

The Social Security Earnings Test and Work Incentives[†]

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Abstract

The labor supply and benefit claiming incentives provided by the early retirement rules of the Social Security Old Age benefits program are of growing importance as the Normal Retirement Age (NRA) increases to 67, the labor force participation of Older Americans rises, and a variety of reforms to the Social Security system are considered. Any reform needs to take into account the effects and rationale of the Social Security Earnings Test and the Actuarial Adjustment Factor, which are likely to be widely misunderstood due to the relatively little attention paid by policy makers and researchers to the fact that Americans are willing to work while receiving benefits. We describe these incentives, and emphasize that individuals who claim benefits before the NRA but continue to work, or return to the labor force, can reduce the early retirement penalty by suspending the collection of monthly benefits if they earn above the Earnings Test limit. We then argue that the Earnings Test can be distortionary and is costly to administer, and that these characteristics are inflated by the lack of information given to Older Americans regarding the consequences of working while receiving retirement benefits. We present results from statistical models of labor force exit behavior using data from the Health and Retirement Survey showing the relevance of these incentives, and investigate the importance of informational asymmetries among beneficiaries regarding benefit withholding using a dynamic life-cycle model of labor supply and benefit claiming. We then use the latter framework to compare the behavioral and welfare implications of a removal of the Earnings Test to the policy of providing more information regarding the Earnings Test and the adjustment of the rate of benefit pay to Older Americans.

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Introduction

The labor supply and benefit claiming incentives provided by the early retirement rules of the Social Security Old Age benefits program are of growing importance as the Normal Retirement Age (NRA) increases to 67, the proportion of Americans claiming before the NRA increases, the labor force participation of Older Americans rises, and a variety of reforms to the Social Security system are considered.¹ Under the current system, the early retirement age (ERA) is 62, and the NRA will gradually increase from the current 65 years and eight months to 67 for cohorts born between 1942 and 1960 and thereafter. Some recent remarks by influential (but independent) U.S. policy makers indicate that the NRA is likely to increase further in the next few years in order to avoid even more radical (and painful) changes to Social Security.² Whether these changes will occur at the same time that some kind of private accounts are introduced, or benefits are reduced, is still an open question.

Social Security provides fairly complex incentives that affect the labor supply and benefit uptake behavior of individuals between the ERA and NRA. Two of the most important incentives are the Social Security Earnings Test, which determines the maximum level of earnings that do not result in a benefit reduction for individuals who have claimed retirement benefits before the NRA, and the Actuarial Reduction Factor (ARF), which determines the permanent reduction in benefits that individuals face if they claim benefits early. However, the role of the Earnings Test in the context of the adjustment of the ARF is not well-documented in the publications provided by

¹ As of November of 2006, 70.6% of men and 75.5% of women in the U.S. claimed Social Security benefits before the normal retirement age (NRA) compared to 36% and 59% in 1970, respectively.

² In his testimony on February 25, 2004 before the Committee on the Budget, U.S. House of Representatives, Alan Greenspan, Chairman of the Federal Reserve at the time, stated: *Under current law, and even with the so-called normal retirement age for Social Security slated to move up to 67 over the next two decades, the ratio of the number of years that the typical worker will spend in retirement to the number of years he or she works will rise in the long term. A critical step forward would be to adjust the system so that this ratio stabilizes.* (The full testimony is available online at: <http://www.federalreserve.gov/boarddocs/testimony/2004/20040225/>.)

Social Security. For example, the benefits calculator provided by the Social Security Administration (www.ssa.gov) does not have any reference to the mechanism that allows individuals to affect their Actuarial Reduction Factor by earning above the Earnings Test after claiming and receiving benefits. As a result, the full incentives provided by these two features may be widely misunderstood.³ In order to adopt any reform that could affect the interaction between work, retirement benefits, and retirement behavior, the research community and the government must communicate effectively to current and future retirees how those reforms affect their benefits.

Although researchers have occasionally documented these fairly complex incentives, they have paid relatively little attention to the possible consequences of these provisions for labor supply and claiming behavior of early retirees.⁴ The existing research has primarily focused on the taxation aspects of the Earnings Test.⁵ Since the removal of the Earnings Test in the year 2000 for those above the NRA, there has been relatively little discussion of the Earnings Test for younger retirees, despite the fact that the arguments used against the former Earnings Test also apply to this case. In fact, the incentives provided by the Earnings Test for early retirees have remained essentially unchanged in the last three decades, but with a larger fraction of Americans retiring early, these incentives have become increasingly important. The literature has not analyzed the implications for labor supply and claiming behavior, of the possibility to affect the Actuarial Reduction Factor by working after claiming benefits and earning above the Earnings Test limit.

³ For example we have been recently contacted by some concerned citizens who discuss financial issue online in the Morningstar Personal Finance electronic board, who came across our work and were interested in finding out more about the possibility of affecting lifetime benefits even after claiming Social Security. In their communications with us they stated the following: *“The fact that no one who participates on this forum understands the nuances of the Earnings Test speaks to your comments about the misinformation associate[d] with the subject.”* (e-mail communication with the authors, May 13 2006). In another case a private citizen wrote the following to us, expressing a concern about the post-NRA period as well: *“As you found in your pre-NRA study, SSA does a poor job of publicizing possibilities. The post-NRA information from SSA is even poorer, and is undoubtedly causing many or most of those earning DRCs to lose their spousal benefits.”* (e-mail communication with the authors, November 6 2006.)

⁴ Gruber and Orszag (1999, 2000); Gustman and Steinmeier (1991); and Myers (1993, p. 52), discuss this mechanism in some detail.

⁵ See Baker and Benjamin (1999); Burtless and Moffitt (1985); Friedberg (1998, 2000); Honig and Reimers (1989); Leonasio (1990); Reimers and Honig (1993, 1996); Votruba (2003); Vroman (1985)

In this paper, we describe the incentives provided by Social Security during the period between the early and normal retirement ages and analyze the implications of these incentives for labor supply and claiming behavior. We provide evidence regarding such effects from analyses of benefit withholding data, labor force exit behavior using household level data, and simulation of a dynamic life-cycle retirement model. We also discuss the potential costs of the current Earnings Test both from an administrative perspective as well as from an individual perspective. We argue that the Earnings Test, as implemented in the current informational environment, is costly and distortionary, and these characteristics are mostly the result of a few features of the system, and the information provided to Older Americans regarding the consequences of work while receiving retirement benefits (or lack thereof).

Information on the benefit receipt when working after claiming early can be an important policy instrument to provide work incentives for the growing proportions of Americans affected by the Earnings Test as the NRA increases. This kind of policy is considerably simpler to implement than programs trying to influence work among individuals at other stages of their life cycle, like the term limits part of the Temporary Aid to Needy Families (TANF), and the Earned Income Tax Credit (EITC), and perhaps has more predictable effects than active labor market policies that focus on labor supply, like training and re-training programs, or policies targeted to increase work among disabled individuals.⁶

Even though the cost of trying to increase the percentage of Americans aware of the trade-offs between work and claiming Social Security benefits is difficult to assess, and the benefits might be hard to empirically identify separately from labor market fluctuations, providing more information about the Earnings Test and the Actuarial Reduction is likely to be one of the most

⁶ Grogger (2003) analyzes the effects of the imposition of time limits, as part of the creation of TANF, on employment and finds sizable effects, as well as large effects of the EITC. Heckman, Lalonde, and Smith (1999) review the literature on training programs, and Benítez-Silva, Buchinsky, and Rust (2006) present an evaluation of a policy trying to promote work among SSDI recipients.

direct and readily implementable policies to foster work among Older Americans. It is likely to have a positive effect on the finances of the system as well due to the actuarial unfairness features of the current rules (as we explain herein) and the expected rise in labor supply among individuals who currently perceive the Earnings Test only as a tax and who do not work, or work part-time, in order to keep their earnings below the limits.

Our results indicate that there is no compelling reason to maintain the Earnings Test for those between the early and normal retirement ages, unless the government is willing to use this policy instrument, and invest more time and resources in informing the general public about the complex set of trade-offs involved in the decision to work while claiming benefits, and even in that case the cost of running the system and providing the information might outweigh the benefits derived from these incentives.

The next section describes in some detail the incentives provided by Social Security between the ERA and the NRA. We then discuss the implications for labor supply and claiming behavior, and describe the potential distortions to labor supply and claiming behavior when the assumption that individuals are fully informed about the mechanisms that govern the relationship between work and retirement benefits, is relaxed. The main results section provides evidence about the effects of the incentives on behavior. We analyze benefit withholding patterns using publicly available data from the Social Security Administration, present results from a statistical model of labor force exit behavior using data from the Health and Retirement Survey, and investigate the importance of informational asymmetries among beneficiaries regarding benefit withholding using a dynamic life-cycle model of labor supply and benefit claiming. We then use the latter framework to compare the implications of a removal of the Earnings Test to the more readily implementable policy of providing more information regarding the Earnings Test and the adjustment of the rate of benefit pay to Older Americans. The final section concludes.

Social Security Incentives for Early Retirement

Individuals who claim benefits before the NRA but continue to work or reenter the labor force can reduce the early retirement penalty by suspending benefit payments.⁷ The Actuarial Reduction Factor (or early retirement reduction factor), in turn, will be increased proportionally to the number of months without benefits, which will increase benefits permanently after the individual reaches the NRA. Given a NRA of 66, which will be the prevailing one for the cohort born between 1943 and 1954, the Actuarial Reduction Factor is a number between 0.75 and 1 depending on when the individual claims benefits, and how many months he or she earns above the Earnings Test after claiming benefits. This adjustment of the ARF allows those who become beneficiaries before the NRA to partially or completely reverse the financial consequences of their decision, averting being locked-in at the reduced rate. In the sequel of this section the exact details of these incentives are presented.

Benefit Calculation

Individuals aged 62 or older who had earned income that was subject to the Social Security payroll tax for at least 10 years since 1951 are eligible for retirement benefits under the Old Age benefits program. Earnings are subject to the tax up to an income maximum that is updated annually according to increases in the average wage. To determine the monthly benefit amount (MBA), the Social Security Administration calculates the Primary Insurance Amount (PIA) of a worker as a concave piece-wise linear function of the worker's average earnings subject to Social Security

⁷ In this paper we are not considering spousal benefits and joint decision making in the household. The complexities introduced by those considerations are out of the scope of this analysis. By ignoring spousal benefits we are not taking into account the fact that approximately 5.96% of the individuals who receive some type of Old Age, Survivors, or Disability Insurance (OASDI) benefits receive them as spouses of entitled retirees. This percentage comes from the Public-Use Microdata File provided by the Social Security Administration and refers to a 1% random sample of all beneficiaries as of December of 2001.

taxes taken over her 35 years of highest earnings. If the benefits are claimed at the NRA (66 for those born between 1943 and 1954, and currently at 65 and 8 months), the MBA equals the PIA. If an individual decides to begin receiving benefits before the NRA and exits the labor force or stays below the earnings limit, her MBA is reduced by up to 25%, assuming a NRA of 66. Under the current regulation of the OA program, the monthly benefit amount received upon first claiming benefits depends on the age (month) of initiation of Social Security benefits, in the following way,

(1)

$$MBA_t = \begin{cases} (0.75 + 0.05 * \frac{1}{12} * (\text{Months not claimed in the period prior to 3 years before NRA})) * PIA & \text{if claimed more than 3 years before NRA;} \\ (0.80 + 0.20 * \frac{1}{36} * (\text{Months not claimed in 3 years before NRA})) * PIA & \text{if claimed within the 3 years before NRA.} \end{cases}$$

where MBA_t represents the monthly benefit amount before the NRA (see SSA-S 2005, p.18).

Assuming that the individual continues to receive benefits, her MBA_t is permanently reduced. The Actuarial Reduction Factor (ARF) underlying this calculation is a permanent reduction of benefits by 5/9 of 1 percent per month for each month in which benefits are received in the three years immediately prior to the NRA. The reduction of benefits is 5/12 of 1 percent for every month before that. Thus, the maximum actuarial reduction will reach 30 percent as the NRA increases to 67 over the next few years (see SSA-S 2005, p.18). The reductions in benefits for early claimers are designed to be approximately actuarially fair for the average individual. During the post-NRA period additional adjustments exist: Workers claiming benefits after the NRA earn the delayed retirement credit (DRC). For those born in 1943 or later it is 2/3 of 1 percent for each month up to age 70 which is considered actuarially fair. For those born before 1943 it ranges from 11/24 to 5/8 of 1 percent per month, depending on their birth year.

Actuarial Reduction Factor

One less-emphasized feature of the process of benefit reduction due to early retirement is the possibility to reduce the penalty even after initiating the receipt of benefits. The specifics of this adjustment to the Actuarial Reduction Factor are documented in the Social Security Handbook (SSA-H, §724. *Basic reduction formulas*, §728. *Adjustment of reduction factor at FRA*) and in the internal operating manual used by Social Security field employees when processing claims for Social Security benefits (SSA-M, RS00615. *Computation of Monthly Benefits Amounts*) but may not be well-understood by the retirees. To illustrate this feature of the system, suppose the NRA is 66 years, and an individual claims benefits at age 62 and n months, where $n \ll 48$, receives checks for x months where ($n + x \ll 48$), and suspends receiving checks after that until she turns 66 (after which she retires for good). In this case she receives x checks of

(2)

$$MBA_t = \begin{cases} (0.75 + 0.05 * \frac{1}{12} * n) * PIA & \text{if claimed more than 3 years before NRA;} \\ (0.80 + 0.20 * \frac{1}{36} * n) * PIA & \text{if claimed within the 3 years before NRA.} \end{cases}$$

After turning 66, her MBA will be permanently increased to

$$MBA_t = [0.75 + (0.20 * \frac{1}{36} * n) + (0.20 * \frac{1}{36} * (36 - n - x)) + 0.05] * PIA. \quad (3)$$

It is important to note that the adjustment of the ARF is automatic and becomes effective only after reaching the NRA.

Earnings Test

The Earnings Test limit defines the maximum amount of income from work that a beneficiary who claims benefits before the NRA under OASI may earn while still receiving the “full” MBA . Some sources of income do not count under the Earnings Test. For details see SSA-H §1812.

Notice that retirement contributions by the employer do not count towards the limit, but additional contributions by the employee even if they are through a payroll deduction are counted. This means that individuals earning above the limit cannot just increase their retirement savings to avoid being subject to the limit. We thank Barbara Lingg and Christine Vance from the Social Security Administration for clarifying this point, which is rarely discussed in any publication. Earnings above the limit are taxed at a rate of 50 percent for beneficiaries between age 62 and the January of the year in which they reach the NRA, and 33 percent from January of that year until the month they reach the NRA (SSA-S 2005, p.19; SSA-S 2005, Table 2.A18). For the latter period, the earnings limit is higher, \$31,800, compared with \$12,000 for the earlier period as of 2005 (SSA-S 2005, Table 2.A29). Starting in 2000, the Earnings Test was eliminated for individuals over the NRA.

Individuals who continue or reenter employment after claiming Social Security benefits before the NRA, and whose earning power or hours constraints are such that their income from work is around or below the earnings limit, are mailed their full monthly check from Social Security and are locked-in at the reduced benefit rate permanently. Those with earnings above the limit will not receive checks from Social Security for some months and thereby adjust their ARF. Notice that a beneficiary may receive a partial monthly benefit at the end of the tax year if there are excess earnings that do not completely offset the monthly benefit amount (see SSA-H, §1806). Individuals have the option of informing Social Security to suspend the monthly benefit payment at any time if they believe they will be making earnings high enough above the Earnings Test. However, during the first year after claiming benefits, the Social Security Administration performs a monthly test to determine whether the person should receive the monthly check. As a result an early claimer who is not working or earns below the limit in the months after claiming (“grace year”) will receive all monthly benefits even if earnings for that calendar year exceed the Earnings Test limit due to high

earnings before claiming.

Social Security claim specialists emphasized to us that during the first year after claiming they do what is most advantageous to the claimer, the monthly or the yearly test, if they have enough information. However, they failed to clarify what that means. Some of them said the number of checks individuals receive is maximized, but we were unable to find documentation of such practices. In any case, the internal operating instructions used by Social Security field employees when processing claims for Social Security benefits state that the monthly Earnings Test only applies for the calendar year when benefits are initiated unless the type of benefit changes (see SSA-M, RS02501.030). After the first year, the test is typically yearly and it depends on the expected earnings of the individual. Given the scarce documentation of the functioning of the ARF, having earned above the earnings limit, and thus receiving fewer checks, may be a common way for beneficiaries to learn about the possibility of undoing the early retirement penalty.

Example

To illustrate these incentives we present the following example assuming a NRA of 66, and with the calculations based on a scenario for individuals born between 1943 and 1954: Think of two otherwise identical individuals who turn 62 on July 1st of a given year, and earn \$30,000 of labor income between July of that year and the following June. The earnings of \$30,000 in this example are just large enough to phase out *all* benefits for the 12 months period. In general in order for the Social Security Administration to withhold benefits an individual has to earn enough above the Earnings Test limit such that the implied taxes completely offset at least one month of benefits. We note that individuals, in general, may also be able to replace a past year of (lower) earnings and increase their Primary Insurance Amount when they work after claiming. These individuals had the same earnings history and hence the same implied Primary Insurance Amount (PIA) of \$11,680.

The PIA is calculated as a concave piece-wise linear function of the worker's average earnings subject to Social Security taxes taken over her highest 35 years of earnings. The assumed PIA is the product of a given history of earnings. With this PIA, someone who claims at age 62 would be entitled to a benefit amount of \$8,760 a year, assuming a NRA of 66. If that person has a labor income of \$30,000 in the year after turning 62, all her benefits would be withheld. This calculation uses an Earnings Test limit of \$12,480 a year, the one prevailing in 2006, and assumes that the \$30,000 labor income does not affect the PIA. One of the individuals claims benefits in the month she turns 62 while the other waits until her 63rd birthday to claim benefits. Suppose first that both decide to withdraw from the labor force for good at the time when they claim benefits. In this case, the early claimer receives yearly benefits of \$8,760 ($=\$11,680 * (1-0.25)$) between age 62 and her death while the later claimer receives benefits of \$9,344 ($=\$11,680 * (1-36*5/9)$) between age 63 and her death. Assuming average longevity, and assuming that the reduction factor is actuarially fair, the benefit streams for these two individuals should be approximately equal from the point of view of a 62 year old person. Alternatively, if the early claimer decides to continue to work until her 63rd birthday and earns at least \$17,520 ($=2*\$8,760$) above the assumed earnings limit of \$12,480, then she receives annual benefits of \$8,760 between age 63 and 66, and \$9,344 thereafter. In this case the benefits received after age 66 are the same for the early and the later claimer since the benefit rate of early claimers after the NRA is adjusted to reflect the actual benefit pick-up before the NRA. In this scenario the person who claims later receives a higher benefit stream at any reasonable discount rate, assuming average longevity.

Behavioral Implications and Costs

Effects on Benefit Claiming, Working Behavior and Earnings

The key elements of the current policy as described in the previous section are (a) individuals can affect their ARF even after claiming benefits early and (b) benefits withheld due to the Earnings Test increase the ARF only after reaching the NRA, resulting in a benefit flow that can be actuarially unfair for early claimers. These rules have important implications for work and benefit claiming behavior between the early and normal retirement age.

The possibility of affecting the ARF provides an incentive to claim benefits before the NRA even if the individual expects to continue to work (or to return to work) since having claimed benefits provides a type of insurance. First, given that an individual's labor income stream is uncertain (it depends on individual health and macroeconomic conditions among other things) individuals may file for Social Security benefits as soon as they are eligible to secure benefit payments if needed. The fact that processing the initial Social Security claim takes up to three months while reinstating the monthly payments takes around six weeks, suggests an interest, at the margin, in being in the system as soon as possible. Also, in most states unemployment benefits are not deducted from Social Security benefits and vice-versa, i.e. unemployment benefits and Social Security benefits can be received at the same time. Second, with the ongoing debate about reforming the Social Security system, individuals eligible for early retirement benefits may become claimers even though they do not plan to withdraw from the labor force. Their motivation is to insure that they cannot be made worse off by changes to Social Security. Benítez-Silva, Dwyer, Heiland, and Sanderson (2006) present a dynamic model similar to ours but accounting for Social Security reform expectations, and show that the uncertainty over future benefit levels can help explain the large proportion of Americans claiming benefits early.

In addition to the incentive to claim benefits earlier, the rules are also expected to affect the decision to work. Given that the reduction factor is not adjusted instantaneously for benefits that are withheld between benefit initiation and the NRA, it is only actuarially fair for early claimers who have either all or none of their benefits withheld during that time. We hence expect that some individuals will drop out of the labor force soon after claiming (or earn consistently below the Earnings Test limit throughout after claiming). Others, for example those who claimed benefits early while expecting to remain in the labor force after claiming (or those who claimed early and returned to the labor force after a leisure spell) for the reasons explained in the previous paragraph, are expected to continue to work and earn above the Earnings Test limit in order to suspend the receipt of benefits until reaching the NRA. In other words, we expect the labor force exit hazard for individuals between the early and normal retirement age to be high around the time of claiming and then to decrease in the time since claiming.

Distortions and Costs

The discussion in the previous section assumes that individuals are aware of the rules that govern the receipt and level of Social Security benefits under the current system of the Earnings Test. However, retirees may have a hard time finding the appropriate information to understand the effect that claiming early has on their benefits when they decide to continue to work (or return to the labor force) after claiming. The information publicly available documents the reduction in benefits associated with claiming before the NRA but pays little attention to the possibilities of affecting the reduction factor. In particular, to date the benefits calculator provided by the Social Security Administration (www.ssa.gov) does not have any reference to the mechanism that allows individuals to affect their Actuarial Reduction Factor by earning above the Earnings Test after claiming and receiving benefits.

On the other hand, individuals can relatively easily gather information on how high their labor earnings can be without incurring benefit withholding. Therefore, many retirees may make their labor supply decisions primarily based on the perceived tax incentive provided by the Earnings Test, overlooking the effect on future benefits via the adjustment of the Actuarial Reduction Factor as documented above. In this situation individuals perceive benefits withheld due to excess earnings as a loss.

In this case the Earnings Test may result in substantial distortions of labor supply and claiming behavior. Individuals who expect to maintain a relatively high level of attachment to the labor force likely delay claiming benefits, possibly until the NRA, or until they expect their earnings to be below the Earnings Test limit. For the almost 30% of individuals who are not claiming before the NRA, lack of information may be a key factor in the decision not to claim earlier. Individuals who have claimed to secure a stable income stream early on, may avoid benefit withholding by working fewer hours or lower earnings jobs before the NRA. This rationale is potentially present in the labor supply decisions of all early claimers, who currently represent 72.8% of American retirees.

Even if individuals are fully informed about the details of the Earnings Test and the adjustment of the Actuarial Reduction Factor as discussed above, these mechanisms may prevent them from supplying their desired amount of time to the labor market. Individuals who claimed benefits early cannot increase the rate at which benefits are paid before reaching the NRA. Thus, if they are borrowing constrained they may supply more labor before reaching the NRA than they desire as a result of this (negative) income effect. Such distortions are greater in the presence of hours constraints (e.g., lack of part-time jobs) and fixed costs of working.

Also, individuals who seek to affect their reduction factor after claiming benefits early, may work more hours than desired to generate enough earnings to have benefits withheld. This situation

can arise if the retiree realizes that the reduced rate is not sufficient to achieve the current or future desired standard of living (e.g., after experiencing a negative wealth shock), her preferences for leisure or consumption change, or the opportunity costs for leisure rise as a result of better labor market conditions or job matching.

For these individuals an increase in the Earnings Test limit makes it more difficult to affect their future benefit rate. Even if the benefit reduction were actuarially fair for individuals with low earnings potential, they may be made worse off by a higher Earnings Test limit since it eliminates the option to affect the rate of future benefit pay for them. In this sense the Earnings Test limit can be regressive. We note, however, that individuals who have low incomes and also expect to have a shorter life may benefit from a higher Earnings Test limit, since for them the possible increase of benefits resulting from withholding has relatively little value.

This discussion shows that the Earnings Test is likely to constitute a nontrivial loss of welfare for individuals between the early and the normal retirement age. This is especially the case if retirees focus on the taxation aspect of the Earnings Test. In a study of the welfare effects of the 1983 removal of the Earnings Test for the 70-71 year old, Friedberg (2000, p.59) estimates utility losses due to the Earnings Test equivalent to up to \$4,603 (with an average income of \$22,449 in 1983). These estimates may give an upper bound of the current welfare loss due to the Earnings Test for those 62-64 since benefits were reduced at a rate of 50 percent for earnings above the \$5,000 limit just before the policy change for the 70-71 year-old in 1983. Also the percentage of those who understand the benefit adjustment mechanism may have increased since 1983. We note that the implied deadweight losses are possibly even larger if a life-cycle perspective is taken, since the lack of information about the rules of the system between the early and normal retirement age will also distort decisions in the years before retirement. In Section 4.3 below, we present results from a welfare analysis using compensating variation calculations from a dynamic life-

cycle model.

In addition to the likely welfare costs born by individuals, the Earnings Test also contributes significantly to the administrative costs of Social Security. The annual administrative costs involved in maintaining the system that keeps track of individuals earnings and actuarial adjustment levels are substantial, and believed to be of the order of \$100 to \$150 million as of 1999 (Gruber and Orszag 1999, p.10). We have tried, unsuccessfully, to obtain an updated estimate of these costs from Social Security, now that the Earnings Test no longer affects those above the NRA. In any case, with the current yearly increases in the NRA, and the resulting different rates of adjustment depending on the age at claiming, the administrative costs are likely to be of the same order of magnitude as in the late 1990s.

Results from Empirical Analyses and Simulations

Aggregate Evidence from Social Security Benefit Withholding Data

The Social Security Administration provides information on beneficiaries based on the Master Beneficiary Record (MBR), a database of all beneficiaries, as well as a 10% and a 1% random sample of the MBR. To illustrate the incidence of adjustments to the Actuarial Reductions Factor, some estimates of overall trends and distribution of benefit withholding based on the 1% sample taken from the Annual Statistical Supplements of 2000 to 2005 (Table 6.B1) are presented in Figure 1.

Among the 1,264,500 individuals who turned 62, 63 or 64 and initiated early retirement benefits in 2004, the most recent year available, 71,100 saw some or all of their monthly checks withheld due to the Earnings Test in that year (first panel), and therefore had their actuarial reduction factor affected by their labor supply decisions after claiming benefits. The majority of these individuals

had more than half of their benefits withheld suggesting that they earned significantly above the Earnings Test limit between age 62 and the NRA.

The second panel shows that women are less likely to see their benefits withheld than men. In 2004, 6.6% of men who claimed benefits early saw at least some of their benefits withheld by Social Security compared to 5.8% of women. This reflects both the lower labor supply and the lower wages of the women in that age group compared to men. The data also show that the fraction of early claimers has decreased by more than 3 percentage points since 1999. This trend likely reflects worsening labor market conditions between 2000 and 2002. As the job prospects deteriorated, fewer early claimers found employment which resulted in fewer cases of earnings above the Earnings Test limit.

The third panel illustrates the incidence of benefit withholding at ages 62, 63 and 64 for male and female beneficiaries combined since 1999. Those claiming at age 63 almost twice as often experienced some withholding of reduced retirement benefits compared to those who claim at 62. While the incidence rate has fallen slightly among those who claim at 62 or 63, it has fallen quite dramatically for those claiming at age 64, from 25.3% in 1999 to 5.5% in 2002. Since then it has increased to 9.7% as of 2004. This abrupt change is likely to be the result of the sharp increase in the Earnings Test limit that occurred between 1999 and 2002 for those who work between the January of the year in which they turn 65 and their birthdays. This limit increased from \$15,500 in 1999 to \$30,000 in 2002, suggesting that even in the absence of any behavioral response to the change, the number of individuals affected by the limit would decline considerably.⁸ Also, changing labor market opportunities may play a role in these trends for those 62 to 64. Individuals who initiate early benefits when they are closer to the NRA may be more attached to the labor

⁸ This unusually sharp increase in the Earnings Test limit in a short period of time could in principle provide a useful experiment to analyze the effects of the Earnings Test. However, we believe that the very nature of the incentives we describe in this paper, which suggest that lower taxation of benefits results in lower adjustments to future benefits, would likely have a dampening effect on any behavioral responses in the months before a person reaches the NRA.

force than those claiming as soon as they become eligible for reduced benefits. In the environment with fewer employment opportunities in the years 2000-2002, those claiming late may have been increasingly likely to withdraw from the labor market compared to the boom years of the late 1990s.

Individual-Level Evidence on Work Behavior, Earnings, and Claiming

Most previous studies have argued that individuals respond to the taxation incentives provided by the Earnings Test (Vroman 1985, Burtless and Moffitt 1985, Honig and Reimers 1989, Leonesio 1990, Reimers and Honig 1993, Reimers and Honig 1996, Friedberg 1998, Baker and Benjamin 1999, Friedberg 2000, and Votruba 2003). Friedberg (1998 and 2000) studies the effect of changes in the Earnings Test rule prior to 2000 on labor supply and finds that up to 5% of individuals bunch just below the Earnings Test limit and appear to adjust with the Earnings Test limit. This suggests that there are individuals who consider benefits withheld due to the Earnings Test as a loss, for example due to lack of information about the adjustment process or differences that make the adjustment actuarially unfair for them (e.g., lower life expectancy). However, this does not rule out that a second group of individuals exists that is aware that benefits withheld before the NRA increase the rate of future benefit pay and that takes the greater flexibility that the option to adjust the reduction factor after claiming offers into account.

Reimers and Honig (1993 and 1996) interpret their findings that current Social Security benefits, not Social Security wealth, predict labor force reentry behavior as evidence that individuals do not take the subsequent replacement of withheld benefits into account. However, their analysis does not consider the possibility that individuals seek to affect the reduction factor by continuing to work. Other related literature has approached the issue by estimating structural models of retirement (Rust and Phelan 1997; French 2005; Gustman and Steinmeier 2002; van der Klaauw and

Wolpin 2005, to name some of the most recent research efforts), but in that work there is little discussion of the mechanism we are emphasizing, and it is unclear to what extent the findings from that literature reflect this particular set of incentives provided by Social Security.

As argued above (see Section 3.1), one important effect of the possibility to affect the ARF after claiming benefits early (before the NRA) is that it provides those who have claimed benefits early and remain attached to the labor force with an incentive to continue to work and earn above the Earnings Test limit. In this section we investigate whether the labor force exit behavior of Americans is consistent with this incentive. Using monthly employment data of 7,203 men and women from the first five waves of the Health and Retirement Study (HRS), we construct measures of the time-to-exit from the labor force for individuals who are employed continuously from age 62. Within the group of individuals whose status changed from employed to not employed, we do not distinguish individuals who became unemployed, since the fraction of respondents exiting due to unemployment is less than 2% in the relevant age group. We also construct monthly indicators of claiming behavior which—given data limitations—reflect the month the individual started receiving Social Security Old Age benefits. Given the structure of the questions in the HRS we are unable to verify whether the respondent continuously receives benefits. If none of the respondents in the sample had their benefits withheld our identification strategy, as explained in the previous section, should fail to capture any effect of the time since claiming on labor force exit.

The frequency distributions of the employment spells are shown in Table 1. Of the 7,203 individuals in the HRS who are 62 or older, 3,381 have a complete work history after turning 62, and among those the 1,723 individuals who are working at 62 constitute our sample. Table 2 provides summary statistics for the earnings and hours of work in the calendar year corresponding to each month of the event of work/not work, claim/not claim. Males have higher earnings on average, and so do non-claimers. Claimers have earnings higher than the limits of the Earnings

Test, which suggests that the average claimers who work might seek to increase the rate of future benefit pay, i.e. increase the ARF. The large standard deviations of the earnings measures suggest that there are a substantial number of individuals below the Earnings Test limit. The distribution of average hours of work is consistent with the earnings distribution.

We expect that—on average—the labor force exit hazard will be higher for individuals who have claimed benefits than for those who have not, as many individuals claim at the time they retire, or soon afterwards, once they reach age 62. Thereafter, we expect—for the reasons explained above—that time since claiming exhibits positive duration dependence on the working hazard, i.e. the longer someone who has claimed benefits early stays in the labor force the smaller her exit hazard becomes compared to someone who has not claimed at the time, holding everything else constant. To capture this potentially non-linear effect the exit hazard models include a linear and a quadratic term for the time since benefits were claimed. To distinguish those who have not claimed yet in a particular month we construct a dummy variable, *Not Claimed Yet*, that equals 1 if the month is prior to becoming a claimer and 0 otherwise. We also include an indicator for the month when benefits are initiated. One potential concern in our single-equation approach is the endogeneity of the claiming decision. In a companion paper we estimate simultaneous hazard models of benefit claiming and labor force exit and find effects similar to those reported here (see Benítez-Silva and Heiland 2006).

To be able to identify the hypothesized non-linear effect of time since claiming on labor force exit, we estimate a continuous-time proportional hazard model controlling for a large set of factors that are expected to influence the labor force exit decision independently of the time since claiming. The set of explanatory variables used is shown in Table 3. To construct the time-varying covariates we assign characteristics from the closest previous survey wave available in each month. As proxies of a person's market earnings power we use measures of educational attainment, cog-

nitive ability and work-related health limitations. Together with marital status and subjective life expectancy, poor health may also capture leisure preferences. The availability and type of health insurance, pension wealth, and asset wealth are expected to play an important role in the decisions of when to withdraw from the labor force. Hence we have constructed an indicator for individuals without health insurance (non-missing for 84% of the respondents) and for those with private health insurance (84% non-missing). The individual's wealth during this part of the life cycle is measured by net total household wealth (83% non-missing), and an indicator for whether they have a private pensions (99% non-missing). Using the restricted earnings data from the HRS we have constructed a person's PIA, i.e. a measure of the respondent's actuarially fair Social Security wealth based on their history of earnings (79% non-missing).

The restricted earnings data provide the history of earnings for the 9,472 individuals, as of the first wave of interviews, that gave permission to link their files, from 1951 to 1991. Haider and Solon (2000) find little evidence of non-randomness and lack of representativeness in this subsample of individuals. The PIA we include in our estimations uses these histories and then imputes earnings up to the individuals' 62nd birthday in order to calculate the retirement benefits as of that age. For the months after that we just use the monthly actuarial adjustment factor.

Table 4 presents estimates from a hazard model that employs a flexible piece-wise Gompertz form of duration dependence. The *Time Since Claiming* variable has the sign hypothesized and is statistically significant. The longer it is since someone has claimed early benefits, the more likely they are to stay in the labor force compared with someone who has not claimed benefits at that time. The square term is positive and significant, indicating that the exit hazard decreases at a decreasing rate in the number of months since claiming. The net effect of time since claiming is negative, indicating a lower likelihood of dropping out of the labor force, which supports the importance of the incentives provided by the rules regarding the adjustment of the reduction factor.

The model predicts that an individual who has claimed benefits in a particular month is about 20.6% less likely to drop from the labor force in the following month than an individual who has not claimed benefits and is still in the labor force. This percentage comes directly from the results in Table 4. We use -0.237 and 0.006 and compute the percentage increase in the probability as $100 \cdot (\exp(-0.237 + 0.006) - 1)$. An individual who claimed benefits 6 months ago is about 70% less likely to drop from the labor force a month later than an individual who has not claimed benefits and continues to work. This percentage goes up to 86% if the individual claimed benefits a year ago. Also consistent with the incentives, we also find that this effect weakens as the person approaches the NRA. Notice the positive and significant effect of the quadratic term on the Time Since Claiming variable in the table.

Notice the large effect that the indicator of not having claimed yet has on decreasing the likelihood of dropping from the labor force. This control is necessary to account for the level shifter that indicates that those who have not claimed as of that month are unconditionally more likely to participate in the labor market. The sizable coefficient captures the increased exit probability associated with becoming eligible for early retirement benefits after turning 62 typically found in studies of retirement behavior during the 1990s. Also consistent with the fact that many early claimers retire when they claim, the indicator of month of claim increases the retirement hazard, which indicates that a number of respondents retire in the same month they claim benefits.

Evidence from a Life-Cycle Model

Our previous analysis shows that the observed claiming and working behavior of a recent cohort of Older Americans is consistent with (some) individuals responding to the incentives provided by the current early retirement rules of Social Security. In this section we use a life-cycle model of retirement to further explore the potential sensitivity of individuals' behavior with respect to these

rules, to assess the extent to which Older Americans know about these incentives, and to compare individuals' welfare under different reform scenarios.

We build upon an established framework to analyze retirement behavior, modeling for the first time the complete set of incentives provided by the Earnings Test and ARF adjustment. The model used in this paper is closely related to those presented in Rust and Phelan (1997), and Benítez-Silva, Buchinsky, and Rust (2003 and 2006). Rust and Phelan (1997) did not model consumption and savings decisions, but did estimate the parameters of the model, using a Nested Fixed-Point algorithm, instead of calibrating them. Benítez-Silva, Buchinsky, and Rust (2003 and 2006) present the most closely related models, which are calibrated to match aggregate data and household level data from the Health and Retirement Study, and model the Social Security Disability Insurance decisions on top of the OASI incentives. Unlike the structural model developed in the present paper, these earlier models (or any other structural models we are aware of) do not explicitly account for the possibility of affecting the Actuarial Reduction Factor. Our model also shares a number of characteristics with the work of French (2005), van der Klaauw and Wolpin (2005), and Blau (2004) among other researchers who solve, simulate, and in some cases estimate, dynamic retirement models under uncertainty.

The model presented here predicts individuals' labor supply, benefit initiation and receipt, and earnings. The model also predicts wealth accumulation and consumption decisions, but we focus here on the variables most relevant to our analysis. As discussed in Benítez-Silva, Buchinsky, and Rust (2006), the simulations of the model are broadly consistent with empirical evidence on a variety of measures.

We simulate the model to study different cases of familiarity with the current rules in the population and discuss the results in light of observed behavior and existing evidence on the informational asymmetries among Older Americans.

To further assess the sensitivity of behavior with respect to the Earnings Test, we use the model to study the likely consequences of a removal of the Earnings Test and contrast such a policy to one that focuses on informing retirees better about the existing rules.

Description of the Model

We assume that individuals maximize the expected discounted stream of future utility, where the per period utility function $u(c, l, h, t)$ depends on consumption c , leisure l , health status h , and age t . We specify a utility function for which more consumption is better than less, with agents expressing a moderate level of risk aversion. The flip side of utility of leisure is the disutility of work. We assume that the utility (disutility of work) is an increasing function of age, is higher for individuals who are in worse health than individuals who are in good health, and is lower for individuals with higher human capital measured by the average wage. In addition, we assume that the worse an individual's health is, the lower their overall level of utility is, holding everything else constant. Moreover, we assume that individuals obtain utility from bequeathing wealth to heirs or to institutions after they die. This model assumes that individuals are forward looking, and discount future periods at a constant rate β , assumed here to be equal to 0.96. The model also allows for a variety of sources of uncertainty, like lifetime uncertainty, health uncertainty, and wage uncertainty.

Any person who is not already receiving Social Security Old Age benefits is eligible to apply for OASI benefits.⁹ Individuals with at least 40 quarters of earnings covered for OASI before reaching their 62nd birthday are eligible to apply and benefit award is guaranteed. In the present version of the model we allow decisions to be made on an annual basis and assume no lag between

⁹ We are abstracting from Social Security Disability Insurance (SSDI), a program that allows workers with severe disabilities to receive Social Security benefits before the NRA. This program currently covers about 7 million Americans. See Benítez-Silva, Buchinsky, and Rust (2006) for a life-cycle model of retirement and SSDI application.

application date and date of first receipt.

Calculation of benefits and the reduction factors are as explained in the previous sections, assuming a NRA of 66. In particular the number of checks received in a year depends on the earnings after claiming: the number of checks (or the benefit amount on some checks received towards the end of the period) are reduced reflecting the 50% rate on labor incomes exceeding the Earnings Test limit between 62 and the January of the year a person turns 66 (33% thereafter). In other words, adjustments to benefits and ARFs occurs in accordance with the earnings and the Earnings Test limit, and we do not consider the possibility that beneficiaries ask Social Security for a reduction of benefits or return benefits received. Even though we set up an annual decision-making process, the Social Security Earnings Test is enforced semiannually, i.e. the benefits received by a beneficiary are adjusted, after reaching the NRA, for the earnings in excess of the Earnings Test limit, as long as six months or more, of benefits were withheld in the years between the early and normal retirement ages. The structure and the details of the model are described in the model appendix.

Taxation vs. ARF Adjustment

Table 5 presents results on working behavior (full-time, part-time and not working, working full-time conditional on being a claimer), claiming behavior (claim initiation in a given age group), benefit withholding, and earnings above the Earnings Test limit, from 10,000 simulations of the life-cycle model. The top panel in the table, which we label Model 1, reports on the model with Earnings Test but without adjustment of the ARFs. Since earnings above the Earnings Test limit are lost in this specification, it represents individuals who are only aware of the taxation aspect of the Earnings Test. On the other hand, the results in the middle panel, labeled Model 2, correspond to the full information case, i.e. individuals who understand that benefits withheld due to the

Earnings Test are not lost but lead to higher benefits after the NRA is reached (here age 66) via the ARF adjustment discussed earlier.

Both models correctly predict a spike in claiming at age 62 (the early retirement age) accompanied by a reduction in labor force participation resulting from declining full-time employment. These results reflect that individuals are borrowing-constrained prior to the ERA and take into account their survival probability to the next period, claim Social Security benefits when eligible and subsequently afford to consume more leisure (see Rust and Phelan 1997). Data from SSA's Statistical Supplement (SSA Table 6.A4, 2005) show that in 2004 57.5% of eligible beneficiaries claimed benefits at age 62, 7.2% at age 63, 10.9% at age 64, and 18.62% at age 65.¹⁰

As shown in Table 5 our simulations capture the decline in new claims immediately after the ERA and the subsequent increase fairly well. Models 1 and 2 predict that 35-48% of individuals claim at age 62, 14-17% at age 63, 11-14% at age 64, and 18-23% at age 65 (the last year before reaching the NRA in the simulations). Labor force participation in our models declines from about 71% at age 60 to 38-45% at age 65. Data from the 2005 Current Population Survey show an average participation rate of 71.4% between age 55-59 and 51.6% between age 60 and 64.

The results also show that the additional incentives provided by the ARF adjustment have substantial effects on labor supply and claiming behavior. Regarding claiming behavior, 95.9% of individuals claim benefits early (ages 62-65) when the rate of benefit pay can be affected even after claiming, compared to 83.8% in the model where the ARF cannot be altered once benefits are claimed. Not surprisingly, among individuals who are aware of the ARF adjustment more than half of early claiming (48.3%) occurs as soon as individuals are eligible for benefits. This result reflects the option to reverse being locked in at a low benefit rate that is implicitly granted in the current system and that implies more flexibility. While benefits continue to be taxed against earnings

¹⁰ Benítez-Silva and Yin (2006) analyze the trends in claiming behavior and benefits received in the last decade.

in excess of the Earnings Test limits at the time, individuals who understand that these benefits increase the rate of benefit pay in the future will be more likely to claim early and continue to work or return to the labor force after a leisure spell if there are earnings opportunities. Consistent with this we find that informed individuals are more likely to participate in the labor force at all ages except at age 62 where the greater number of claimers also implies a higher number of exits from the labor force.

The result shows a substantial increase in employment in the full information model (Model 2) compared to the taxation case (Model 1). As a result many individuals earn above the Earnings Test limit and have benefits withheld and their ARFs adjusted. As shown in Table 5, 9.4% of individuals who claim at age 62 have at least six months of benefits withheld due to the Earnings Test. Intuitively, some of the individuals who view the Earnings Test as a tax only and do not participate (or constrain their hours) to be close to or below the Earnings Test limit work more and trade some benefits today for a higher rate of benefit receipt after the NRA. Estimates by Friedberg (2000, p.60) confirm the importance of the taxation effect for individuals' labor supply. She predicts a 5.3% increase in hours worked for earners close to the limit or above based on a counterfactual removal of the Earnings Test for the 65-69 year olds in 1983.

While there are no survey data that would allow us to directly estimate the extent to which Americans know about the Earnings Test and the ARFs, the simulation results discussed above can help us assess the percentage of individuals who understand that benefits withheld due to the Earnings Test affect the reduction factor. In the model where all individuals perceive benefits withheld as a loss, no claimer works full-time prior to age 65, no one earns above the limit at age 62, and very few earns sufficiently above the limit to have six consecutive months of benefits withheld. Under the assumption that all individuals are fully aware of the Earnings Test rules, claiming and working afterwards is quite common. We find that 9.4% of all individuals who have

claimed at age 62 have at least six months of benefits withheld due to earnings. Recent data from the SSA (Table 6.B1 of SSA's Statistical Supplement 2005) indicates that as of 2004 this figure was 3.6%, a number between our predictions based on the extreme cases of taxation only vs. full information. This 3.6% comes directly from Table 6.B1, and is the result of dividing the 34,600 claimers who had six or more months of benefits withheld at age 62, by the 962,500 individuals who claim benefits at age 62. This figure is directly comparable to the one produced by the Dynamic Programming Model, while for ages 63 and 64, SSA only reports the withholdings for individuals who claim at 63 or 64, not for all individuals of that age who ever claimed. The observed figure in the data is consistent with results from a model where about 40% of individuals are aware of the ARF adjustment rules.

Other studies have provided evidence on the knowledge on Social Security of Older Americans. Gustman and Steinmeier (2001) report that 27% of the respondents in the first wave of the Health and Retirement Survey can predict their Social Security benefits within 75-125 percent accuracy (+/- \$1,500 of their actual benefits).¹¹ Given this finding and our simulation results, we believe it is likely that 30-40% of Older Americans are currently aware of this rule. We believe, however, that the percentage could increase substantially through the appropriate information flow to current and future retirees.

Interestingly, Gustman and Steinmeier (2001) find that those respondents who are more dependent on Social Security are precisely the ones less likely to be informed about the system. In

¹¹ At the same time, they find that almost 50% of respondents answered "don't know" when asked about their expected Social Security benefit amount. In analyzing financial reporting behavior in the HRS, Cao and Hill (2005) study whether answers of the "do not know" type, reflect lack of knowledge or lack of willingness to share the information. Given the possibly sensitive nature of reporting Social Security benefits, especially for those more dependent on it, the 40% mentioned in the text could be considered a possible upper bound on the number of individuals who are truly unaware of their benefit level. This is especially true because Americans regularly receive statements from Social Security informing them of their future benefits (see Mastrobuoni 2006 for a discussion of the consequences of this policy). It seems unlikely that such a high percentage would be ignorant enough not to be able to give a ballpark figure if they absolutely had to (see Blinder and Krueger 2004, for a discussion of survey responses to general questions regarding Social Security benefits and prospects).

addition, those with private pensions appear to be more informed about the public pension system.¹² These latter results suggest that information asymmetries can exacerbate retirement income inequality.

Efforts that would remove the information asymmetries potentially present in the current system would make most individuals better off, since they would understand that they have the option to adjust their reduction factor. All individuals with (potential) earnings power that puts them significantly above the Earnings Test limit have the option to forego benefits before the NRA to increase their future rate of benefit pay.

As argued above, individuals with very low income potential (generating earnings below the limit) would be unaffected. Welfare calculations based on our life cycle model show that individuals are on average willing to pay to become fully informed, confirming that individuals' are better off with more information about the Earnings Test rules. We calculate that a 60 year old individual in Model 1 would, on average, be willing to pay \$3,370 (4% of their wealth) to become fully informed about the Earnings Test rules, i.e. to be a 60 year old in Model 2. Younger individuals would experience a smaller welfare gain from moving from Model 1 to Model 2 due to discounting and life-time uncertainty but the differences are still notable, averaging around 1.7% of the wealth of a 30 year old individual. As could be expected, the willingness to pay is a bit higher for a 62 year old individual, and in our simulations reaches almost 7% of the average wealth of a retirement age individual.

While most individuals would benefit from the greater flexibility achieved under full information, such a policy may raise costs from the Administration's point of view. With the Earnings Test

¹² Mitchell (1988) studies informational awareness regarding private pension plans for a sample of workers. She finds widespread informational problems, and informational asymmetries correlated with socio-demographic characteristics. Starr-McCluer and Sundén (1999) revisit the issue with matched employer-employee data from the 1989 SCF and find that around 75% of workers are aware of the type of plan they have, but only around two thirds of that group are aware of the more subtle characteristics of their plans.

in place and more people claiming early and taking advantage of the flexible adjustment mechanism, the costs of monitoring and administering the system would likely rise.

Earnings Test Removal vs. Better Information

Given the distortionary nature of the Earnings Test, which is exacerbated under informational asymmetries as discussed above, policy makers may consider its removal. We now analyze this scenario in more detail, and compare it to the alternative of keeping the current system of incentives but providing more information on the nature of the Earnings Test, as illustrated in the model with Earnings Test and ARF adjustments (Model 2) above.

The bottom panel in Table 5, labeled Model 3, presents results from an experiment where the Administration removes the Earnings Test and opts to make the reduction associated with claiming early irreversible. The results show that Older Americans would be more likely to claim benefits early compared to Model 1. In particular, the fraction of individuals claiming as soon as they are eligible, i.e. at age 62, is 61.6% in Model 3, compared to 34.9% in Model 1. Compared to Model 2, in which 48.3% claim at 62, Model 3 still predicts a higher peak at age 62, but also predicts that fewer Americans would claim benefits before the NRA. Intuitively, the effect on claiming is ambiguous since individuals who currently do not claim before the NRA as a result of the taxation aspect of the Earnings Test (up to 30%) may claim earlier if the Earnings Test was abolished while those who now claim before the NRA and take advantage of the flexibility under the current system to affect their ARF may delay claiming if claiming is irreversible.

Regarding labor supply, the results confirm that more Americans are expected to participate in the labor market if the Earnings Test was eliminated. While the participation rate is 43.7% at age 62 in Model 3, compared to 51% in Model 2 (59.4% in Model 1), participation—in particular full-time work—is substantially higher after age 62 compared to either model with the Earnings

Test. This result reflects that individuals with low earnings power work less due to the Earnings Test under the current system but are likely to work more, on average, if the Earnings Test was removed. For those who claimed early and subsequently earned above the Earnings Test limit to increase their future rate of benefit pay, a removal of the Earnings Test may reduce their labor supply since the possibility of changing the rate of future benefits does not enter their rationale for working anymore. It seems unlikely, however, that this latter group could dominate the overall aggregate change since these individuals are only part of the 6-10% of early claimers that are currently affected by the Earnings Test (see Figure 1), and the simulation results confirm that labor force participation is higher overall in the model without Earnings Test.

The evidence provided by our simulations is consistent with evidence gathered after the removal of the Earnings Test for those above the NRA which took place in 2000. Based on the Earnings Test removal simulation experiment in Gustman and Steinmeier (2004), a 10-13% increase in the percentage of early beneficiaries may occur. They also find that the rate of full-time work increased 11 percentage points more for 65-67 year olds than for 62-64 year olds in the HRS when the Earnings Test for those after age 65 (NRA) was removed in 2000. We find a smaller increase in full-time work but large effects on part-time work relative to the model that only captures the taxation effect of the Earnings Test. When allowing for the full incentives provided by the Earnings Test, the increases in labor force participation are smaller.

French (2005), using his estimates from a dynamic structural model, performs the experiment of removing the Earnings Test for those between age 65 and 70. He finds large effects in terms of the hours worked after age 65, and also in terms of the number of years in the labor force, even if the average hours worked by workers are largely unchanged. Although these are results in a partial equilibrium setting, they indicate that a possible removal of the Earnings Test for those between the ERA and the NRA would have significant effects on the labor supply of Older Americans. Gruber

and Orszag (2000), using the CPS and taking a more descriptive approach, find little evidence of the effects of the Earnings Test on the labor supply of men, but some evidence of effects on benefit claiming behavior. Song (2004) using the SIPP finds that the removal of the ET leads to uneven effects over the earnings distribution, with large effects on the earnings of high earners. The author also finds an increase in claiming for the 65 to 69 age group. More recently, Song and Manchester (2006) using SSA's Continuous Work History Sample reach similar conclusions.

Educating beneficiaries regarding the complete rules of the Earnings Test, including the possibility to adjust the ARFs after claiming, reduces the taxation characteristic of the Earnings Test for the average individual. In this regard the implications of educating individuals under the current system with Earnings Test are similar to a system without Earnings Test where the ARF cannot be altered once benefits are claimed. Not surprisingly, the results shown in Table 5 are more similar for these two models than one with Earnings Test and taxation (Model 1). We note that the effect of a change towards a system without the Earnings Test (and no reversibility of the reduction factors) on the welfare of individuals with earnings potential above the Earnings Test limit is ambiguous, since the loss of flexibility (ability to respond to shocks by working more and adjusting the actuarial reduction factor) may outweigh the welfare gains from fewer distortions. Again, for individuals with very low earnings power we do not expect large welfare effects either way. This group is not likely to be affected much by the Earnings Test since their (potential) earnings are below or close to the limit.

Willingness-to-pay calculations based on our life cycle model suggest that individuals are slightly better off in the full information case (Model 2) than without the Earnings Test and no option to affect the ARF (Model 3). Not surprisingly, individuals prefer both situations to the limited information case (Model 1). In a situation without the Earnings Test, it would take a payment of \$1,180 (2.1% of their wealth) to make the average 60 year old indifferent between this situation

and the one with Earnings Test and full information.

The welfare discussion assumes that individuals understand the trade-offs provided by the early retirement incentives, i.e. they apply to individuals who are forward-looking. As has been noted in this context before (e.g., Gruber and Orszag 1999), if there are myopic individuals who are kept from claiming early by the Earnings Test limit, a removal may reduce their welfare since they may then elect to claim benefits earlier not realizing (in time) that the lower benefit rate leaves them worse off at old-age. In our context, the possible presence of myopic individuals, would support advocating for a full-information model with Earnings Test as a more interesting option than a complete removal of the incentive with no opportunity to affect the ARF after claiming early.

From an administrative perspective providing more information on the consequences of working after claiming seems fairly straightforward and relatively inexpensive, but would not reduce administrative costs in the long run. Removing the Earnings Test, on the other hand, likely has beneficial long-term consequences for public accounts. This is the result of smaller administrative responsibilities once the Earnings Test is removed. These cost savings are expected to be significant and permanent, but somewhat smaller if the early retirement reduction is reversible due to the efforts to administer the postponement of benefit checks for individuals who choose to do that. Furthermore, this policy would have little effect on long-term liability of Social Security but could worsen the immediate cash flow problems of the system; two issues we will discuss in turn now.

Given the limited documentation on withholdings due to the Earnings Test, it is difficult to estimate the revenue to Social Security from benefit withholding due to earnings in excess of the Earnings Test limit under the current system. Based on the figures for early claimers in 2004 we estimate that the amount of benefits withheld due to earnings for new OA beneficiaries in that year was around \$534 millions. We have reached this figure through a back of the envelope calculation based on aggregate data provided by the Social Security Administration through their publication

SSA-S 2005, Table 6.B1, and after discussing it with some of the Administration's researchers in the statistical department, who have told us that no official figures exist, as far as they know, regarding this number. We have done the following calculation:

$$(12 * 13,500 * \$922.00) + (8.5 * 39,500 * \$993.40) + (3 * 18,100 * \$943.50) \approx \$534 \text{ million. (4)}$$

The first parenthesis represents the group for which all checks were withheld, the second parenthesis represents the group for which more than half of the checks (but not all) were withheld, and the third parenthesis represents the group for which fewer than half of the checks were withheld. The first number in each of the parenthesis represents the number of months that checks were withheld for the particular group, the second number represents the number of individuals in the particular group, the third number is the approximation to the monthly benefit withheld by Social Security. This calculation assumes that all early claimers claimed at the age 62 rate in 2004, and that their last monthly benefit is representative of the benefits they should have received if they had not earned above the limit. Given these assumptions, we believe the figure we are providing probably slightly overestimates the actual Earnings Test tax revenue to Social Security.

Of course the revenue Social Security collects due to the Earnings Test results in a greater liability of Social Security to these beneficiaries after they reached the NRA due to the adjustment of the ARF. Since the Actuarial Reduction Factor is approximately actuarially fair, the removal of the Earnings Test should have no negative consequences on the long-term liability of Social Security, because benefits withheld at any point in time before the NRA will have to be paid back to individuals in the form of a greater benefit after the NRA. We note that, by the same logic, a greater incidence of early benefit take-up due to the abolition of the Earnings Test (as predicted by our structural model) would not affect long-term liability. It is true under the current system with Earnings Test, however, that if an individual who had benefits withheld drops from the labor force

before reaching the NRA, the benefits paid in the years, or months, before the NRA will be at the lower rate, saving Social Security some money, even if we take a dynamic fiscal perspective.

Thus, the removal of the Earnings Test should have little real consequences on the long-term benefit liability of Social Security but yield potentially significant and permanent administrative cost savings. The accumulated cost savings could benefit the Social Security Trust fund or they could be used to finance programs to address the informational needs of those Americans who rely mostly on public pensions for financial security at old age, and are hence most vulnerable to the consequences of poor and suboptimal decisions.

From a short-term perspective, the removal of the Earnings Test likely worsens the system's cash flow problem temporarily. If this policy was implemented Earnings Test tax revenue would cease immediately and benefit payouts would likely increase due to earlier benefit take-up. The expected administrative cost savings (which may not be effective immediately) and the greater payroll base (as shown by the higher incidence of full-time work and high earning individuals) since all workers will continue to pay Social Security taxes, might not outweigh the expected lower revenue and higher outlays during the period of implementation.

Conclusion

As the population ages, and the number of years between the early and the normal retirement age increases over time, the administrative costs and the welfare burden currently associated with the Earnings Test and the actuarial reduction mechanism will likely increase since these incentives affect every American who reaches retirement age. As part of the ongoing debate on Social Security Reform, one possible set of changes that has been discussed includes increasing both the NRA and the ERA in the coming years in order to avoid even more radical changes to the system. Although

raising the early retirement age appears to have little support today, it cannot be ruled out that it will be considered more seriously as the system approaches insolvency. If the limited documentation of the Earnings Test and its role in affecting the rate of future benefits remains, its distortionary incentives are likely to continue to affect millions of Americans who consider working after claiming benefits early. As the NRA increases, the distortions will increasingly affect older retirees, and if the ERA also increases, the burden shifts from younger to older retirees.

As we have argued herein, the distortionary impact is in part the result of the lack of information about the Actuarial Adjustment Factor. Relatively simple steps by the Social Security administration, such as providing proper documentation of this incentive in conjunction with the Earnings Test, would help current and future retirees to make more informed retirement decisions. The provision of more information would be accompanied by increased labor supply, earlier claiming of benefits and welfare gains for Older Americans. We find, therefore, that information can be an important policy instrument to provide work incentives to Older Americans, who have grown more interested in receiving benefits before the NRA. This kind of policy is considerably easier to implement than other programs trying to influence work like the time limits linked to TANF, and the EITC, and its consequences are more readily predictable than those of active labor markets policies that focus on labor supply, like training and re-training programs, or policies targeted to increase work among disabled individuals.

The administration could include a description of the adjustment of the ARF in the Annual Statistical Supplements and provide more discussion about how withheld benefits affect a beneficiaries' future MBA on their website. More importantly, the Social Security Administration could train claims experts to make workers aware of the ARF and the possibility to (partly) undo early retirement decisions. Currently, claim specialists seem to follow the simple strategy of recommending late claiming to those expecting to earn wages sufficiently above the limit. This is

the source of some of the distortions we have emphasized, which results in reduced flexibility for Older Americans considering work at a time that Social Security benefits are a possible source of income for them. Finally the government could allow for more sophisticated work and claiming scenarios in the benefit calculator (e.g., like the example we presented above) that is available to the public. In addition, the administration could complement the provision of better information with the removal of some of the characteristics of how the ARF is implemented that distort individuals' decisions. For example, it could allow for an adjustment of the ARF for benefits withheld even if the person receives the benefits before the NRA. Currently individuals have to wait until the NRA to see the adjustment in their benefits. To maintain actuarial fairness such immediate adjustment of the reduction factor would require a correction factor, but the policy change would reduce the distortions of the system to a minimum.

While the benefits of better documentation of the current rules may be hard to track and to empirically identify separately from labor market fluctuations and other policy changes, we believe that a strategy focussing on providing information about the Earnings Test and the Actuarial Reduction Factor is likely to be one of the most effective and readily implementable policies to foster work among Older Americans. The cost of implementing any policy that tries to increase the percentage of Americans aware of the trade-offs between work and Social Security benefits may be difficult to assess, but it is likely to have a positive effect on the finances of the system due to the actuarial unfairness features of the current rules and the expected rise in labor supply among individuals who are currently only aware of the taxation aspect of the Earnings Test and hence do not work, or work part-time, in order to keep their earnings below the limits.

In an effort to avoid administrative costs, Social Security may opt to make the initiation and receipt of benefits irreversible, essentially eliminating the Earnings Test and the option to adjust the ARFs. As our simulations from a life-cycle model of retirement show, this would increase

labor supply between the early and normal retirement age, especially fostering full-time work, and possibly lead to even more Americans claiming benefits at the early retirement age. While it would simplify the early retirement incentives considerably, thereby reduce administrative costs, it would also limit the flexibility of early retirees to respond to shocks. If benefit reduction due to early claiming was made irreversible then providing adequate information about the consequences of claiming benefits before the normal retirement age to American workers would be especially important. The administrative cost savings from abolishing the Earnings Test could be used to finance programs to address the informational needs of those Americans who rely mostly on public pensions for financial security at old age, and are hence most vulnerable to the consequences of poor and suboptimal decisions.

From our analysis of the current system, we conclude that the interaction between work and Social Security benefits is clearly not perceived as a priority by the Social Security Administration. However, the general public might feel very differently, and the lack of information probably results in suboptimal, and potentially hard-to-reverse decisions. We believe the government should consider providing more information to current and future beneficiaries regarding the options of increasing the Monthly Benefit Amount even after claiming before the NRA. In addition, one of the objectives of this paper is to foster a debate about the removal of the Earnings Test. While such a move would eliminate the automatic adjustment of the reduction factor, it would constitute a significant simplification of the early retirement incentives. As the Earnings Test is removed the option to affect the reduction factor by postponing benefits could be made available to maintain flexibility. This may be the best way to minimize possible welfare losses and generate administrative cost-savings to improve the balance of the Social Security Trust Fund in the long run.

Table 1: Percentage Distribution of Working Spells

Sample	Total Number of Subjects	Mean Duration ^a	Outcome	
			Not Working	Censored
Worked at 62	1,723	14.0	36.7	63.3
Male	984	14.6	37.9	62.1
Female	739	13.2	35.2	64.8
Claimer ^b	474	14.5	53.0	47.0
Non-Claimer	1,249	13.8	30.6	69.4

Notes: ^aIn months. ^bEver benefit claimer.

Table 2: Distribution of Earnings and Hours

Sample	Earnings ^a		Hours Worked ^b	
	Mean ^c	Standard Deviation	Mean	Standard Deviation
Worked at 62	23,626	32,550	1,320	830
	(18,474)		(21,699)	
Male	30,177	39,178	1,410	872
	(10,809)		(12,927)	
Female	14,388	15,598	1,188	746
	(7,665)		(8,772)	
Claimer	16,406	27,143	1,050	785
	(5,264)		(6,167)	
Non-Claimer	26,503	34,046	1,427	824
	(13,210)		(15,532)	

Notes: ^aAverage calendar year earnings in current US-\$. ^bAverage calendar year hours worked.

^cNumber of cases (person-months) in parentheses.

Table 3: Means of Variables in Labor Market Exit Analysis

Variable Name	Definition	Mean ^a
Subject-Invariant		
Male	1 if male, 0 otherwise	0.57 (1.00)
White	1 if white, 0 otherwise	0.78 (1.00)
No Diploma	1 if no high school diploma, 0 otherwise	0.68 (1.00)
Voc. Training	1 if vocational training received, 0 otherwise	0.23 (1.00)
BA	1 if Bachelor degree obtained, 0 otherwise	0.25 (1.00)
Prof. Degree	1 if professional degree obtained, 0 otherwise	0.09 (1.00)
Cogn. Test	Cognitive Ability Test Score (Scale: 0-14)	6.30 (0.90)
Others	9 regional dummies	
Sample Size ^b		1,723
Subject-Varying^c		
Married	1 if currently married or living together, 0 otherwise	0.77 (0.85)
Primary Respondent	1 if respondent is financially knowledgeable person, 0 otherwise	0.64 (0.86)
Month Claimed	1 if month when first received Social Security Benefits, 0 otherwise	0.02 (1.00)
Time since Claiming ^d	number of months since initiation of benefits	4.4 (0.28)
Pr. Living to 85	self-reported probability of living to age 85	0.47 (0.14)
Health Lim. for Work	1 if health limitations for work exist, 0 otherwise	0.09 (0.85)
PIA	nominal monthly primary insurance amount (in \$1,000s)	0.73 (0.79)
Net Wealth	total net household wealth (in \$100,000s)	2.82 (0.83)
Private Pension	1 if has private pension, 0 otherwise	0.54 (0.99)
No Insurance	1 if no health insurance currently, 0 otherwise	0.06 (0.84)
Private Insurance	1 if has private health insurance, 0 otherwise	0.23 (0.84)
Hourly Pay	1 if job pays hourly, 0 otherwise	0.53 (0.20)
Hours Worked	total hours worked in corresponding calendar year	1,320 (0.90)
Earnings	total labor earnings in corresponding calendar year	23,626 (0.77)
Sample Size ^e		24,097

Notes: ^aMean for subject-varying variables is computed using the overall mean. Fraction of subjects with complete observations in parentheses. ^bData are based on the most recent available survey in each month. ^cNumber of subjects (=respondents). ^dExcludes respondents who do not initiate benefits before age 65. ^eNumber of subject-months.

Table 4: Piece-Wise Gompertz Labor Market Exit Hazard Model

Variable Name	Coefficient	Standard Error
Month Claimed	0.383**	0.166
Time since Claiming	-0.237**	0.037
Time since Claiming Square	0.006***	0.001
Not Claimed Yet	-2.497***	0.168
Male	-0.071	0.106
White	-0.061	0.105
BA	-0.104	0.125
Prof. Degree	-0.059	0.189
Married	-0.029	0.135
Primary Respondent	-0.488***	0.100
Cognitive Test	-0.015	0.016
Pr. Living to 85	-0.559	0.355
No Insurance	-0.048	0.277
Private Insurance	0.099	0.177
Net Wealth	-0.039**	0.016
PIA	0.099	0.167
Private Pension	0.001	0.002
Dur0-3	0.290**	0.127
Dur3-6	-0.144**	0.070
Dur6-12	0.055*	0.030
Dur12-36	-0.024**	0.010
Dur36+	1.057***	0.177
Constant	-1.820***	0.480
Log Likelihood		-2,612.242
Sample Size		24,097

Notes: The dependent variable is time-to-exit after age 62. The estimates indicate the direction and magnitude of a proportional shift of the hazard, i.e. a positive sign indicates that exit is more likely (= time-to-exit from labor force is shorter). The model also controls for regional dummies and year dummies for the 62nd birthday and for missing observations on marital status, health, primary respondent, cognitive score, probability of living to 85, health insurance, net wealth, PIA, and private pension. Robust standard errors are reported in the second column. Data are based on the most recent available survey in each month.

Table 5: Simulation Results: 10,000 Simulations of the Dynamic Programming Model

Ages	Survivors	Full-Time ^a	Part-Time ^a	No Work ^a	Claimers ^b	Claim & FT	ARFS ^c	Wages > ET ^d
Model 1: Earnings Test as a Tax								
Age 60	8,234	5,749 (69.8%)	163 (5.7%)	2,322 (28.8%)	—	—	—	—
Age 61	8,078	5,635 (69.7%)	213 (2.6%)	2,230 (27.6%)	—	—	—	—
Age 62	7,951	4,714 (59.2%)	2 (0.02%)	3,235 (40.6%)	2,672 (34.9%)	0	—	0
Age 63	7,762	2,013 (25.9%)	856 (11.0%)	4,893 (63.0%)	1,331 (17.4%)	0	—	218
Age 64	7,586	495 (6.5%)	2,008 (26.4%)	5,083 (67.0%)	1,048 (13.7%)	0	—	584
Age 65	7,420	113 (1.5%)	2,731 (36.8%)	4,576 (61.6%)	1,362 (17.8%)	113	—	78
Age 66	7,239	414 (5.7%)	3,484 (48.1%)	3,341 (46.1%)	847 (11.0%)	414	—	—
Model 2: Earnings Test with ARF Adjustments								
Age 60	8,234	5,749 (69.8%)	154 (1.8%)	2,331 (28.3%)	—	—	—	—
Age 61	8,078	5,636 (69.7%)	214 (2.6%)	2,228 (27.5%)	—	—	—	—
Age 62	7,951	4,058 (51.0%)	0	3,893 (49.0%)	3,741 (48.3%)	439	351 (9.4%)	439
Age 63	7,762	1,657 (21.3%)	1,387 (17.8%)	4,718 (60.7%)	1,073 (13.8%)	450	380 (8.1%)	808
Age 64	7,586	434 (5.7%)	2,413 (31.8%)	4,739 (62.5%)	815 (10.5%)	309	256 (4.7%)	1049
Age 65	7,420	175 (2.4%)	3,139 (42.3%)	4,106 (55.3%)	1,808 (23.3%)	175	9 (0.1%)	125
Age 66	7,239	553 (7.6%)	4,179 (57.7%)	2,507 (34.6%)	306 (4.1%)	553	—	—
Model 3: Removal of the Earnings Test								
Age 60	8,234	5,754 (69.9%)	160 (1.9%)	2,320 (28.1%)	—	—	—	—
Age 61	8,078	5,639 (69.8%)	207 (2.6%)	2,232 (27.6%)	—	—	—	—
Age 62	7,951	3,480 (43.7%)	1 (0.01%)	4,470 (56.2%)	4,787 (61.6%)	827	—	824
Age 63	7,762	1,783 (23.0%)	2,095 (27.0%)	3,884 (50.0%)	555 (7.1%)	731	—	1,271
Age 64	7,586	714 (9.4%)	2,627 (34.6%)	4,245 (56.0%)	572 (7.4%)	559	—	1,320
Age 65	7,420	387 (5.2%)	3,150 (42.4%)	3,883 (52.3%)	859 (11.0%)	387	—	256
Age 66	7,239	575 (7.9%)	3,501 (48.4%)	3,163 (43.7%)	710 (9.1%)	575	—	—

Notes: ^aIn numbers, and as percentage of survivors. ^bNumber of First Claimers at that age, and as percentage of the total who ever claimed. ^cIndividuals with Benefits Withheld: In numbers, and as percentage of all claimers at that age. ^dIndividuals who earn above the Earnings Test limits. In the third panel these calculations are just illustrative.

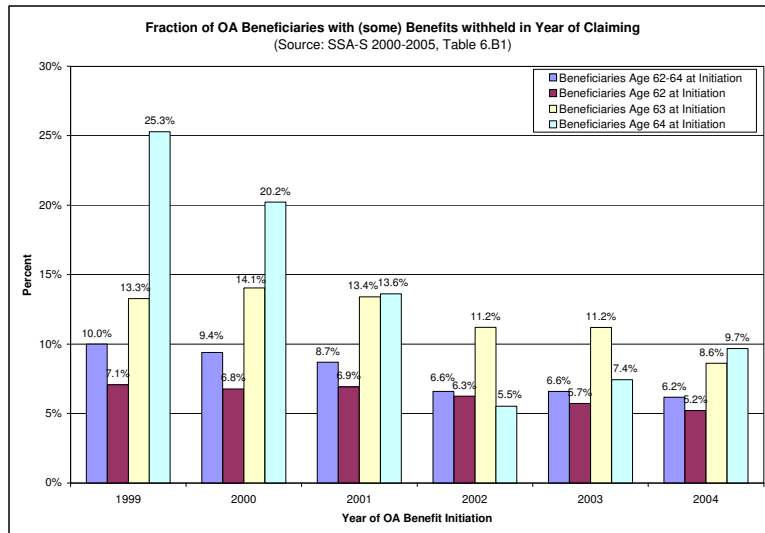
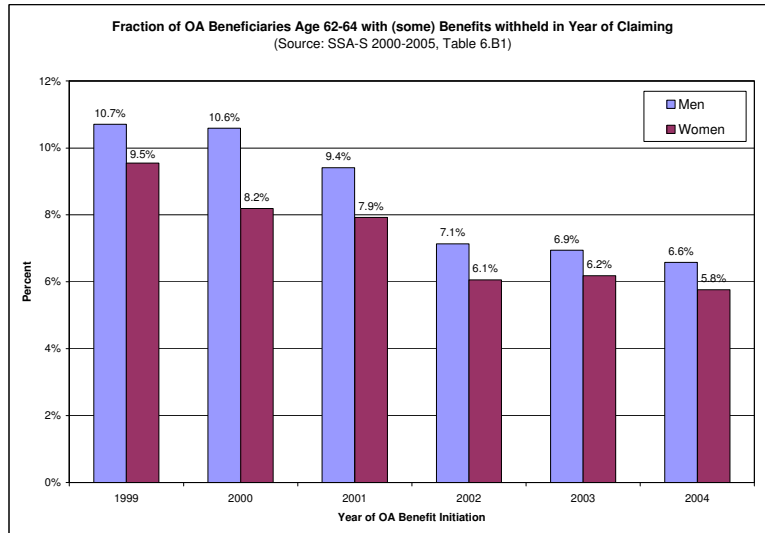
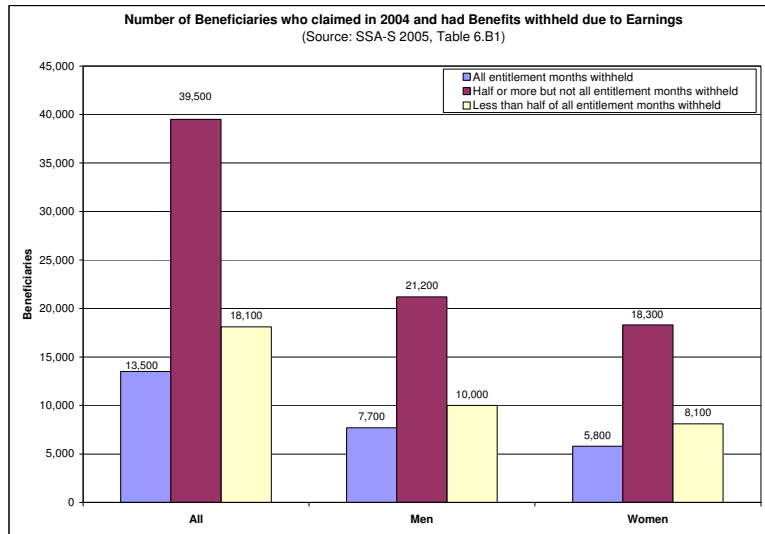


Figure 1: Incidence of Benefit Withholding among Early Claimers

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Appendix: Model Details

We solve the dynamic life-cycle model by backward induction, and by discretizing the space for the continuous state variables. The terminal age is 100 and the age when individuals are assumed to enter the labor force is 21. Prior to their 62nd birthday, agents in our model make a leisure and consumption decision in each period. At 62 and until age 70, individuals decide on leisure, consumption, and application for OASI benefits, denoted $\{l_t, c_t, b_t\}$, at the beginning of each period, where l_t denotes *leisure*, c_t denotes *consumption*, which is treated as a continuous decision variable, and b_t denotes the individual's Social Security *benefit* claiming decisions. After age 70 is assumed that all individuals have claimed benefits, and again only consumption and leisure choices are possible. Leisure time is normalized to 1, where $l_t = 1$ is defined as not working at all, $l_t = .543$ corresponds to full time work, and $l_t = .817$ denotes part-time work. These quantities correspond to the amount of waking time spent non-working, assuming that a full-time job requires 2000 hours per year a part-time job requires 800 hours per year. We assume two possible values for b_t . If b_t equals 1 the agent has initiated the receipt of benefits. If the individual has not filed for benefits or is not eligible then b_t is equal to 0.

If benefits are claimed before the NRA the monthly benefit amount is calculated similar to equation (1). For a NRA of 66 years the reduction factor if claimed at 62 is 75%, 80.0% if claimed at 63, 86.67% if claimed at 64, and 93.33% if claimed at 65. Due to the Earnings Test, benefit initiation between the ERA and the NRA does not necessarily imply benefit receipt, nor is the reduction in the benefit rate necessarily permanent after the NRA as a result of the adjustment of the ARFs as discussed above (see equation (2)). In particular, we use an annual Earnings Test limit of \$12,480 between 62 and 65 and \$33,240 between 65 and 66 (these numbers reflect the 2006 limits). In the former period benefits are reduced at a rate of \$1 per \$2 of earnings above the limit and \$1 per \$3 of earnings above the limit for the latter period. These are the correct rules for someone who turns 66 in December. Since those whose birthday is earlier in the year face the higher limit and lower tax rate for less than a year (January to month of birthday) we have also simulated two alternative versions, one with the \$12,480 limit throughout, and another using \$20,760, the midpoint between the two limits and a tax rate of 50%. The results of these models do not differ markedly from those presented in Table 5 and are available from the authors upon request. Those claiming after 66 earn the delayed retirement credit. We model it following the rates faced by the 1943-1954 cohorts, of 2/3 of 1% for each month not claimed between age 66 and 70.

We also incorporate a detailed model of taxation of other income, including the progressive federal income tax schedule (including the negative tax known as the EITC – Earned Income Tax Credit), and state and local income, sales and property taxes. Individuals whose combined income (including Social Security benefits) exceeds a given threshold must pay Federal income taxes on a portion of their Social Security benefits. We incorporate these rules in our model as well as the 15.75% Social Security payroll tax.

The model allows for three different sources of uncertainty: (a) lifetime uncertainty: modeled to follow the Life Tables of the United States with age specific survival probabilities; (b) wage uncertainty: modeled to follow a log-normal distribution, function of average wages as explained in more detail below; (c) health uncertainty: assumed to evolve in a Markovian fashion using empirical transition probabilities from a variety of household surveys, including the NLSY79 and the HRS. The random draws to simulate these uncertainties are the same for all the models compared in this paper, such that the differences presented are only due to the changes in the incentive schemes.

The *state* of an individual at any point during the life cycle can be summarized by five state variables: (i) Current age t ; (ii) net (tangible) wealth w_t ; (iii) the individual's Social Security benefit claiming state ss_t ; (iv) the individual's health status, and (v) the individual's average wage, aw_t .

This translates into a problem with over half a million states in which to solve the model (80 periods, 15 discretized wealth states, 8 discretized average wage states, 3 health states, and 18 Social Security states). We are able to solve this model and simulate it 10,000 times in under 20 minutes in a Dual-Processor Linux Machine with 3.6GHz Xeon Processors using Gauss, and exploiting its capability to link dynamic libraries written in C by the authors and some of their co-authors. These C libraries perform over 95% of the computations involved in solving and simulating these models. The code used for these simulations is available upon request, and will eventually be available on the web.

For computational simplicity, we assume that decisions are made annually rather than monthly, but we allow for the benefit adjustments due to earnings above the Earnings Test limit to happen semi-annually. This means that although individuals can only decide to claim benefits at the time they turn 62, 63, etc. their Social Security state can be updated every year, depending in their labor earnings, to reflect that their benefits will be adjusted for benefits withheld for periods of six months, or one year. Since the adjustment in benefits becomes effective only after they reach the NRA individuals still receive benefits at the original claiming rate in the period between the time of withholding of benefits until the NRA, consistent with current rules.

The ss_t variable can assume up to fourteen mutually exclusive values between 62 and 66: $ss_t = 0$ (not entitled to benefits), $ss_t = 62$ (entitled to OASI benefits at the ERA), and $ss_t = 62.5, 63, 63n, 63.5, 64, 64n, \dots, 65.5, 66, 66n$ represents the remaining 12 Social Security states corresponding to the level of benefits individuals will receive when they reach the NRA. For individuals who decide to claim after the NRA, ss_t can take four additional values, age 67 to 70, since everyone is assumed to claim no later than age 70. We created an additional (implicit state) variable, ssn_t , which can assume up to five mutually exclusive values: $ssn_t = 0$ (all benefits received, i.e. no benefits withheld), $ssn_t = 1$ (representing an original claim at age 62 of someone who had some benefits withheld; this applies, for example, to individuals with a ss_t equal to 62.5, 63n, or 64n), $ssn_t = 2$ (representing an original claim at age 63 for someone who had some benefits withheld), $ssn_t = 3$ (representing an original claim at age 64 for someone who had some benefits withheld), etc. With this structure we are able to separate, for example, whether someone is a 63 claimer, denoted by $ss_t = 63$, or is really a 62 claimer who has accumulated one year of withheld benefits, represented here by $ss_t = 63n$. These two individuals will receive the same amount of benefits after the NRA, but their benefit would differ before the NRA, as in our example in Section 2.

In addition to age, wealth, health, Social Security status, Benefit Adjustment status, and current income, the average indexed wage is a key variable in the dynamic model, serving two roles: (1) it acts as a measure of *permanent income* that serves as a convenient *sufficient statistic* for capturing serial correlation and predicting the evolution of annual wage earnings; and (2) it is key to accurately model the rules governing payment of the Social Security benefits. An individual's highest 35 years of earnings are averaged and the resulting *Average Indexed Earnings* (AIE) is denoted as aw_t . If there is less than 35 years of earnings when the person first becomes eligible for OASI, then the 5 lowest years of earnings are dropped and the remaining wages are averaged. Social Security usually reports the monthly equivalent or AIME. The PIA is the potential Social Security benefit rate for retiring at the NRA. It is a piece-wise linear, concave function of aw_t , whose value is denoted by $pia(aw_t)$.

In principle, one needs to keep as state variables the entire past earnings history. To avoid this,

we follow Benítez-Silva, Buchinsky, and Rust (2006) and approximate the evolution of average wages in a Markovian fashion, i.e., period $t + 1$ average wage, aw_{t+1} , is predicted using only age, t , current average wage, aw_t , and current period earnings, y_t . Within a log-normal regression model, we follow Benítez-Silva, Buchinsky, and Rust (2003), such that the average wages take the form:

$$\log(aw_{t+1}) = \gamma_1 + \gamma_2 \log(y_t) + \gamma_3 \log(aw_t) + \gamma_4 t + \gamma_5 t^2 + \varepsilon_t. \quad (5)$$

The R^2 for this type of regression is very high, with an extremely small estimated standard error, resulting from the low variability of the $\{aw_t\}$ sequences. This is a key aspect of the model given the important computational simplification that allows us to accurately model the Social Security rules in our DP model with minimal number of state variables.

We then use the observed sequence of average wages as regressors to estimate the following log-normal regression model of an individual's annual earnings:

$$\log(y_{t+1}) = \alpha_1 + \alpha_2 \log(aw_t) + \alpha_3 t + \alpha_4 t^2 + \eta_t. \quad (6)$$

This equation describes the evolution of earnings for full-time employment. Part-time workers are assumed to earn a pro-rata share of the full-time earnings level (i.e., part-time earnings are $0.8 \cdot 800/2000$ of the full-time wage level given in equation (6)). The factor of 0.8 incorporates the assumption that the rate of pay working part-time is 80% of the full-time rate. Using the history of earnings from the restricted HRS data set we obtained very high R^2 using this methodology.

The advantage of using aw_t instead of the actual Average Indexed Earnings is that aw_t becomes a sufficient statistic for the person's earnings history. Thus we need only keep track of aw_t , and update it recursively using the latest earnings according to (5), rather than having to keep track of the entire earnings history in order to determine the 35 highest earnings years, which the AIE requires.

For the 1943-1954 cohort the NRA is 66 and the PIA is permanently reduced after the NRA by an actuarial reduction factor of $\exp(-g_1(k - adjm))$, where k is the number of years prior to the NRA but after the ERA that the individual first starts receiving OASI benefits and $adjm$ corrects for periods where no benefits were received due to earnings above the Earnings test limit. Before the NRA, benefits are reduced by an actuarial reduction factor of $\exp(-g_1 k)$. In the absence of adjustments to the ARFs, the actuarial reduction rate for the 1943 to 1954 cohort is $g_1 = .0713$, which results in a reduced benefit of 75% of the PIA for an individual who first starts receiving OASI benefits at age 62 in the absence of any adjustments of the ARFs.

To increase the incentives to delay retirement, the 1983 Social Security reforms gradually increased the NRA from 65 to 67 and increased the delayed retirement credit (DRC). This is a permanent increase in the PIA by a factor of $\exp\{g_2 l\}$, where l denotes the number of years after the NRA that the individual delays receiving OASI benefits. The rate g_2 is being gradually increased over time. The relevant value for the 1943 to 1954 cohort is $g_2 = 0.0769$, which corresponds to an increase in 8% in benefits per year of delay after the NRA. The maximum value of l is $MRA - NRA$, where MRA denotes a "maximum retirement age" (currently 70), beyond which further delays in retirement yield no further increases in PIA. As noted above, it is not optimal to delay applying for OASI benefits beyond the MRA, because due to mortality, further delays generally reduce the present value of OASI benefits the person will collect over their remaining lifetime.

We assume that the individual's utility is given by

$$u_t(c, l, h, age) = \frac{c^\gamma - 1}{\gamma} + \phi(age, h, aw) \log(l) - 2h, \quad (7)$$

where h denotes the health status and $\phi(\text{age}, h, aw)$ is a weight that can be interpreted as the *relative disutility of work*. We use the same specification for ϕ and the disutility from working as in Benítez-Silva, Buchinsky, and Rust (2006). The disutility of work increases with age, and is uniformly higher the worse one's health is. If an individual is in good health, the disutility of work increases much more gradually with age compared to the poor health, or disabled health, states. The disutility of work decreases with average wage. We postulate that high wage workers, especially highly educated professionals, have better working conditions than most lower wage blue collar workers, whose jobs are more likely to involve less pleasant, more repetitive, working conditions and a higher level of physical labor.

We assume that there are no time or financial costs involved in applying for OASI benefits.

The parameter γ indexes the individual's level of risk aversion. As $\gamma \rightarrow 0$ the utility of consumption approaches $\log(c)$. We use $\gamma = -.37$, which corresponds to a moderate degree of risk aversion, i.e., implied behavior that is slightly more risk averse than that implied by logarithmic preferences.