# Induced Entry Effects of a $1 for $2 Offset in SSDI Benefits

Hugo Benítez-Silva‡
*SUNY-Stony Brook*

Moshe Buchinsky
*UCLA and NBER*

John Rust
*University of Maryland*

March, 2005

**Abstract**

This paper describes an empirical life cycle model and uses it to predict the behavioral responses to a change in the Social Security Disability Insurance (SSDI) program known internally within the Social Security Administration as the "$1 for $2 benefit offset". This policy has not been enacted yet, but it has been supported by disability advocates as a way to provide greater incentives for SSDI beneficiaries who have fully or partially recovered from their disabilities to return to work. In contrast to the large predicted increase in return to work, the life-cycle model predicts that the $1 for $2 benefit offset will not have a very significant induced entry effect. The number of SSDI applications increases by 2.2% in our simulations, and SSDI rolls increase by 3.2%. The mean duration on the program increases only slightly, from 12.7 years to 13 years.

**Keywords:** Social Security Disability Insurance, Induced Entry, Life Cycle Models, Health and Retirement Study.

**JEL classification:** H5

‡Corresponding author: Hugo Benítez-Silva, Department of Economics, SUNY-Stony Brook. Stony Brook, New York 11794-4384. e-mail: hugo.benitez-silva@sunysb.edu.

# 1 Introduction

The U.S. Social Security Disability Insurance (SSDI) program covers almost 7 million Americans who have some type of severe health problem that according to the government is likely to last more than 12 months or result in death, and that prevents them from engaging in any substantial gainful activity (SGA) that provides them with earnings of more than $810 a month.[1]

In the last years the Social Security Administration (SSA) has considered a number of policy changes with the objective of fostering work among SSDI recipients. This has become an important priority in the government's agenda regarding disability policy. For example, Jo Anne B. Barnhart, Commissioner of Social Security, in her address before the House Committee on Ways and Means Social Security Subcommittee in September of 2003, stated that expanding the employment opportunities for people with disabilities was one of the main objectives of her administration in front of the agency. Also, in the Social Security 2003-2008 strategic plan, she sets as an objective to have an increase of 50%, by 2008 with respect to 2001 levels, in the number of people with disabilities who achieve employment.

SSA has also put in place the Ticket to Work program, which allows SSDI recipients to obtain free vocational counseling from thousands of different agencies located around the U.S. to help them return to work.[2] While the Ticket to Work Act seems like a highly innovative program, there are few regulations about the qualifications of agencies that provide the vocational counseling and rehabilitation. It is questionable as to whether the Ticket to Work Program will represent a cost-effective use of government funds, and whether it will help a significant number of DI beneficiaries return to work. Since the policy is already implemented, the only alternative for researchers is to do an *ex post* evaluation of this uncontrolled policy experiment once it had been in place for a sufficiently long period of time. It is quite possible that we will subsequently find that the Ticket to Work Program is not cost-effective, but it may be hard to reverse, since thousands of agencies around the country will have become beneficiaries of potentially lucrative government payouts.

[1] As of December of 2003, 6.83 million individuals received SSDI benefits as disabled workers, disabled widow(er)s, or disabled adult children. Of the total, 86% were disabled workers. The most common impairments among disabled workers were mental disorders other than mental retardation, problems of the nervous system, problems of the musculoskeletal system and connective tissue, endocrine diseases, and problems of the circulatory system. These conditions account for over 80% of the impairments of disabled workers on the rolls.

[2] The agency that provides the counseling is paid *prospectively,* that is, for every year a DI beneficiary stays off the rolls due to the vocational training and rehabilitation services it had provided up front. The agency receives 40% of the DI benefit the person would have been paid if they had stayed on the rolls.

Another important policy change directed at fostering employment among disability recipients is, what is termed internally as, the "$1 for $2 benefit offset". This policy has not yet been enacted, but Commissioner Barnhart herself told Congress in September of 2003 that "Ongoing Employment Supports to assist beneficiaries to obtain and sustain employment will be tested, including a Benefit Offset demonstration to test to effects of allowing DI beneficiaries to work without total loss of benefits by reducing their monthly benefit $1 for every $2 of earnings above a specified level." This policy has also been supported by disability advocates as a way to provide greater incentives to return to work for SSDI beneficiaries who have fully, or partially, recovered from their disabilities.

Under the current law SSDI recipients who return to work during a 9 month "trial work period" (TWP) face no loss of benefits.[3] However, continued work beyond the TWP (and an additional three-month grace period) which results in earnings that are higher than the SGA ceiling will result in termination from the rolls. Under the $1 for $2 benefit offset, an SSDI recipient who earns more than the SGA after the TWP and the grace period, would not be terminated from the rolls. Instead their DI benefits would be reduced by $1 for every $2 earned above the SGA disregard. In simple terms, the $1 for $2 amounts to replacing the current 100% forfeiture of benefits due to earnings in excess of SGA, with a 50% surtax.

Clearly, the $1 for $2 offset would increase the overall level of generosity of the SSDI program, because under the suggested plan no SSDI recipient would be made worse off, while some recipients would be strictly better off. This is particularly clear for those who have fully or partially recovered and who would like to return to work to supplement their SSDI benefits. While it seems likely that the $1 for $2 offset would increase the amount of labor supplied to the market by some SSDI recipients, it is less clear whether or not it would result in significant cost savings from permanent *induced exit* from SSDI. It is possible that the $1 for $2 offset might make it more comfortable for SSDI recipients to remain on the rolls and supplement their DI benefits with earnings from a part-time job. Hence, it is plausible that the $1 for $2 offset might not generate an increase, and even lead to a decrease, in the number of beneficiaries who exit SSDI after the trial work period.

[3] The trial work period is an entirely voluntary program offered by SSA in order to allow individuals to test their ability to work without facing the risk of losing their benefits. The TWP can last up to 9 months (not necessarily consecutive) in a rolling 60-month period. In 2004, any month in which earnings exceed $580 is considered a month of services for an individual's trial work period.

Perhaps the biggest concern to policy makers is the possibility that the increased generosity of SSDI under the $1 for $2 offset would result in significant *induced entry* by individuals who are not yet on SSDI, but who could be induced, on the margin, to apply because of the change in policy. Previous studies by the SSA and the Congressional Budget Office (CBO) provide very different forecasts of the magnitude of the induced entry effect. The CBO (1997) estimates that the $1 for $2 offset would result in an increase of 75,000 SSDI beneficiaries over a ten-year period, whereas the SSA estimates that it would increase SSDI rolls by 400,000 over the same time period. There are also large differences in the two forecasts of the net increase in the costs of the DI program resulting from the $1 for $2 offset. The CBO predicts that over five years, the net costs will increase by $410 million, while the SSA predicts that costs will increase by $5.1 billion. We will see that our model predicts an induced entry effect that lies between these two projections.

The $1 for $2 offset has already been implemented for the Supplemental Security Income (SSI) program, but with a lower disregard of $65 per month.[4] However, since there are strict asset/income tests imposed on the SSI applicants, the induced entry effect is likely to be much smaller than it would be for the SSDI applicants. A study by Muller, Scott, and Bye (1996) concluded that the changes in labor force participation or earnings are negligible. In contrast, Neumark and Powers (2003) find significant labor supply disincentives, due to State level supplements to the SSI benefits. These benefits appear large enough to completely swamp the effect on work incentives of the $1 for $2 proposal. The idea of extending the $1 for $2 offset to the SSDI program is extremely popular with disability advocates. They claim that the threat of loss of benefits due to earnings in excess of the SGA after the TWP is the primary reason why those SSDI beneficiaries who are able to return to work, not to do so.

In 1999 President Clinton signed a Federal law mandating that the Social Security Administration undertake a "demonstration project" (i.e., a controlled randomized experiment), to estimate the magnitude of labor supply response and the level of induced entry that would likely occur under the $1 for $2 offset. It turns out that it is extremely difficult to measure induced entry via

[4] SSI is a means-tested cash assistance program enacted in 1974. Unlike SSDI, there is no work requirement for SSI benefits. However, SSI applications are evaluated according to the same process as DI benefits and satisfy the same basic definition of disability. SSI is mean-tested with very low earnings and asset thresholds of $545 per month and $2,000, respectively, for a single individual. As a result of different eligibility requirements, the SSI program serves a different "clientele" than does the SSDI program: 55% of disabled adults under 65 receiving SSI benefits are women, whereas 58% of adult SSDI beneficiaries are male. In contrast to SSDI, SSI recipients are not subject to a five-month waiting period to receive benefits, and are immediately eligible for Medicaid benefits. However, monthly SSI benefits are significantly lower, averaging only $385 per month in 2001.

controlled experiments. For example, a panel of consultants chosen by the Social Security Administration to evaluate the feasibility of measuring induced entry by way of randomized experiments concluded that classical experimental designs should not be used to study induced entry, instead recommended to rely on the insights of dynamic models of individual behavior, and responses to hypothetical surveys (Tuma, 2001, p. v). Our research provides a detailed examination of the induce entry effect, and other effects, using the dynamic approach to provide predictions of the effects of the $1 for $2 offset proposal.

In this paper we use a prototype of an empirical life-cycle model which can be used to provide detailed predictions of the behavioral responses to a wide range of hypothetical changes in Social Security policies. Here, we use a calibrated version of this life cycle model to predict and examine the behavioral responses to the proposed $1 for $2 benefit offset plan. The model incorporates a realistic treatment of the Social Security rules, particularly with regard to the SSDI program. We have calibrated the model so that the behaviors observed in a simulated population of life-cycle optimizers resemble the behaviors we observe for a sample of real individuals born between 1931 and 1941, from the Health and Retirement Study.[5] Although, due to computational limitations, the life-cycle model used here makes some simplifying assumptions, it is sufficiently realistic to be able to provide a convincing illustration of the potential value of life-cycle models for policy forecasting and evaluation in general, and specifically for evaluating the effects of the $1 for $2 offset alternative.

The life-cycle model predicts that the $1 for $2 offset provides a very effective labor supply incentive. Under the baseline simulations of the model, which we will refer as the *status quo* since it tries to replicate the current policy environment, we find that approximately 9.5% of the SSDI recipients eventually return to work. In sharp contrast, under the $1 for $2 offset, 48.9% of the SSDI recipients eventually return to work at some point during their spells on SSDI. However, nearly all of the DI beneficiaries who return to work do so only on a part-time basis and for a

[5] It would be ideal to assess the robustness of the results of our model to the underlying population whose decisions we are trying to match. For example, it is fair to argue that younger populations might be more likely to be influenced by policy and social changes, like the ones introduced by the Americans with Disabilities Act, or the Individuals with Disabilities Education Act, than the relatively older sample that we are using as our baseline. Unfortunately, there are few panel data sets with information detailed enough to match the data requirements of our model. There is little doubt that disability is a socially evolving concept, however, we have no reason to believe that the policy changes will affect the nature of the optimizing behavior of the agents in our models, even if they affect the actual incentives, and therefore actual decisions of those agents. We therefore believe that the model presented here is still valuable for researchers and policy makers worried about the changing population affected by disability policy.

relatively short duration. The average number of years worked while receiving SSDI benefits is about 2.9 years. The mean earnings of those who return to work is $9,096, which is significantly higher than the SGA for this cohort ($6,000 annually for a $500 per month SGA). Our model of health dynamics predicts that 75% of the individuals who enter the DI rolls will eventually experience some partial recovery during their spells, while 50% will fully recover. Thus, under the $1 for $2 offset, nearly all of the fully recovered beneficiaries have sufficient incentive to return to work, whereas only 18% of them have sufficient incentive to do so under the *status quo*.

An important reason why the predicted labor supply response is relatively large under the $1 for $2 offset is that we explicitly assume that SSA is able to make a credible commitment not to increase the audit rates—known internally at SSA as *continuing disability reviews* (CDRs)—for DI recipients who return to work. Under the *status quo* individuals believe that engaging in the TWP would put them at substantially greater risk of being terminated due to the audits. This is why only 10% of DI recipients take advantage of the TWP. If we assume that individuals continue to have these beliefs under the $1 for $2 offset, then the fraction of DI recipients who ultimately return to work falls from 48.9% to 36.8%.

The life-cycle model also predicts that the $1 for $2 offset will not have a very significant induced entry effect. In the simulations conducted here, the number of SSDI applications increases by only 2.2%, while SSDI rolls increase by 3.2%. The percentage increase in the rolls is larger than the percentage increase in applications because the $1 for $2 offset provides a greater incentive for SSDI recipients who have fully or partially recovered to stay on the program and supplement their benefits via part-time work. However, the mean duration of a beneficiary on the program increases only slightly, from 12.7 to 13.0 years. Thus, the induced entry effect is primarily responsible for the 5.9% increase in the total number of person-years spent on SSDI.

Due to the offsetting effects of benefit reductions of SSDI beneficiaries who return to work, the present value of benefit payments (discounted to age 21 at a 2% interest rate) increases by only 1.7%, from $115,000 per beneficiary to $117,000 per beneficiary. However, since there are more DI beneficiaries due to induced entry, the total discounted value of SSDI benefit payments is predicted to increase by 4.9%. The present value of Social Security contributions increases by 4.2% under the $1 for $2 offset, but even after subtracting the discounted value of these increased contributions from the present value of benefits, the net discounted cost of the SSDI program still increases by 5%.

The $1 for $2 offset provides a clear benefit to a subset of SSDI recipients, allowing them to achieve higher income, consumption, and wealth accumulation during, and following, their spells on SSDI. In particular, recipients' annual consumption increases by an average of 2.2% over their full lifetimes, and by 6.9% between the ages of 45 and 65. Nevertheless, due to the relatively high marginal tax rate of 50% and the increasing disutility of effort at older ages, the *ex ante* increase in welfare for a younger person who has not yet experienced a disabling condition is small. This is the main reason why the model predicts that the induced entry effect is small. The main welfare gains of the $1 for $2 occur *ex post* for people who have already entered SSDI and who have experienced a full or partial recovery.

The remainder of the paper is organized as follows. Section 2 explains why it is hard to predict the effects of the $1 for $2 offset policy change using alternative methods, such as randomized experiments with human subjects. Section 3 provides a summary of our version of the life-cycle model, and shows that the model is capable of approximating the behavior of real individuals by comparing the predictions of the model to actual behavior observed in aggregate and micro panel datasets. Section 4 provides detailed analysis of the predictions provided by the life-cycle model regarding the impact of the $1 for $2 offset proposal. Section 5 offers some concluding remarks and some policy discussion.

## 2 Evaluating the Effects of the $1 for $2 Offset

The intention of the $1 for $2 offset proposal is to provide a tax incentive that would encourage SSDI beneficiaries to leave the rolls and return to work. However, since the $1 for $2 offset policy makes the DI program more generous than the *status quo*, there is a concern that it could actually result in a net increase in the cost of the DI program as a result of *induced entry*, i.e., an increase in the propensity to apply for benefits to take advantage of the increased benefits. The U.S. Congress was sufficiently concerned about the possibility of induced entry that it mandated that the Social Security Administration (SSA) undertake studies to predict the net effect of the $1 for $2 offset proposal. The 1999 *Ticket to Work Act and Work Incentives Improvement Act* authorized the SSA to carry out *demonstration projects*, that is, a large scale controlled experiments with human subjects, in order to predict the impact of the $1 for $2 offset.

Demonstration projects are regarded by many as the most credible way for predicting the impacts of policy changes. However, they also suffer from a number of disadvantages. First, they are extremely costly and time-consuming. Second, it is not clear that a demonstration project would be able to accurately predict the induced-entry effect. Most analysts anticipate the increase in the propensity to apply for SSDI benefits resulting from the \$1 for \$2 offset to be small. If that is the case, recent analyses by the Office of Research, Evaluation, and Statistics (ORES) at the SSA suggest that a huge demonstration project—possibly in excess of one million people in the treatment and control groups—would be necessary to obtain a statistically reliable estimate of the induced entry effect. Furthermore, even a large scale experiment may not accurately estimate the ultimate impact of the \$1 for \$2 offset if it were adopted nationally. This is because it is difficult to control for informational and *social interaction effects* in an experimental setting. An individual's decision about whether or not to apply for SSDI is affected by his/her understanding of the program rules and procedures, and this information might come from a variety of sources other than the SSA. To control for these effects a panel of advisors to the SSA have considered the feasibility of a *county design* whereby all individuals in entire counties are assigned to either the treatment or the control groups. In this case, any information about the \$1 for \$2 could be made uniformly available in the counties that are randomly selected to receive the treatment. Eventually, the information about the new program should percolate through the various channels in the treatment counties. Hence, the opportunities that individuals in these counties have to obtain information about the new program will closely approximate the opportunities they had to obtain information about the existing SSDI rules. But even then, there are likely to be unobserved State and county level factors that also affect application decisions that will not be controlled for in a county level design. Because of these problems, the panel concluded that there are serious uncertainties about whether an expensive large scale demonstration project would necessarily be able to provide accurate predictions of the induced entry effect.

A recent paper by Tuma (2001) discussed a number of serious problems with various strategies for implementing a demonstration project for measuring the induced entry effect. The most important of them being the large sample of counties and individuals needed to obtain reliable estimates, and the huge cost of such a project. These huge costs would be applicable for a demonstration project with a *single* design, i.e., in which the treatment group is given a \$1 for \$2 with a fixed disregard. However, in general, it would also be of interest to study the incentive effects of other effective tax rates on benefits, such as a \$1 for \$3 or a \$1 for \$4 benefit offsets, or other *optimal* tax rates. As noted above, the SSA made separate predictions for two different values of the disregard and there was considerable internal debate about whether a low or high disregard should be implemented. However, if it is not cost-effective to evaluate the induced entry effects of the $1 for $2 offset, then it is certainly hopeless to use the demonstration project methodology to systematically evaluate alternative policies, in order to isolate the most promising one.

In view of these problems, Tuma's report recommended that a number of alternative, more cost-effective, strategies for predicting the impact of the $1 for $2 be considered, including dynamic models of individual behavior using results of previous studies, and individuals' responses to a survey with hypothetical questions. In the next two sections we demonstrate the feasibility of a particular type of dynamic model, namely the *life-cycle model*. The next section describes the dynamic programming (DP) model, and via a comparison of the predictions of the model and the observed behavior of real individuals from a variety of micro and macro data sources, we show that the life-cycle model is capable of providing a realistic and accurate empirical characterization of behavior, which could be of substantial value for forecasting the impacts of wide range of policy changes including, the $1 for $2 offset proposal.

The limitations of randomized experiments have long been recognized by economists and sociologists. Moffitt's (2003) survey of this literature concluded that randomized field trials have an important but limited role in future welfare reform evaluations, and that it is essential that they be supplemented by non-experimental research. A particular limitation of experimental methods noted in Moffitt's survey is their inability to estimate entry effects.

# 3 The Life-cycle Model

The life-cycle model is one of the cornerstones of economic theory and is originally credited to the work of Modigliani, Brumberg, Ando and others. Generally, there is no single life-cycle model, but rather a class of models that could be described as life-cycle models, where specific models differ in the details about labor supply, consumption, savings, uncertainty, and details about the private and social insurance institutions. There have been some economists, such as Bernheim, Skinner and Weinberg (2001), who argued that the life-cycle model cannot account for observed levels of *under-saving*, and consequently low wealth accumulation by a significant fraction of Americans. We argue that this conclusion is erroneous since it is based on an oversimplified formulation of the life-cycle model which can be solved analytically. Current versions of life-cycle model are a much more realistic and account for more aspects of the individuals' decision process, such as labor supply decisions, incomplete markets, Social Security, pensions, etc.[6] Although these models are typically too complex to be solved analytically, the advent of fast computers and improved algorithms, allows us to solve increasingly realistic versions of the life-cycle model numerically. Via computer simulations of these models, it becomes clearer that the life-cycle model is sufficiently rich to be able to provide insightful explanations for a wide variety of previously puzzling aspects of savings, labor supply, pensions, and Social Security application decisions.

A prime example is the *age 65 retirement puzzle*. Previous oversimplified life-cycle models were unable to explain the peaks in retirements, particularly at ages 62 and 65. Obviously, these peaks must have some connection to the fact that early and normal Social Security retirement benefits are available at these ages and that Medicare benefits are available at age 65. However, previous reduced-form models, and life-cycle models that failed to accurately model the Social Security rules, were unable to explain the peaks in retirements at these ages. Consequently, some economists conjectured that the only way one can explain the concentration of retirements at age 65 is via a *sociological age 65 retirement effect*. In contrast, Rust and Phelan (1997) showed that the peaks in retirements can be explained as a rational response to retirement incentives, using a version of the life-cycle model that accounted for incomplete markets and incorporated a more realistic treatment of the incentives created by the SSA.

We have developed a version of the life-cycle model that is specifically focused on providing a realistic treatment of the U.S. Social Security program. We follow the general approach of Rust and Phelan (1997) who developed an econometric algorithm that repeatedly re-solves the life-cycle model until the estimates of the unknown parameters enable the predictions of the life-cycle model to best fit the actual behavior of individuals that are observed in micro panel datasets.[7]

The parameters of the life-cycle model include parameters that determine individuals' preferences for consumption and leisure, and parameters that characterize their beliefs about their uncertain future health, mortality, and earnings. Other parameters can be imposed exogenously, if one is willing to assume that individuals are rational and fully informed. These include the parameters

[6] Examples of the latter type of models are Rust and Phelan (1997), French (2001), and van der Klaauw and Wolpin (2002).

[7] Rust and Phelan used the Retirement History Survey, while we use the Health and Retirement Study, which began in 1992 and is continuing to collect data from an initial panel of more than 12,000 individuals in two year intervals.

determining the eligibility and benefits under the Social Security program, such as: (1) the ages of early and normal retirement; (2) the bend points in the function relating the average indexed monthly earnings (AIME) to the primary insurance amount (PIA); and (3) the actuarial reduction factors for payment of Social Security benefits at the early retirement age, and so forth.

The Rust-Phelan model, however, has several important limitations. First, it was estimated for the 1903-1911 birth cohort using the Retirement History Survey that was collected in the 1970s, and is thus out of date. Second, our model relaxes an important restriction of Rust-Phelan model, that consumption equals income, which was a reasonable approximation for the predominantly lower income, blue collar workers in their RHS sample. But their model would be of questionable value for evaluating more radical Social Security reform proposals such as *individual accounts*, for which modeling and understanding individual savings and wealth accumulation decisions is likely to be critical. Third, Rust and Phelan ignored the SSDI program, which is one of the most volatile components of the Social Security programs, with DI rolls and costs rising at unsustainable rates. A more comprehensive model that includes all the key components of the Social Security program is necessary to obtain accurate predictions of the net fiscal impacts of various policy changes. For example, an attempt to save money by increasing the early retirement age from 62 to 64 or 65 may be partially offset by an increased in applications for DI benefits at those ages.

We now describe a life-cycle model that overcomes many of the limitations of the Rust-Phelan model. First, the unknown parameters of this successor model will be estimated using the most recent available panel data from the six waves of the Health and Retirement Study (HRS) over the 1992-2002 period. Second, the model includes the consumption/savings decision in addition to the labor/leisure decision. Third, the model incorporates an integrated treatment of the SSDI and the Old Age and Survivor's Insurance programs of Social Security (OASDI).[8] Below we first describe

[8] Because of computational difficulties the present version of the life-cycle model does not yet include Medicare, private health insurance, or the Unemployment Insurance components of the Social Security program. These will be incorporated in a future version of the life-cycle model that we present below, along with a more realistic treatment of the family that includes income from spouses and other sources of unearned income, asset/business income and other sources of unearned income. We believe that these additions will allow the life-cycle model to do a better job of fitting observed behavior, particularly with respect to wealth accumulation and labor supply. The fact that we do not include the health insurance incentives provided by the SSDI program in our model, deserve some further explanation. After all, the access, after two years, to Medicare, can be of substantial appeal to individuals with health problems serious enough to consider applying for disability benefits. Notice, however, that the evaluation of the $1 for $2 offset policy is unlikely to be affected by the introduction of this feature, at least in terms of comparing two alternative policy scenarios. The proposed reform does not affect health insurance coverage at all. We believe that the explicit introduction of Medicare in our model will allow us to better match some of the features we observe in the data, and rely less on difficult to test characterizations of the utility function to explain certain behavior such as the lack of interest in the trial work period, for example.

the life-cycle model briefly and intuitively, and illustrate some comparisons of the behavior predicted by a calibrated version of this model with actual behavior observed in the HRS and other micro data, as well as data from aggregate program statistics from the SSA and other agencies. We demonstrate the richness of the life-cycle model and the additional insights that this model provides. While the results reveal a number of areas where the model could be improved so that it does a better job of fitting the data, it is already sufficiently developed to be used for analyzing important policy issues, particularly the $1 for $2 offset proposal.

## 3.1 Description of the Model

The life-cycle model predicts an individual's behavior over their full life-cycle starting at age 21 until their death. In each period, assumed to be one year in length, the individual makes decisions about how much to consume and how much to save, whether or not to work, and if so, whether to work full- or part-time, and whether or not to file an application for disability benefits, and, if the person is over age 62, whether to apply for Old Age benefits. An individual conditions his/her decisions on current information, which includes their current age, wealth, and health status. The individual faces uncertainty about future health status, mortality, and earnings. The individual saves in order to accumulate a precautionary buffer stock in the event of protracted periods of low earnings and/or bad health, as well as in order to prepare for retirement.

The model has three health states which can be classified as: (1) excellent/good health; (2) fair/poor health; and (3) "disabled". We put quotation marks around the latter state since it does not coincide with the Social Security definition of disability, but rather denotes a condition sufficiently severe such that it prevents the individual from working entirely.[9] The transition probabilities among the various health states were estimated from data on self-reported health and disability status in the HRS. Health states (1) and (3) are relatively persistent, in the sense that once one is in either good health or one has a disability, he tends to continue to remain in good health, or continue to have a disability, for a long time. Specifically, if a person is currently in good health, there is a 95% probability that he/she will be in good health in the following year.

[9] There are a number of conditions that automatically qualify individuals, without further consideration of the residual functional capacity. Examples of these include blindness, multiple sclerosis, and AMS. Notice, however, that some of these conditions do not necessarily mean that the person is in poor health, in fact, there are many cases of individuals with conditions which are considered "disabling," who work. There appears to be intangible, difficult to measure characteristics such as intelligence, motivation, and determination that enable certain people to work in spite of severe handicaps.

Similarly, if a person is disabled, there is a 87.5% probability that he/she will remain disabled in the following year. The poor health state represents a *transitional state*, that is, when someone is in poor health there is a 20% chance that they will be in good health in the following year and a 12% chance that they will become disabled in the following year. initially we assume that these transition probabilities do not depend on age. However, we do assume that the probability of dying depends on age, as well as on the person's health status. Using the HRS data we have estimated age and health-dependent survival probabilities. Not surprisingly, the results show that survival probabilities decline with age and decline with the worsening of the health status.

Figure 1 compares the aggregate survival probability of a simulated sample of 1,123 individuals to the survival probabilities from the U.S. Decennial Life Tables for 1997. We see that the survival curve for our simulated population is very close to the survival curve implied by the life tables. This clearly indicates that we have accurately estimated the age-health survival probabilities from the HRS survey. Moreover, it also implies that our assumption that health status transition probabilities do not depend on age may be a reasonably good approximation, at least in the current context.

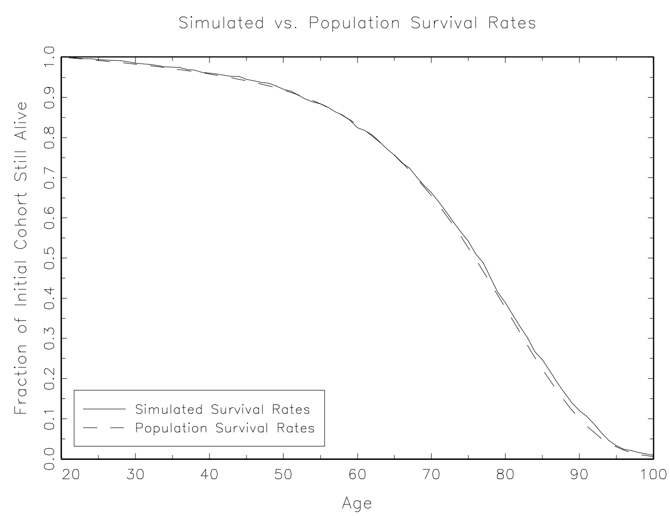


**Figure 1: Simulated versus Actual Survival Curves**

Individuals are assumed to 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 $t$. Obviously, we specify a utility function for which more consumption is better than less, and more leisure is better than less. The flip side of the utility of leisure is the disutility of work. We assume that the utility of leisure (disutility of work) is an increasing function of age and is higher for individuals who are in worse health than for individuals who are in good health. Thus, the main factor that distinguishes a person who falls into the health state *disabled* from a person who is in *fair/poor* health is that the former has a higher disutility of work. In addition, we assume that the worse a person's health is, the lower their overall level of utility is, holding age, leisure, and consumption constant. We also allow for a bequest motive by providing a utility of wealth bequeathed to heirs or to institutions after one dies.

Any person who is not already receiving SSDI benefits is eligible to apply for SSDI benefits provided they are younger than the *normal retirement age* (currently 65 and six months). If they are over the normal retirement age, then the only option they have is to apply for Social Security Old Age benefits. Prior to the normal retirement age any person has the option of applying for either SSDI or Old Age benefits, provided that he/she is over the *early retirement age* (currently 62).[10] While there is a 100% probability of being awarded OA benefits if one applies and is age-eligible, the probability of being awarded SSDI benefits is considerably less than 100%. Using data from the HRS and aggregate program data from the SSA web site, we estimated a probabilistic model of the SSDI award process (for details see Benítez-Silva, Buchinsky, Chan, Cheidvasser, and Rust (1999)).

The probabilities of being awarded benefits depend on the individual's health status and the labor supply decision in the year of application. It is higher the worse one's health status is, but it is zero if they choose to work at a level in which earnings exceed the SGA level. A person is allowed to appeal a denial, and also to repeatedly apply (and/or appeal) for SSDI benefits. This *repeated game* aspect of the SSDI program translates in the fact that the *ultimate award rate* is about 70%, much higher than the 50% *initial award rate* that would be inferred by looking only at the initial decisions by the Disability Determination Services (DDS). The reason that the ultimate award rate is higher than the initial award rate is because a significant fraction of applicants who are denied benefits by the DDS choose to appeal. The first level of appeal is to ask the DDS to perform a reconsideration, and if denied again, they can appeal the case to an Administrative Law Judge (ALJ). In principle, an individual can subsequently appeal to the Social Security Appeals Board, and then to the Federal Court, but only a small fraction of awards are due to successful appeals to these last two stages. Our life-cycle model does not model each of these separate appeal stages. Instead, we simply assume that a denied applicant can reapply an unlimited number of times. In the model, at each reapplication, an applicant has the same chance of being awarded benefits as

[10] The OA benefits are actuarially reduced based on the number of months prior to the normal retirement age at which the individuals first start receiving the OA benefits.

their initial application. As indicated above, in reality, the chance of being awarded benefits via an appeal to an ALJ is significantly higher than the chance of receiving an initial award via the DDS. On the other hand, the SSA is likely to keep track of previous applications to the program, and a person who repeatedly applies for benefits may have lower chances of success. These two considerations have opposing effects, and we feel it is a reasonable approximation to model appeals as new applications.

A person that has been awarded SSDI benefits will not necessarily remain on the program until he/she dies. First, if an person reaches the normal retirement age he/she will be automatically transferred from the SSDI program to the OA program. Individuals can also decide to return to work on a full- or part-time basis, and consequently will be terminated from the SSDI rolls after the 9 month trial work period, provided that their earnings exceed the SGA level. There is also a small probability that an individual will be involuntarily terminated as a result from random audits that are known internally in SSA as *continuing disability reviews* (CDRs). We allow the probability of being terminated due to a CDR to be a function of a person's health status, with persons in good health status having a substantially greater risk of termination than those who are in poor health, or who are disabled. Furthermore, as noted above, under the *status quo* version of the model we assume that DI recipients believe that engaging in a TWP will put them at permanently higher risk of termination due to a CDR. When calibrated the probability of termination due to a CDR is three times higher after engaging in a TWP, the life-cycle model was able to provide a reasonable explanation as to why only about 10% of DI recipients ever take advantage of the TWP. Without these altered beliefs the life-cycle model over-predicted the fraction of DI recipients who would take advantage of the TWP option.

## 3.2 Choice variables, state variables, and laws of motion

We solve the life-cycle model by backward induction, starting from the terminal age of 100 and working backward until age 21, when we assume individuals enter the labor force. Agents in our model make three decisions at the start of each period, denoted by $\{l_t, c_t, ssd_t\}$, where $l_t$ denotes *leisure*, $c_t$ denotes *consumption*, which is treated as a continuous decision variable, and $ssd_t$ denotes the individuals *Social Security decision*. Here, $l_t$ denotes the amount of waking time devoted to non-work activities, normalized to 1. Thus we define, $l_t = 1$ to denote not working at all, $l_t = .543$ corresponds to full-time work, while $l_t = .817$ corresponds to part-time work. These latter quantities correspond to the amount of waking time spent in leisure, assuming that a full-time job requires 2000 hours per year and a part-time job requires 800 hours per year.[11]

We assume three possible values for $ssd_t$, when equal to 1 denotes the decision to apply for Old Age benefits, $ssd_t = 2$ denotes the decision to apply for DI benefits, and $ssd_t = 0$ denotes the decision not to apply for benefits. Some of these choices may be infeasible under certain circumstances. For example, individuals who are below the early retirement age (denoted by ERA, currently set at 62) are not allowed to receive OA benefits. Hence, their choice set reduces to $ssd_t \in \{0,2\}$. Also, if a person is already receiving OA benefits they cannot re-apply for additional benefits, so they face no further choices unless their age $t$ satisfies ERA $\leq t <$ NRA (where NRA denotes the normal retirement age, currently at 65 and six months), in which case they still have the option to apply for DI benefits, even while receiving OA benefits.

The *state* of an individual at any point in time can be summarized by five variables: (i) Current age $t$; (ii) net (tangible) wealth $w_t$; (ii) the individual's Social Security state $ss_t$; (iv) the individual's health status, and (v) the individual's average wage, $aw_t$. The $ss_t$ variable can assume up to ten mutually exclusive values: $ss_t = 0$ (not entitled to benefits), $ss_t = 62$ (entitled to OA benefits at the early retirement age), and $ss_t = 63,\dots,70$ represent the remaining 8 Social Security states corresponding to first becoming entitled for benefits at each of the ages $63,\dots,70$, respectively. The reason these states are required is that under the SSA benefit formula, the individual's monthly old age benefit is based on their *primary insurance amount* (PIA) and a permanent actuarial adjustment factor that depends on the age at which the person was first entitled to OA benefits. If the age of first entitlement is before the NRA there is a permanent actuarial reduction.[12] If it occurs after the NRA there is a permanent increase in benefits due to the delayed retirement credit (DRC).

In addition to age, wealth, health, Social security 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 $aw_t$.[13] The PIA is

[11] This is how we get the leisure values: $l = .543 = (12*365-2000)/(12*365)$ and $l = .817 = (12*365-800)/(12*365)$ corresponding to full and part-time-work, respectively.

[12] See Benítez-Silva and Heiland (2004) for a discussion of the connections between the actuarial reduction and labor supply behavior.

[13] If there is less than 35 years of earnings when the person first becomes eligible for SSDI, then the 5 lowest years

the potential Social Security benefit rate for retiring at the normal retirement age. It is a piece-wise linear, concave function of $aw_t$, whose value is denoted by $pia(aw_t)$.

In principle, one need to keep as state variables the entire past earnings history. To avoid this, we 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, $y_t$. Specifically, we use the observed sequence of average wages as regressors to estimate the following log-normal regression model of an individual's annual earnings:

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

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 $800/2000$ of the full-time wage level given in equation (1)).

The SSA's AIE is an indexed average of the 35 highest earnings years in a worker's earnings history. We have found that the AIE is well approximated by a simple moving average of indexed earnings (truncated at the Social Security maximum earnings limit), taken over the entire earnings history (i.e., we have not dropped the lowest 5 years of earnings). This moving average can be written recursively as

$$aw_{t+1} = \frac{t}{t+1} aw_t + \frac{1}{t} y_t. \tag{2}$$

If we regress $aw_t$ on the exact average indexed earnings (calculated from the person's earnings history using SSA's *ANYPIA* program), the $R^2$ of the regression is 98%, which confirms that $aw_t$ is an accurate predictor of the AIE. The advantage of using $aw_t$ instead of the AIE 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 (2), rather than having to keep track of the entire earnings history in order to determine the 35 highest earnings years, which the AIE requires.

The dynamic model also accounts for actuarial reductions in old age benefits claimed prior to the NRA, and for the delayed retirement credit (DRC) for benefits claimed after the NRA. For the 1931-1941 cohort the NRA is 65 and the PIA is permanently reduced by an actuarial reduction factor of $\exp(-g_1 k)$, where $k$ is the number of years prior to the NRA but after the ERA that

of earnings are dropped and the remaining wages are averaged. Social Security usually reports the monthly equivalent or AIME.

the individual first starts receiving OA benefits. The actuarial reduction rate for the 1931 to 1941 cohort is $g_1 = .0713$, which results in a reduced benefit of 80% of the PIA for an individual who first starts receiving OA benefits at age 62. Note that a person who is accepted into the DI program prior to the NRA receives the full PIA regardless of his/her age. However, the SSA does apply an actuarial reduction to the DI benefits that are awarded after the individual started receiving early retirement benefits.

To increase the incentives to delay retirement, the 1983 Social Security reforms gradually increased the NRA from 65 to 67 and increased the 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 OA benefits. The rate $g_2$ is being gradually increased over time. The relevant value for the 1931 to 1941 cohort is $g_2 = 0.05$. 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 OA benefits beyond the MRA, because due to mortality, further delays generally reduce the present value of OA benefits the person will collect over their remaining lifetime.

A another aspect of the Social Security rules that we model concerns taxation of benefits. We are solving the life-cycle model for a cohort of individuals who were born around 1930, and thus we have implemented a version of the Social Security benefit formula that was in effect during the mid 1990s, when these individuals started to reach the NRA (65 for this cohort). 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.

In addition to these taxes, we account for the Social Security *earnings test.* If a person retires between the ERA and NRA, each dollar of earnings above a certain threshold (approximately $10,800 in the mid 1990s) results in a 50 cent reduction in Social Security benefits. Between the NRA and MRA the implicit earnings test tax rate falls to 33% for earnings above a higher threshold ($17,000 in the mid 1990s). For individuals who are above the MRA, there is no earnings test. The earnings test provision has been recently eliminated for individuals who are over 65. However, since the earnings test was relevant for most of the HRS birth cohort at the time of their retirement, we include it in our model. Our model also incorporates 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.

We assume that the individual's utility is given by

$$u_t(c,l,ssd,h,age) = \frac{c^{\gamma}-1}{\gamma} + \phi(age,h,aw)\log(l) - 2h - K \quad (3)$$

if $ssd = 2$, otherwise, the individuals utility is given by

$$u_t(c,l,ssd,h,age) = \frac{c^{\gamma}-1}{\gamma} + \phi(age,h,aw)\log(l) - 2h, \quad (4)$$

where $h$ denotes the health status and $\phi(age,h,aw)$ is a weight that can be interpreted as the *relative disutility of work*. We assume that $\phi$ is an increasing function of age and health status (that is, individuals in worse health have a higher disutility of work, as discussed above). We also assume that $\phi$ is a decreasing function of $aw$, reflecting the fact that individuals with higher wages typically have more interesting and physically less demanding jobs, and thus a lower disutility of work than a "blue collar" worker who typically earns lower wages.[14] The parameter $K$ represents the "hassle" and "stigma" costs involved in applying for DI benefits. One can allow $K$ to be a function of observed covariates (such as age and average wage), as well as unobserved heterogeneity, but we abstract from this specification in this paper. In the results shown below, we have used a value of $K = .001$. We assume that there are no time or financial costs involved in applying for OA benefits, but we do explicitly account for the time and "hassle" costs involved in applying for DI. Accounting for these costs is essential, otherwise the life-cycle model substantially over-predicts the number of people who apply for DI benefits.

The parameter $\gamma$ indexes the individual's level of risk aversion. As $\gamma \to 0$ 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.

Figure 2 plots the function $\phi$ that we used in the solution and simulations of the life-cycle model. The left panel shows that 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 right hand panel of Figure 2 shows how the disutility of work decreases with average wage. We postulate that

[14] In the subsequent econometric analysis we will allow the disutility to contain parameters reflecting unobserved heterogeneity for leisure, and let the data determine the distribution of the disutility of work conditional on the average wage and other observable variables.

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.


**Figure 2: Relative Weight on Leisure as a Function of Age, Health and Average Wage**

## 3.3 Simulations of the Life-cycle Model

Figures 3 through 10 illustrate the rich types of behavior that the dynamic programming (DP) model predicts. Each of the curves is an average of 1,123 independent and identically distributed (*iid*) simulations, with each simulation corresponding to a separate individual followed from age 21 until their death. The averages were computed at each age, for the sub-population of survivors who lived until at least that age.

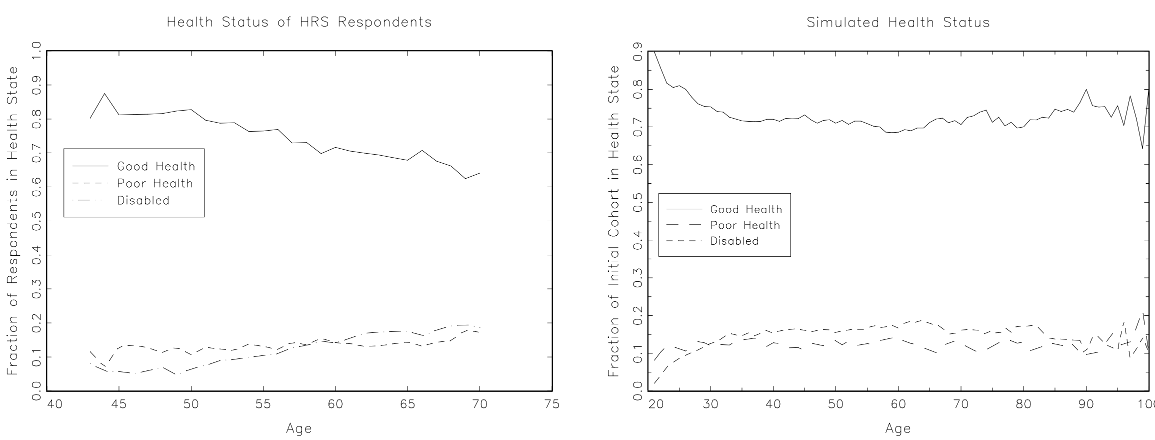


**Figure 3: Actual vs. Simulated Health Status**

Figure 3 compares actual and simulated health status by age. The simulated health status in the right panel of Figure 3 does a reasonable job of matching the actual pattern in the left panel of the figure. The fraction of people reporting good health status is declining with age a little more rapidly than in our model, and the fraction in poor health and disabled is increasing more rapidly with age than in our model. This suggests that our initial assumption of age-invariant health transition probabilities is one that we should relax, and this should enable us to do a better job matching the "age-health profiles" in Figure 3.

The left hand panel of Figure 4 shows the employment status from the HRS data as a function of age. Note that there is a clear decline in labor force participation starting at about age 54. There is also significant increase in part-time work after the age of 60. The simulation results shown in the right hand panel of Figure 4 exhibits a similar, but more exaggerated pattern. The DP model under-predicts the amount of part-time work between ages 45 and 60, and, generally, over-predicts the amount of part-time work at later ages. The pronounced peaks in part-time work at ages 65 and 70 (when the earnings test tax falls from 50% to 33% and 0%, respectively) are absent in the HRS data. It appears that the life-cycle optimizers are far more responsive to these incentives than real people are, a point which should be kept in mind when evaluating the predicted impact of the $1 for $2 offset. Another discrepancy is that the life-cycle model over-predicts the fraction of full-time workers between ages 45 and 60, and under-predicts this fraction at later ages. None of the 1,123 individuals in the simulated data worked full-time after age 65, whereas approximately 20% of the HRS sample in this age range continued to work full-time.

We believe that many of these discrepancies can be reconciled in future more general versions of the model. Specifically, adding more heterogeneity with regard to how rapidly the disutility of work increases with age, will make it possible to better predict the number of part-time workers at younger ages as well as the number of full-time workers at later ages. In the current version all individuals share the same utility function and the only source of heterogeneity is differences in health, average wages, and wealth. In reality, many of the individuals who continue working full-time into their 70s may be high paid professionals such as doctors, lawyers or academics, who have much better working conditions and more job flexibility, and who are more likely to love their work. As noted in the discussion of Figure 2, we have tried to capture some of this effect in a parsimonious way by allowing the disutility of work to be a declining function of the average wage.

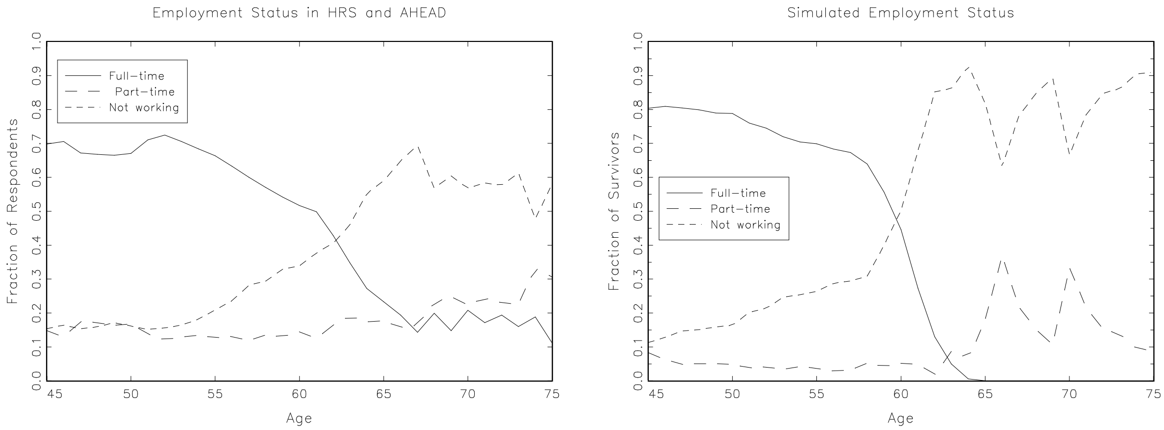


**Figure 4: Actual vs. Simulated Labor Force Participation**

Figures 5 compares the distribution of ages at which people first receive OA benefits. In the left panel of Figure 5 we present the actual distribution of retirement ages in 1998, from the 1999 Annual Statistical Supplement to the *Social Security Bulletin.* In the right panel we depict the results of our simulation of the life cycle model. The model captures the main features of the data, particularly the large peak in retirements at age 62. However, the current version of the model does not capture the relatively small fraction of individuals who claim benefits at age 63 and 64, and at ages after the normal retirement age. Again, we believe that the main reason for this apparent discrepancy is because of lack of heterogeneity in the life-cycle model, other than that which is produced by randomly evolving incomes, average wages, and health.

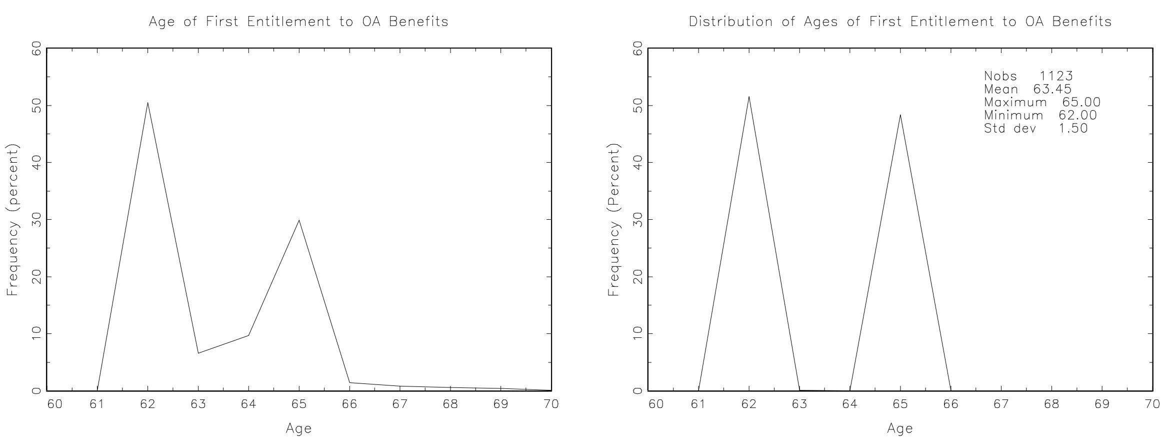


**Figure 5: Actual vs. Simulated Distributions of Ages of First Receipt of OA Benefits**

Figure 6 shows the evolution of the population between the 3 states of: (1) not receiving any Social Security benefits; (2) receiving SSDI benefits; and (3) receiving OA benefits. We see that the model captures these trends fairly well, except that in the model, entry into SSDI is more concentrated in the 45 to 60 age range than it is in the HRS data.

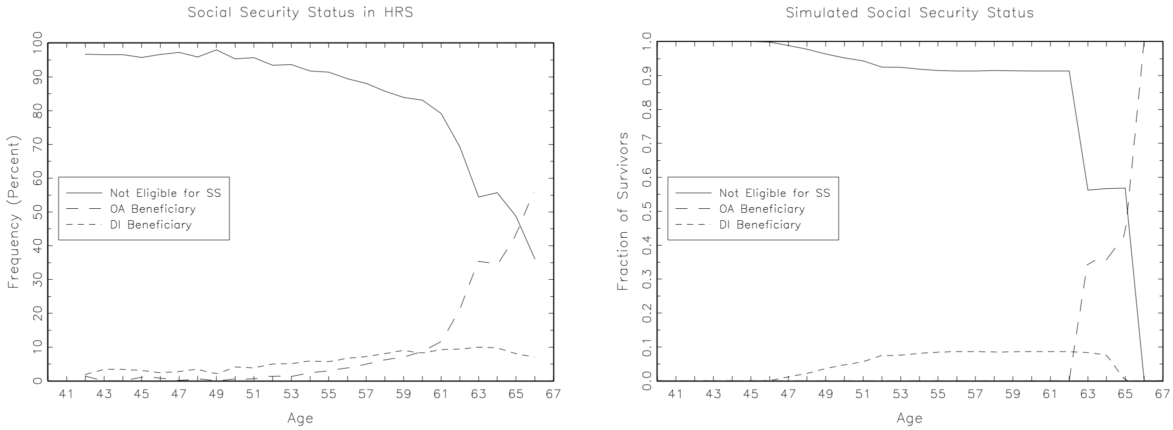


**Figure 6: Actual vs. Simulated Social Security Status**

Figure 7 shows actual and simulated trajectories for wages, and wealth. In the right panel of the figure we also provide the simulated trajectories of Social Security benefits and consumption over the life-cycle. First, we see that wages increase over the first part of the individuals' life-cycle and start dropping in their late 50's in both panels of the figure. During the first 30 years, individuals consume only about 70% of their wage earnings, resulting in a rapid buildup of net worth that peaks at age 60 in our simulations, and slightly later in the actual data. The maximum level of wealth accumulation Is about the same in the data and the simulations, but the life-cycle model predicts a more peaked trajectory for wealth. Wealth accumulates up faster than we observe in the HRS prior to age 60, and then decumulates at a faster rate than we observe after at 60.

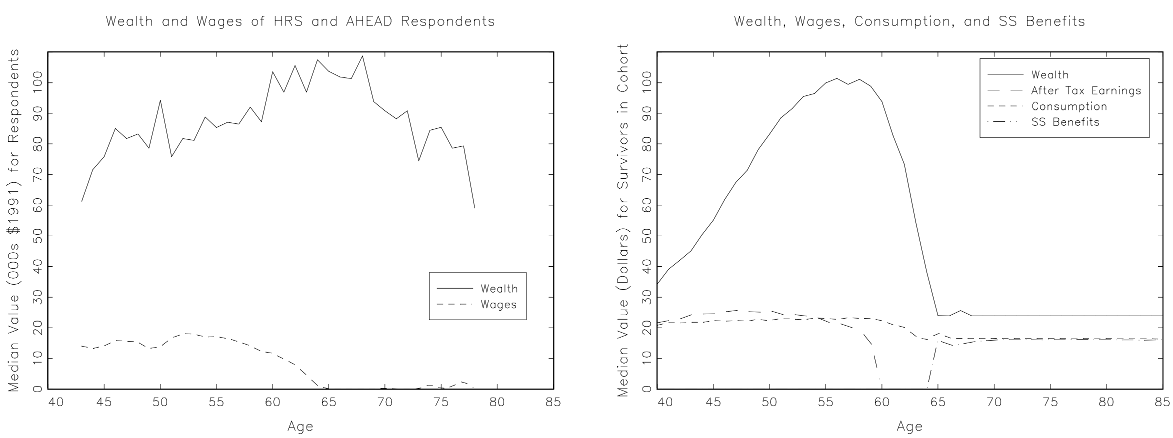


**Figure 7: Wealth, Earnings, Social Security Benefits, and Consumption**

The actual distribution of wealth is more skewed in the HRS data than in our simulations (not reported directly for brevity). In particular, the mean net worth at age 60 for the HRS respondents is more than two times greater than median wealth at that age, whereas in our simulations mean wealth is only slightly higher than median wealth. It is conceivable that the reason why the life-cycle model does not generate a sufficiently skewed wealth distribution is because we have not yet incorporated other sources of income, such as spousal income and inheritances. Additional heterogeneity in earnings processes could also help generate extra skewness in the wealth distribution. We believe that once we account for other risks such as the risk of involuntary unemployment and uninsured medical costs, the life-cycle model will predict substantially higher precautionary savings rates than we observe in the current model. Recall that in the current model the only risks an individual faces is loss of job due to health problems, mortality, and uncertainty about future wage rates.

Overall, it appears that the simulation results provide a reasonable approximation to the data. Contrary to claims made by some researchers that individuals have inadequate savings at the eve of retirement, our simulations of the life-cycle model suggest that the individuals born between 1931 and 1941, who were followed by the HRS, have adequately prepared for retirement. If anything, these individuals have a higher level of wealth accumulation both before and after the retirement age than what is predicted to be optimal by our life-cycle model. Our conclusions are similar to those obtained by Engen, Gale and Uccello (1999), which also analyzed simulations of a numerically solved life-cycle model.[15] Thus, we see little evidence that individuals in the HRS are under-saving for retirement, a conclusion supported by direct empirical analyses of wealth and pension accumulations of HRS respondents by Gustman and Steinmeier (1999). The life-cycle model shows how wealth accumulation plays an important role in consumption smoothing over the life cycle. In particular, the rapid decumulation of wealth after retirement allows individuals to maintain a relatively smooth pattern of consumption over their life cycle, even when major changes in labor supply occur.

Figure 8 depict the net wage (net of taxes), Social Security benefits, and consumption over the life cycle. Clearly, the life-cycle model predicts that as individuals enter retirement, they make significant reductions in their consumption spending. The right hand panel of Figure 8 shows that mean consumption spending declines from a peak of $22,000 per year at age 60 to about $19,000 per year at age 65.[16]

[15] Engen et al.'s life-cycle model did not allow a choice of labor supply and did not incorporate a realistic treatment of the Social Security. Allowing for Social Security and endogenous labor supply, *ceteris paribus*, leads to lower levels of wealth accumulation. However, our model also incorporates an additional risk that Engen et al. did not consider—uncertain health status—that creates a motive for higher precautionary wealth accumulation. These two effects seem to counterbalance each other. Consequently, both our model and the Engen et al. model lead to roughly similar levels of wealth accumulation over the life-cycle.

[16] A number of previous authors such as Bernheim, Skinner and Weinberg (2001) have argued that large drops

There is a sharp peak in consumption at age 70 that reflects the significant number of individuals who return to work to take advantage of the fact that there is no earnings test after age 70. The large drop in consumption is caused primarily by the large drop in wealth, which is being consumed as a result of early retirement. As we can see in the left hand panel of Figure 8 individuals are starting to retire in their 50s, whereas Social Security benefits do not begin to kick in until individuals are eligible to receive them at ages 62.

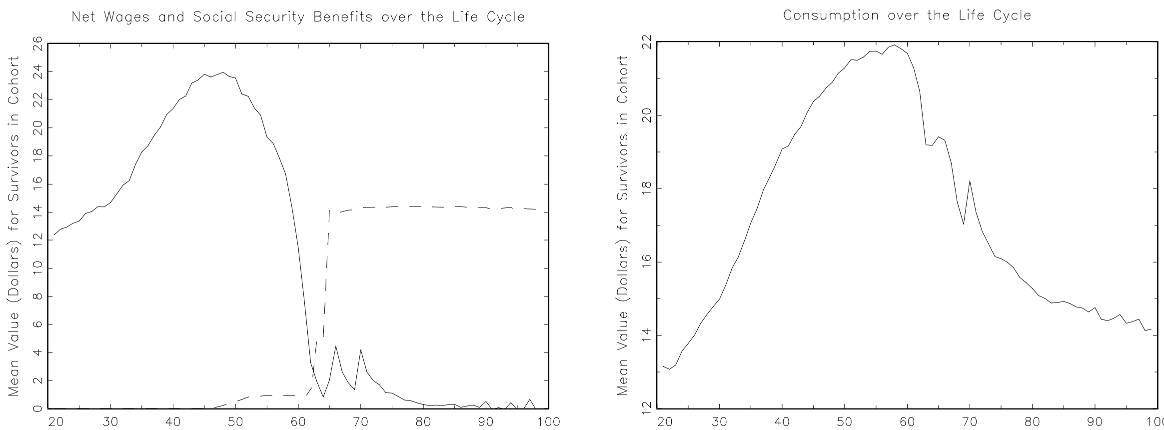


**Figure 8: Detail on Net Wages, Social Security Benefits and Consumption**

Figure 9 compares the distribution of ages of first receipt of DI benefits. The right hand side panel presents the simulation results, while in the left panel we provide the distribution from the HRS. Our simulations are qualitatively similar to the actual distribution, except that the life-cycle model under-predicts the mean age of first receipt of DI benefits. We have calibrated the life-cycle model to approximate the average age of first receipt of SSDI benefits in the aggregate, which was 49.3 in 1997.[17]. Our model is also consistent with the fraction of DI recipients who are ultimately awarded benefits, namely 70%, which we have found in previous work with the HRS data (see Benítez-Silva, Buchinsky and Rust, 2004 and 2005). Furthermore, we find that nearly 9.5% of SSDI recipients ultimately return to work, all via the TWP, which is consistent with Muller's (1992) analysis of the New Beneficiary Survey. In our simulations, approximately 10% of all SSDI recipients leave the rolls as a result of continuing disability reviews (CDRs). This is also consistent with Muller's analysis of the New Beneficiary Survey. Finally, the mean duration

in consumption after retirement are inconsistent with the predictions of the life-cycle model. Figure 8 demonstrates that this claim might not be correct. We believe that it is premature to conclude that the life-cycle model is incapable of explaining observed behavior. On the contrary, sufficiently rich and realistic versions of the life-cycle model do provide extremely good approximations to observed behavior.

[17] See Table 6.C in the 1999 Annual Statistical Supplement to the *Social Security Bulletin*.

on SSDI for our simulation sample, 12.7 years, is somewhat higher than the 10.9 year duration for the SSDI recipients in 1993 (Wheeler, 1996).

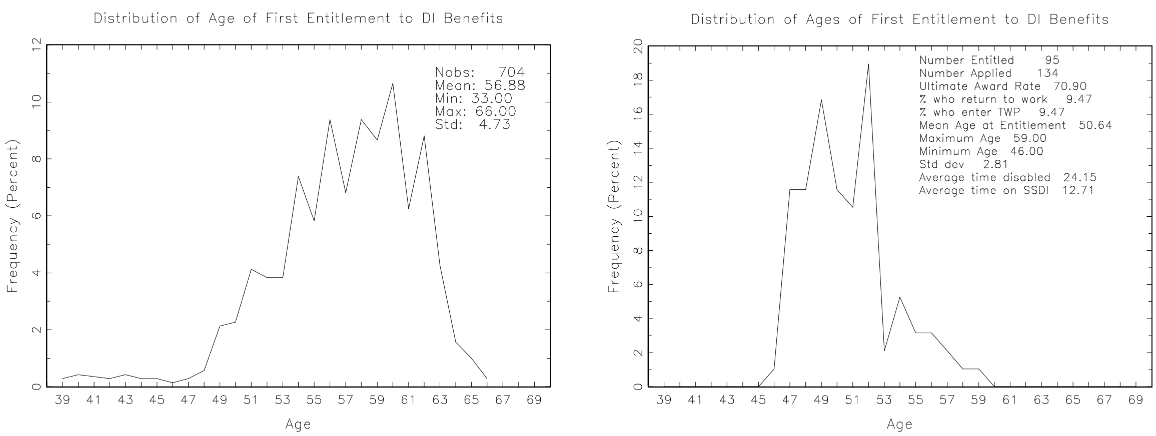


**Figure 9: Distribution of Age of First Receipt of DI Benefits**

There are two key aspects of individuals' preferences and beliefs that affect their decisions to apply for SSDI, and to return to work under the TWP. The first is the perceived stigma of being on SSDI. The second is an individual's beliefs about the chances that they will be a subject of a CDR if they reveal themselves as no longer disabled by taking advantage of the TWP. Without any stigma effect the life-cycle model greatly over-predicts the number of individuals who apply to SSDI. In our calibrations we have found that we can approximate the fraction of the population who applies for SSDI by including a fairly small stigma effect, $K = .001$, in the utility function in (3). The stigma effect also helps generate an incentive for individuals to leave the DI rolls, since without it, we find that very few DI recipients have an incentive to permanently exit the program, even when they have completely recovered from their disability.

The life-cycle model also over-predicts the number of DI recipients who use the TWP opportunistically, that is, those who return to the DI rolls immediately after the TWP. As noted in the introduction, our model of health dynamics predicts that about 50% of new awardees to the DI program will eventually experience a recovery sometime during their spell on the DI program. The life-cycle model predicts that nearly all of these individuals should take advantage of the return to work incentives provided by the fact that they can keep 100% of their DI benefits during the 9 month TWP and the subsequent 3 month grace period. However, the work of Muller (1992, 2000) indicates that only about 11% of new DI awardees eventually take advantage of the TWP. One way the life-cycle model is able to capture this phenomenon is via a belief, on the part of recipients, that engaging in TWP will *reveal* to the SSA that they might no longer be disabled, and hence will put them at much greater risk of leaving the rolls via a CDR.

The results provided in Table 1 of Muller (1992) suggest that these beliefs may be well-justified. Among the 405 DI beneficiaries in the New Beneficiary Survey who returned to work at some point in their DI spells, 46 of them were removed from the rolls due to: “Report of work led to continuing disability review and termination for medical recovery.” (p. 5). This appears to be a significantly higher termination due to CDRs than for the DI population as a whole. We therefore assume that DI beneficiaries believe that their chances of being removed from the DI rolls due to a CDR is permanently 3 times higher after engaging in a TWP, compared to not doing so. This enables us to match the fact that only about 10% of DI beneficiaries take advantage of the TWP at some point during their spells.

We believe the results presented here clearly show the richness and the insights that can be obtained from analyzing a sufficiently realistic version of the life-cycle model. While the comparisons of model predictions to the data in this section have revealed some discrepancies, the main features of the data have been captured quite accurately. Regardless of the refinements that will be introduced to the model in the future, it is unlikely to provide a perfect fit to the data. All models are approximations to reality, so the most relevant issue is not whether a particular model is rejected by statistical goodness of fit tests (almost any model will be rejected by such tests), but instead whether the model is a sufficiently good approximation to be a useful and credible input into policy making, and whether the model provides more accurate forecasts and predictions of behavior than competing statistical and behavioral policy forecasting models. We are not aware of any other currently available model which integrates SSDI and Social Security Old Age benefits and that can provide individual-level predictions of labor supply, savings, and DI and OA benefit application decisions, and which can also predict how behavior and welfare will change in response to changes in Social Security policies. Hopefully, in the near future there will be other competing models that can predict behavioral responses to policy changes.

# 4 The Impact of the $1 for $2 Offset

We now use the life-cycle model described in the previous section to predict the behavioral, welfare, and fiscal impacts of the imposition of the $1 for $2 benefit offset proposal. The great advantage of the life-cycle model is that it provides an opportunity to conduct a very special type of “controlled experiment” that would be impossible to conduct in the real world. The experiment works as follows. We simulate a population of 1,123 individuals starting at age 21 under the *status quo* Social Security policy with the de facto 100% tax on earnings above the SGA (up to the amount paid by the SSA). Then we re-solve and re-simulate the life-cycle model under the hypothesis that the $1 for $2 offset is in effect. We then save the random seeds for the simulation of the 1,123 individuals under the *status quo* and treat them as “experimental controls,” to be applied to another simulated population of 1,123 individuals who are given the $1 for $2 benefit offset “treatment”. This means that the trajectories for health and mortality in the control and treatment groups are *identical*, and thus the only differences in the outcomes for the two groups are changes in the endogenous variables, which reflect the behavioral responses to the $1 for $2 treatment. This is an especially powerful type of experimental control that is clearly not possible to conduct in any experiment with human subjects.

Figure 10 shows the labor supply effects of $1 for $2 offset. The left hand panel shows the impact on the fraction of the sub-sample of SSDI recipients who engage in full-time work and the right hand panel shows the fraction that engage in part-time work. We see that the $1 for $2 offset has very little effect on full-time work: it results in a slight reduction in the number of individuals engaging in full-time work between age 51 and 60. For example, at age 55, 2.1% of the sample works full-time under the *status quo*, whereas only 1.0% works full-time under the $1 for $2 offset.

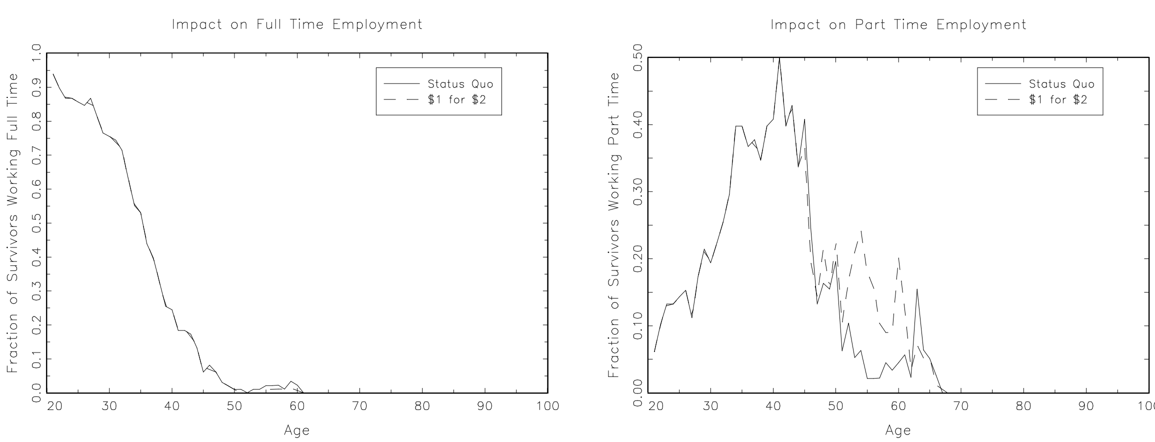


**Figure 10: Impact on Full and Part Time Employment**

The right hand panel of Figure 10 shows that there is a significant impact of the $1 for $2 offset on part-time work, which concentrates between the ages of 50 and 61, when these individuals are receiving DI benefits, and are thus taking advantage of the $1 for $2 offset provision. There is virtually no change in part-time work earlier in the life-cycle, especially not before the age of 45, the age at which individuals start to enter the DI program. There is some part-time work at ages 45 and 46 under the $1 for $2, reflecting the fact that a number of individuals are induced to begin their application for DI earlier than they do under the *status quo.* From ages 47 to 50, the fraction of individuals engaging in part-time work is uniformly higher under the $1 for $2 offset. There are particularly large peaks in part-time work at ages 54 and 60, when 24% and 20% of the sample, respectively, are working part-time.

Under the *status quo*, we see a big peak of part-time work at age 63, where 14% of the sample are working part-time. The significant increase in return to work behavior after age 62 in the *status quo* simulations reflects the opportunistic use of the TWP option. Why should such opportunistic use of the TWP increase after age 62 as opposed to earlier ages? This is explained by the fact that after age 62 DI recipients have a fall back option in the form of Social Security early retirement benefits, which helps shield them from the risk that a return to work could trigger a higher chance of termination due to a CDR.

Overall, the fraction of SSDI recipients who choose to return to work at some point during their DI spell increases from 9.5% under the *status quo*, to 48.9% under the $1 for $2 offset. Furthermore, those who return to work, work for more years: under the $1 for $2 offset they work an average of 2.9 years, whereas under the *status quo* they work only 1 year. This is because under the *status quo* DI recipients are largely exploiting the trial work provision and do not work beyond it since it would result in termination from the DI program. In contrast, under the $1 for $2 offset DI recipients are significantly more likely to enter a TWP and to continue to work a few years after the end of the TWP.

Independent evidence that a $1 for $2 benefit offset provides a strong work incentive is provided in a study by Muller (1992) that followed 59,000 SSDI beneficiaries who were first entitled to benefits between age 55 and 64. A total of 6,518 of them, or 11% of the sample, returned to work at some point after their initial entitlement. Of these, 71% returned to work after age 62, and 47% returned to work after age 65. This is of significant importance, because SSDI beneficiaries can convert from DI to OA benefits at age 62, and the OA program has a $1 for $2 offset above a substantially higher disregard level.[18] At age 65 the earnings test falls to a $1 for $3 offset above

[18] For example, in 1989 the SGA was $300 per month, but the OA earnings test disregard for early retirees was $540 per month, and $740 per month for normal retirees.

the higher disregard level. Thus, it is not surprising to find that the majority of SSDI beneficiaries who return to work do so at ages where the earnings test is less binding and less taxing. The life-cycle model's predictions of the timing of return to work by DI beneficiaries are quite consistent with these findings.

Figure 11 shows the life-cycle model's prediction of the other major effect of the $1 for $2, namely the *induced entry* effect. The left hand panel depicts the fraction applying for DI benefits, while in the right panel the fraction on the SSDI rolls is depicted. We see only a modest induced entry effect here. Overall, 134 individuals apply for SSDI, and 95 of those are ultimately awarded SSDI benefits under the *status quo* simulation, whereas 137 individuals apply and 98 of them are ultimately awarded SSDI benefits under the $1 for $2. Evidently, the net gain in expected discounted utility resulting from the option to work while receiving DI benefits under the $1 for $2 offset is not large enough to induce people to apply for benefits. This is also because of the hassle and stigma costs, and the significant risk that they will be denied benefits. Note that under the $1 for $2 offset the ultimate award rate is 71.5% ($= 98/137$), only slightly higher than 70.9% ($= 95/134$) under the *status quo*. This shows that there is a very small *induced persistence* effect, that is, applicants who are initially rejected have a slightly stronger incentive to appeal an initial rejection under the $1 for $2 offset than under the *status quo*.

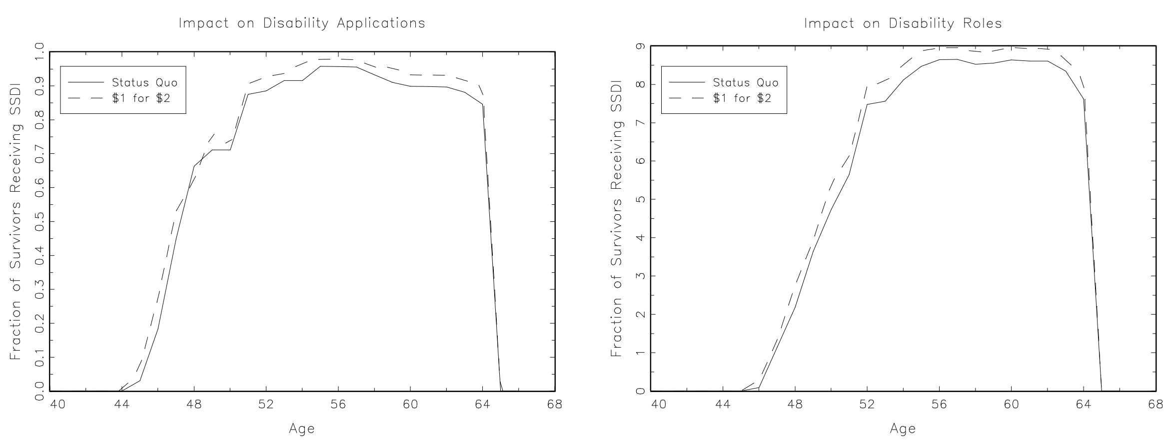


**Figure 11: Impact on SSDI Applications and Rolls**

In the right hand panel of Figure 11 we see that SSDI rolls increase by 3.1% in our simulations, which is somewhat larger than the 2.2% increase in applications for SSDI. The DI rolls increase by a larger amount due to the fact that the mean duration on the DI program increases by .3 years, from 12.7 years under the *status quo* to 13.0 years under the $1 for $2 offset. It is tempting to blame this increase on *reduced exit* i.e., that DI recipients have less incentive to leave the rolls under a $1 for $2 offset. However, the increase in durations is actually due to a .3 reduction in the mean age of first receipt of DI benefits. The reduction in age of application is closely related to the induced entry effect. At the margin some new disabled individuals who did not apply for DI benefits under the *status quo* are induced to apply under the $1 for $2 offset. In addition there are also individuals who applied in both cases, but who were induced to apply slightly *earlier* under the $1 for $2 offset. Consequently, the combined effects of induced entry and the increase in mean duration on the program result in an increase of 5.9% in the number of *person-years* spent on SSDI rolls.

The life-cycle model's prediction of the induced entry effect lies between the projections of the SSA and CBO. A 1994 study by James McGlaughlin, of the SSA Office of the Actuary, predicted that the $1 for $2 program would result in 40,000 additional *induced filers* being awarded DI benefits each year, over a 10 year period. The number of new DI benefits per year awarded to disabled workers (we exclude their dependents since they would not be affected by the $1 for $2 offset) has ranged from a low of 587,000 workers in 1997 to a high of 662,000 in 1992. Using the annual average between 1994 and 2001, McGlaughlin's predicted increase of 40,000 induced awardees, amounts to an approximate 6.4% increase in the annual number of workers awarded DI benefits. This is nearly three times larger than the 2.2% increase predicted by our life-cycle model. Projecting the latest data on DI rolls from the 2004 Annual Statistical of the Social Security Program, the 5.86 million adult beneficiaries as of December of 2003, will grow to 6.18 million by the end of 2004, if the 5.3% average growth rate in DI rolls over the period 2001 to 2003 persists. Thus, McGlaughlin's study implies an induced entry effect of approximately 6.5% (i.e., the 400,000 induced filers divided by the projected 6.18 million adult worker DI beneficiaries at the end of 2004).[19] The CBO predicts that there would be 75,000 induced filers over the 10 year period considered by McGlaughlin. Dividing by the projected DI population of 6.18 million workers in 2004, the CBO predicts that induced entry will increase SSDI by approximately 1.2%.

Figure 12 shows the impact of the $1 for $2 offset on Social Security contributions and benefit

[19] It is not clear whether McGlaughlin's estimates take account of mortality and conversions of DI benefits to OA benefits at the normal retirement age. Our projections do account for these sources of attrition from the DI program, as well as continuing disability reviews and voluntary exits due to the TWP. Also, McGlaughlin study assumed that the monthly disregard at which the $1 for $2 offset would take effect was $85, substantially lower than the prevailing SGA level at that point in time of $500. The McGlaughlin report assumed that the amount of induced entry would not change much if the disregard was increased to the full SGA level. The life-cycle model predicts that there would be a slightly smaller increase in the rolls, due to induced entry under the lower $85 disregard. DI rolls increase by 2.1% under the $85 disregard compared to 3.2% under the $500 disregard.

payments for the sub-population of SSDI recipients. *A priori* the effect of the $1 for $2 on net benefit payments is unclear. Although recipients are on the rolls for a longer period, they are receiving reduced benefits when they are working due to the $1 for $2 offset. Also, when they are working they are making Social Security contributions on their wage earnings. The left hand side panel of Figure 12 shows that despite the reduction in benefits due to increased part-time work under the $1 for $2 offset, DI benefit payments are slightly higher. In particular, between the ages of 50 and 60 DI benefits are 4.3% higher under the $1 for $2 offset compared to the *status quo*.

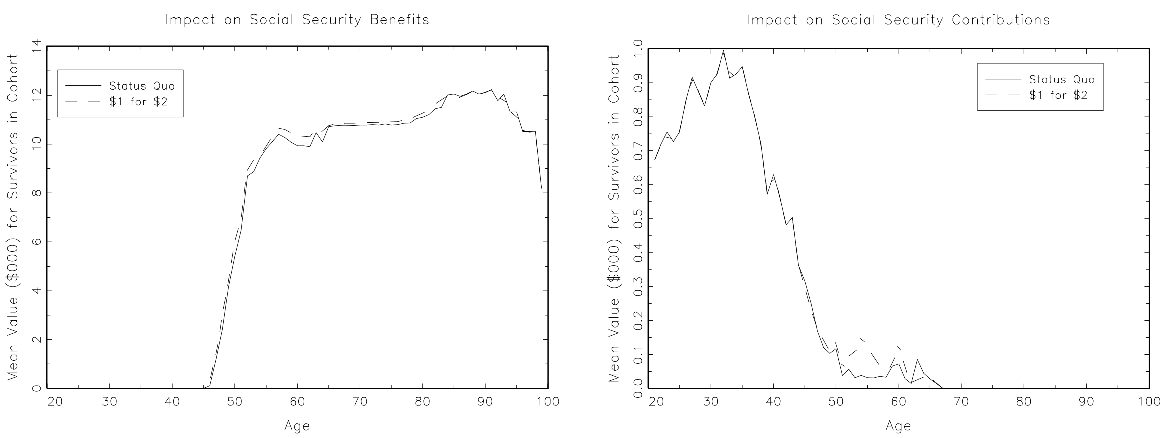


**Figure 12: Impact on Social Security Contributions and Benefits**

The right hand panel of Figure 12 shows the impact of the $1 for $2 on Social Security contributions. Not surprisingly, the higher level of part-time work between the ages of 50 and 60 results in higher Social Security contributions. However, contributions are lower at ages 62 and 63 since, as we noted above, there is a surge of opportunistic re-entry under the *status quo* at those ages. Under the $1 for $2 offset individuals tend to get higher earnings, which in turn, increases the average wages of DI beneficiaries. Consequently, this leads to a lasting increase in Social Security benefits at retirement. This is why even though the SSDI $1 for $2 offset is no longer relevant after age 65, since all DI beneficiaries have been converted to OA benefits, their Social Security benefits continue to exceed the benefits that they would have received under the *status quo*.

Figure 13 shows the impact of the $1 for $2 offset on the distributions of ages of first receipt of OA and DI benefits. The right hand panel of Figure 13 shows that under the $1 for $2 offset there is a slight downward shift in the ages of first receipt of DI, from 50.6 years under the *status quo* to 50.3 years under the $1 for $2 offset. The left hand panel shows that there is hardly any effect on the ages of first receipt of OA benefits. We do see a very small increase in claims for OA benefits at age 65 relative to age 62. This also contributes, via few actuarial reductions in benefits, to higher benefit payments after age 65 under the $1 for $2 offset.

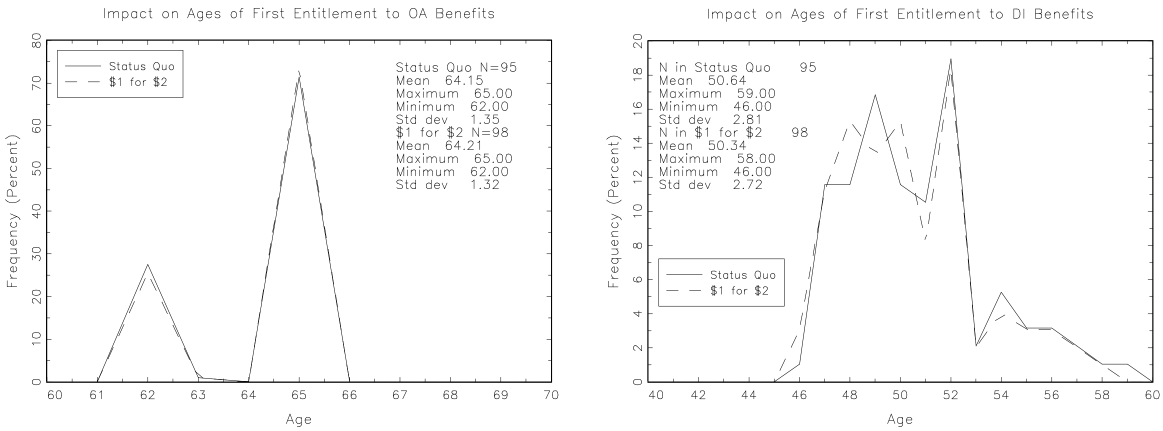


**Figure 13: Impact on Age of Entitlement to OA and DI Benefits**

In order to summarize the net impact of the $1 for $2 on the fiscal balance of the SSDI program, we compute the net present discounted value of SSDI benefits, where both contributions and benefits paid to the sub-population of SSDI recipients over their lifetimes are discounted at a real interest rate of 2%. Table 1 summarizes the fiscal implications of the $1 for $2 offset for the sub-population of SSDI recipients in the simulation cohort.

**Table 1: Summary of the Budgetary Impacts of the $1 for $2 Offset**

| Item | Status Quo | $1 for $2 Offset | % Change |
|---|---:|---:|---:|
| Number of DI applicants | 134 | 137 | +2.2% |
| Number of DI recipients | 95 | 98 | +3.2% |
| Person-years spent on DI | 1273 | 1348 | +5.9% |
| Number of DI recipients who returned to work | 9 | 48 | +533% |
| Mean Years of Part Time Work on DI | 1 | 2.9 | +290% |
| Mean Years of Full Time Work on DI | 0 | 0 | 0% |
| Present value of Federal Tax Payments ($000) | $1938.92 | $ 1872.75 | -3.4% |
| Present value of Social Security contributions ($000) | $3,003.26 | $3,129.84 | +4.2% |
| Present value of Social Security benefits ($000) | $10,940.08 | $11,474.07 | +4.9% |
| Net Present value of Cost of SSDI beneficiaries ($000) | $ 5,997.90 | $6,471.48 | +7.9% |
| Present value of pre-tax wage earnings ($000) | $24,219.80 | $25,240.65 | +9.3% |
| Present value of consumption ($000) | $ 33,116.34 | $ 34,684.56 | +4.6% |

We see that in discounted terms, the present value of benefits paid under the $1 for $2 offset increases by 4.9% from $10.9 million to $11.5 million. However, on a per beneficiary basis, the present value of benefits increases by only 1.6%, from $115,159 to $117,082. Thus, while each beneficiary is collecting slightly more benefits due to a longer duration in the program under the $1 for $2 offset, the majority of the increase in aggregate benefit payments is due to the induced entry effect.

Note that the present value of Federal tax payments is actually slightly *lower* under the $1 for $2 offset. This is due to the fact that the low part-time earnings of many of the DI recipients who return to work qualify them for tax rebates under the EITC program. If we calculate the net present value of the cost of the DI program in our simulations (i.e., the present value of benefits less the present value of contributions and Federal taxes), we find a 7.9% increase in net costs under the $1 for $2 offset, from $6.0 million to $6.5 million. On a per beneficiary basis, discounted costs rise by 4.6%, from $63,147 per beneficiary to $66,041 per beneficiary.

Thus, these calculations suggest that implementation of the $1 for $2 offset policy would result in a modest increase in DI applications, awards, rolls, and net expected discounted costs. However, the $1 for $2 offset provides some of the SSDI recipients with clear welfare improvement. The $1 for $2 policy is found to be strictly welfare enhancing, since it raises the payments (and thus consumption) to SSDI recipients under states of the world where they experience a recovery and wish to return to work. On the other hand, these increase payment do not reduce payments to the SSDI beneficiaries in other states of the world. Indeed, we see from Table 1 that the present value of pre-tax wage earnings is 9.3% higher, and the present value of consumption is 4.6% higher, under the $1 for $2 offset policy than under the *status quo*.

Figure 14 shows the impact of the $1 for $2 on consumption and wealth accumulation by age. The left hand panel shows the average consumption under the *status quo* and under the $1 for $2 offset. The mean consumption is higher under the $1 for $2 offset at every age. Similarly, the right hand panel of Figure 14 shows that net worth is also higher under the $1 for $2 offset at all ages. Nevertheless, there is virtually no increase in consumption and net worth prior to age 45, and the biggest increases occur between the ages of 55 and 70. It is evident that individuals who return to work under the $1 for $2 offset are using part of their earnings to generate an immediate increase in consumption, but they are also saving a significant fraction of these earnings to increase their buffer stock of savings for their retirement years. This additional buffer stock lasts well into their 80s.

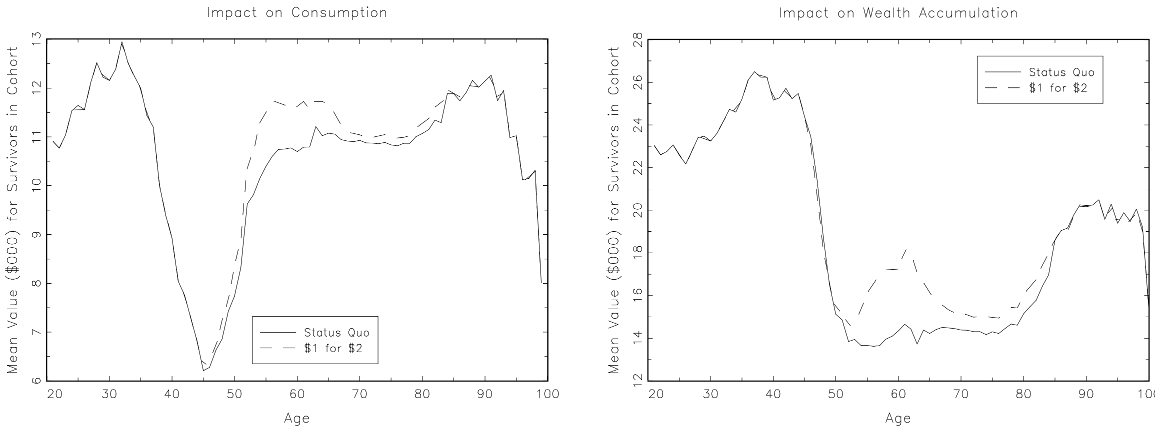


**Figure 14: Impact on Consumption and Net Worth**

Figure 15 plots the ratio of the mean consumption for DI beneficiaries under the $1 for $2 offset and mean consumption under the *status quo*. We see that there are particular ages at which there are fairly big increases in consumption, such as around age 45, where consumption is more than 18% higher under the $1 for $2 offset. Over the entire life-cycle, consumption increases by an average of 2.2% per year, and by 6.9% per year between ages 45 and 65.

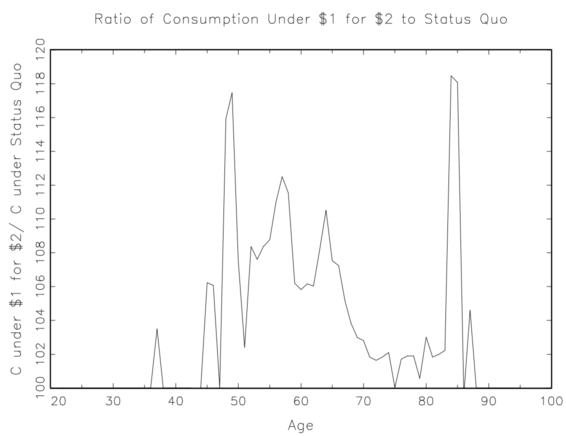


**Figure 15: Ratio of Consumptions: $1 for $2 Offset vs. status quo**

We conclude this section with Figure 16, which summarizes the welfare effects of the $1 for $2 offset policy. As we have emphasized in the previous sections, the $1 for $2 offset is certainly strictly welfare improving relative to the *status quo*. Under the $1 for $2 offset policy, those that experience a recovery have the option of continuing to receive reduced SSDI benefits even though they continue working after the trial work period. The simulations of the life cycle model show that this is an attractive option for nearly 50% of SSDI beneficiaries, who have experienced an improvement in their health status, and are willing to return to part-time work. These individuals are now receiving a combination of wage earnings and (reduced) SSDI benefits, rather than not working at all and relying exclusively on a relatively small SSDI benefits.

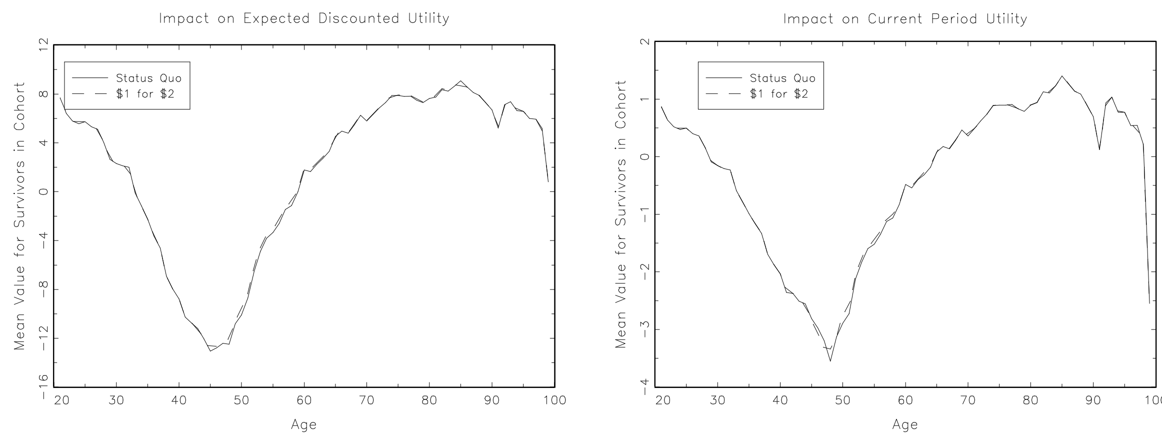


**Figure 16: Impact on Expected Discounted and Current Period Utility**

The left hand panel of Figure 16 plots the mean of the value function $V_t(aw, w, h, ss)$, i.e., the expected discounted utility from the current age onwards, as a function of age. The right hand panel plots the current period utility function $u(c, l, h, ss)$, as a function of age. We see that both $V$ and $u$ initially decline with age until about age 45 and then they increase until leveling off around age 70. (The large decreases in utility at the very end of the life-cycle is probably a statistical fluke due to small numbers of simulated observations at this age range.)

The decline in utility between ages 20 and 45 is a result of the fact that this population started off healthy when they were in their 20s, but their health declined in their 30s and 40s. Many actually became disabled in these age ranges, but were deterred from applying for DI benefits by the “hassle costs”. They stopped working and lived off of their savings, hoping to experience a recovery. However, as their disability persisted and their savings dwindled, most of these individuals decided to incur the hassle costs of applying for DI in their 40s. Once they got onto DI their welfare started to improve since their DI benefits enabled them to increase their consumption without relying entirely on consuming from their depleted savings. Also, about 50% of these individuals started to experience recoveries after several years on DI, and this lead to increasing welfare between ages 50 and 75.

In both panels of Figure 16 we observe that welfare is only slightly higher under the $1 for $2 offset than under the *status quo*. Indeed the increase in utility and welfare is barely visible in these graphs. There are several reasons for this finding. The first and most important point to note is that our welfare calculations account for the disutility of work effort. Thus, while consumption does rise significantly under the $1 for $2 offset, the rise in consumption came at a cost of forgone leisure by individuals who decide to return to work. While individuals are better off from having done so, in an *ex ante* sense, the disutility of work effort very nearly counterbalances the increased utility from the higher consumption they could afford as a result of their work effort.

The second point to note is that although the $1 for $2 offset is strictly more generous than the *status quo*, it still amounts to a very high 50% surtax on earnings. Furthermore, this surtax applies to individuals with low average wage earnings anyway, who are not able to find very lucrative jobs, and who are older and face a higher disutility of work. Thus, the combination of the high tax rates, the higher disutility of work at older ages, and the relatively low earnings prospects of DI beneficiaries implies that the $1 for $2 offset is, on average, not a great deal for DI beneficiaries.

The final point to note is that the utilities in Figure 16 are an average of utilities of 50% of the population of DI beneficiaries who never experienced a recovery from disability and 50% who did. For those who never experienced any recovery, the $1 for $2 offset is not a highly valuable option. It is always possible that a disabled DI beneficiary might recover in the future and thus the $1 for $2 offset is an option that has some value. However, the value of this option is not very high for DI beneficiaries since the degree of persistence in the disabled state is quite high as noted in section 3.

Clearly, the $1 for $2 option is most valuable for DI beneficiaries who have recovered from their disabilities. However, when we compute the increase in welfare due to the $1 for $2 offset to a younger person who has not yet become disabled, or considered applying to the DI program, the increase in *ex ante* welfare is negligible. The increase in welfare due to the $1 for $2 does become more significant once a person gets into their middle ages and becomes disabled. The welfare gain is highest for those who are already on DI and who have recovered from their disability.

The analysis of welfare changes is the key to understanding why the induced entry effect is not very large in our model. The *ex ante* gains facing a prospective SSDI applicant are not large when one factors in: (1) the chance that after incurring the hassle of submitting an application it would ultimately be rejected; (2) the chance that once on the program the person would actually experience a medical recovery that would make it possible to work; and (3) the high effective 50% surtax on the benefits for SSDI beneficiaries who do return to work. The combination of all these factors implies that the net gain from the $1 for $2 from an *ex ante* point of view is not large. Unless the “gradient” in the hassle costs for those who are at the margin of indifference between applying and not applying for SSDI benefits is very flat, the small increase in net expected discounted utility from the $1 for $2 offset will not result in a large amount of induced entry.

# 5 Conclusions and Discussion

This paper examines the impact of a new disability policy that has been considered recently by the Social Security Administration (SSA), namely the $1 for $2 benefit offset. We use a numerically solved life-cycle model, and show that it can be an extremely useful tool for Social Security policy evaluation and forecasting, particularly for examining the proposed reform of the SSDI program. The SSA was initially mandated to evaluate this policy change using a large scale demonstration project. The key issue that motivated the U.S. Congress to obligate the SSA to undertake a costly, time-consuming demonstration project, is the concern about *induced entry*. The key question that has been raised is: Would the $1 for $2 offset be considered a significant increase in the generosity of the SSDI program by potential DI applicants resulting in large increases in applications, awards, and program costs?

Our analysis has provided a number of new insights into how entering the DI roll and return to work incentives might be affected by the way the SSDI program is being administered. Specifically, the life-cycle model indicates that individuals are very sensitive to the SSA's policy regarding continuing disability reviews (CDRs). If DI recipients believe that taking advantage of the $1 for $2 offset will result in them being a target for higher rates of CDRs in the future, then a significantly lower number of DI recipients will return to work and, in turn, the induced entry effect becomes negligible. We also demonstrate the usefulness of the life-cycle model in providing accurate predictions for the possible impact of the $1 for $2 benefit offset proposal that has been considered recently by the SSA. In particular, the model is able to accurately predict individuals' observed responses in the Health and Retirement Study regarding: (1) health status; (2) employment decisions; (3) age of first receipt of DI and OA benefits; (4) wealth; and (5) wages. Since these are the most important factors affecting the application decisions for DI benefits, and/or are the most obvious outcomes of such decision, it makes one comfortable using it for the purpose of evaluating the proposed $1 for $2 benefit offset policy.

Careful examination of the various simulations provided in the paper indicates that the cost of the newly suggested policy is not huge. Moreover it provides some of the people with very strong incentives to return to work, even if in many cases it is only to part-time jobs. The induced entry effect that Congress and the SSA are very concerned about seems to be quite small. This is mainly because the proposed policy provides a welfare enhancement tool only for people who found themselves disabled at some point of their career. From an ex-ante point of view, the proposed plan does not give people enough incentives to apply for disability benefits. However, once a person finds himself on the DI rolls, it gives him/her ex-post incentives to get of them. Consequently, the overall net increase in costs of the SSDI program are relatively small.

It is clear from our results that the $1 for $2 offset proposal would benefit those currently receiving disability benefits, however, does not necessarily have the positive fiscal effects the government agencies would be hoping for. If the policy objective is to try to integrate disabled workers into the labor force at a reasonable cost, this could be a good policy, given the relatively small *induced entry effects* we predict. If the objective is to reduce the overall cost of the system by allowing disabled individuals to come back to work so that they eventually get off the rolls, then this might not be the ideal policy to put in place.

There is, however, a different way of thinking about this proposed reform that can illuminate the policy debate, and it is as an example of how to essentially change the current disability system from one that only offers benefits to those completely disabled, to one, that for all purposes, offers partial benefits. The appeal of this proposal to accomplish the latter objective is that it allows individuals to self-select themselves into their own disability level (defined here by their benefit level with respect to someone that receives full benefits), without imposing particular ex-ante thresholds, like in countries were partial benefits are the norm, such as Germany, Sweden, or Spain. An alternative reform of the system might be to actually offer partial benefits. However, that is likely to come at a higher administrative cost, and would still leave open the handling of the millions currently on the rolls.[20] Given that the dichotomous nature of disability in the United States is possibly imposing a high welfare cost on those partially disabled, our results can be understood as an initial measure of the gains of moving towards a *de facto* system of partial benefits, which would allow individuals to adjust their dependence from the system to their ability to exert productive work in the market.

The empirical life-cycle model we have developed is a prime example for the non-experimental alternatives that have been advocated by Tuma (2001) and Moffitt (2003), as a necessary alternative to randomized experiments. Indeed, the approach used here may be one of a few alternatives at our disposal when it comes to the evaluation of program entry effects. The calibrated model we have used here to forecast the induced entry effects associated with the $1 for $2 offset delivers detailed

[20] With the exemption of the current efforts by Yin (2005), which has help us understand our contribution to the policy debate better, there is currently almost no research on this topic regarding the U.S. system.

and credible predictions about the implication of the proposed policy. In fact, we are not aware of any other alternative modeling approach that is capable of generating predictions that would be more detailed and accurate than the approach we used here.

While we make no claim that randomized experiments are not useful, we do argue that they are not sufficient, and in many cases are not feasible. When randomized experiments are not feasible, the most obvious alternative is the approach we have adopted here, not simply introducing new policies without any pretesting. This is particularly true when it comes to something as important as Social Security, since many people are crucially dependent on these benefits. While some policy changes are inevitable, it is better, in general, to have fewer well thought out policy changes than to have many semi-experimental or haphazardly chosen ones.

We have argued throughout this paper that the life-cycle models are sufficiently realistic to provide credible predictions of a wide range of policy changes, but we also argue that there is a very important complementarity between survey data collection, randomized experiments, and econometric modeling. We believe that the government should be investing in all three areas, and that these "R&D expenditures" will have a very high long term payoff in enabling the government to develop more cost-effective policies, particularly with respect to welfare and Social Security.[21] However, we strongly believe that model building is the most inexpensive investment that can be made to improve the nation's analytical capabilities. It will then be up to researchers at government institutions, and policy makers, to decide whether these models provide useful tools in their decision making process.

It is still an open question whether any of these models will actually be used in practice as inputs to policy making. However, some government agencies, particularly the Congressional Budget Office, are already using life-cycle models for their long term forecasting. It seems likely that inter-agency competition will ultimately lead to the adoption of better analytical tools, and hopefully greater investment in data collection and (controlled) experimentation.

[21] A good illustration for this complementarity is provided in a recent study by Todd and Wolpin (2003), which uses data from a large scale randomized experiment in Mexico (known as PROGRESA), and panel data on the families under study well beyond the duration of the policy, to determine whether subsidies to parents who keep their children in school will significantly improve educational outcomes.

# 6 References


Benítez-Silva, H., Buchinsky, M., Chan, H. Cheidvasser, S. and J. Rust (1999): "An Empirical Analysis of the Social Security Disability Application, Appeal and Award Process" *Labour Economics*, **6**, 147–178.

Benítez-Silva, H. Buchinsky, M. and J. Rust (2004): "How Large is the Bias in Self-Reported Disability?" *Journal of Applied Econometrics*, **19-6** 649–670.

Benítez-Silva, H. Buchinsky, M. and J. Rust (2005): "How Large are the Classification Errors in the Social Security Disability Award Process?" manuscript, University of Maryland.

Benítez-Silva, H., and F. Heiland (2004): "Early Claiming of Social Security Benefits and Labor Supply Behavior of Older Americans," manuscript, SUNY-Stony Brook.

Bernheim, D., Skinner, J., and S. Weinberg (2001): "What Accounts for the Variation in Retirement Wealth Among U.S. Households?" *American Economic Review*, **91-4**, 832–857.

Congressional Budget Office (1997): "Time-Limiting Federal Disability Benefits," Memorandum. Washington D.C.

Engen, E., Gale, W.G., and C.E. Uccello (1999): "The Adequacy of Household Saving," *Brookings Papers on Economic Activity*, **2**, 65–165.

French, E. (2001): "The Effects of Health, Wealth, and Wages on Labor Supply and Retirement Behavior," forthcoming in the *Review of Economic Studies.*

Moffitt, R. (2003): "The Role of Randomized Field Trials in Social Science Research: A Perspective from Evaluations of Reforms of Social Welfare Programs" manuscript, Department of Economics, Johns Hopkins University.

Muller, L.S. (1992): "Disability Beneficiaries Who Work and Their Experience Under Program Work Incentives" *Social Security Bulletin*, **55-2**, 2–19.

Muller, L.S. (2000): "The Search for Evidence of a Labor Supply Response to a Benefit Offset" Office of Research, Evaluation and Statistics, Social Security Administration.

Muller, L.S., Scott, G., and B.V. Bye (1996): "Work and Earnings of SSI Disability Recipients" *Social Security Bulletin* **59-2** 22–42.

Neumark, D. and E.T. Powers (2003): "The Effects of Changes in State SSI Supplements on Pre-Retirement Labor Supply" NBER working paper 9851.

Rust, J. and C. Phelan (1997): "How Social Security and Medicare Affect Retirement Behavior in a World of Incomplete Markets," *Econometrica*, **64-5**, 781–832.

Todd, P. and K. Wolpin (2003): "Using a Social Experiment to Validate a Dynamic Behavioral Model of Child Schooling and Fertility: Assessing the Impact of the School Subsidy Program in Mexico," manuscript, University of Pennsylvania.

Tuma, N. (2001): "Approaches to Evaluating Induced Entry into a New SSDI Program with a $1 Reduction in Benefits for each $2 in Earnings," manuscript, Stanford University.

van der Klaauw, W., and K.I. Wolpin (2002): "Social Security, Pensions and the Savings and Retirement Behavior of Households," manuscript, University of North-Carolina-Chapel Hill.

Wheeler, P.M. (1996): "Message from the Associate Commissioner," *Social Security Bulletin*, **59-1**, p. 2.

Yin, N. (2005): "Partial Benefits in the Social Security Disability Insurance: A Policy Alternative," manuscript, SUNY-Stony Brook.