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How Did the Elimination of the Earnings Test above the Normal Retirement Age Affect Retirement Expectations?

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How Did the Elimination of the Earnings Test above the Normal Retirement Age Affect Retirement Expectations? [1]

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Abstract

We look at the effect of the 2000 repeal of the earnings test above the normal retirement age (NRA) on retirement expectations of male workers in the Health and Retirement Study (HRS). Using administrative records on Social Security benefit entitlements linked to the HRS survey data, we can distinguish groups of respondents according to how, before the repeal, the earnings test would have affected their marginal wage rate after the NRA. We use panel data models with fixed and random effects to investigate the effect of the repeal on the subjective probability to work full-time after the NRA as well as after age 62. We find that male workers whose marginal wage rate increased because the earnings test was repealed, had the largest increase in this probability. We find no significant effects of the repeal on the probability to work full-time past age 62 Since the tax introduced by the earnings test was small when accounting for actuarial benefit adjustments, our results suggest that male workers misperceive the complicated rules of the earnings test.

Keywords: Social security earnings test, expectations, retirement, difference in differences, panel data

JEL codes: H55, J22

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1. Introduction

While several papers study the effect of the social security earnings test in the U.S. on actual retirement (e.g., Leonesio, 1990; Gruber and Orszag, 2003; Haider and Loughran, 2005; Song and Manchester, 2007), little is known about how workers in their late fifties or early sixties adjust their retirement plans and expectations in response to such an earnings test, which taxes away earnings later in life. The Senior Citizens' Freedom to Work Act of 2000, which eliminated the earnings test for workers aged 65 to 69, provides an excellent opportunity to look at this issue, involving a change in the effective tax structure across age groups.

Recent studies find significant responses to the earnings test in terms of labor supply, claiming of benefits, and "bunching" of workers' earnings at the minimum exempt amount (Friedberg, 2000; Tran, 2004; Song, 2004; Haider and Loughran, 2005; Song and Manchester, 2007). This is surprising at first sight since benefits lost due to the earnings test are reimbursed at a later age through an actuarial adjustment. This adjustment is generally believed to be actuarially fair for recent cohorts. One interpretation is that the adjustment is misunderstood (Benitez-Silva and Heiland, 2005). Another interpretation of these effects is that workers are myopic instead of forward looking.

In the end, the consequences of the earnings test depend on its disincentive effects on lifetime labor supply and wealth.[3] In this paper we do not consider actual labor supply after the NRA, but expected labor supply of workers approaching retirement. If forward looking workers in their late fifties and early sixties are aware of the repeal of the earnings test, their expectations concerning future labor market behavior may change. These expectations are important not only because they predict actual future labor market behavior, but also since they may affect current behavior, such as their savings for retirement. Moreover, considering expectations rather than actual behavior makes it possible to analyze within person differences, since the same respondents' expectations are observed before and after the repeal.

[3] Another consideration on the consequences and desirability of the earnings test is that its elimination may induce workers to retire "too early", not taking into account the lower benefits level (Gruber and Orszag, 2003). This could have damaging implications for poverty in old age. Gustman and Steinmeier (2004) point to the fact that the elimination of the earnings test could affect the short-term viability of the Social Security Trust Fund. Mastrobuoni (2006) evaluates the elimination positively affected the long-term finances of the Trust Fund.

Research using expectations questions has increased exponentially in recent years (Manski, 2004). There seems to be general consensus that expectations have predictive power for realizations, and affect actual behavior. This particularly applies to retirement expectations. See, for example, Bernheim (1989) who uses the RHS and Chan and Stevens (2004) who find substantial correlations between retirement expectations and realizations in the HRS. Disney and Tanner (1999) provide similar evidence for the UK, and also show that retirement expectations data help to predict actual retirement, controlling for standard covariates. Benítez-Silva and Dwyer (2005) analyze dynamics in retirement expectations in the HRS and show that individuals correctly anticipate most uncertain events. Haider and Stephens (2006) show that subjective expectations of accumulated *savings* at the time of retirement are predictive for actual retirement savings. Our analysis does not look at actual retirement decisions, but the existing studies imply that if we find an effect of the policy change on expectations, it is likely that there is also an effect on actual behavior. Analyzing the effect on expectations then has the advantage that we observe expectations of the same people before and after the policy change.

This paper first documents the size of the taxes induced by the earnings test for older workers in the Health and Retirement Study (HRS), using administrative earnings records from the Social Security Administration. These calculations take account of the actuarial adjustment and allow for differential mortality profiles exploiting heterogeneous subjective survival probabilities elicited in the HRS. This helps gauge how big the disincentives really are, and whether they are consistent with observed behavioral responses found in the literature. Second, we look at the effect of the repeal of the earnings test on expectations of workers not yet affected by the test in 2000. We consider the subjective probabilities to work full-time past ages 62 and 65. The identification strategy makes use of the pre-repeal tax rates calculated in the first step to form groups affected differently by the repeal. We study whether the changes in expectations around the time of the repeal vary across these groups.

Section 2 discusses the functioning of the earnings test and how it affects behavior according to theory. Section 3 presents the data and evidence on the disincentives due to the earnings test. In section 4, we analyze the effect of eliminating the earnings test on the subjective probabilities to work full time after age 65 and age 62. Section 5 concludes.

2. The Earnings Test and Its Potential Effects on Labor Supply

The parameters determining the earnings tests before and after the normal retirement age (NRA) are given in Table 1. The earnings test that was abolished in 2000 concerns people above the NRA,[4] which was 65 years in 2000, but has gradually increased since 2003. It was 65 years and 4 months for individuals turning 65 in 2004 and will be 65 years and 10 months for those reaching age 65 in 2007. The test applied until April 7 2000 to those who claimed benefits and had positive earnings.[5] Their Old Age Social Insurance (OASI) benefit was reduced by one dollar for every three dollars earned in excess of the exempt amount, which was $14,500 in 1998.[6] It is important to note that workers got compensated for not receiving OASI benefits in a given year by receiving more in the future. The compensation rate is called the Delayed Retirement Credit (DRC), shown in the final row of Table 1. The compensation for postponing claiming in the years after the NRA has increased over time. For those born prior to 1926, DRC was 3.5%. It was 7.0% in 2004 and will eventually reach 8% for future cohorts reaching NRA.

An earnings test still applies for OASI benefits received before the NRA (see Table 1). If someone claims OASI benefits before reaching the NRA, the OASI benefit is reduced by one US dollar of every two dollars earned above an exempt amount. The exempt amount grew from $7,440 per year in 1992 (the year of the first wave of HRS) up to $11,640 in 2004 in nominal terms. If individuals[7] postpone claiming for another year and have not yet reached the NRA, they get 6.8 percent (ARF, the actuarial reduction factor) higher benefits every year in the future than they would get if they started

[4] Social Security refers to the Normal Retirement Age as the Full Retirement Age (FRA).
[5] On April 7th 2000, President Clinton signed the "Senior Citizen Freedom to Work Act". Congress approved a preliminary version proposed on March 1st and the Senate approved the amended version on March 22nd. The desirability of the reform had already been emphasized in his 1999 State of the Union Address: "we should eliminate the limits on what seniors on Social Security can earn.". The vote was unanimous in the Senate in favor of the repeal. On March 23rd, the passing of the measure in the Senate surfaced in popular media (New York Times, March 23rd 2000). There was some discussion in the regular press about the upcoming reform. On February 20th, the New York Times reports that the president already signaled his attention to sign the bill if passed which shows that there was little uncertainty about the possibility that the law would be in effect before the end of the year. The repeal was in effect for earnings after December 31st 1999.
[6] In the year a worker reaches the normal retirement age, there is a special exemption for earnings in that calendar year. This exemption was $17,000 in 2000. See §1803.2 of the Social Security Handbook.
[7] For couples, the situation is often more complicated, due to spouse benefits. For those collecting spouse benefits, the earnings test is applied on their spouse's earnings. We ignore this issue in the current paper.

claiming immediately. On average this appears to be a close to actuarially fair growth rate of future old age benefits.[8]

A Two-Period Model

In a static model of labor supply, agents only look at the current period, and the actuarial compensation in later years (the DRC) for reduced benefits is ignored. Hence, the earnings test is akin to a means-tested benefit. In a dynamic framework, optimizing individuals will take the DRC into account when making their labor supply decisions, under the condition that they are aware of it. Whether the latter is indeed the case is not so clear. Friedberg (2000) argues that actual labor supply behavior reveals that individuals are not aware of the DRC. Gruber and Orszag (2003) show that in one of the leading tax guides, no mention of the DRC is made.

To understand the labor supply effects of the earnings test in a dynamic framework, we construct a simple two-period model along the lines of Disney and Smith (2001). The static model and the model in which people are not aware of the delayed retirement credit will be captured as special cases.

For simplicity, assume individuals make decisions over two periods. In period 1, they can decide to claim OASI benefits or not, and can also choose hours of work *h*. In period 2, individuals claim (irrespective of whether claiming in period 1 or not) and do not work. The hourly wage rate in the first period is denoted by *w*. If claiming already in period 1, the individual gets pension P_1 in period 1 and P_2^c in period 2. Let $P_2^n = P_2^c + \delta P_1$ be the benefit in period 2 if the individual delays claiming to period 2. The actuarial adjustment factor is $\delta \geq 0$. Individuals discount period 2 income at a rate $\theta \geq 0$ (which incorporates mortality risk). Hence, the adjustment is perceived as unfavorable if $\delta < 1/\theta$, in which case income P_1 in the first period is preferred to δP_1 in the second period. The case of a myopic individual is represented by $\theta = 0$.

[8] For earnings lost before the NRA, the actuarial adjustment starts at the NRA. Each full monthly check lost gives rise to a one month actuarial adjustment. Hence someone who claims at age 62 and loses all his checks in that year because of high earnings will receive the same check as someone who claimed at age 63 from the point where they reach the NRA onwards. Before the NRA however, the one who claimed early (and lost his first year benefit), will get checks from age 63 to the NRA that do not include the actuarial adjustment.

If the individual does not claim in the first period, the total discounted value of income is[9]

$$Y = wh + \theta P_2^n \tag{1}$$

If the individual decides to claim and work in the first period, income can be affected by the earnings test. The earnings test rule is defined by two parameters: the exempt amount *E* (the maximum earnings allowed without being taxed) and the "tax rate" τ (the rate at which benefits are taxed away by the earnings test for each dollar above *E*). Three situations can occur depending on how many hours the individual decides to work. If $h < E/w$, the earnings test does not reduce benefits, and the present value of total income is

$$Y = wh + P_1 + \theta P_2^c \tag{2}$$

If hours are above the threshold (or, in other words, earnings are above *E*), benefits are reduced. The reduction is $e = \tau(wh - E)$ up to complete exhaustion of the benefit P_1. Exhaustion will occur when hours worked are given by:

$$h_{\max} = (P_1/\tau + E)/w.$$

If the benefit is completely lost, the individual gets $P_2^n = P_2^c + \delta P_1$ in the second period, the same as if he would not have claimed. Define $\pi = e/P_1$, the fraction of the benefit lost in period 1. If benefits are partly taxed away, the benefit in the second period is $P_2^c + \pi\delta P_1$. On the segment $h \geq E/w$ and $h < h_{\max}$, the present value of total income over the two periods is thus given by

$$Y = wh + (P_2^c - \tau(wh - E)) + \theta(P_2^c + \pi\delta P_1) \tag{3}$$

Finally, an individual who works more than $h_{\max}$ gets

$$Y = wh + \theta P_2^n. \tag{4}$$

Note that (1) and (4) are equivalent in the case where working hours are so high that all benefits are exhausted. This would not be true if there was no actuarial adjustment under the earnings test. In that case, we would essentially have $\pi = 0$ instead of $\pi = e/P_1$. This will also be the relevant case for individuals who realize that they get a compensation for postponing claiming ($\delta > 0$) but do not realize that they are compensated in the same way if they have started to claim but their benefits are partially

[9] We abstract from other taxes such as federal and state income taxes.

or completely taxed away by the earnings test; such individuals will base their decisions on the perception that π equals zero.

For individuals who do not intend to work in period 1 or want to work few hours such that their earnings are below *E,* it may still be profitable to delay claiming rather than to claim immediately. This is the case if the actuarial adjustment δP_1 is large enough to compensate for the lost benefits P_1. In this two period model, the condition for this is $\delta > 1/\theta$, i.e., the individual perceives the compensation for delayed claiming as more than fair.

To illustrate how expected income is affected by the earnings test, we consider the example in Figure 1, based upon the parameter values

$$w = 20,\ E = 14{,}500,\ \delta = 0.75, \tau = 0.33,\ \theta = 0.97,\ P_1 = P_2^c = 10{,}000$$

Since in this example $\delta < 1/\theta$, the individual considers the DRC as actuarially less than fair and will not postpone claiming if the earnings test does not apply. We consider two situations with claiming in period 1. One is the actual situation where adjustment due to the earnings test is possible ($\pi > 0$) and the other one is the situation where the individual is unaware of the adjustment in case the earnings test applies (and uses $\pi = 0$ in making his decisions).

Figure 1 presents this individual's "budget set", i.e., the present value of perceived total income as a function of hours of leisure (3000-hours of work) in period 1. If the individual does not claim in period 1 (dashed line), the budget set is linear (progressive federal taxes are ignored in this stylized model). In the other two cases, the budget set is piecewise linear, with kinks at $h_{\min} = E/w$ (= 725, i.e., 2275 hours of leisure) and $h_{\max} = h_{\min} + P_1/(\tau w) = 2225$ (775 hours of leisure). The slopes of the flatter part in the middle, however, are quite different. If $\pi = 0$, the slope is $(1-\tau)w$ (= 13.33), since the individual perceives no compensation for the benefits that are taxed away. In this case, the individual may easily think that it is better not to claim. In the actual situation on the other hand, where $\pi = e/P_1$, the slope is higher ($13.33 + \theta\delta\tau w = 18.18$), because of the actuarial adjustment. The difference with the slope of w (=20) is due to the fact that the individual's subjective discount rate makes the actuarial adjustment unfair, so that the delayed receipt of benefits is still seen as a mild tax on earnings.

Abolishing the earnings test can have different effects on labor supply in period 1, depending on where the individual would be on the budget curve in the presence of the earnings test and depending on whether or not he claims in the first period.

First consider someone who is claiming benefits in the presence of the earnings test, and works more than $h_{\max}$ hours (group 1). Abolishing the earnings test does not change the marginal wage rate but has a negative income effect. Hence, the repeal is expected to reduce the work effort.

Next consider the group claiming benefits and working between $h_{\min} = E/w$ and $h_{\max}$ in the presence of the earnings test (group 2). This group has some benefits taxed away by the earnings test and faces both a substitution and an income effect from the repeal. With no earnings test, the worker gets higher income, reducing hours worked (income effect) but also a higher marginal reward from additional working hours, leading to an increase in labor supply (substitution effect). The total effect is ambiguous.

Individuals just above or exactly at the kink $h_{\min}$ will want to work more if the earnings test is eliminated, since for them, there is hardly any income effect. The income effect will be larger if the individual is closer to $h_{\max}$. We thus expect a positive effect on labor supply for those close to or at $h_{\min}$, and a smaller positive or even negative effect for those close to $h_{\max}$. In our empirical work, we will exploit information from SSA earnings records to determine where individuals are before the earnings test is repealed and how close the respondents actually are to the two kinks.

For the group who claim benefits in period 1 and work less than $h_{\min}$ (group 3), the earnings test is irrelevant – their earnings are so low that the earnings test does not reduce their benefits. Their behavior will not change if the earnings test is abolished.

Finally, consider the respondents who do not claim benefits as long as the earnings test applies because they see the actuarial adjustment as favorable. For this group (group 4), the repeal has no effect – they will also not claim if the earnings test is eliminated.

Another group of non-claimants are those who perceive the actuarial adjustment as unfavorable ($\delta < 1/\theta$) but misinterpret the rules of the earnings test and perceive $\pi = 0$. Their perceived budget set in case of claiming will change with the repeal, and this may induce them to start claiming. In figure 1, these are the people on the dashed line who work more than (approximately) 1200 hours – for them, as long as the earnings test applies, the present value of total income is perceived as higher if they do not claim. This changes if the earnings test is abolished. They will then claim and reduce their working hours due to a negative income effect.

3. Data

We only consider males, since the consequences of the earnings test for females are often complicated by the presence of spouse benefits.[10] We use all available cohorts of the Health and Retirement Study (HRS) in the waves 1992 - 2004. Table A.1 in the appendix presents the design of the HRS, illustrating when respondents were interviewed and how old they were at the time of the repeal. The original HRS cohort born 1931-1941 was first interviewed in 1992, the AHEAD cohort born before 1923 entered in 1993, the War Babies (born 1942-1947) and Child of Depression Age (CODA, born 1924-1930) entered in 1998, and the Early Boomers (EB, born 1948-1953) first participated in 2004, the last available wave. The cohort directly affected by the repeal is the original HRS cohort, for whom the normal retirement age was 65. When the earnings test was repealed in 2000, respondents of this cohort were between 59 and 69 years old. Their delayed retirement credit varies from 5.0% to 7.5%). Although the NRA of War Babies and some HRS respondents is after the year of the repeal, *expectations* of these younger workers can be affected by the repeal. They face a more favorable delayed retirement credit than their predecessors, however.

3.1 Match with Social Security Earnings Records and Sample Selection

To obtain exact information on OASI entitlements and how they are affected by labor supply and claiming decisions, we link respondent records with their Social Security earnings history records. Thus we can accurately compute social security incentives and avoid measurement errors, which can be an important source of bias (see Haider and Loughran, 2005). We use the administrative earnings records to compute benefit eligibility as well as the earnings profile. We have access to records for the HRS, War Babies and CODA cohorts.[11]

[10] According to Social Security Fast Facts 2006, very few males are eligible for spouse benefit.

[11] The HRS asked respondents in 1992, 1998, and 2004 for permission to match their earnings records. We do not have access to the earnings records data for 2004. Hence, we have no Social Security earnings data for the Early Boomers.

There are two potential drawbacks of using earnings record matched with HRS respondents. First, Social Security earnings are top-coded at the maximum taxable earnings (presently about $90,000). This applies to 6% of respondents in 1991 (HRS) and 1999 (for WarBabies and CODA). Respondents subject to the earnings test have lost their complete social security benefits before reaching the threshold of $90,000. Hence, the classification of respondents in terms of the incentive they face due to the earnings test is not affected by the censoring – all censored respondents are in group 1 in the model of the previous section.

Second, there are a fair number of respondents for whom a match to an SSA earnings record is not possible. In the HRS cohort, 75.1% of respondents have a successful match. For CODA and War Babies, the match rates are much lower (50-60%). We present some descriptive statistics for the two groups (those with and those without a match) in the appendix (Table A.2). Differences in characteristics between the overall sample and the sample with matched SS.Er earnings records appear to be small. Apart from this difference, some under representation of blacks is found, as well some difference in total financial wealth. Table A.2 also gives the numbers of observations in each wave along with the numbers for which we have Social Security Earnings Records (SS.Er). The sample of workers gets smaller over time because of the age range we chose. The fraction of respondents with an SS.Er is large in early years and decreases because of lower match rates for War Babies in 1998.

We use the Average National Wage Index constructed by the Social Security Administration to project earnings into the future. These earnings are needed to compute various measures of future retirement incentives. Over the period 1985-2003, the average growth rate was roughly 4%. Over the same period, inflation (measured by the Consumer Price Index published by the Bureau of Labor Statistics) was on average 2.9% per year, thus yielding an about 1% real growth in earnings.[12]

For our analysis, we select an unbalanced sample of respondents aged 51 to 61 who report to be working for pay. We do this because the expectations questions we analyze are only asked to workers. In 1992, the entire original HRS cohort is age eligible, but this is not the case in later waves. Some respondents aged 51-61 have already retired, but this number is low compared to after age 61 when workers become eligible for Social

[12] The assumptions made for the projections are that workers keep working their current hours, and that the growth rate of wages is the same across all groups of workers. An alternative would be to forecast earnings at an individual level. We do not do this, since it leads to selection issues due to retirement incentives.

Security benefits on their own earnings record. Age 62 and 65 appear also to be the most common normal retirement age for employer defined benefit plans in the data. The first major refreshment of the original HRS sample is the War Babies cohort, aged 51-56 when entering in 1998.[13]

3.2 Descriptive Statistics

Table A.2 in the appendix presents descriptive statistics of some background variables that we use in the analysis. One potentially important job characteristic is the flexibility of the current job (see, e.g., Hurd, 1996). If workers cannot change hours at their current employer, they need to change jobs to reduce hours. Some information on job flexibility is available in the HRS as of 1996. We use two questions. The first refers to whether the respondent feels pressured by co-workers to retire before 65. This is used to measure the attitude of co-workers (and often employers) to older workers. The other question refers to whether the respondent thinks that a transition to a low demanding job is easy at the current employer. This measures the flexibility to reduce work pressure, hours, or responsibilities in the current job. We code the answers as 1 (yes) if the respondent reports either "strongly agree" or "agree" and 0 (no) otherwise. Over all waves, approximately 11% of workers aged 51-61 think they are pressured to retire before 65 at their current employer. About 28% think that a transition to a low demanding job with the same employer is possible.

Table A.2 also includes measures of current earnings, accumulated financial wealth (liquid = savings, stocks, bonds, CDs, IRAs), non-financial assets such as real estate, and whether the respondent has a (defined benefit or defined contribution) occupational pension on the current job. AIME is Average Indexed Monthly Earnings, a measure of life-time earnings, computed using the SS.Er earnings records. It is the monthly equivalent of the average earnings over the 35 years of highest admissible Social Security earnings. It is the basis for the primary insurance amount (PIA), the benefit to which a worker is entitled at the normal retirement age.[14] In 2004 US dollars per month, the median worker aged 51-61 had an AIME of $2,018 in 1994, compared to $2,370 in 2002.

[13] The Early Boomers refresh the sample in 2004. For most of the analysis, we will not use the Early Boomers because we do not have their Social Security earnings records.

[14] The PIA is a piece-wise linear function of the AIME with two kink points and marginal tax rates of 0.9, 0.4 and 0.1 on the three segments.

Our main dependent variable is the subjective probability to work full-time in any period past age 65. This measure is well documented by, e.g., Hurd (1999) and Chan and Stevens (2004).[15] We refer to it as P65. The question is only asked when the respondent provided a positive probability to a preceding question asking the probability of working full-time past age 62. If the answer to this question (P62) is zero, P65 is assigned a value of zero as well. Respondents are not asked P62 and P65 if they are 62 or older.[16] We will analyze the effect of the repeal of the earnings test after NRA on P65, but will also consider its potential effects on P62, since respondents who change their mind about working at age 65 may be more likely to keep working between age 62 and age 65, due to the costs of labor force exit and entry.[17]

Table 2 shows the evolution of P65 over time, revealing an upward trend, particularly so in 2000. A closer look shows that the jump is most strinking for 51-54 year old workers, perhaps because they have not fixed their retirement plan yet. However, we do not know if this is a true time effect because the composition of the sample changes over waves. This is a consequence of the age restriction to respondents younger than 62.

3.3. Incentive Measures from the Earnings Test

For respondents with a match, we calculate social security benefits and potential loss due to the earnings test. From these we can calculate the following three measures of social security wealth that involve the effect of the earnings test at the early retirement age (62) and the normal retirement age (65 or 66):

Myopic loss: In a year in which the earnings test applies, this is given by

$$e_k = \max(\min(\tau_k[wh - E_k], P_1), 0), \quad k = ERA, NRA \qquad (5)$$

It is the loss in benefit that the worker incurs at age k if he earns wh at age k.[18]

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15 The exact wording of the question is "Thinking about work generally and not just your present job, what do you think are the chances that you will be working full-time after you reach 65". The answer is a number between 0 and 100 (in 1992 between 0 and 10 which is recoded).

16 There are some exceptions due to routing inconsistencies.

17 A third expectations question that seems relevant is the age at which respondents expect to claim Social Security benefits. This is not a probability question but a point estimate, and if respondents are uncertain, the interpretation of this point estimate is ambiguous (cf. Manski, 2004). We therefore do not consider this measure in our analysis.

18 We calculate the gross loss due to the earnings test ignoring taxation issues, which will give an upper bound of the loss after tax. We ignore that progressive taxes can also have a labor supply effect because the

Forward-Looking Loss according to Life-Table Survival Probabilities: This measure is the sum of the myopic loss and the gain arising from the actuarial adjustment (DRC) compared to a situation where there is no earnings test:

$$f_{L,k} = e_k - \sum_{s=k}^{A} S_{L,k}(s)\theta^{s-k+1}(\pi_k \delta_k P_{k,s}) \tag{6}$$

where $S_{L,k}(s)$ is the life-table probability of living to age *s* given survival up to age *k*. The terminal age *A* is set such that $S_{L,k}(A) \approx 0$ (here *A*=109). $P_{k,s}$ is the pension someone gets at age *s* when claiming from age *k*.

Forward-Looking Loss according to Subjective Survival Probabilities**:** As discussed by Tran (2004), the actuarial adjustment may be fair for some but not for others. Individuals who are at the kink (the point where the earnings test kicks in), are likely to have lower socio-economic status and health than those higher in the earnings distribution, simply because they have lower earnings. The earnings test might have an effect on lower socio-economic status workers since actuarial adjustment is relatively unfair for them because of their low survival probabilities. We also consider a forward-looking loss measure that takes account of the dispersion in survival probabilities in the population. Delavande and Rohwedder (2006) find that the heterogeneity in subjective probabilities proxies very closely the variation in true survival probabilities in the HRS/AHEAD panel. We therefore construct a set of average subjective probabilities $S_{j,k}(s)$ for groups of respondents characterized by health, education, gender and age (see Appendix B for details on the construction of such probabilities). The subjective loss is given by[19]

$$f_{j,k} = e_k - \sum_{s=k}^{A} S_{j,k}(s)\theta^{s-k+1}(\pi_k \delta_k P_k)\,. \tag{7}$$

For the two forward-looking measures, we use a real discount rate of 3% (i.e., $\theta = 0.97$). We use a 2.9% inflation rate and thus a nominal discount rate of 5.9%.

marginal tax rate changes as a result of the elimination of the earnings test, since this effect will generally be small.

[19] The notation is (6) and (7) is not completely correct in the case where we evaluate the loss at the early retirement age (62). There, the actuarial adjustment only kicks in once the worker reaches the NRA, and we incorporate this by defining $\pi_{ERA,s} = I(s \geq NRA)\pi_{ERA}$.

Social security benefits are based on projected AIME from ages 62 and 69. Appendix C gives details on the construction of benefits. We do not take account of spouse benefits. This omission is likely more important for females than males.

We first describe patterns of expected social security wealth assuming workers retire when they claim Social Security benefits. This helps to understand the heterogeneity in the actuarial adjustment which workers face when they consider claiming benefits. We compute Social Security wealth as

$$\begin{aligned} W_{L,k} &= \sum_{s=k}^{A} S_{L,k}(s)\theta^{s-k} P_{k,s} \\ W_{j,k} &= \sum_{s=k}^{A} S_{j,k}(s)\theta^{s-k} P_{k,s} \\ k &= 62,...,69 \end{aligned} \quad (8)$$

Here $P_{k,s}$ is the projected annual social security benefit at age s if the respondent starts claiming at age k. In addition, we compute an "accrual" rate as

$$A_{L,k} = \frac{W_{L,k+1} - W_{L,k}}{W_{L,k}}, k = 62,..,68 \quad (9)$$

Similarly, we compute accrual rates $A_{j,k}$ using subjective mortality rates instead of life tables. Because workers differ in terms of their potential benefits, earnings history, birth cohort (determining many benefit rule parameters), and life expectancy (in the subjective case), there is considerable variation in the accruals.

Table 3 presents quantiles of expected Social Security wealth at age 62 and accruals of male workers aged 51-61, using both life-table and subjective probabilities. Using life-table probabilities, median expected social security wealth at age 62 is about \$179,000, but there is considerable dispersion. The dispersion is still larger when subjective survival rates are used.

Social Security accruals are generally positive until age 65 where for some workers DRC is not sufficient to compensate for increased mortality risk and, if subjective probabilities are used, more than half of the sample have negative accruals. In general, accruals tend to be lower using subjective probabilities.

Table 4 presents the loss (or gain) due to the earnings test using the myopic loss e_k and the forward-looking measures using life-table survival probabilities $f_{L,k}$ and subjective survival probabilities $f_{j,k}$. These losses are reported in dollars and as a fraction of earnings,. The myopic loss is larger at age 62 than at NRA, due to a higher exempt amount and a lower marginal tax rate at NRA. The heterogeneity in myopic losses is mainly due to differences in projected earnings and benefit entitlements.

Because of actuarial adjustments, the tax is much lower if people are forward-looking rather than myopic. Additional heterogeneity is introduced when computing these forward-looking taxes, e.g. since they vary by birth cohort (due to different actuarial adjustment).

About 90% of workers aged 51-61 face a loss smaller than $5000 on life-time Social Security wealth. At the median, the life-time loss is less than 7% of one year's earnings. Hence if workers perceive the rules correctly, we should not expect large labor supply effects of the repeal. This is particularly true for later cohorts, for whom the rate of actuarial adjustment is larger (cf. Table 1).

4. The Effect of the Repeal on P65 and P62

As explained in Section 2, workers with different expected loss due to the earnings test are predicted to react differently to the repeal. This is the case if workers are not aware of the actuarial adjustment compensating for benefits lost due to the earnings test, or, to a lesser extent, to workers who perceive the actuarial adjustment as actuarially unfair. This suggests that we can use a difference-in-difference approach by grouping workers according to the pre-repeal incentives induced by the earnings test. The key to this identification strategy is to determine groups that get different treatments. We define the groups based on the percentage of social security benefits predicted to be lost if they do not change their hours at the normal retirement age (NRA). This is somewhat different from the way we defined groups in section 2, where we distinguished on the basis of claiming behavior and labor supply during the time period to which the earnings test applies – a distinction that cannot be made for respondents eliciting expectations before actually reaching their NRA.

Those whose earnings are below the exempt amount are not affected by the earnings test. There seems to be no reason why they should behave differently after the repeal. (They can be expected to reduce their hours when reaching the NRA, both before and after the repeal of the earnings test, because of a negative income effect from getting the OASI benefit).

When those whose earnings before NRA are above the exempt amount reach NRA, the negative income effect may induce them to earn less than the exempt amount irrespective of the earnings test. In this case, there is no effect of the repeal, as in the previous case. It is also possible, however, that the negative income effect is not large enough to reduce their earning to below the exempt amount. In this case, the repeal of the earnings test will induce a positive substitution effect – their marginal wage rate increases since their (additional) earnings are no longer taxed away. The earnings test might induce them, for example, to reduce earnings to the exempt amount, and this is no longer the case if the earnings test is eliminated. The repeal of the earnings test will also induce a negative income effect, however, which goes in the opposite direction.

The positive substitution effect of the repeal also applies to those who would earn so much that they would lose almost all their benefits. In this case, however, the income effect induced by the increase in the marginal wage rate is substantial (the repeal gives them an additional income that is close to the benefit amount), so that the total labor supply effect of the repeal may be smaller.

The final case is the group whose OASI benefit would be completely taxed away under the earnings test when they keep working their before NRA hours. If the earnings test is eliminated, reaching NRA would induce a negative income effect. With the earnings test in place, however, their behavior when reaching the NRA is less clear, since they now face a non-convexity in their budget set. They may either stay where they were before reaching the NRA (and work more than they would if the earnings test were eliminated, due to the income effect), or reduce hours and receive partial or full OASI benefits (and probably work less than they would if the earnings test were repealed).

Following the arguments made above and in section 2, we categorize the respondents in four groups on the basis of actual earnings and SS.Er records, assuming they will keep working thos hours until the NRA. This is a proxy to the ideal treatment group assignment which would use actual behavior after the NRA. To account for measurement and projection errors around the exempt amount, we include the people around the exempt amount in the second group, following Haider and Loughran (2005). This can also be rationalized if workers cannot choose freely their hours. We thus define the four groups in the following way:

1. No benefit lost: Projected earnings below 80% of the exempt amount,
2. Projected earnings >80% of exempt amount and <50% of benefit lost
3. between 50% and 100% of benefit lost
4. 100% of benefit lost

We use 1998 as the year to define the grouping since it is the wave just before the repeal. Since job characteristics are only observed from 1996 onwards, we only use observations from 1996 until 2002.

We first consider the respondents with non-missing P65 or P62 in waves 1998 and 2002. The idea is to look for a differential change between the two waves across groups. Composition effects cannot occur because we consider the same respondents in both waves. The identifying assumption is that all groups would have similar trends in P65 or P62 if there were no repeal. Table 5 reports the means of P65 and P62 in both waves for each group, as well as fractions with P65>0 and P62>0.

The results for P65, the probability to work full-time at any point in time after reaching age 65, are in line with what the theory predicts. For respondents for whom the earnings test was not binding (group 1) the average hardly changes and the fraction with nonzero P65 slightly falls. For group 2, the group for which we predicted the largest positive effect, we indeed find a substantial increase in the average value of P65, and also a substantial increase in the fraction reporting a nonzero probability. Taking group 1 as the control group (with no treatment), the difference in differences estimates of the effect of the repeal on group 2 are a 2.98%-points increase for the average P65 and a 7.75%-points increase in the percentage with nonzero P65. For group 3, we find positive but smaller effects, in line with theory – the positive substitution effect is partly cancelled by a negative income effect. Finally, for group 4, we find small changes only. We would have expected to find a negative income effect here, but the change in P65 is actually somewhat larger than that for the control group. This group is quite small, however. Social Security benefits may actually represent a small share of their total wealth.

For the average value of P62, we hardly find any treatment effects for groups 2 and 3. A positive effect might have been expected if people would anticipate staying in the labor market after age 65 and would want to avoid costs of exit and reentry. A negative effect would result if the earnings test would induce people to substitute working after NRA by working more between age 62 and age 65. The negative treatment effects on the fraction of respondents with P62>0 for groups 2 and 3 suggest that the latter may play a larger role than the former. For group 4, large negative effects are found on both the average P62 and the fraction with P62>0, but again, since this group is small it might be due to a few observations.

The difference in differences estimator only uses the balanced sample of individuals who work and answer the P62 and P65 questions both in 1998 and 2002. In order to exploit the complete unbalanced sample and to control for several background characteristics, we formulate some panel data models.

Denote by $g_c, c = 1,2,3,4$ the dummies that take value 1 when the respondent is in one of these four groups. Define a variable REP_t that takes value 1 after the repeal (in 2000 and beyond). We observe for each individual i in wave $t = 1,...,T_i$, the subjective probability P65 (or P62), p_{it}. We model p_{it} with a two-limit tobit equation, accounting for the substantial number of answers equal to 0 or 100:

$$p_{it}^* = \alpha_0 + \alpha_1 g_{i1} + \alpha_2 g_{i2} + \alpha_3 g_{i3} + \lambda_t + x_{it}\delta + \sum_{c=1}^{3} \xi_c (REP_t \times g_{ic}) + u_{it}$$
$$p_{it} = \min[\max(0, p_{it}^*), 100]$$
$$i = 1,..., N, t = 1,..., T_i$$

We include dummies for three of the four groups to capture permanent differences between groups,[20] and time dummies to capture the trend relevant for all groups. (These variables were also included in the model which implicitly was behind the difference in difference estimates presented in Table 5). We also incorporate a number of background characteristics, some constant over time (race and education), others time varying (health, job characteristics, pension entitlements, household wealth).

We consider two specifications, a random effects model where the u_{it} are assumed to be independent of the regressors, homoskedastic, jointly normal, and equicorrelated (i.e., are the sum of an error term which is assumed to be independent over time, and an individual effect which remains the same over time), and a fixed effects model, where the only condition on the u_{it} is that their conditional distribution given the regressors is symmetric (see Honoré, 1992).

The random effects model is estimated using maximum likelihood. The fixed effects model is estimated using the technique developed by Honoré and Sørensen (2006), generalizing the fixed effects estimator of Honoré (1992) for the model with one-sided censoring to the two-sided case.

[20] In the fixed effects model, all time-invariant regressors are subsumed in the individual effects.

We also estimated models for the binary event P65>0 (coded as 1) or P65=0 (coded as 0). We used a random effects probit model and a fixed effects logit model (conditional logit; see Chamberlain, 1980), with the same specification of right hand side variables as used for the censored regression models.

Complete results for P65 and details on which background variables are included are presented in the appendix (Table D.1). They establish well-known features of retirement differences across demographic groups, such as lower P65 for blacks than for whites, and a positive relation between P65 and education. Job characteristics and wealth play some role in the random effects models, but not if fixed effects are allowed for. In the RE models, the projected accrual has a positive effect on P65, while the effect of AIME is negative This can be explained by income and substitution effects. In RE models, Social Security wealth enters positively which is counterintuitive. The fixed effect results show that the source of that effect is likely not causal since the sign of the effect goes from positive to negative and significant at the 10% level. Here we focus on the parameters of main interest, for which the estimates are presented in Table 6. The insignificant estimates of the coefficient on the repeal dummy shows that there is no clear time trend from before 2000 to after 2000 for the group not affected by the earnings test. The coefficients on the interactions (ξ_c) measure the differential effect of elimination of the earnings test for each of the three groups affected by the earnings test.

There are some differences in size of coefficients between the two columns, but qualitative conclusions are largely similar. The findings are in line with the difference in differences estimates in Table 5 and with economic theory – positive effects of eliminating the earnings test are found for those who are affected. The effects for the group whose earnings are taxed away completely by the earnings test are inaccurately determined and insignificant, due to the small size of this group. For both groups of workers whose marginal wage is affected, however, we find the expected positive effects of eliminating the earnings test, and these effects are significant in four out of eight cases. Unlike in Table 5, however, there is no clear evidence that an income effect in the opposite direction would reduce the total change for those with a substantial income gain (group 3). In the tobit models, the estimated effect for group 3 is actually larger than that for group 2, though not significantly so. The results for the binary choice models are more in line with the theory than those for the tobit models, in the sense that group 2 is affected most. The effect for group 3 is positive also, but smaller and not significant.

Table 7 presents some marginal effects for the RE models.[21] According to the RE Tobit model, the elimination of the earnings test increased the probability to work full-time after NRA by about 4%-points for those who were affected. It increased the likelihood that this probability was larger than zero by 10 and 5%-points for the two groups whose marginal wage rate changed.

Because our data set has more than two time periods, the hypothesis of a common trend in groups 1-4 can be tested. This hypothesis is not rejected in either the RE or the FE models.

We also considered P62, the probability of working past age 62. We have estimated the same models for this as for P65, but found that the repeal of the earnings test had a small and insignificant effect for all groups. See the Appendix for the results (Table D.2). This is understandable – although there are reasons why there could be indirect labor supply effects of the earnings test on P62, the effects are likely to be smaller than those on P65 where within period income is immediately affected.

5. Conclusions

The elimination of the earnings test on Social Security benefits after the normal retirement age has been used as a natural experiment in various studies on actual labor supply at an older age. In this study, we have focused on how this policy change affected expectations of workers who did not yet reach an age at which they can claim these benefits. We have presented a two period theoretical model, demonstrating that workers should react in different ways, depending on where they are on their budget set while the earnings test is still in place. This model also implies that the effects are smaller if workers realize that taxed away benefits will be returned in later years with actuarial adjustment. In that case, depending on the individual's discount factor and the actuarial adjustment rate, it may even be the case that the earnings test is irrelevant.

The advantage of looking at expectations is that we can see how expectations of the same people develop over time. Moreover, since some groups were not affected by the earnings test in the first place, a control group is available. Administrative Social Security Earnings records linked to the core HRS data allow us to distinguish between a control group and several treatment groups. Combining this with the time dimension

[21] Comparable effects cannot be computed for the fixed effects models without making additional assumptions.

allows for a difference in differences approach. We applied this to the self-reported probability of working full-time after age 65 (the normal retirement age during the time period we consider) and after age 62 (the earliest age at which benefits can be claimed).

For men aged 51-61, we find substantial effects of elimination of the earnings test that on the probability to work after the normal retirement age, and the qualitative effects are in line with the theoretical predictions under the assumption that people do not realize that benefits taxed away by the earnings test are returned later with actuarial adjustment, or under the assumption that people have large discount rates or face liquidity constraints so that they hardly account for the future consequences of their current decisions.

We applied the same methodology to women, but found no clear effects of elimination of the earnings test, probably due to the relation between the effect of the earnings test on own benefits and changes in spousal benefits, relevant to a large fraction of women in the sample. The issue of spouse benefits is not dealt with in the current paper and is an issue of further research.

The conclusion that people adjust their future work and retirement plans to the rules of the social security system is important for public policy. It also implies that people realize that the rules change, giving them at least a chance to reconsider their retirement savings and investment portfolio. On the other hand, the result that the adjustment of plans is largely based on misperception of the rules, ignoring the actuarial adjusted compensation in later years for benefits lost under the earnings test, is also relevant. It confirms that many people do not always base their expectations and decisions on fully rational economic optimization and suggests that providing information and keeping the rules simple and transparent is as important in formulating policy measures as incorporating the desired financial incentives.

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Appendix A

Table A.1: Design of HRS Study

			Pre-Repeal				Post-Repeal			
Birth year	**DRC**	**NRA**	**1992**	**1994**	**1996**	**1998**	**2000**	**2002**	**2004**	**HRS cohort**
1918	3.50%	65	74	76	78	80	82	84	86	*AHEAD*
1919	3.50%	65	73	75	77	79	81	83	85	
1920	3.50%	65	72	74	76	78	80	82	84	
1921	3.50%	65	71	73	75	77	79	81	83	
1922	3.50%	65	70	72	74	76	78	80	82	
1923	3.50%	65	69	71	73	75	77	79	81	
1924	3.50%	65	68	70	72	74	76	78	80	*CODA*
1925	3.50%	65	67	69	71	73	75	77	79	
1926	3.50%	65	66	68	70	72	74	76	78	
1927	4.00%	65	65	67	69	71	73	75	77	
1928	4.00%	65	64	66	68	70	72	74	76	
1929	4.50%	65	63	65	67	69	71	73	75	
1930	4.50%	65	62	64	66	68	70	72	74	
1931	5.00%	65	61	63	65	67	69	71	73	*HRS*
1932	5.00%	65	60	62	64	66	68	70	72	
1933	5.50%	65	59	61	63	65	67	69	71	
1934	5.50%	65	58	60	62	64	66	68	70	
1935	6.00%	65	57	59	61	63	65	67	69	
1936	6.00%	65	56	58	60	62	64	66	68	
1937	6.50%	65	55	57	59	61	63	65	67	
1938	6.50%	65.02	54	56	58	60	62	64	66	
1939	7.00%	65.04	53	55	57	59	61	63	65	
1940	7.00%	65.06	52	54	56	58	60	62	64	
1941	7.50%	65.08	51	53	55	57	59	61	63	
1942	7.50%	66	50	52	54	56	58	60	62	*War Babies*
1943	8.00%	66	49	51	53	55	57	59	61	
1944	8.00%	66	48	50	52	54	56	58	60	
1945	8.00%	66	47	49	51	53	55	57	59	
1946	8.00%	66	46	48	50	52	54	56	58	
1947	8.00%	66	45	47	49	51	53	55	57	
1948	8.00%	66	44	46	48	50	52	54	56	*Early Boomers*
1949	8.00%	66	43	45	47	49	51	53	55	
1950	8.00%	66	42	44	46	48	50	52	54	
1951	8.00%	66	41	43	45	47	49	51	53	
1951	8.00%	66	41	43	45	47	49	51	52	
1952	8.00%	66	40	42	44	46	48	50	51	
1953	8.00%	66	39	41	43	45	47	49	50	

Table A.2: Descriptive Statistics for Sample Age 51-61

	1994		1996		1998		2000		2002	
	All	SS.Er	All	SS.Er	All	SS.Er	All	SS.Er	All	SS.Er
demographics (Mean)										
age	56.3	56.3	57.3	57.3	56.3	56.7	57.0	57.5	57.7	58.2
widow	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
sep(or)div	0.08	0.09	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.07
never married	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
black	0.12	0.11	0.12	0.12	0.11	0.10	0.11	0.10	0.11	0.10
other race	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
school yrs	12.6	12.7	12.8	12.8	13.1	13.1	13.2	13.3	13.4	13.5
health good	0.30	0.29	0.31	0.30	0.32	0.32	0.29	0.30	0.33	0.34
health fair/poor	0.13	0.13	0.12	0.12	0.15	0.15	0.13	0.12	0.11	0.11
Job Characteristics (Mean)										
self-employed	0.23	0.21	0.23	0.22	0.21	0.20	0.21	0.18	0.21	0.19
tenure (yrs)	15.4	15.3	14.8	14.5	15.0	14.9	15.2	15.4	15.1	15.3
pressured to retire <65 by co-workers	0.00	0.00	0.14	0.14	0.13	0.13	0.12	0.11	0.11	0.12
transition low demanding job easy	0.00	0.00	0.24	0.26	0.26	0.27	0.28	0.29	0.27	0.29
Median wealth and earnings (USD 2004)										
total fin. wealth	152,670	149,476	155,668	153,255	149,843	147,520	162,728	159,429	173,128	163,130
liquid fin. wealth	22,996	22,357	22,807	22,445	22,070	22,070	28,587	29,687	33,152	31,784
Total HH Income	63,879	64,645	68,204	67,818	70,670	70,623	74,767	73,904	73,678	73,735
Current AIME		3,320		3,371		3,716		3,836		3,792
% with pension plan	0.594	0.600	0.582	0.586	0.610	0.624	0.643	0.656	0.610	0.620
% with DC Plan	0.291	0.298	0.325	0.329	0.380	0.390	0.386	0.390	0.368	0.387
% with DB Plan	0.399	0.402	0.349	0.353	0.361	0.371	0.355	0.368	0.343	0.344
# observations	2693	2060	2104	1600	2443	1625	1794	1164	1200	719
fraction match		0.76		0.76		0.67		0.65		0.60

Notes: Dollar amounts converted to $2004 using the BLS consumer price index.

Appendix B: Calculation of Survival Probabilities

Using life tables

To operationalize our adjustment of life-table survival probabilities, we start from a simple exponential hazard model widely used to approximate survival curves, the Gompertz hazard. We assume that life table mortality rates follow the specification $m_L(a) = \kappa_{0,L} \exp(\kappa_{1,L} a)$, where a is age and the parameters $\kappa_{0,L}$ and $\kappa_{1,L}$ control the level and the slope of the log mortality rate. Using $S_L(a) = \exp(-\int_0^a m_L(s)ds)$, the probability to survive until at least age a is given by

$$S_L(a) = \exp[\tfrac{\kappa_{0,L}}{\kappa_{1,L}}(1-\exp(\kappa_{1,L} a))]. \tag{8}$$

Conditional on surviving up to age *a,* an individual has a probability to survive up to age s ($s > a$) given by $S_{L,a}(s) = S_L(s) / S_L(a)$.

Using subjective probabilities

The HRS asks age eligible respondents to report the probability they will survive up to age 75. Answers to such questions are known to include considerable measurement error, as well as focal responses (at 0, 50 and 100). Hence, estimation of individual survival curves is difficult (see Gan, Hurd and McFadden, 2003). We therefore prefer to estimate group level subjective survival curves. We define groups by age (2 year age categories), education level (less than 12 yrs, 12 yrs, more than 12 yrs) and health status (excellent /very good/good or fair/poor). We pool all waves (ignoring calendar time effects) and calculate the mean of the subjective probability responses within each age-education-health cell. Hence, a respondent's cell and reference subjective life-table can change over waves if the respondent changes group, e.g. due to deterioration of health or simply due to aging.

In terms of the Gompertz model, the answers to the subjective probability question from age a to age 75 represent a point on the conditional subjective survival curve of group *j*,

$$S_{j,a}(75) = \frac{\exp[\tfrac{\kappa_{0,j}}{\kappa_{1,j}}(1-\exp(\kappa_{1,j} 75))]}{\exp[\tfrac{\kappa_{0,j}}{\kappa_{1,j}}(1-\exp(\kappa_{1,j} a))]}. \tag{9}$$

We impose that the baseline hazard across all groups is the same as the baseline hazard of the life-table ($\kappa_{1,j} = \kappa_{1,L}$). This means we estimate the proportional change in the mortality hazard across groups but not the baseline hazard. The shape could be estimated using the probability question to age 85 or using the fact that the conditional survival curve is observed at different ages (from age 51 to 61). However, an analytical solution is difficult to obtain for the two parameters simultaneously.

We can estimate $\kappa_{0,L}, \kappa_{1,L}$ from the life table mortality rates, using the yearly life-tables available at www.mortality.org (based on Vital Statistics). We regress $\log(m_L(a)) = \log(\kappa_{0,L}) + \kappa_{1,L}a + u$ where u is an error term. Define the log ratio of the conditional survival probabilities to age s from age a as

$$r_{j,a}(s) = \log[\frac{S_{j,a}(s)}{S_{L,a}(s)}] = (D_L(s) - D_L(a))[\kappa_{0,j} - \kappa_{0,L}], \tag{10}$$

where

$$D_L(x) = \exp(\tfrac{1}{\kappa_{1,L}}(1 - \exp(\kappa_{1,L}x))). \tag{11}$$

This last term is "known" from estimation of the life-table parameters of the mortality hazard. The proportional constant for group *j* is then given by

$$\kappa_{0,j} = \frac{r_{j,a}(s)}{d_L(s) - d_L(a)} + \kappa_{0,L}, \tag{12}$$

where $d_L(x) = \log(D_L(x))$.

The conditional subjective survival at each age for group *j* can be calculated from (9). These "corrections" adjust only for differences in the level of the log mortality hazard. Since this is probably the predominant difference in the underlying true hazard, this is likely to capture a considerable amount of differential mortality across groups.

Table B.1 reports the distribution of survival probabilities for 55 year old males in 1992. The table shows a tendency to slightly underpredict survival probabilities to age 75, but to overpredict survival to ages 85 and higher.[22]

[22] Similar calculations for females show much stronger underprediction for women, in line with results of Hurd and McGarry (1995).

Table B.1 Survival Probabilities based on Life-Tables and Subjective Probabilities Conditional on Surviving to Age 55 – Males

	conditional survival				
age	life-table	subjective	Std.	Min	Max
55	1	1	0	1	1
56	0.991	0.987	0.005	0.978	0.991
57	0.980	0.974	0.009	0.954	0.981
58	0.969	0.960	0.014	0.930	0.971
59	0.957	0.945	0.019	0.904	0.960
60	0.944	0.929	0.024	0.878	0.948
65	0.862	0.838	0.052	0.729	0.879
75	0.610	0.590	0.102	0.381	0.675
85	0.271	0.299	0.102	0.101	0.393
95	0.037	0.082	0.044	0.007	0.130
105	0.001	0.007	0.005	0.000	0.014
109	0.000	0.001	0.001	0.000	0.003

Notes: Respondents aged 55 in 1992

Appendix C: Calculation of Social Security Benefits

We calculate the AIME of each respondent for each year in the survey as well as the projected AIME from ages 62 to 69. For growth in future earnings, we use the growth in the Average National Wage Index. We take the last Social Security earnings in the SS.Er as the basis for computing each projection. This also assumes that the worker continues to work until the age at which we calculate the AIME. Hence, we adjust quarters of coverage accordingly so that an individual who is not eligible at age 55 but works until 62 could become eligible at age 62. In general workers are eligible if they accumulated more than 40 quarters of coverage (10 years where they accumulated 4 credits from covered earnings). To calculate benefits, we use a formula based on the Social Security Handbook. Many parameters of the benefit formula are adjusted every year by SSA to reflect general changes in prices and cost-of-living. For years after 2004, parameters of the formula such as bend points for computing the PIA, the exempt amount under the Earnings test, and the maximum taxable earnings for Social Security are updated using their average growth rate over the period 1985-2003. This is usually closely in line with the average national wage index and thus implies that workers expect a change in those parameters that is consistent with previous recent changes to the benefit formula.

We take into account the minimum PIA in case the worker's PIA is too low. Upon calculating the PIA, the benefit is adjusted for early or late claiming using the Actuarial Reduction factor (ARF, before NRA) and the Delayed Retirement Credit (DRC, after NRA), which depends on the birth cohort. We implement the cost of living adjustment COLA, which adjusts for inflation and cost-of-living increases. The average cost-of-living adjustment over the period 1985-2003 is used (2.9%). Finally, the earnings test is implemented using the rules in effect as outlined in Table 1.

Appendix D

Table D.1 Complete Results for P65 Regressions

covariate	RE tobit P65	RE probit (P65>0)	Fixed Effect Tobit	Conditional Logit (P65>0)
widow	-7.046	-0.373		
(ref: married)	0.173	0.190		
divorced	0.749	0.076		
	0.741	0.589		
never married	2.186	0.381		
	0.595	0.205		
black	-10.960	-0.646		
	0.000	0.000		
other race	3.513	-0.156		
	0.377	0.538		
years schooling	1.187	0.069		
	0.000	0.000		
health good	-5.450	-0.189	-5.105	-0.076
	0.000	0.016	0.095	0.672
health fair/poor	-0.579	-0.004	-7.765	-0.492
	0.844	0.984	0.131	0.101
self-employed	20.014	0.793	1.253	0.006
	0.000	0.000	0.874	0.988
tenure current job	-0.240	-0.014	-1.562	-0.036
	0.000	0.000	0.359	0.010
pressure to retire	-4.501	-0.255	-3.531	-0.369
< 65 from co-workers	0.024	0.014	0.376	0.114
transition less	2.041	0.105	0.122	-0.005
demanding job poss.	0.152	0.180	0.974	0.976
1st quntile wealth	13.610	0.394	12.821	0.561
	0.000	0.004	0.019	0.111
2nd quntile wealth	5.738	0.083	4.200	-0.020
(ref: 3rd quintile)	0.002	0.437	0.423	0.938
4th quntile wealth	-3.284	-0.220	5.624	-0.239
	0.075	0.033	0.121	0.335
5th quntile wealth	-9.125	-0.521	5.813	-0.681
	0.000	0.000	0.190	0.059
has DB plan current	-7.068	-0.170		
job	0.000	0.056		
has DC plan current	0.978	0.072		
job	0.481	0.360		
total HH income	9.023E-06	1.862E-06	2.806E-06	2.546E-06
	0.003	0.000	0.011	0.063
Social Security wealth	3.176E-04	1.034E-05	-2.240E-05	
age 62 - subjective	0.000	0.001	0.09	
SS accrual age 62	0.641	0.072	0.036	
(%) - subjective	0.001	0.054	0.102	
Current AIME	-0.011	-3.713E-04	-0.018	
	0.000	0.001	0.058	
t=1998	2.181	0.104	6.201	0.036
(ref: t=1996)	0.133	0.172	0.049	0.862
1-50% of P	0.059	-0.097		
Control is no tax	-4.057	-0.105		
51-99% of P	0.098	0.518		
	-12.723	-0.286		
100% if P	0.000	0.164		
	-7.732	-0.408		
repeal (REP=1)	1.253	0.114	0.119	-0.132
Control is no tax	0.632	0.437	0.983	0.773
1-50% of P X REP	5.944	0.448	5.926	0.783
	0.058	0.010	0.271	0.023
51-99% of P X REP	7.505	0.229	15.430	0.233
	0.015	0.169	0.029	0.475
100% of P X REP	3.033	0.018	18.512	0.184
	0.6008	0.9536	0.150	0.744
constant	-2.351	-0.880		
	0.697	0.015		
age dummies	yes	yes		
N	4146	4146	4146	1166
rho (share UH)	0.590	0.666		

Notes: Sample of workers aged 51-61 from 1996 to 2002. Pvalue under parameter

Table D.2 Results for P62

	RE tobit P62	RE probit (P62>0)	Fixed Effect tobit P62	Conditional Logit (P62>0)
repeal (REP=1)	2.756	0.273	1.387	0.670
Control is no tax	(0.364)	(0.065)	(0.785)	(0.188)
Groups X REP				
1-50% of P	0.453	0.031	1.784	0.138
	(0.901)	(0.863)	(0.764)	(0.712)
51-99% of P	1.536	0.007	10.763	-0.275
	(0.665)	(0.968)	(0.163)	(0.427)
100% if P	5.022	-0.392	16.345	-0.299
	(0.458)	(0.237)	(0.154)	(0.627)
N	4146	4146	4146	1166

Notes: Sample of workers aged 51-61 from 1996 to 2002. Pvalue under parameter estimates. P62 is the subjective probability to work full-time past 62.

Figure 1 Expected Income, Claiming and First Period Hours of Work (Leisure)

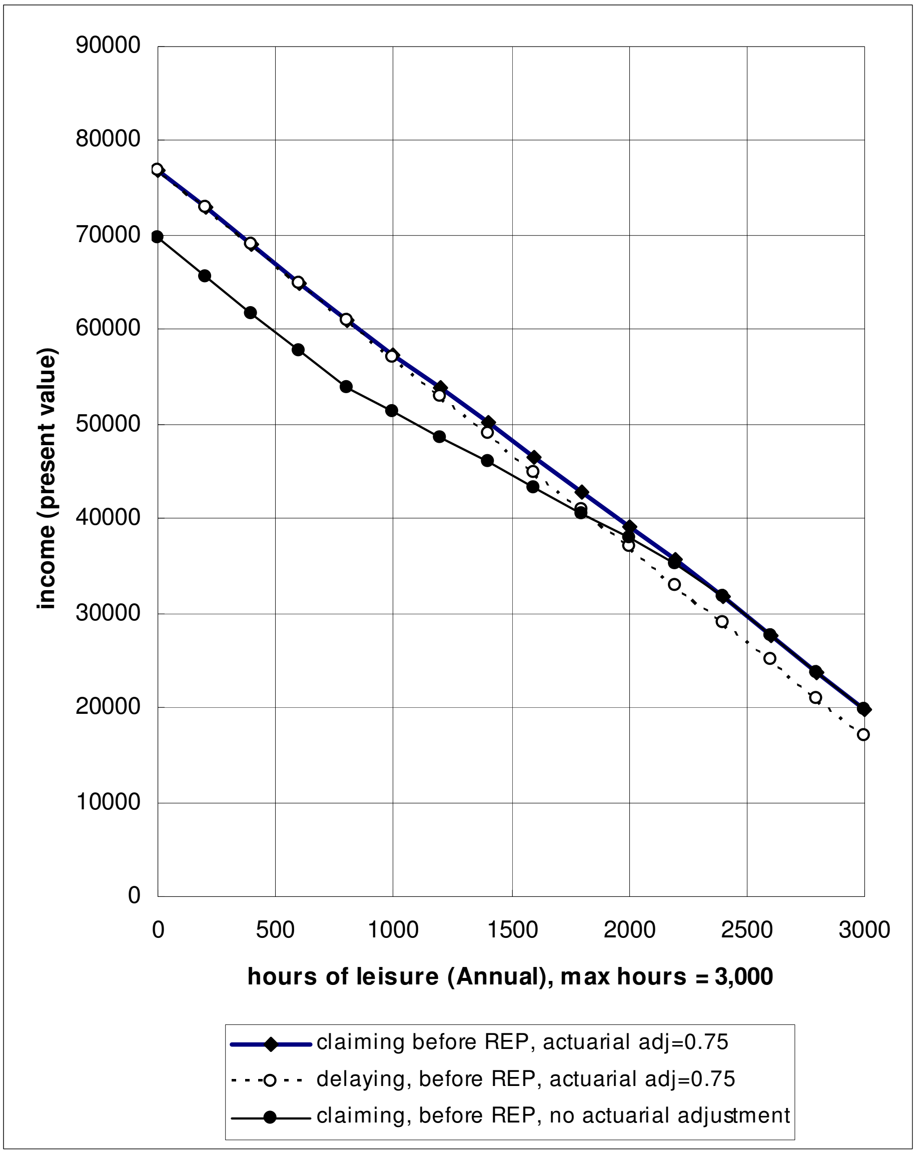

Table 1. Parameters of the Earnings Test and Actuarial Adjustment 1992-2004

for those reaching the NRA in	**1992**	**1994**	**1996**	**1998**	**2000**	**2002**	**2004**
NRA	65	65	65	65	65	65	65 4mo
Earnings Limit before NRA	7,440	8,040	8,280	9,120	10,080	11,280	11,640
Earnings Limit after NRA	10,200	11,160	12,500	14,500	None	None	None
Tax before NRA	50%	50%	50%	50%	50%	50%	50%
Tax after NRA	33%	33%	33%	33%	0%	0%	0%
Actuarial Reduction Factor	6.8%	6.8%	6.8%	6.8%	6.8%	6.8%	6.8%
Delayed Retirement Credit	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%

Notes: Earnings limit defined in rule §1803.2 of the Social Security Handbook 2004. Normal retirement age defined in §723.5. Delayed retirement credit §720.3. §724.1 defines the actuarial reduction factor.

Table 2. Summary Statistics of Expectations for Male Workers Age 51-61

mean and %>0	probability work at 65 by year					
age	1992	1994	1996	1998	2000	2002
51-54	27.26	26.88	24.81	30.16	31.24	29.43
	0.52	0.59	0.55	0.64	0.69	0.71
55-57	31.96	26.13	27.63	29.62	32.36	28.94
	0.56	0.56	0.55	0.60	0.68	0.68
58-61	30.01	29.13	30.77	29.04	32.11	32.51
	0.54	0.55	0.57	0.56	0.61	0.66
Total	29.32	27.45	28.79	29.50	31.98	31.20
	0.53	0.57	0.56	0.59	0.64	0.67

Notes: mean (including zeros) and % positive for each year and age group. Workers aged 51-61.

Table 3. Expected Social Security Wealth and Incentives to Claim Social Security Benefits for males aged 51-61 from 1992 to 2004

using life-table mortality rates									
	SS	relative to	accrual (% of W62)						
quantile	wealth 62	median	62	63	64	65	66	67	68
10th	90,157	0.503	0.42	-0.39	-1.13	-2.55	-3.09	-3.58	-4.07
25th	135,609	0.757	0.72	-0.09	-0.83	-1.71	-2.34	-2.91	-3.48
Median	179,091	1.000	1.32	0.48	-0.30	-1.03	-1.65	-2.27	-2.88
75th	213,326	1.191	1.81	0.91	0.10	-0.46	-0.77	-1.52	-2.21
90th	233,987	1.307	2.59	1.64	0.80	0.11	0.06	-0.72	-1.46
using subjective mortality rates									
	SS	relative to	accrual (% of W62)						
quantile	wealth 62	median	62	63	64	65	66	67	68
10th	87,043	0.485	-0.04	-0.99	-1.86	-3.01	-3.45	-4.04	-4.64
25th	129,972	0.724	0.81	0.01	-0.70	-1.76	-2.27	-2.78	-3.28
Median	179,536	1.000	1.47	0.65	-0.09	-0.79	-1.33	-1.90	-2.45
75th	219,491	1.223	2.09	1.27	0.54	-0.10	-0.40	-1.06	-1.65
90th	245,663	1.368	2.85	1.95	1.16	0.57	0.39	-0.31	-0.97

Notes: median social security wealth at 62 for the sample aged 51-61 between 1992 and 2004. Expressed in $2004 USD. The accrual at age a is defined in terms of the % difference between the expected present value of social security wealth if claimed at $a+1$ compared to age a.

Table 4. Projected Loss from the Earnings Test before 2000

	Predicted Loss due to the earnings test					
	age 62			normal retirement age		
		forward-looking using			forward-looking using	
quantile	myopic	life-table	subjective	myopic	life-table	subjective
Loss in dollars						
10th	0	0	0	0	0	0
25th	3,003	868	832	0	0	0
50th	12,020	3,485	3,010	6,913	1,549	1,114
75th	15,300	4,387	3,698	15,486	3,473	2,785
90th	16,856	4,758	4,336	21,201	5,451	4,727
as fraction of earnings						
10th	0	0	0	0	0	0
25th	0.193	0.055	0.043	0.091	0.016	0.005
50th	0.239	0.069	0.059	0.191	0.039	0.030
75th	0.292	0.084	0.080	0.233	0.062	0.055
90th	0.327	0.095	0.098	0.251	0.077	0.075

Notes: workers aged 51-61 interviewed before 2000.

Table 5. Unconditional Difference-in-Difference Grouping Estimates

Myopic loss		Prob work past 65			Prob work past 62		
% of benefit at NRA		mean P65 (N=589)			mean P62 (N=589)		
Group	% in grou	1998	2002	Diff 2002-1998	1998	2002	Diff 2002-1998
0	20.91	35.17	34.79	-0.37	51.61	54.79	3.18
1 to 49%	35.70	34.20	36.83	2.63	57.81	61.70	3.89
50 to 99%	40.60	25.84	26.98	1.15	52.33	53.98	1.65
100%	2.81	25.31	26.88	1.56	49.69	39.06	-10.63
Group		% P65>0 (N=589)			% P65>0 (N=589)		
0	20.91	64.46	61.98	-2.48	73.95	78.99	5.04
1 to 49%	35.70	65.09	72.17	7.08	84.73	84.24	-0.49
50 to 99%	40.60	66.67	67.50	0.83	85.28	82.25	-3.03
100%	2.81	68.75	68.75	0.00	81.25	68.75	-12.50

Notes: Sample of workers 51-61 who report in both waves.

Table 6. Difference-in-Difference Grouping Estimates – RE and FE Models

	RE tobit P65	RE probit (P65>0)	Fixed Effect tobit P65	Conditional Logit FE (P65>0)
repeal (REP=1)	1.253	0.114	0.119	-0.132
Control is no tax	(0.632)	(0.437)	(0.983)	(0.773)
Groups X REP				
1-50% of P	5.944	0.448	5.926	0.783
	(0.058)	(0.010)	(0.271)	(0.023)
51-99% of P	7.505	0.229	15.430	0.233
	(0.015)	(0.169)	(0.029)	(0.475)
100% if P	3.033	0.018	18.512	0.184
	(0.601)	(0.954)	(0.150)	(0.744)
N	4146	4146	4146	1166

Notes: Sample of workers aged 51-61 from 1996 to 2002. Pvalue under parameter estimates. P65 is the subjective probability to work full-time past 65. REP is a dummy variable that takes value 1 for 2000 and 2002 observations. The grouping is done by the share of benefits loss at NRA. Controls for age dummies, demographics, job characteristics, current financial resources and projected social security wealth and accrual at age 62 as well as AIME. Full results in Appendix.

Table 7. Average Treatment Effect Estimates

	RE tobit		RE probit (prob65>0)	
	ATE	Std.E	ATE	Std.E
tax 1-50	3.855	2.389	10.415	3.956
tax 50-99	4.370	2.292	5.330	3.940
tax 100	1.738	4.329	0.547	7.163

Notes: Average treatment effect computed from estimates. Standard errors obtained by Monte Carlo.