DI-insured status by cohort[5]. Strikingly, we find that respondents in the treatment cohort are more likely to be insured for DI. Between ages 55 and 63, the average DI coverage rate is 71.2 percent for those in the treatment cohort compared to 66.5 percent for those in the control cohort. This cohort difference in DI-insured status reflects the reversal of the early retirement trend in recent

[5] We combine the SSA earnings records and annual employment/earnings information in the HRS core survey to determine the total number of quarters of coverage during one's life time and in the last 10 years. DI insured status at each wave is computed using the estimated history of annual quarters of coverage before the wave.

years (Gustman and Steinmeier, 2008) and the stronger labor force attachment of later birth cohorts (Maestas, 2007).

It is worth noting that people who are insured for DI are always insured for the OA benefit as well (while the reverse is not true). Therefore we can interpret DI application behavior as an individual's choice between the two retirement channels. For people insured for DI but who did not apply for DI before their FRA, we know they will eventually retire with the OA benefits.

Besides dropping time *t* to time *t+2* transitions associated with time *t* non-insured status, we also exclude respondents who were already receiving or applying for DI at time *t* and respondents' whose time *t* age is greater than age 63 (thus the corresponding time *t+2* age might exceed the FRA) or below age 55 (which is the lowest age that we can observe the DI application behaviors of both cohorts). In addition, we drop observations with missing values in time *t* covariates. Applying all the restrictions described above, we end up with 7,654 time *t* to *t+2* transitions from the control cohort and 4,174 transitions from the treatment cohort. Altogether we have 11,828 person-wave observations in our analysis sample.

In the analyses that follow, we compute treatment effects for all DI-insured individuals and for those who are disabled. We assign disability status on the basis of responses to the HRS work limitation question, "Do you have any impairment or health problem that limits the kind or amount of paid work you can do?" [6] Benitez-Silva et al.

[6]In Wave 7, if re-interviewees had previously reported having a work-limiting health condition, they were assumed to still have the condition. Using hot-deck imputation based on demographic characteristics, socioeconomic status, and health status, we find that some of those assumed to still have a work-limiting condition in Wave 7 are not likely to actually still have one. The imputation is based on answers given by all respondents between waves 5 and 8 who provided a valid ("yes" or "no") response to the work-

(1999, 2004, 2006) have shown that HRS responses to this question and a follow-on question asking whether this limitation prevents them from working altogether can be considered an approximate sufficient statistic of "true" disability status[7] and an unbiased indicator of SSA's ultimate DI award decision. Since we are interested in DI application, not award, we use the work limitation variable rather than the work prevention variable to measure disability status.[8]

5. Results

5.1 Cross Cohort Comparison of DI Application Rate

In the third panel of Figure 1, we show the two-year DI application rate by cohort. The DI application rate is higher when individuals are in their mid 50s and declines smoothly with age, reflecting the declining opportunity cost of applying for DI (in terms of lost expected earnings) as people approach retirement. The DI application rate drops to its lowest level after people reach the earliest eligibility age for the OA benefit (62), suggesting that the availability of the OA benefit deters DI application. Surprisingly, the treatment cohort, which has a higher average FRA and also a higher probability of having previously applied for DI, has a relatively lower DI application rate overall.

The difference in past DI application rates across treatment and control cohorts raises the possibility of compositional differences between the cohorts. For example,

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limitation questions. Another important cross-wave difference is that beginning in Wave 7, "not working" is added as a possible response category.

[7] In the sense that other health variables add very little additional predictive power once the work limitation variable is included in models predicting DI application.

[8] See Burkhuaser et al. (2004) for a dynamic programming model of DI application that assumes workers start to make DI application timing decisions after the onset of a work limitation.

those in the "treatment" cohort who are not already receiving (or applying for) DI by time *t* (i.e., those whom we retain in our sample) might have lower propensities for experiencing work-limiting health problems. In order to control for this factor, in the fourth panel of Figure 1 we plot the DI application rate holding constant disability status at time *t*. As expected, people with a work limitation at time *t* have much higher disability application rates between *t* and *t+2*. The average application rate between ages 55-63 conditional on having a work limitation at time *t* is about 12 percent compared to 1.5 percent among those without a work limitation at time *t*. In other words, most DI applications come from individuals with health problems that limit their work ability. Among those with no work limitation, DI application rates are almost the same across the treatment and control cohorts. Among those with a work limitation, the cohort difference in the DI application rate is not exactly the same as that in the third panel: the treatment cohort has lower DI application rates between ages 55 and 61, but slightly higher DI application rates at ages 62 and 63.

Putting the third and the fourth panels together, we can see that age and the existence of a work limitation both have strong associations with DI application. The sign and the magnitude of the cohort difference in the DI application rate also vary with work limitation and by whether age at time *t* is below 62 or not (i.e., according to whether the possibility of claiming OA benefits is part of the immediate choice set). This suggests the treatment effect of the FRA increase on DI applications may vary by age and disability status.

The descriptive analyses in Figure 1 imply that the treatment effect has the expected sign (that is, higher DI application rate for the cohort with higher FRA) only at

ages 62 and 63 among those with a work limitation at time *t*. The difference itself is quite small (3.6 percent for the "control" cohort and 4.9 percent for the "treatment" cohort). However, these contrasts control only for age and the presence of a work limitation. Since respondents are not actually randomly assigned to each cohort, there are likely to be cohort differences in other observable characteristics that may be related to the DI application propensity and thus confound the true effect. We turn to an examination of such differences next.

5.2 Cross Cohort Comparison of Other Related Variables

In Table 2 we present for the treatment and control cohorts sample means of our outcome measure, measures of OA/DI relative generosity, life-time earnings and labor force attachment, health and disability status, and a set of demographics and socioeconomic status (SES) variables. We find no statistical difference between the average DI application rate across cohorts in the sample, although the "treatment" cohort contains a higher non-age-adjusted ratio of observations with past DI application experience (4.3 percent vs. 3.4 percent). It is reasonable to expect that DI application decisions are serially correlated – those who applied before time *t* would be more likely to apply between time *t* and *t+2* because they might have a more severe underlying disability level or they have other unobservables that make them more prone to apply for social welfare programs.[9] Benitez-Silva, et al. (1999) have shown that having previously applied for DI is a strong predictor of current DI application.

[9] In addition, former beneficiaries who have had their benefits terminated for earnings above the substantial gainful activity threshold can reinstate benefits during a three-year Extended Period of Eligibility should they stop working and continue to be disabled.

We present three measures of the relative generosity between OA and DI. The first and most obvious one is the FRA itself: on average the FRA for the treatment cohort is 0.33 years (or four months) higher than the control cohort's FRA. The second measure is the ratio of the OA benefit to the DI benefit[10] at time *t+1*, which has already been shown in Table 1. Duggan et al. (2005) used the value of this ratio at age 62 as the key independent variable in their model. Since the DI benefit amount is always larger than the OA benefit at any given age before the FRA (assuming the potential DI applicant stops working altogether and at *t+1*), this ratio is always below 1. We link the OA/DI ratio at 62 to wave-to-wave transitions with time *t* ages no older than 61. OA/DI ratios at age 63/64 are respectively associated with transitions with time *t* age at 62/63. Almost all of the variation in the OA/DI benefit ratio originates from the birth year difference. The treatment cohort has an average OA/DI ratio at 80.3 percent, which is significantly lower than that among the control cohort (82.7 percent).

The third relative generosity measure is the ratio between the present values of the OA and DI benefit streams at time *t+1*. This present value ratio compares the entire expected Social Security wealth associated with each retirement path. It has more variation across individuals and age, but because it is based on life-time earnings and survival probabilities, it is less exogenous compared to the OA/DI benefit ratio. The

[10] We use the SSA administrative earnings file for the original HRS cohort to compute OA and DI benefits, present values, and Average Indexed Monthly Earnings (AIME). The SSA administrative earnings files contain HRS respondents' annual Social Security covered earnings from 1951 to 1991. We forecast earnings forward by averaging respondents' two highest years between the last five years of earnings when the SSA records are available (i.e., 1987-1991 for the original HRS cohort), then project the average forward assuming zero real annual growth. The respondents' earnings data are fed into a set of Social Security retirement benefits computation SAS macros developed by Nicole Maestas. The macros calculate retirement benefit amounts for any claiming date between age 62 and 70, or any retirement date before age 62 (assuming no further work after retirement). Since we do not model the joint retirement decision of couples, we treat respondents as single and ignore spousal benefits and survivor benefits. We construct the present value of Social Security benefits at time *t* by summing the stream of benefits payable at time *t*, weighted by life table survival probabilities (1998) and discounted at a real interest rate of 3 percent.

average OA/DI present value ratio is 69.2 percent in the "treatment" cohort, which is much lower than that in the "control" cohort (74.8 percent).

Not all of the cross-cohort difference in the third relative generosity measure can be attributed to the FRA increase, given that the present value ratio is also dependent on the Primary Insurance Account (PIA), which is a piecewise linear function of the AIME. The "treatment" cohort, with a higher DI-insured rate as shown before, also has significantly higher AIME ($2,745 vs. $2,376), which is evidence of its higher life-time labor force participation level. AIME is not only a measure of life-time earnings but also a measure of potential future earnings. Because the DI program has very strong labor supply restrictions, those with higher AIME should be less likely to apply for DI, holding everything else constant. In Table 2 we also examine another labor force attachment measure – life-time total quarters of coverage. Although respondents in the treatment cohort are significantly younger (58.8 vs. 59.7), the total quarters of coverage they accumulate by time *t* are significantly greater compared to the control cohort (129.7 vs. 126.0).

It is interesting to see that despite the large difference in past DI application rates (non-age-adjusted) disability status is similar across the cohorts. The time *t* fraction of people with a work limitation is 12.6 percent in the control cohort and 12.5 percent in the treatment cohort.

Although their disability rates are similar, there could be differences in the severity and types of disabilities experienced across cohorts which could lead to differential propensities to apply for DI. We examine a battery of objective and subjective health measures available in the HRS, including (1) sum of ADL and other functional

limitations (a 0-13 index counting the number of activities that the respondent reports having some difficulty performing[11]), (2) self-reported fair or poor health, (3) sum of major health conditions (a 0-8 index[12]), (4) whether often troubled with pain[13], (5) whether obese (with corrected BMI equal to or above 30) [14], and (6) subjective probability of living to age 75. We call our obesity measure "corrected" because we have adjusted the self-reported BMI based on height and weight measurements provided in the HRS biomarker data available in Wave 7 and Wave 8. In so doing, we follow the approach described in Cawley and Burkhuaser (2006).[15]

Although relatively younger on average, respondents in the treatment cohort experience more functional limitations (1.40 vs. 1.21), have more major health conditions

[11] Those activities include: walking across the room, dressing, bathing, eating, getting in/out of bed, walking one block, walking several blocks, sitting for about 2 hours, getting up from a chair after sitting for long period, climbing one flight of stairs without resting, climbing several flights of stairs without resting, stooping/kneeling/crouching, and pushing/pulling large objects. These variables at Wave 1 and Wave 2 are not quite comparable to those in later waves. However, since our primary interest is in comparing the measure across cohorts rather than over time, we leave the inconsistent values in this comparison.

[12] These conditions include: high blood pressure, arthritis, mental health problem, cancer, stroke, lung diseases, diabetes, and heart problems.

[13] See Kapteyn et al (2008) for a study on the relationship between pain and disability.

[14] See Burkhauser and Cawley (2004) for a study on the relationship between obesity and DI enrollment.

[15]When measuring body mass index (BMI), the HRS core survey only records respondents' self-reported height and weight, both of which are subject to large measurement error, according to Cawley and Burkhauser (2006). In general, people tend to underreport their weights and overreport their heights, leading to an underestimate of obesity rate. Cawley and Burkhauser (2006) have used a data set (NHANES III) that includes both self-reported and measured height and weight to estimate a prediction equation for the measured height and weight. Although some researchers (e.g., Michaud et al., 2007) have directly applied these coefficients to the HRS, the transportability of these coefficients is questionable. (Questions arise from the fact that the survey mode of NHANES III is face-to-face, while many other surveys, including the HRS, are generally conducted through telephone; the estimation sample in Cawley and Burkhauser (2006) does not include people older than 65; and the NHANES III covers the period from 1988 to 1994, which is earlier than most HRS waves.) Because the HRS itself includes biomarker data for a random group of respondents at W7 and W8 (about 8,000 wave-respondent observations), it is more appropriate to use the HRS-based biomarker data to correct for the measurement error in the HRS self-reported height and weight. Cawley and Burkhauser estimated separate models for gender and race groups because each group was essentially equally represented in the date. However, the HRS includes fewer black, Hispanic, and other races. Thus, we estimate pooled equations with weight and height interacted with gender and race. We also include self-reported fair or poor health, education, and self-reported BMI as controls. The predicted BMI is about 1.3 units higher than self-reported BMI. The cleaned obesity prevalence is about 8 percentage point higher than that based on self-reported height and weight. Detailed estimates are available from authors upon request.

(1.21 vs. 1.11), are more frequently troubled with pain (20.5 percent vs. 18.9 percent), and are more likely to be obese (35.8 percent vs. 30.5 percent) than their counterparts, suggesting that their disabilities may be more severe.

Comparing the demographic and SES variables, respondents in the treatment cohort are significantly younger, more racially diverse, better educated, have higher labor income, higher net worth[16], and are more likely to be covered by health insurance at time *t*. Generally speaking, those born after 1937 have a higher SES level, which might decrease their propensity to apply for DI. The marginal value of the DI benefit (and associated value of access to Medicare after two years of DI receipt) should be lower among high SES people because they have a higher opportunity cost of applying, a potentially lower discount rate on future OA benefits, are less likely to be liquidity constrained, have a higher chance of already possessing health insurance coverage, and may perceive greater social stigma associated with the take-up of government benefits labeled "disability" benefits.

To sum up, cross-cohort differences also exist with respect to other observables that are potentially correlated with an individual's propensity to apply for DI – especially, past DI application experience, life-time earnings, disability severity, and SES variables. In the next section we present estimates of the effect of the FRA increase on the DI application rate that control for these factors. We note that data limitations have meant that most studies have been unable to control for life-time earnings or life-time total quarters of coverage (measures of labor force attachment); rather, these factors were

[16] Net worth is the sum of assets (primary residence, other real estate, vehicles, businesses, IRAs, stocks, bonds, checking accounts, CDs, and other assets) less liabilities (mortgages, other home loans, and other debt).

unobservable omitted variables. However, because our research design is based on access to administrative SSA records, we are able to control for these factors, and with very little measurement error. In addition, we have shown that past DI application experience and the severity of underlying health problems clearly vary across cohorts, yet most studies have been unable to control for these (usually unobserved) cohort differences.

5.3 Regression Estimation Results

We estimate a set of probit models of DI application based on our analysis sample with 11,828 time *t-t+2* observations. The estimation results are shown in Table 3. The dependent variable is whether the individual applied for DI between time *t* and *t+2*. Each column in Table 3 presents estimation results (coefficients and standard errors) from one specification of the model. For each specification, we include an indicator for having applied for DI before time *t*, the OA/DI relative generosity measure at time *t+1*, a third-order polynomial in the AIME (allowing for a non-linear relationship between AIME and the DI application rate), life-time total quarters of coverage, health and disability status, demographics, and socioeconomic status at time *t*. The standard errors in all specifications are clustered by birth year because the exogenous variation in the OA/DI relative generosity measures originates from the difference in the FRA by birth year.

To control for the fixed effects of age and calendar year, we add a flexible set of age band dummies (one dummy for each age band [55], [56-57], [58-59], [60-61], and [62, 63]) and interview wave dummies (one dummy for each interview wave) to all specifications. These are important because the DI application rate is correlated with the

unemployment rate and economic cycle (Autor and Duggan, 2006) and because the expected payoff associated with the decision to apply for DI also depends on the rejection rate, which varies by age and calendar year.

We are interested in the effect of the FRA increase on the DI application rate as it operates through changes in the relative generosity between the OA and DI programs; relative generosity is measured by the OA/DI monthly benefit ratio in specifications (1)-(3), and the OA/DI present value ratio in specifications (4)-(6). Based on the third and the fourth panels in Figure 1, we hypothesize that the treatment effect might differ before and after the EEA (because OA enters the immediate choice set at the EEA) and among individuals with and without work limitations. To separately test these hypotheses, in specifications (2) and (5) we interact the generosity measure with a dummy equal to 1 if time *t* age is greater than or equal to 62; in specifications (3) and (6) we include a similar interaction term between the generosity measure and a dummy for having a work limitation at time *t*. The benchmark specifications (1) and (4) do not include any interaction terms.

The estimation results vary across specifications. In specification (1), the coefficient for the OA/DI benefit ratio is negative and significant; while the coefficient for the OA/DI present value ratio is negative but insignificant in specification (4). We also find significant and negative coefficients on both types of interaction terms in specifications (2), (3), (5), and (6), suggesting that the decline in OA/DI relative generosity does encourage insured individuals to apply for DI after they reach the EEA or when they have a work-limiting health problem. In each specification with the interaction terms ((2), (3), (5), and (6)), the coefficient for the OA/DI generosity measure

main effect becomes insignificant, implying that the effect of the change in OA/DI relative generosity is limited for people below the EEA or among people without a disability.

The larger estimated effect of the relative OA/DI generosity among people with a work limitation seems natural – they have higher probability of receiving a DI award conditional on application due to their disability status. The change in the relative financial incentives between OA/DI is less relevant for people who do not have a work limitation, simply because they are less likely to be medically eligible for DI

How should we interpret the larger estimated effect at ages 62 and 63, which are the two oldest possible ages for claiming DI and also the ages when the possibility of claiming OA benefits enters one's choice set? As suggested by Duggan et al. (2005), the effect of the FRA increase could rise with age for two complementary reasons: (1) potential applicants have a lower expected rejection rate as they grow older, and (2) people discount OA benefits less as they approach the EEA. In fact, they find the largest estimated effect of the FRA rise on DI enrollment at the two oldest ages: 63 and 64. To test whether our age 62/63 interaction term instead captures the first order positive correlation between the effect of OA/DI relative generosity on DI application and age, we experiment with replacing the "reaching EEA" interaction term with an alternative interaction between the relative OA/DI generosity measure and an age trend variable defined as age at time t minus 51 (the lowest bound of the age range in our sample). The coefficient on the new interaction term (not shown) is smaller and insignificant, either with or without inclusion of the original "reaching EEA" interaction term. This suggests that there is no effect of OA/DI generosity on DI application behavior as people age after

we control for the heterogeneity in the effect before and after age 62. This points to a certain amount of myopia in decision-making; individuals do not appear to take account of the OA option when it is not in their immediate choice set.

Most of the coefficients for the other covariates included in the model have the expected signs as discussed in section 5.2. Previous DI application before time *t* is strongly and positively correlated with DI application after *t*. Most health and disability measures have consistently strong and positive associations with DI application across specifications. Among the demographics and SES variables, being female and the number of schooling years have significant and negative associations with the DI application rate, suggesting that DI application is more likely to be selected as a retirement path by relatively disadvantaged people.

To better interpret the regression estimates, we compute the marginal effect of the relative generosity variables in each specification. This is particularly important since the sign and significance of the coefficient for an interaction term in a nonlinear model does not necessarily match the sign and significance of the marginal effect of the interaction term (Ai and Norton (2003)). We use the Stata module "inteff" (Norton et al., 2004) to compute the corrected average marginal effect for each interaction term of interest. The average marginal effects of the OA/DI relative generosity measure in specifications (1) and (4) are estimated using Stata module "margeff", which is developed by Bartus (2005). The results are shown in the top panel of Table 4, where each row gives the marginal effect of interest for the different specifications in Table 3.

The magnitudes of the average marginal effects are not consistent across the two benefit generosity measures. Generally speaking, the OA/DI benefit ratio is associated

with a larger marginal effect, suggesting that perhaps older people are more responsive to changes in terms of the more immediate and readily understandable monthly benefit amount; the change in terms of relative present value might be difficult to calculate and understand. We find that a one percentage point decrease in the OA/DI benefit ratio leads to a 0.527 percentage point increase in the DI application rate among people with a work limitation, while a one percentage point decrease in the OA/DI present value ratio only leads to a 0.149 percentage point increase in the DI application rate among the same sample. Not all of the marginal effects are statistically significant, most notably the average marginal effects for the generosity measures interacted with reaching the EEA at ages 62/63 are not statistically different from zero.

In the second to fifth panels in Table 4, we present four sets of "treatment effect" estimates, those implied by each of two "treatments" – raising the FRA by 0.33 years and 2 years (from age 65)– based on the two relative generosity measures (OA/DI benefit ratio or present value ratio). The "treatment effect" is the predicted change in the DI application rate attributed to the FRA increase. We use the treatment cohort sample for this exercise and also show the treatment effect for subsamples of those with ages at or beyond the EEA and those with a work limitation.

In each panel, we show the predicted change in the relative generosity measure arising from the indicated FRA increase; 0.33 is the average FRA increase actually experienced by our HRS sample, whereas 2 years is the full legislated FRA increase. The numbers in the column "change in OA/DI benefit/PV ratio" are the differences between the actual value of the relative generosity measure and the simulated value when the FRA was 65. Alternatively, the simulated changes in the relative generosity measures caused

by a “2 year” increase are the differences between the counterfactual values when the FRA is 67 and the values when the FRA is 65.

Multiplying the simulated change in the relative generosity measure by the corresponding average marginal effect in the first panel gives the treatment effect of a given change in the FRA on the two-year DI application rate among the whole treatment cohort sample and the subsamples of interest. The treatment effect resulting from the actual FRA increase (“0.33 year” increase) is 0.30 percentage points when the OA/DI benefit ratio is used, and 0.04 percentage points when the OA/DI present value ratio is used. Among people reaching the EEA, the treatment effect is 1.47 percentage points or 1.31 percentage points, for the benefit ratio and present value ratios respectively. Among people with a work-limiting health problem, the effect is 0.89 percentage points or 0.22 percentage points for the benefit ratio and present value ratios, respectively. Although the estimates are somewhat different across generosity measures, it is not obvious which measure is superior. The OA/DI benefit ratio and present value ratio are just two alternative ways of parameterizing the change in relative financial incentives between the two programs, and their salience for real decision-making probably depends on how forward-looking people are.

It is of interest to compare our estimates to those reported in previous studies. However, the outcome variable in Duggan et al. (2005, 2007) is DI enrollment (a stock measure). It is difficult to transform our DI application estimates to something similar to theirs without an arbitrary assumption on the DI rejection rate (which is essentially a policy parameter that could be manipulated by the SSA in order to maintain target caseload levels) and lagged DI enrollment rate. Based on a structural dynamic

programming model, Bound et al. (2008) estimated a 0.2 percentage point increase in the one-year (time *t-t+1*) DI application rate in response to a simulated two-year FRA increase among single men in the original HRS cohort (b.1931-1941) who are (1) in the labor force at time *t*, and (2) have matched SSA records and private pension plan information. To facilitate comparison with their findings, we include a row for "single working men" (which is close to the definition used in Bound, et al. (2008)) in each of the four treatment effect panels, and convert our treatment effects, which pertain to the two-year DI application rate, to effects on the one-year application rate. We find that a two-year increase in the FRA increases the one-year DI application rate among single working men by 0.12-0.46 percentage points. Bound, et al. (2008)'s estimate (0.2 percentage points) falls within this range.

6. Conclusion

As the full retirement age rises, the generosity of the Social Security retirement benefit drops relative to the disability benefit, resulting in an incentive for people to substitute toward applying for disability benefits as an alternative way of exiting the labor force. This paper examines the actual behavioral response to this policy change by comparing the DI application rates of two birth cohorts in the Health and Retirement Study, one (b.1931-1937) unaffected by the change and the other (b.1938-1940) affected by the change.

Descriptive analyses reveal that the cohort affected by the FRA increase has a higher DI application rate only among the subsample of people with a work limitation at or after the earliest eligibility age for retirement benefits. We estimate a set of probit models of DI application to control for other covariates that potentially affect the decision

to apply for DI, especially health and disability status, past DI application experience, life time earnings and labor force attachment, socioeconomic status, age, and calendar year. The predicted treatment effect of the FRA increase (ranging from 2 months to 6 months, with average of four months) on the two-year DI application rate among people born between 1938 and 1940 is relatively small – between 0.04 and 0.30 percentage points depending on the way we characterize the treatment (by either the benefit ratio or the present value ratio). The effect is significantly larger among those with a health problem that limits their work capacity.

Our results imply that the spillover effect of the FRA increase on the DI program is small. Even though the effect is larger among individuals with a work limiting health problem, people with work limitations only account for 12.3 percent of our sample. Our estimate is similar to estimates reported by Bound, Stinebrickner, and Waidmann (2008), who predicted that the rise in the FRA was likely to have quite small effects on applications for DI.

References

Ai, Chunrong, and Edward C. Norton (2003), "Interaction Terms in Logit and Probit Models, "*Economic Letters*, 80, 123-129.

Autor, David H., and Mark G. Duggan (2006), "The Growth in the Social Security Disability Rolls: A Fiscal Crisis Unfolding," *Journal of Economic Perspectives*, 20(3), 71–96.

Bartus, Tamas (2005), "Estimation of Marginal Effects Using Margeff," *The Stata Journal*, 5(3), 309-329.

Benitez-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, 147–178.

Benitez-Silva, Hugo, Moshe Buchinsky, Hiu Man Chan, Sofia Sheidvasser, and John Rust (2004): "How Large is the Bias in Self-Reported Disability?" *Journal of Applied Econometrics*, 19, 649–670.

Benitez-Silva, Hugo, Moshe Buchinsky, and John Rust (2006): "How Large are the Classification Errors in the Social Security Disability Award Process?" Mimeo.

Bound, John, Timothy Waidmann (2007): "Estimating the Health Effects of Retirement," Michigan Retirement Research Center, WP 2007-168.

Bound, John, Todd Stinebrickner, and Timothy Waidmann (2008): "Health, Economic Resources and the Work Decisions of Older Men," Population Studies Center Research Report, 07-630.

Burkhauser, Richard, J.S. Butler, and Gulcin Gumus (2004): "Dynamic Programming Model Estimates of Social Security Disability Insurance Application Timing," *Journal of Applied Econometrics*, 19: 671-685.

Burkhauser, Richard V., and John Cawley (2004): "Obesity, Disability, and Movement Onto the Disability Insurance Rolls," Michigan Retirement Research Center, WP 2004-089.

Cawley, John, and Richard V. Burkhauser (2006): "Beyond BMI: The Value of More Accurate Measures of Fatness and Obesity in Social Science Research," NBER Working Paper, No.12291.

Coile, Courtney and Jonathan Gruber (2007): "Future Social Security Entitlements and the Retirement Decision," *The Review of Economics and Statistics*, 89(2), 234–246.

Dave, Dhaval, Inas Rashad, Jasmina Spasojevic (2006): "The The Effects of Retirement on Physical and Mental Health Outcomes," NBER Working Paper, No.12123.

Duggan, Mark, Perry Singleton, and Jae Song (2005): "Aching to Retire? The Rise in the Full Retirement Age and its Impact on the Disability Rolls," NBER Working Paper, No.11811.

Duggan, Mark, Perry Singleton, and Jae Song (2007): "Aching to Retire? The Rise in the Full Retirement Age and Its Impact on the Social Security Disability Rolls," *Journal of Public Economics*, 91, 1327–1350.

French, Eric (2005): "The Effects of Health, Wealth, and Wages on Labour Supply and Retirement Behaviour," *Review of Economic Studies*, 72, 395–427.

GAO (1999): "Social Security Reform: Implications of Raising the Retirement Age," GAO HEHS-99-112.

Goldman, Dana, Baoping Shang, Jayanta Bhattacharya, Alan Garber, Michael Hurd, Geoffrey Joyce, Darius Lakdawalla, Constantijn Panis and Paul Shekelle (2005): "Consequences of Health Trends and Medical Innovations for the Future Elderly," *Health Affairs – Web Exclusive*, September 26, 2005, W5-R5-W5-R17.

Gustman, Alan, and Thomas Steinmeier. (2005): "The Social Security Early Entitlement Age in a Structural Model of Retirement and Wealth," *Journal of Public Economics*, 89(2-3), 441-463.

Gustman, Alan, and Thomas Steinmeier (2008): "How Changes in Social Security Affect Recent Retirement Trends," NBER working paper 14105.

Kapteyn, Arie, P.C. Michaud, J. Smith, and A. van Soest. (2006): "The Effects of Attrition and Non-Response in the Health and Retirement Study," IZA Discussion Paper, 2246.

Kapteyn, Arie, James P. Smith and Arthur van Soest (2008): "Dynamics of work disability and pain," *Journal of Health Economics*, 27, 496–509.

Lakdawalla, Darius N., Jayanta Bhattacharya, and Dana P. Goldman (2004): "Are The Young Becoming More Disabled? Rates of disability appear to be on the rise among people ages eighteen to fifty-nine, fueled by a growing obesity epidemic." *Health Affairs*, 23, 168-176.

Maestas, Nicole (2007): "Cohort Differences in Retirement Expectations and Realizations," in Brigitte Madrian, Olivia Mitchell, and Beth Soldo (eds.), *Redefining Retirement: How Will Boomers Fare?*, Oxford University Press.

Michaud, Pierre-Carl, Arthur van Soest, and T. Andreyeva (2007): "Cross-Country Variation in Obesity Patterns among Older Americans and Europeans," *BE Press Forum for Health Economics & Policy*, 10(2), 8.

Michaud, Pierre-Carl, and Arthur van Soest (2008): "How Did the Elimination of the US Earnings Test above the Normal Retirement Age Affect Labour Supply Expectations?" *Fiscal Studies*, 29(2), 197–231, 0143-5671.

Mitchell, Olivia S., and John W. R. Phillips (2000): "Retirement Responses to Early Social Security Benefit Reductions," Michigan Retirement Research Center, WP2000-006.

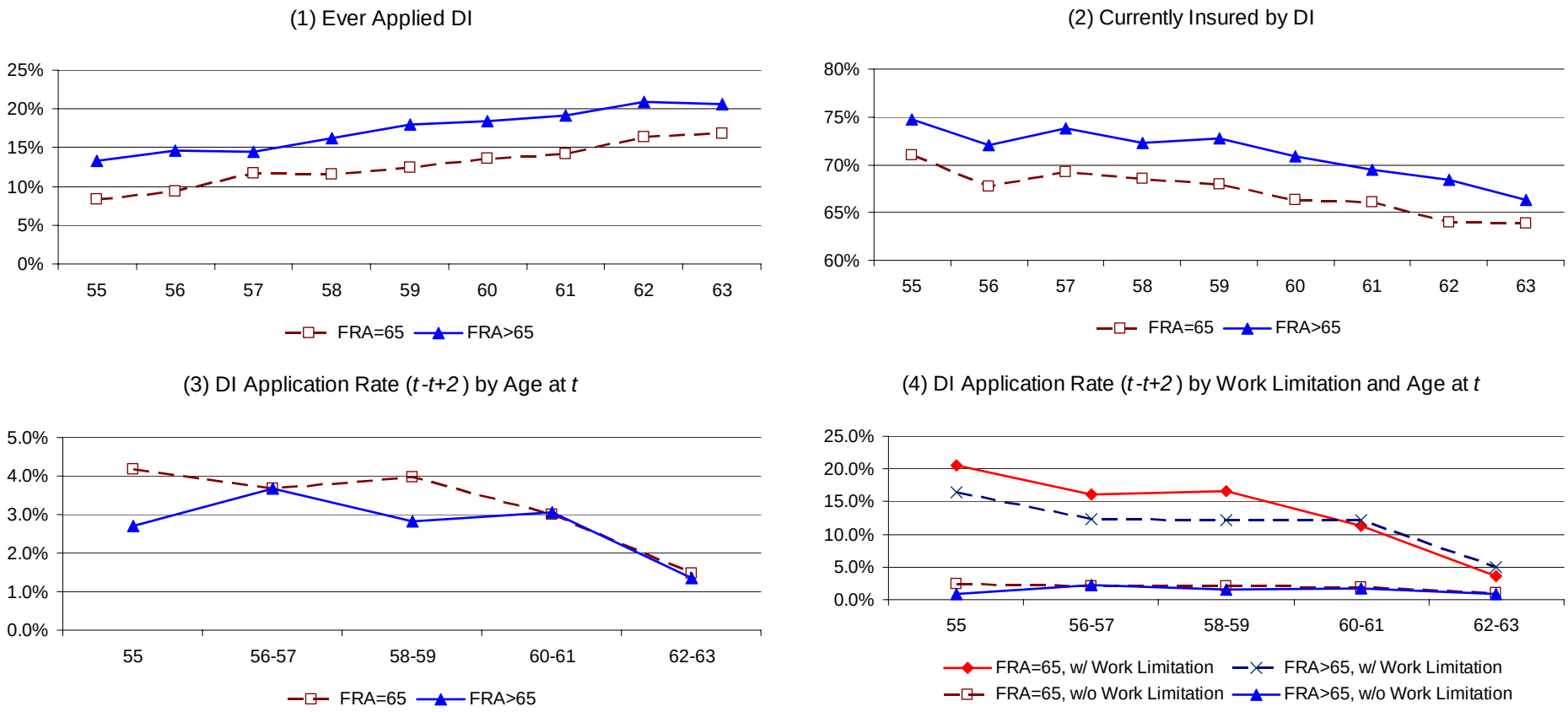
Mitchell, Olivia S., and John W.R. Phillips (2001): "Eligibility for Social Security Disability Insurance," Michigan Retirement Research Center, WP2001-011.

Norton, Edward, Hua Wang, Chunrong Ai (2004): "Computing Interaction Effects and Standard Errors in Logit and Probit Models," *The Stata Journal*, 4(2), 154-167.

Panis, Constantijn, Michael Hurd, David Loughran, Julie Zissimopoulos, Steven Haider and Patricia StClair (2002): "The Effects of Changing Social Security Administration's Early Entitlement Age and the Normal Retirement Age," RAND Corporation, DRU-2903-SSA.

Weir, David R., and James P. Smith (2007): "Do panel surveys really make people sick? A commentary on Wilson and Howell," *Social Science & Medicine*, 65, 1071–1077.

Figure 1. DI Application Rates by Birth Cohort (FRA=65: b.1931-1937; FRA>65: b.1938-1940)



Notes: Sample includes HRS respondents from the original HRS cohort born in 1931-1940 who (1) reached their FRA by Wave 8, and (2) had matched SSA earnings records. Time *t* to time *t+2* DI application rate is conditional on being currently insured by DI and not applying/receiving DI at time *t*.

Table 1. Policy Variation across Birth Cohorts Selected for Comparison and Data Availability in HRS

Birth Cohorts in the Sample	Birth Year	FRA	OA/DI Benefit Ratio at			Age at HRS Interview Waves and Corresponding Calendar Years							
						W1	W2	W3	W4	W5	W6	W7	W8
			Age 62	Age 63	Age 64	1992	1994	1996	1998	2000	2002	2004	2006
"Control" Cohort	1931	65	80.0%	86.7%	93.3%	61	63	65	67	69	71	73	75
Total # in HRS: 4,772	1932	65	80.0%	86.7%	93.3%	60	62	64	66	68	70	72	74
# w/ SSA Match: 4,061	1933	65	80.0%	86.7%	93.3%	59	61	63	65	67	69	71	73
	1934	65	80.0%	86.7%	93.3%	58	60	62	64	66	68	70	72
	1935	65	80.0%	86.7%	93.3%	57	59	61	63	65	67	69	71
	1936	65	80.0%	86.7%	93.3%	56	58	60	62	64	66	68	70
	1937	65	80.0%	86.7%	93.3%	55	57	59	61	63	65	67	69
"Treatment" Cohort	1938	65 and 2 months	79.2%	85.6%	92.2%	54	56	58	60	62	64	66	68
Total # in HRS: 1,976	1939	65 and 4 months	78.3%	84.4%	91.1%	53	55	57	59	61	63	65	67
# w/ SSA Match: 1,666	1940	65 and 6 months	77.5%	83.3%	90.0%	52	54	56	58	60	62	64	66

Note: Sample includes age-eligible respondents from the original HRS cohort who reached their FRA by Wave 8.

HRS Waves Preceeding FRA for Birth Cohort 1931-1937

HRS Waves Preceeding FRA for Birth Cohort 1938-1940

Table 2. Cohort Comparison of DI Application Rate and Related Observables

	FRA=65	FRA>65	
	b. 1931-1937	b. 1938-1940	T-Ratio
Applied for DI between *t* and *t+2*	3.0%	2.7%	0.90
Ever Applied for DI before *t*	3.4%	4.3%	-2.47
OA/DI Generosity Measures at t+1			
FRA	65	65.33	-156.78
OA Benefit/DI Benefit	82.72%	80.28%	28.93
OA Present Value/DI Present Value	74.78%	69.16%	24.51
Lifetime Earnings and Labor Force Attachment at t			
AIME	$2,376	$2,745	-12.84
Lifetime Total Quarters of Coverage	126.0	129.7	-5.64
Health and Disability Status at t			
Work Limitation	12.6%	12.5%	0.18
Sum of ADLs and Other Functional Limitations (0-13)	1.21	1.40	-5.26
Self-Reported Fair or Poor Health	13.1%	14.1%	-1.53
Sum of Major Health Conditions (0-8)	1.11	1.21	-4.99
Often Troubled with Pain	18.9%	20.5%	-2.13
Obese (Corrected BMI>=30)	30.5%	35.8%	-5.84
Probability of Living to 75 or More	67.3%	68.2%	-0.02
Demographics and Socioeconomic Status			
Female	48.9%	49.1%	-0.21
Age at *t*	59.7	58.8	18.64
Years of Education	12.6	13.0	-6.81
Nonwhite	19.5%	21.7%	-2.83
Not Married at *t*	25.9%	26.5%	-0.67
Labor Income at *t*	$39,098	$48,379	-6.81
Household Non-Labor Income at *t*	$23,758	$25,370	-1.29
Net Worth at *t*	$289,338	$357,099	-3.81
Covered by Health Insurance at *t*	80.4%	82.3%	-2.59
Person-Wave Observations	7,654	4,174	

Notes: Sample includes time *t* to time *t+2* transitions made by HRS respondents from the original HRS cohort born in 1931-1940 who (1) reached their FRA by Wave 8, (2) had matched SSA earnings records, and (3) were insured by DI at *t*, but not applying for or receiving DI at *t*, and between age 55 and age 63 at time *t*. All dollar amounts are expressed in 2006 dollars.

Table 3. Probit Model of DI Application between *t* and *t+2*

	(1)	(2)	(3)	(4)	(5)	(6)
Ever Applied for DI before *t*	0.231***	0.233***	0.216***	0.233***	0.231***	0.209***
	(0.076)	(0.077)	(0.073)	(0.074)	(0.076)	(0.072)
OA/DI Generosity Measures at t+1						
OA Benefit/DI Benefit	-3.174***	4.889	-1.791			
	(1.096)	(4.092)	(1.222)			
(OA/DI Benefit Ratio)*I(Age at *t*>=62)		-9.473**				
		(4.727)				
(OA/DI Benefit Ratio)*Work Limitation			-4.794***			
			(1.439)			
OA Present Value/DI Present Value				-0.508	0.925	-0.019
				(0.616)	(0.832)	(0.662)
(OA/DI Present Value Ratio)*I(Age at t>=62)					-5.445***	
					(1.624)	
(OA/DI Present Value Ratio)*Work Limitation						-1.607***
						(0.445)
Lifetime Earnings and Labor Force Attachment at t						
AIME (10,000)	-1.486	-1.401	-1.351	-1.394	-1.449	-1.350
	(1.738)	(1.734)	(1.756)	(1.692)	(1.727)	(1.663)
AIME^2 (10,000)	1.098	0.661	0.702	0.788	0.872	0.840
	(6.895)	(6.990)	(6.959)	(6.713)	(6.868)	(6.662)
AIME^3 (10,000)	0.077	0.777	0.498	0.470	0.479	0.283
	(9.060)	(9.301)	(9.120)	(8.879)	(9.071)	(8.808)
Lifetime Total Quarters of Coverage	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Health and Disability Status at t						
Work Limitation	0.419***	0.419***	4.298***	0.419***	0.420***	1.551***
	(0.121)	(0.120)	(1.185)	(0.122)	(0.121)	(0.366)
Sum of ADLs and Other Functional Limitations (0-13)	0.079***	0.079***	0.081***	0.079***	0.079***	0.082***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)
Self-Reported Fair or Poor Health	0.335***	0.333***	0.332***	0.337***	0.334***	0.335***
	(0.062)	(0.062)	(0.061)	(0.062)	(0.063)	(0.062)
Sum of Major Health Conditions (0-8)	0.067**	0.068**	0.069**	0.067**	0.067**	0.070**
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)
Often Troubled with Pain	0.109	0.112	0.106	0.109	0.111	0.102
	(0.065)	(0.064)	(0.063)	(0.064)	(0.065)	(0.064)
Being Obese (Corrected BMI>=30)	-0.068	-0.065	-0.071	-0.067	-0.066	-0.069
	(0.076)	(0.076)	(0.076)	(0.076)	(0.075)	(0.076)
Probability of Living to 75 or More	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Demographics and Socioeconomic Status						
Female	-0.133**	-0.133**	-0.131**	-0.125**	-0.143***	-0.124**
	(0.054)	(0.054)	(0.053)	(0.055)	(0.053)	(0.056)
Years of Education	-0.034***	-0.034***	-0.034***	-0.034***	-0.034***	-0.034***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Nonwhite	0.036	0.035	0.036	0.038	0.035	0.039
	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.051)
Not Married at *t*	0.074	0.074	0.079	0.072	0.074	0.075
	(0.053)	(0.054)	(0.052)	(0.053)	(0.053)	(0.051)
Labor Income at *t* (10,000)	-0.002	-0.002	-0.001	-0.002	-0.002	-0.001
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
Household Non-Labor Income at *t* (10,000)	0.002	0.002	0.002	0.002	0.002	0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Net Worth at *t* (10,000)	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Covered by Health Insurance at *t*	-0.085	-0.089	-0.083	-0.085	-0.087	-0.085
	(0.055)	(0.055)	(0.056)	(0.055)	(0.055)	(0.057)
Observations	11828	11828	11828	11828	11828	11828
Log Likelihood	-1256	-1255	-1252	-1258	-1255	-1253
Pseudo R-squared	0.1942	0.1952	0.1973	0.1934	0.1950	0.1966

Notes: Sample includes time *t* to time *t+2* transitions made by HRS respondents from the original HRS cohort born in 1931-1940 who (1) reached their FRA by Wave 8, (2) had matched SSA earnings records, and (3) were insured by DI at *t*, but not applying for or receiving DI at *t*, and between age 55 and age 63 at time *t*. All specifications include a constant, dummies for age bands ([55], [56-57], [58-59], [60-61], and [62, 63]), and each interview wave. All dollar amounts are expressed in 2006 dollars. Standard errors in all specifications are clustered by birth year.

, *: Significant on a 0.05 and 0.01 level, respectively.

Table 4. Treatment Effect of the FRA Increase Among People Born in 1938-1940

OA/DI Generosity Measures at *t+1*	Average Marginal Effect	Standard Error	Based on Which Model
OA/DI Benefit Ratio	-0.173 ***	0.065	Table 3, Specification (1)
(OA/DI Benefit Ratio)*I(Age at *t*>=62)	-0.639	0.477	Table 3, Specification (2)
(OA/DI Benefit Ratio)*Work Limitation	-0.527 ***	0.168	Table 3, Specification (3)
OA/DI Present Value Ratio	-0.028	-0.028	Table 3, Specification (4)
(OA/DI Present Value Ratio)*I(Age at *t*>=62)	-0.568	0.342	Table 3, Specification (5)
(OA/DI Present Value Ratio)*Work Limitation	-0.149 ***	0.045	Table 3, Specification (6)

Increase in the FRA=0.33 Year	Change in OA/DI Benefit Ratio	Treatment Effect (2-Year DI Application)	Treatment Effect (1-Year DI Application)
Whole Sample (#: 4,174)	-1.8%	0.30% ***	0.15% ***
Subsamples by Time *t* Characteristics			
Age>=62 (#: 840)	-2.3%	1.47%	0.74%
With Work Limitation (#: 523)	-1.7%	0.89% ***	0.45% ***
Single Working Men (#: 292)	-1.7%	0.29% ***	0.15% ***

Increase in the FRA=2 Years	Change in OA/DI Benefit Ratio	Treatment Effect (2-Year DI Application)	Treatment Effect (1-Year DI Application)
Whole Sample (#: 4,174)	-5.3%	0.92% ***	0.46% ***
Subsamples by Time *t* Characteristics			
Age>=62 (#: 840)	-6.7%	4.26%	2.15%
With Work Limitation (#: 523)	-5.4%	2.82% ***	1.42% ***
Single Working Men (#: 292)	-5.3%	0.92% ***	0.46% ***

Increase in the FRA=0.33 Year	Change in OA/DI PV Ratio	Treatment Effect (2-Year DI Application)	Treatment Effect (1-Year DI Application)
Whole Sample (#: 4,174)	-1.5%	0.04%	0.02%
Subsamples by Time *t* Characteristics			
Age>=62 (#: 840)	-2.3%	1.31%	0.66%
With Work Limitation (#: 523)	-1.5%	0.22% ***	0.11% ***
Single Working Men (#: 292)	-1.5%	0.04%	0.02%

Increase in the FRA=2 Years	Change in OA/DI PV Ratio	Treatment Effect (2-Year DI Application)	Treatment Effect (1-Year DI Application)
Whole Sample (#: 4,174)	-9.1%	0.25%	0.13%
Subsamples by Time *t* Characteristics			
Age>=62 (#: 840)	-12.5%	7.12%	3.62%
With Work Limitation (#: 523)	-9.2%	1.37% ***	0.69% ***
Single Working Men (#: 292)	-8.9%	0.25%	0.12%

Notes: Sample includes time *t* to time *t+2* transitions made by HRS respondents from the original HRS cohort born in 1938-1940 who (1) reached their FRA by Wave 8, (2) had matched SSA earnings records, and (3) were insured by DI at *t*, but not applying for or receiving DI at *t*, and between age 55 and age 63 at time *t*.
, *: Significant on a 0.05 and 0.01 level, respectively.