

# Social Security Literacy and Retirement Well-Being\*

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## Abstract

We build upon the growing literature on financial literacy by studying people's knowledge of Social Security rules and how limited knowledge of these rules affects their retirement and savings decisions. First, we present results of two phone surveys conducted in 2007 and 2008, both of which are aimed to investigate how much people know about the incentives built into the Social Security system. The results of the surveys reveal that less than half of the respondents knew the answers to most of the questions on Social Security. In some cases, about 20 percent of the respondents knew the correct answer. We also find that knowledge of Social Security rules increases with age and education, but there does not seem to be a strong observed correlation with income. In the second part of the paper, we assess the consequences of having limited knowledge of rules governing the Social Security system using a realistic and empirically-based life-cycle model of retirement behavior under uncertainty. In particular, we investigate the individual's retirement and savings decisions under a form of "unawareness,"

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in which agents do not know the Social Security rules and they choose to behave according to the average agent in the economy. We compare the outcomes in this case to the outcome under full information, computing the welfare gain associated with having complete information of the Social Security system. Our analysis shows that the welfare gains from better knowledge of Social Security can be sizable. We find that 95 percent of those who reach age 60 would have to be compensated with more than 50 percent of their wealth in order to move from the full information state to the limited information case.

## 1 Introduction

For decades a large body of literature in economics has tried to explain the relationship between social insurance, labor supply, savings and consumption behavior of individuals. An increasingly influential branch of this literature aims to accomplish this goal by solving complex structural models of rational behavior. A critical assumption of these models is that people know and understand the complicated set of rules of the Social Security system. In this paper, we explore the extent to which the full information assumption is observed in the data, and the welfare consequences of relaxing this assumption. To that end, we first investigate how much people know about some of the most basic rules of the Social Security system by presenting results of surveys we conducted in 2007 and 2008. Then we modify the standard life-cycle model of retirement and savings to incorporate the assumption that individuals have partial information on Social Security rules. Using the modified model, we study the consequences of having limited knowledge of Social Security rules on individuals' retirement, savings decisions, and ultimately on their welfare.

The extent to which people know about the Social Security system and the implications of their limited knowledge on retirement and savings outcomes are crucial factors from a policy perspective because the incentives generated by the Social Security rules are dependent on people's understanding of these rules<sup>1</sup>. If individuals do not know the rules of the Social Security system,

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<sup>1</sup>Gustman and Steinmeier (2001), Blinder and Krueger (2004), Cao and Hill (2005), and Mastrobuoni (2006) focus on knowledge of the Social Security system, especially about expected benefit levels. Mitchell (1988), Starr-McCluer and Sundén (1999), Stevens and Chan (2005), Gustman, Steinmeier, and Tabatabai (2007) analyze pension knowledge.

or do not understand the implications of the rules on the value of their benefits, models that assume perfect information of the Social Security system would not yield accurate measures of the incentives created by the social insurance system. Our objective in this paper is to investigate how much people know about the Social Security rules, how they incorporate this knowledge in their retirement and savings decisions, the extent to which their information regarding the Social Security rules affects their retirement and wealth outcomes, and the implications of their imperfect knowledge on their welfare. We will also explore policies for improving Social Security literacy.

This paper is organized in two main parts. First, we present descriptive results from two phone surveys that are conducted on a small representative sample of the U.S. adult population and aim to gather information on respondents' knowledge of several Social Security rules. The first survey, which was conducted in August 2007, collected information on 500 individuals, and the second survey, conducted in December 2008, had 507 respondents. A randomly chosen sub-group of respondents to the first survey were given the correct answer to one of the Social Security rule questions on the survey and were re-interviewed in the follow-up survey. The follow-up survey included questions that inquire whether these respondents have retained the correct answer given to them during the initial survey. We find that the extent of informational problems regarding Social Security can be quite severe, especially regarding more complex rules of the System. For example, only 23 percent of all respondents knew the maximum retirement age, i.e. the age at which one can claim Social Security retirement benefits so that Social Security will adjust benefits upward. We find that the knowledge of the rules increases with age and education. However, even among those who are nearing retirement, knowledge of Social Security rules may be low. For example, only 33 percent of those in the 55-64 age category knew the maximum retirement age in the 2007 survey.

In the second part of the paper, we provide a measure of the welfare cost brought about by people's limited knowledge of the Social Security system's rules. We accomplish this by solving and simulating a life-cycle model of retirement behavior under different informational assumptions. We start with a model in which agents are assumed to have full information about the Social

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Lusardi and Mitchell (2005, 2007) focus on general financial literacy. Benjamin, Brown, and Shapiro (2006) analyze the link between cognition and preferences.

Security rules regarding their benefits. We compare this benchmark case to the threshold case in which individuals do not know anything case in which individuals have limited knowledge about one of the rules. In particular, we assume that agents do not know anything about the details of the system, and they decide when to claim Social Security benefits based on what they observe others to be doing. The welfare gain associated with moving from the limited knowledge to the full information case can be interpreted as the upper bounds for the social cost of financial illiteracy regarding the Social Security rules. We find that the proportion of individuals who benefit from better information increases with age. While 28 percent of individuals at age 40 benefit from increased knowledge of Social Security rules, by age 60 this proportion reaches around 95 percent of individuals. At all ages, those who benefit from better information are willing to pay a sizable proportion of their wealth (more than 50 percent) to have access to the best information possible.

The next section discusses the results of our 2007 and 2008 surveys. Section 3 presents the dynamic model that we use to assess the welfare consequences of lack of knowledge. It also discusses the estimation of the model and the results of our analysis. The final section of the paper presents concluding remarks, including a discussion of possible strategies that might increase people's knowledge of Social Security rules.

## **2 Results from the Surveys on Social Security Knowledge**

In this section, we present results of two telephone surveys, conducted in August 2007 and December 2008, respectively<sup>2</sup>. The surveys included about 20 questions on respondents' knowledge of several rules that affect their Social Security benefits, such as the age of early and normal retirement and the reduction factors with respect to the normal retirement age. They also included a standard battery of socio-economic and demographic questions, as well as health and longevity expectations questions. The first survey collected information from 500 respondents. A randomly

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<sup>2</sup>Both surveys were conducted through Stony Brook's Center for Survey Research. The first survey was funded by a Seed Grant from the Office of V.P. of Research at Stony Brook. The second survey was funded by the Michigan Retirement Research Center.

chosen sub-group of these respondents were given the correct answer to one of the Social Security rule questions on the survey and re-interviewed during follow-up survey. The second survey had 507 respondents, 179 of which were re-interviews. The results from these surveys show that there is significant variation in people's knowledge of Social Security rules. Here we discuss responses to some of the questions and analyze how the level of knowledge varies by age, education and income categories.

Table 1 presents the break-down of responses to the question regarding the Early Retirement Age. These results show that only 48 percent of respondents in the pooled dataset answered this question correctly. Table 1 also shows that the percentage of respondents providing the correct answer to this question varies considerably over the two surveys. In the 2007 survey, only 42 percent of the respondents knew the correct early retirement age, while 54 percent of those interviewed in 2008, excluding the re-interviewees, gave the correct answer. This considerable improvement from 2007 to 2008 may be due to the fact that 2008 was an election year, in which some discussions of Social Security reached the national debate. There is some re-interview effect for this question, with 56 percent of those re-interviewed in 2008 providing the correct answer, but this effect is fairly small. As expected, we observe significant variation in the percentage of individuals answering correctly by age categories. According to the 2008 survey, the percentage of correct responses varies from around 20 percent among those 18 to 34, to around 72 percent for the 55-64 age category. The variation with respect to income is considerably lower.

Figure 1 focuses on the responses to the question on the Normal Retirement Age, NRA (also known as the Full Retirement Age). These results suggest that people have a better knowledge of the normal retirement age compared to their knowledge of the early retirement age. Figure 2 shows the correct responses to the question on the Maximum Retirement Age, the age at which one can claim Social Security retirement benefits so that Social Security will adjust benefits upward. It shows that the knowledge of the maximum retirement age is quite low with only 23 percent of respondents in both years providing the correct answer of 70. Figure 2 also shows a prominent increase in the percentage of correct answers among re-interviewees to 45 percent. The sharp

increase in correct answers in 2008, which is present in Table 1, does not appear in Figures 1 and 2, suggesting that the 2008 election explanation might apply to only simpler issues, such as the early retirement age. Figure 3 reveals a low level of knowledge regarding the minimum eligibility requirements to receive retirement benefits. 23 percent in 2007 and 21 percent in 2008 knew the minimum number of working years. There is again a clear re-interview effect with 33 percent of re-interviewees providing the correct answer.

Figures 4 and 5 deal with a more complex provision, that of the earnings test. Figure 4 shows the responses to the following question: If you earned \$10,000 in a given year from working after you began receiving Social Security Retirement Benefits at age 62, do you think your Social Security benefits would be reduced? Figure 5 asks a similar question but with the income level \$20,000. We find that 39 percent of those interviewed in 2007 provided the correct answer to the first question. We observe a natural improvement in the second question (Figure 5), which may be due to the fact that the natural progression of the two questions provides some information to respondents. Overall individuals do not do much better than a simple coin toss. The re-interviewees again have a higher percentage of correct answers.

One of the advantages of this survey is that it is not limited to an older subpopulation, so we can assess people's knowledge of Social Security over an entire age profile. Figures 6 to 9 present how the knowledge of Early and Maximum Retirement Ages changes with age and educational categories. As expected in both dimensions, respondents' knowledge improves with age and education increases. We observe a time effect when comparing 2007 and 2008, but it is mostly due to the re-interviewees, who are grouped together with the 2008 in these figures. Only 65 percent of the respondents aged 55 to 64 in 2007 knew the early retirement age, suggesting that the lack of knowledge on Social Security rules is not only prevalent among younger age groups. The knowledge of the Maximum Retirement Age is also surprisingly low among individuals nearing retirement with only around 33 percent of those in the 55 to 64 age range providing the correct answer in 2007. Regarding the early retirement age, there is a clear improvement in knowledge between less than high school and high school graduate categories. Regarding the maximum retirement age, we observe

a sharp increase in knowledge for the college graduates. We expect higher educational categories to exhibit significantly greater knowledge of more complicated questions such as the maximum retirement age.

Figures 10 and 11 explore the relationship between knowledge of Social Security rules and income. Here the results are much less clear, with only those who made over \$100,000 having greater knowledge of the rules than the rest. The results also suggest that those who benefit the most from the re-interviews are the lower income categories, which is quite encouraging as a policy conclusion.

These descriptive results from the two surveys show that the general level of knowledge of some of the simpler Social Security rules is quite low, even among older, educated and higher income individuals. The level of knowledge declines as the type of information increases in complexity. The results present a clear re-interview effect, which is quite encouraging when we consider that the re-interviewed respondents were given the correct answer to only one questions, yet they systematically provided the correct answer to all questions. This result implies considerable promise of policy recommendations, which aim to encourage individuals to go and find out information about Social Security rules.

We find that 55.7 percent of the individuals who were already receiving some kind of government benefits, responded 'yes' to the question "Do you think that you should have had more information about possible changes to the system that could affect you?" This result suggests that the informational problems may have resulted in costs, which were observed by the individual ex post. In the next section, we explore the welfare consequences of the limited knowledge of Social Security rules.

## 3 The Dynamic Life-Cycle Model

### 3.1 Overview of Methodology

We characterize the individual's problem using a structural dynamic life-cycle model of retirement behavior under uncertainty. Our main objective in using such a model is to compute the welfare loss associated with having limited knowledge of the rules governing Social Security retirement benefits. While the evidence presented in the previous section suggests that people make retirement and savings decisions based on limited knowledge of Social Security rules, one has to assess the associated welfare costs to determine whether they are large enough to compensate an individual's cost of acquiring accurate information or the public cost of disseminating it. Therefore, a welfare analysis could shed light on the size of the welfare gains associated with acquiring more information about Social Security benefit rules.

A welfare analysis comparing retirement and benefit claiming behavior under different information structures is important from a policy perspective because it could be easily conjectured that the gains from acquiring all the necessary knowledge to behave optimally might be too small. In that case, most individuals could never compensate the cost of acquiring such knowledge. If on the other hand, we find that the gains from having good information are large, then it brings about new research questions, such as whether the costs of acquiring information are very large or whether the individuals are misperceiving the welfare gains they could be enjoying. In any case, large welfare gains would provide support for policies that are targeted at increasing public's understanding of the system.

Our basic approach consists of comparing individuals' welfare under full information to their welfare when they have limited information about Social Security rules. The full information characterization of our model assumes that an individual has perfect knowledge of all the retirement incentives in the Social Security system. We then present a departure from the full information assumption and assume that agents do not know the rules of the Social Security system. In the limited information case, we assume that they use the average claiming behavior in the population

as a probabilistic determinant of when to claim Social Security benefits.

In this framework, individuals choose how much to consume and save in each period, how much to work, when to retire and when to claim benefits. Therefore, the structural nature of our model allows us to predict individuals' labor supply, benefit initiation and receipt, earnings, as well as wealth accumulation and consumption decisions. The dynamic nature of the model allows us to follow changes in wealth accumulation and labor supply decisions over time. When people make decisions under imperfect knowledge, they may change behavior and take corrective measures when they find out that their expectations diverge from actual realizations. If they realize that their expectations of benefits are different from their actual benefits, they may accelerate wealth accumulation or postpone retirement. The structural approach employed in this paper also allows us to control for the possible endogeneity of information on Social Security. An individual's information on Social Security may have been endogenously determined based on his/her cost of acquiring information. Therefore, we incorporate into the model the individual's cost of knowledge acquisition, which is likely to vary with education and income.

Our model builds upon an established framework to analyze retirement behavior, which is originally designed to model the complete set of incentives provided by the Earnings Test and the Actuarial Reduction Factor (ARF) adjustment. In particular, it is closely related to models presented in Rust and Phelan (1997), Benítez-Silva, Buchinsky, and Rust (2003, 2006), Benítez-Silva and Heiland (2007), and Benítez-Silva et al. (2009). Rust and Phelan (1997) do not model consumption and savings decisions, but they estimate the parameters of the model using a Nested Fixed-Point algorithm instead of calibrating them. Benítez-Silva, Buchinsky, and Rust (2003, 2006) model the Social Security Disability Insurance decisions in addition to the OASI incentives. Benítez-Silva, Buchinsky, and Rust (2003, 2006), Benítez-Silva and Heiland (2007), and Benítez-Silva et al. (2009) present models where parameters are calibrated to match aggregate data as well as household level data from the Health and Retirement Study. Our model also shares a number of characteristics with the work of French (2005), van der Klaauw and Wolpin (2008), and Blau (2008), among others who solve, simulate, and in some cases estimate, dynamic retirement models

under uncertainty.

The model presented here contributes to the existing literature by incorporating different informational structures that describe the incomplete information regarding Social Security rules. Unlike the structural model developed in the present paper, these earlier models (or any other structural models we are aware of) do not assess the consequences of different informational structures. We also add uncertainty about future employment. This latter addition is necessary for the full information model to match the data.

### **3.2 Description of the Benchmark Model – the Full Information Case**

We assume that individuals maximize the expected discounted stream of future utility, where the per period utility function  $u(c, l, h, t)$  depends on consumption  $c$ , leisure  $l$ , health status  $h$ , and age  $t$ . We specify a utility function for which more consumption is better than less and with agents expressing a moderate level of risk aversion. We assume that the utility of leisure (equivalently, disutility of work) is an increasing function of age, is higher for individuals who are in worse health compared to those in good health, and is lower for individuals with higher human capital measured by the average wage. In addition, we assume that the worse an individual's health is, the lower their overall level of utility is, holding everything else constant. Moreover, we assume that individuals obtain utility from bequeathing wealth to heirs or to institutions after they die. This model assumes that individuals are forward-looking and discount future periods at a constant rate  $\beta$ , assumed here to be equal to 0.96. The model also allows for a variety of sources of uncertainty, like lifetime uncertainty, health uncertainty, wage uncertainty, and employment uncertainty. The latter is an innovation of this paper with respect to those we are directly building upon. To model this uncertainty, we use the empirical distribution of transitions from employment to unemployment using the CPS from 1986 to 2006.

Any person who is not already receiving Social Security Old Age benefits is eligible to apply for Old Age and Survivors Insurance (OASI) benefits. Individuals with at least 40 quarters of earnings covered for OASI before reaching their 62<sup>nd</sup> birthday are eligible to apply, and benefit

award is guaranteed. In the present version of the model, we allow decisions to be made on an annual basis and assume no lag between application date and date of first receipt.

Calculation of benefits and the reduction factors are as explained in Benítez-Silva and Heiland (2007), assuming a normal retirement age (NRA) of 66. In particular, the number of checks received in a year depends on the earnings after claiming: The number of checks (or the benefit amount on some checks received towards the end of the period) are reduced, reflecting the 50 percent rate on labor incomes exceeding the Earnings Test limit between 62 and the January of the year a person turns 66 (33 percent thereafter). In other words, adjustments to benefits and ARFs occur in accordance with the earnings and the Earnings Test limit, and we do not consider the possibility that beneficiaries ask Social Security for a reduction of benefits or return benefits received. Even though we set up an annual decision-making process, the Social Security Earnings Test is enforced semiannually; that is, the benefits received by a beneficiary are adjusted, after reaching the NRA, for the earnings in excess of the Earnings Test limit, as long as six months or more of benefits were withheld in the years between the early and normal retirement ages.

We solve the dynamic life-cycle model by backward induction and by discretizing the space for the continuous state variables using data from the Health and Retirement Survey. Individuals are assumed to enter the labor force at the age of 21, and the terminal age is assumed to be 100. Individuals aged 21 through 61 make leisure and consumption decisions in each period, while those aged 62 to 70 individuals decide on leisure, consumption, and application for OASI benefits. Their choices at the beginning of each period are denoted  $\{l_t, c_t, b_t\}$ , where  $l_t$  represents *leisure*,  $c_t$  is *consumption*, and  $b_t$  denotes the individual's Social Security *benefit* claiming decisions. We assume that all individuals older than 70 have claimed benefits, and only consumption and leisure choices are possible for this age group. Based on the assumption that a full-time job requires 2,000 hours per year and a part-time job requires 800 hours per year, we normalize leisure to 1, where  $l_t = 1$  means that 100 percent of the waking time is spent not working.  $b_t$  is assumed to take on two values.  $b_t = 1$  if the agent has initiated the receipt of benefits, and  $b_t = 0$  if the individual has not filed for benefits or is not eligible.

If benefits are claimed before the NRA, the monthly benefit amount is reduced according to the current regulation of the Old Age program. For a NRA of 66 years, the monthly benefit amount is reduced by a factor 75 percent if claimed at 62, 80 percent if claimed at 63, 86.67 percent if claimed at 63, and 93.33 percent if claimed at 65. In addition, we use an annual Earnings Test limit of \$12,480 between 62 and 65, when benefits are reduced at a rate of \$1 for every \$2 earned above the limit. Between 65 and 66, benefits are reduced at a rate of \$1 for every \$3 earned above a limit of \$33,240<sup>3</sup>. Those claiming after 66 earn the delayed retirement credit. We model it following the rates faced by the 1943–54 cohorts, which receive 0.67 percent credit for each month not claimed between age 66 and 70.

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. 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 percent Social Security payroll tax.

The *state* of an individual at any point during the life cycle can be summarized by five state variables: (i) current age  $t$ ; (ii) net (tangible) wealth  $w_t$ ; (iii) the individual’s Social Security benefit claiming state  $ss_t$ ; (iv) the individual’s health status,  $h_t$  and (v) the individual’s average wage,  $aw_t$ . There are 15 discretized wealth states, 8 discretized average wage states, and 3 health states.  $ss_t$  can take up to 14 mutually exclusive values between 62 and 66 and an additional four values between 67 to 70.  $ss_t = 0$  represents being not entitled to benefits and represents being entitled to benefits at the ERA.  $ss_t = 62.5, 63, 63n, 63.5, 64, 64n, \dots, 65.5, 66, 66n$  correspond to the level of benefits that individuals will receive when they reach the NRA.

We assume that the individual’s utility is given by

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

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<sup>3</sup>These numbers reflect the 2006 limits.

where  $\phi(t, h, aw)$  is a weight that can be interpreted as the *relative disutility of work*. We use the same specification for  $\phi$  and the disutility from working as in Benítez-Silva, Buchinsky, and Rust (2006). We postulate that in general higher wage workers have better working conditions than lower wage workers, whose jobs are more likely to involve less pleasant, more repetitive tasks involving a higher level of physical labor. Therefore, we assume that the disutility of work decreases with average wage. The disutility of effort also increases with age and is uniformly higher for individuals with worse health. 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 parameter  $\gamma$  represents the individual's level of risk aversion. We use  $\gamma = -0.37$ , which corresponds to a moderate degree of risk aversion. As  $\gamma \rightarrow 0$ , the utility of consumption approaches  $\log(c)$ ; therefore, individuals are assumed to be slightly more risk averse than that implied by logarithmic preferences.

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

One of the computational challenges associated with such a dynamic, discrete, life-cycle model is that one has to keep the entire past earnings history as state variables. To circumvent this problem, we follow Benítez-Silva and Heiland (2007) and approximate the evolution of average wages in a Markovian fashion; that is, period  $t + 1$  average wage,  $aw_{t+1}$ , is predicted using only age,  $t$ , current average wage,  $aw_t$ , and current period earnings,  $y_t$ . We assume that the average wage

follows the Equation below:

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

This computational simplification allows us to accurately model the Social Security rules in our dynamic programming model with a minimal number of state variables.

The sequence of observed wages is then used as a regressor in estimating the following regression of annual earnings:

$$\log(y_{t+1}) = \alpha_1 + \alpha_2 \log(aw_t) + \alpha_3 t + \alpha_4 t^2 + \eta_t \quad (3)$$

This equation describes the evolution of earnings for full-time employment. Part-time workers' earnings are prorated based on the 800 working hour rule that is, part-time earnings are  $0.8(800/2000)$  of the full-time wage level given in equation (3). The factor of 0.8 represents the lower rate of pay earned by part-time workers compared to the full-time rate. The advantage of using  $aw_t$  instead of the actual Average Indexed Earnings (AIE) is also apparent in the above equation.  $aw_t$  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.

Finally, this model incorporates the fact that benefits are reduced a different actuarial reduction factors before and after the NRA. The details of these adjustments can be found in Benitez-Silva, et. al (2009).

The simulations of this benchmark model with full information about the Social Security rules are broadly consistent with empirical evidence on a variety of measures. It matches the observed data on claiming behavior in the United States. Table 3 shows the proportion of retirement claiming by age predicted by the model compared to the actual data using the Statistical Supplement to the Social Security Bulletin in its 2007 edition, which uses 2006 data. It shows how well the model

does in replicating the data, with only an over-prediction of claiming at age 63 compared with the Supplement.

Of course, this fairly accurate prediction is accomplished with a host of assumptions, chief among them the fact that individuals know, understand, and optimally respond to the complex set of rules of the U.S. Social Security system. This assumption is clearly at odds with the evidence we presented in the previous section.

### **3.3 Extension to the Limited Information Case**

Our decision on how to model the departure from the full information case depends on the computational burden that the departure will bring. Although there are many possible informational structures we could set up, not all of them are easy to incorporate in our framework.

We have chosen to model the partial information case using the framework of unawareness<sup>4</sup>. Unawareness is a distinct framework than that of incomplete information. Generally speaking, under incomplete information individuals aggregate all possibilities without differentiating them (for example assuming that the adjustments for early and late retirement are identical), resulting in biased assessments of the trade-offs that they face. On the other hand, under unawareness, they completely ignore some of the possibilities, and thus cannot exploit any relevant information.

The characterization that we explore is an extreme case of unawareness, in which individuals do not know anything about the details of the system, and they decide when to claim Social Security benefits based on what they observe others to be doing. This means that agents do not behave optimally, and do not take into account their state variables when making decisions. Instead they behave like the average person in the population, following the optimal distribution of claiming, conditional on not having claimed before. For example, when an individual reaches age 62, he/she does not know what is optimal for him or her to do but knows that around 52 percent of those

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<sup>4</sup>The following papers provide more information on awareness: Fagin and Halpern (1988), and Modica and Rustichini (1994, 1999) introduce new logics for belief and knowledge to differentiate full awareness and partial awareness. Heifetz, Meier and Schipper (2006) and Li (2006a) characterize multi-person information structures with unawareness. Feinberg (2004, 2005), Heifetz, Meier and Schipper (2007), Li (2006b), Rego and Halpern (2007) define solution concepts for games with unaware players.

who reach that age and are eligible claim at that age. Therefore, he/she choose to probabilistically match that average. The unawareness framework that we use in our model is partially supported by the empirical evidence revealed by the two surveys discussed earlier. For example, Figures 2 and 3 show that a significant percentage of respondents replied “Don’t Know.” In our model, we assume that such individuals make retirement and claiming decisions based what they observe others to be doing.

We re-solve and re-simulate the model under this new structure in which individuals copy those around them instead of computing their optimal choice. The actual implementation of this informational structure in the dynamic model is technically complex since a probabilistic set of actions is hard to model. In addition, it forces us to solve the model under the assumption that individuals claim as early as possible when they reach an age without having claimed before, but only get the continuation value of having claimed following the empirical distribution of the optimal behavior. In the simulations of the model, it is a bit easier since we just compare probabilistic draws with the average claiming hazard implied by optimal behavior.

Since the model under incomplete information assumes that individuals choose to behave like the average person, the benchmark full information model and the incomplete information model yield identical claiming behavior. However, there exists a difference in welfare between the two cases because under the incomplete information structure, individuals ignore some of their information and trust the people around them to decide what is optimal for them. These welfare differences represent the willingness to pay of individuals to avoid movement from the full-information case to the sub-optimal case of limited information.

The comparison of individuals’ welfare in full information and partial information cases allow us to compute the welfare gain resulting from moving from unawareness to the full information solution. Using this approach, we also compute bounds for the social cost of financial illiteracy regarding the Social Security rules, and at the same time provide a policy tool for the government when considering policy interventions about information issues regarding the social insurance system.

Our initial findings indicate that the welfare improvement from having access to complete information varies by age. This result is since the gains from a better informational structure many years into the future are small. On the other hand, for those close to retirement the gains are very large, and most of them benefit from the better structure.

We find that 95 percent of those who reach age 60 would have to be compensated with more than 50 percent of their wealth in order to move to the sub-optimal informational structure, indicating that they value the information on Social Security rules tremendously. This result is plausible since they are very close to retirement age, and whether they make the right decision or not has a large effect on their welfare. However, only 28 percent of those who reach age 40 value the complete information structure, but those who do value it, do it as much as the 60 year old agent. The percentage of those who benefit from increased knowledge of the Social Security system goes up to 32 percent at age 50, and again the welfare gain is very large for those who value it.

These results, while preliminary, are consistent with the responses to the two surveys that are discussed in the previous section. Younger individuals are less likely to acquire information on Social Security rules because they are less likely to gain from the better information. On the other hand, those who benefit from better knowledge of Social Security rules experience relatively large welfare gains at any age.

## **4 Conclusion**

This paper is one of the first studies that we are aware of, which investigates the implications of people's knowledge of Social Security rules on their wealth, retirement outcomes, and welfare using a structural life-cycle model. The methodology employed in this paper allows us to go beyond documenting the extent of the knowledge within the population regarding the rules of the Social Security system. It allows us to provide, in a life-cycle framework, a formal characterization of the role of information on Social Security rules in the individual's decisions-making and the welfare costs associated with limited information of the system.

In this version of the paper we have chosen a particular sub-optimal informational structure to compare with the full-information case, but many others are possible, and it is debatable which informational structure should be chosen to more accurately perform the welfare gains from informational investments. It seems to us that faced with this situation it would be ideal to show a range of welfare calculations depending on the informational assumptions we make. This is what we hope to do in future versions of this work.

We believe it is a natural extension of our work to consider how individuals learn about the incentive structures of the system. The survey results show that there is considerable learning among re-interviewees, which suggests that the initial interview itself may piqued the interests of the respondents, encouraging them to acquire information about Social Security rules. Therefore, it is potential to realize considerable gains in educating the public about the incentives built into the Social Security system by relatively small investments that float questions among the population.

We also find considerable heterogeneity in the information structure of individuals as well as the welfare gains associated with perfect information. For example, the size of the welfare gains associated with having a better knowledge of the Social Security rules varies with age. Social Security can exploit this heterogeneity to reach the population with more targeted messages by customizing the Social Security statement so different information is highlighted for different age or education groups.

Finally, while we considered a particular departure from the perfect information case in this paper, our framework can be used to calculate welfare costs of making decisions under different informational structures. Such calculations are important in determining the potential net value of any policy or investment that is aimed at increasing the public's knowledge of the Social Security system.

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## Tables and Figures

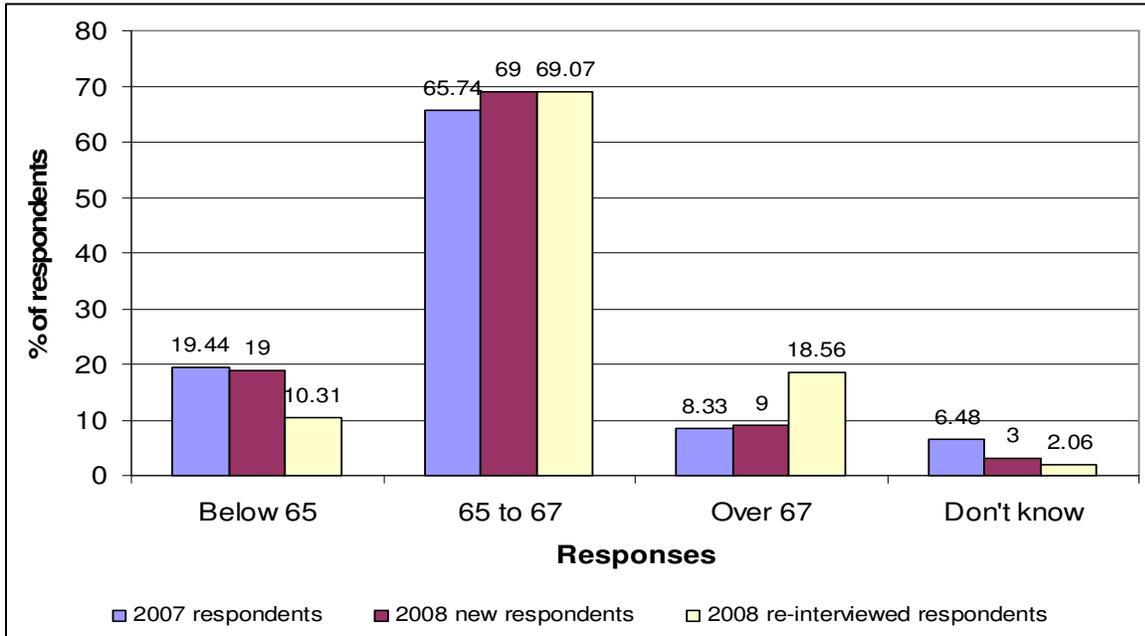
**Table 1. Responses to the question: *What is the youngest age at which an eligible worker can apply for his or her own Social Security retirement benefits? (by type of respondent)***

Response	Sample			Total
	2007 respondents	2008 new respondents	2008 re-interviewed respondents	
Less than 50	9.57%	7.5%	6.19%	8.37%
51 to 61	19.14%	15.5%	15.46%	17.39%
<b>Exactly 62</b>	<b>41.98%</b>	<b>54%</b>	<b>55.67%</b>	<b>47.99%</b>
63 to 64	2.47%	3%	1.03%	2.42%
Exactly 65	15.43%	10%	13.4%	13.37%
Over 66	5.56%	6%	7.22%	5.96%
Don't know	5.86%	4%	1.03%	4.51%
# Obs.	324	200	97	621

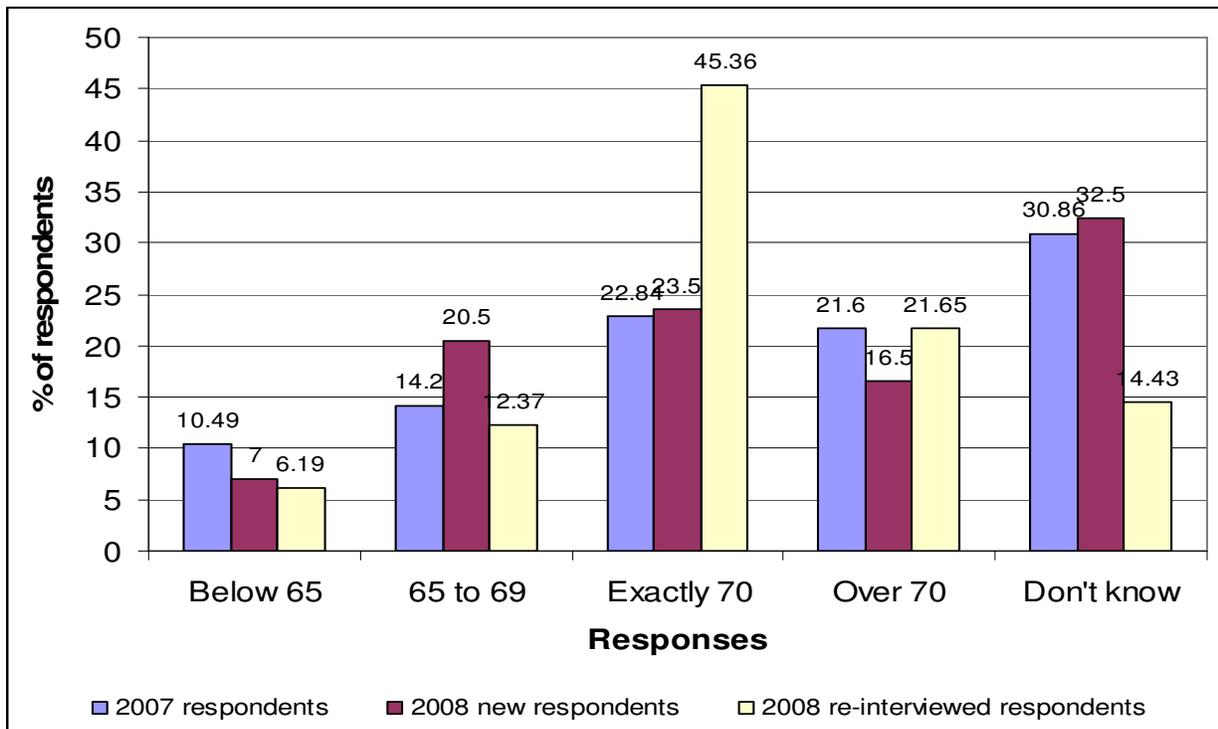
**Table 2. Actual vs. Simulated Retirement Claiming**

Age	Actual (%)	Simulated (%)
62	53.8	52.93
63	8.56	15.84
64	10.4	11.16
65	22.3	17.82
66+	2.7	2.22

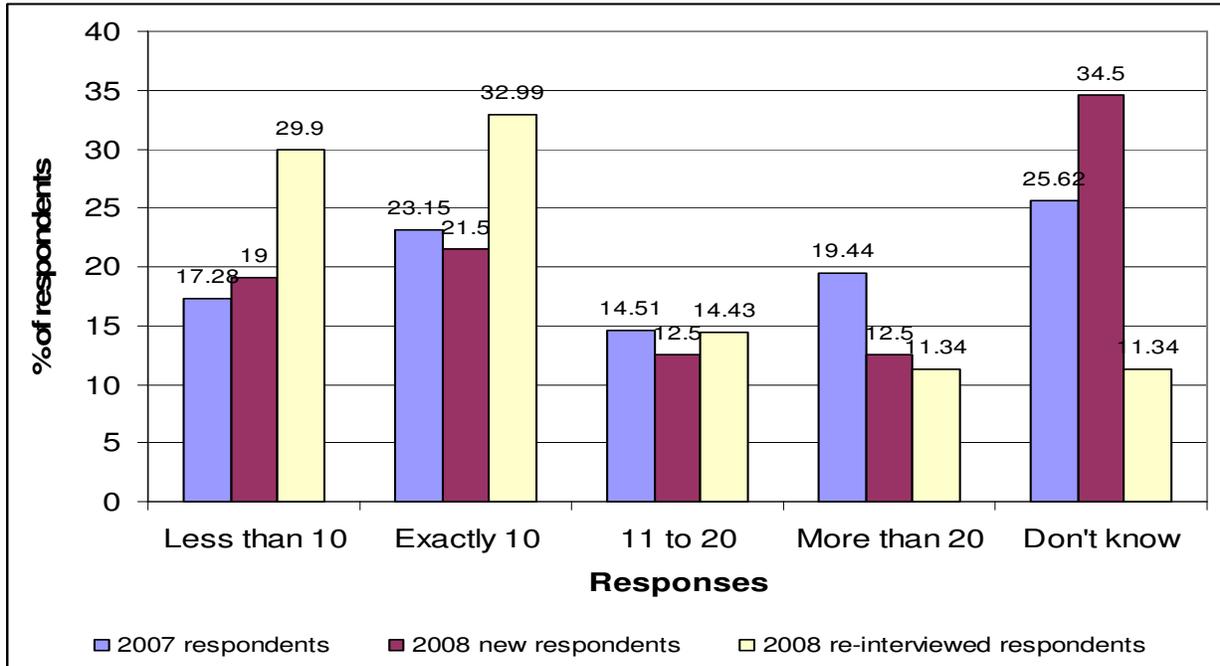
**Figure 1. What is the earliest age of retirement at which Social Security would pay you full, unreduced benefits?**



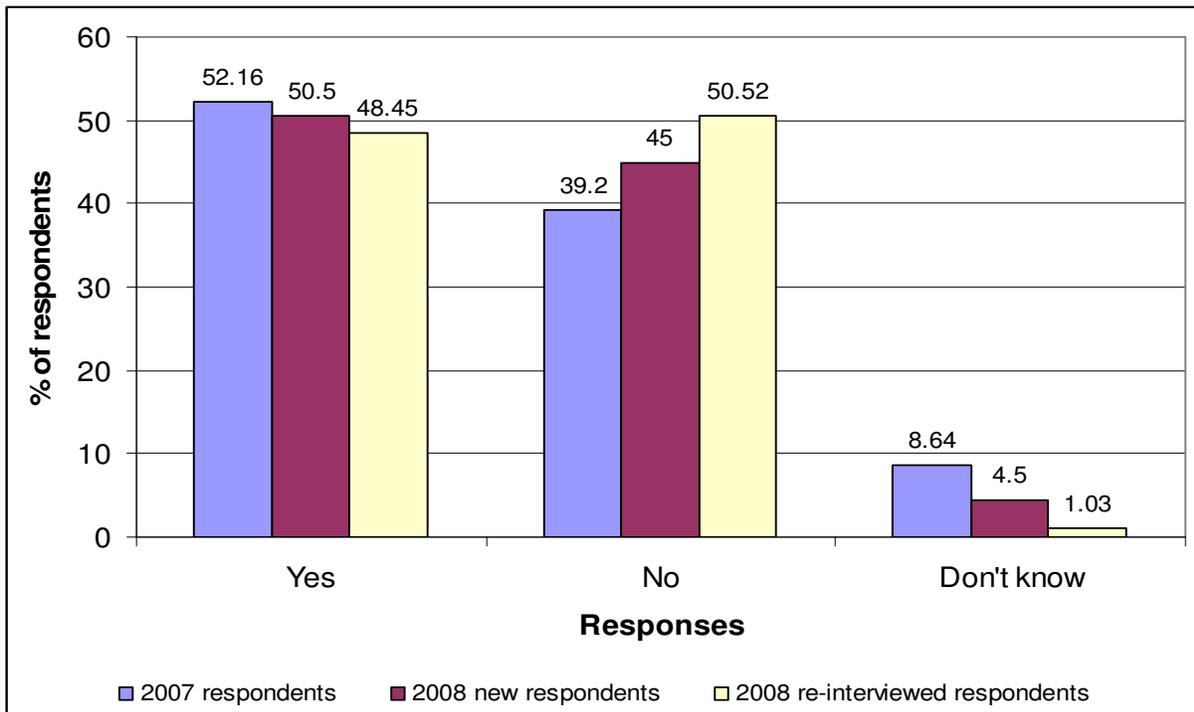
**Figure 2. What is the maximum age at which you can claim Social Security retirement benefits so that Social Security will adjust your benefits upward [because of the delay in claiming benefits]?**



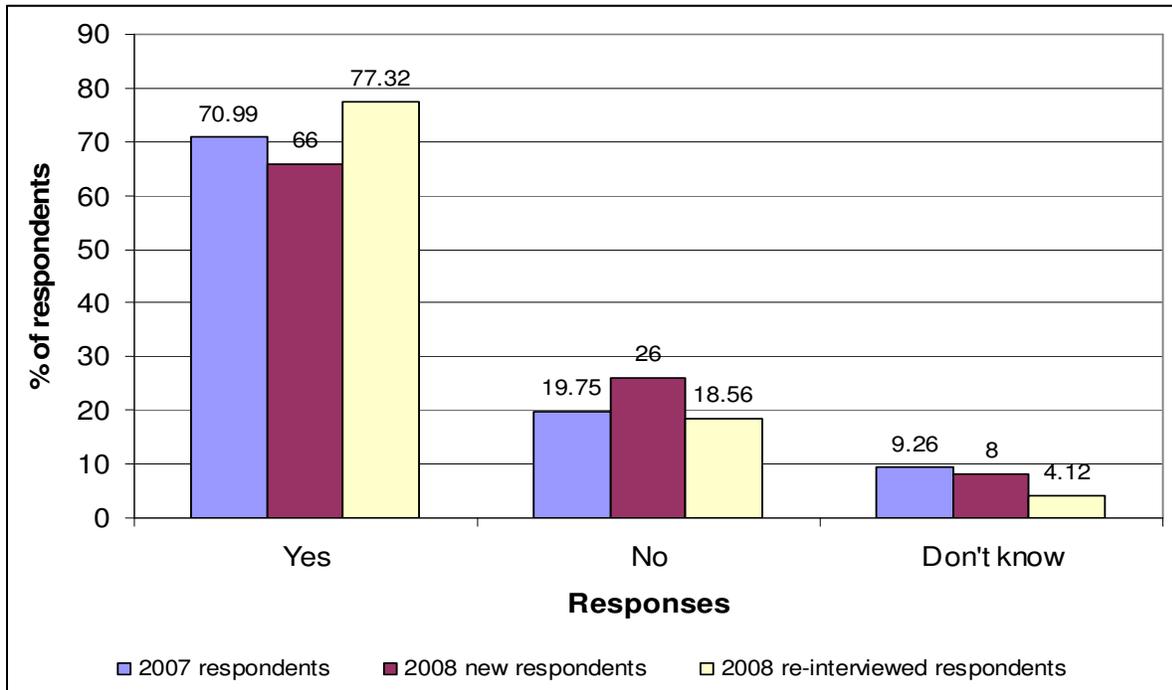
**Figure 3. What is the minimum number of working years that qualify you to receive Social Security Retirement Benefits?**



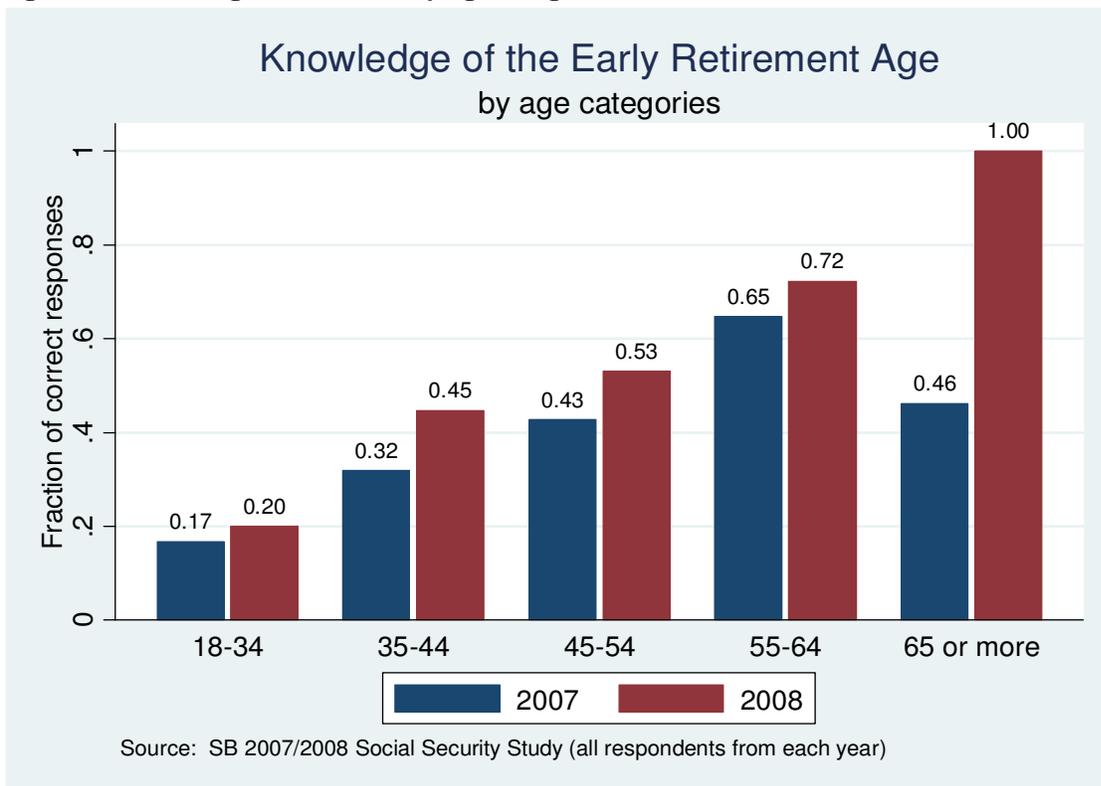
**Figure 4. If you earned \$10,000 in a given year from working after you began receiving Social Security Retirement Benefits at age 62, do you think your Social Security benefits would be reduced?**



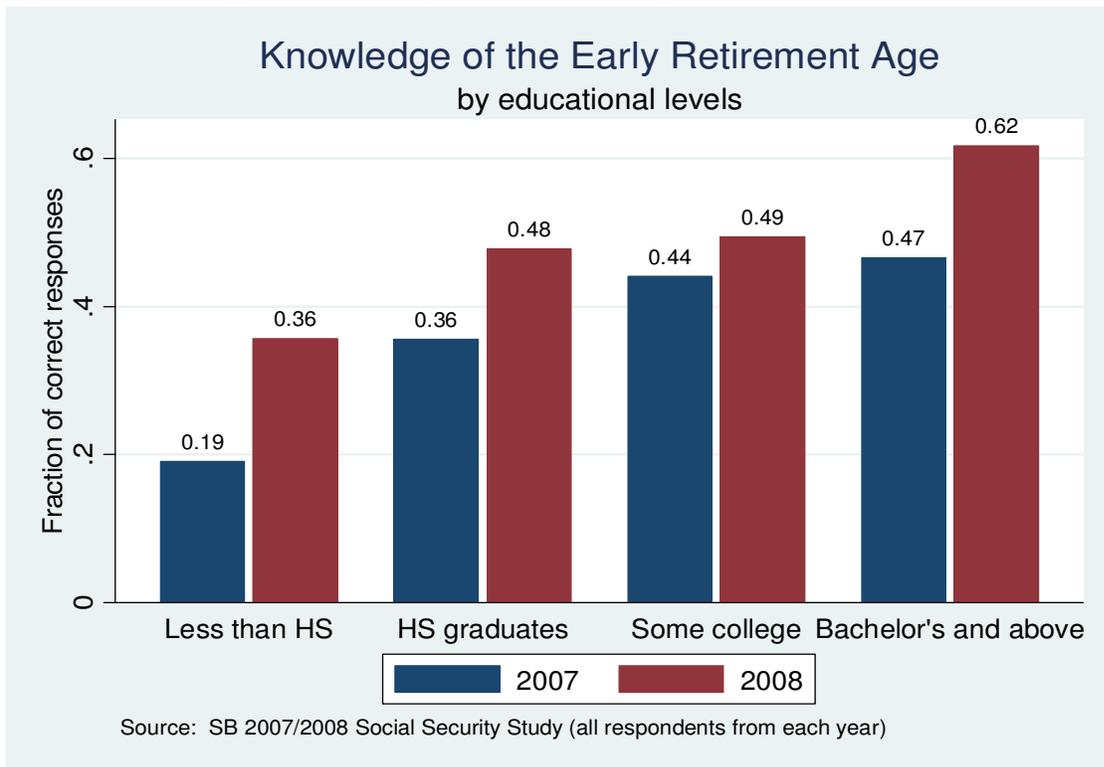
**Figure 5. What about if you earned \$20,000 in a given year from working after you began receiving Social Security Retirement Benefits at age 62, do you think your Social Security benefits would be reduced?**



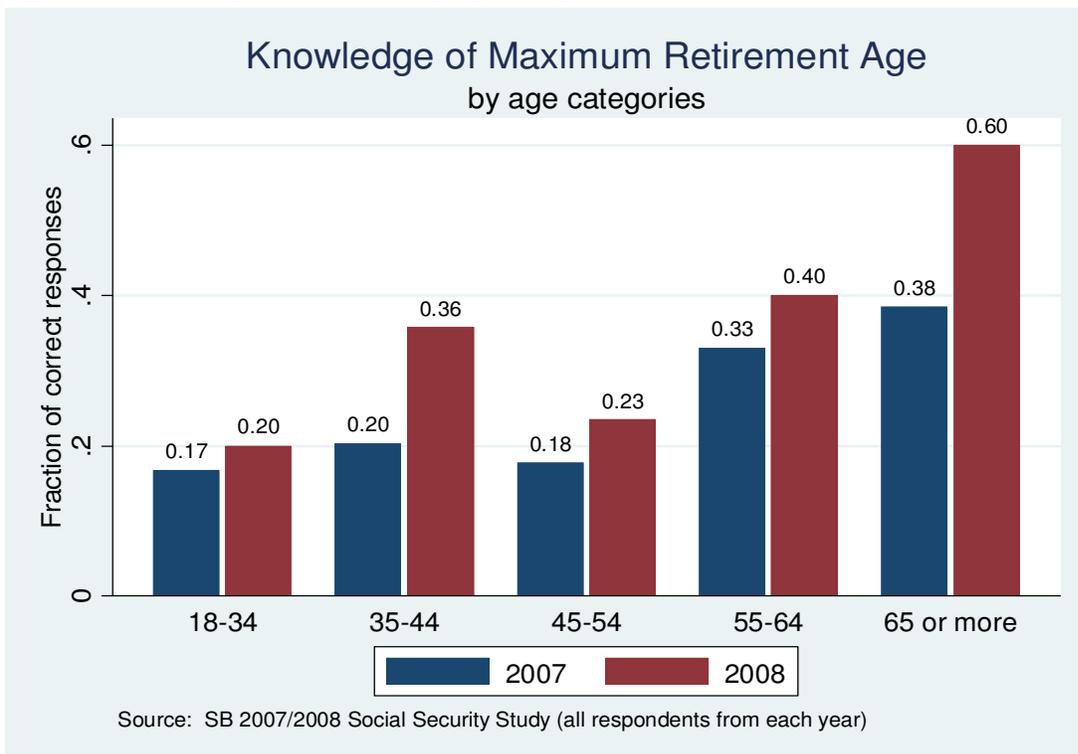
**Figure 6. Knowledge of the ERA by age categories**



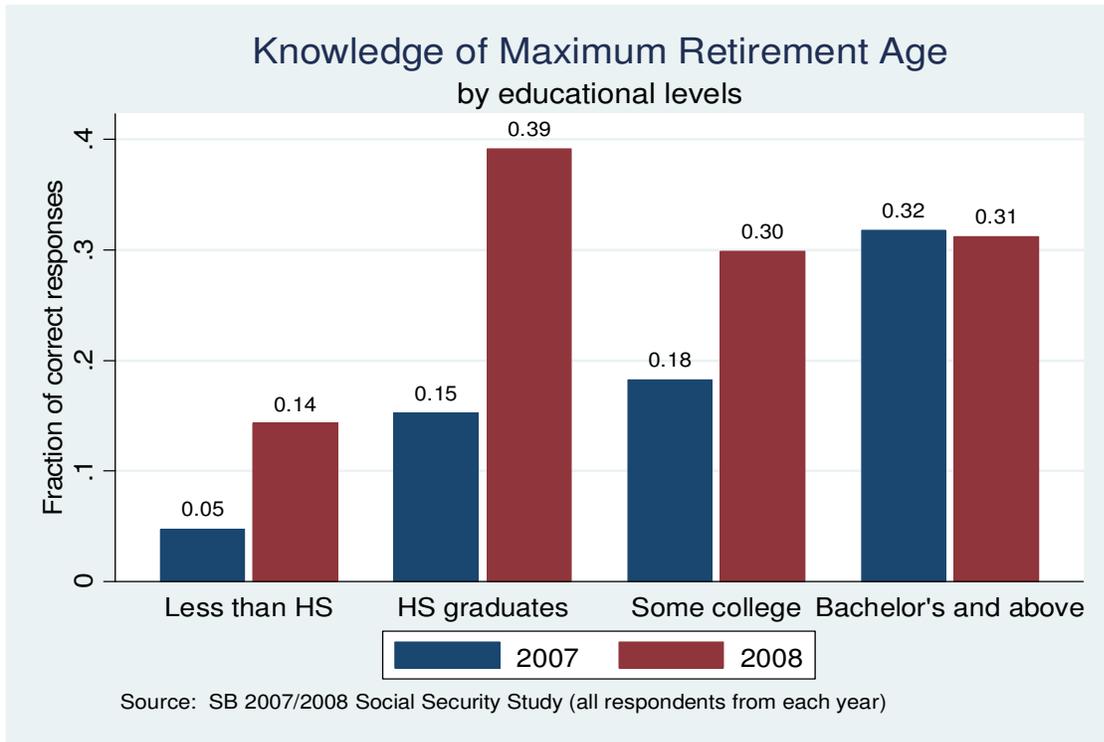
**Figure 7. Knowledge of the ERA by Educational categories**



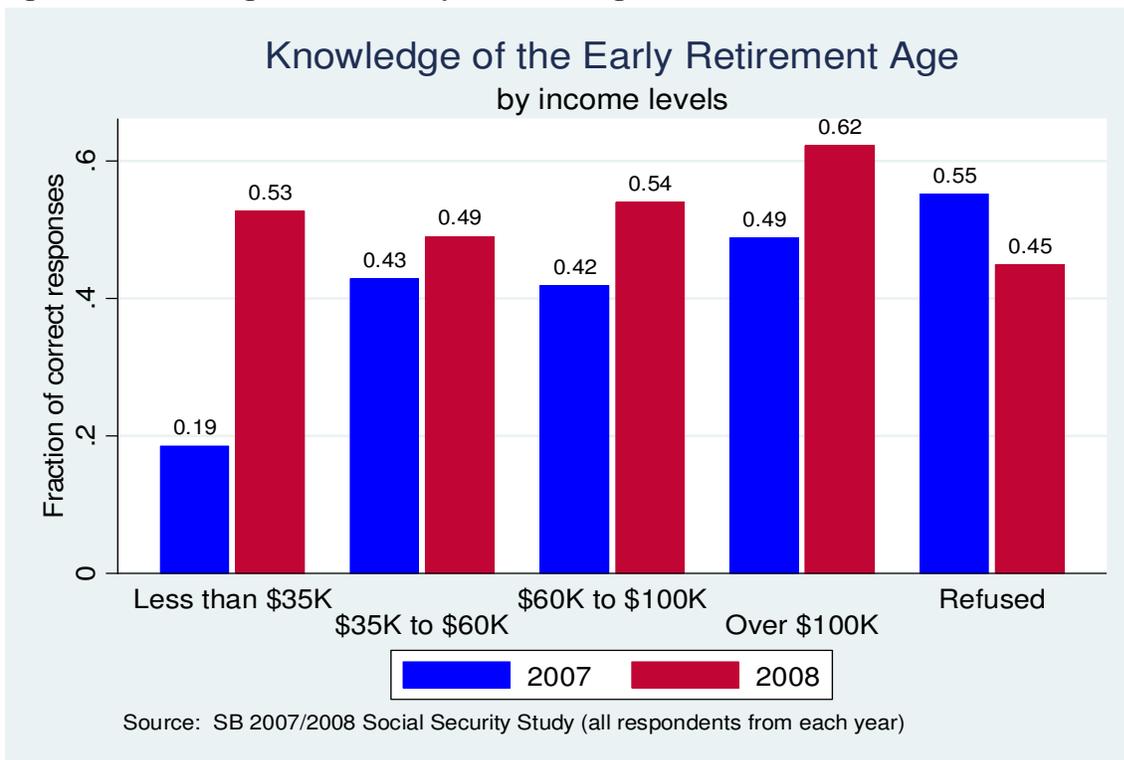
**Figure 8. Knowledge of the MRA by age categories**



**Figure 9. Knowledge of the MRA by educational categories**



**Figure 10. Knowledge of the ERA by Income categories**



**Figure 11. Knowledge of the MRA by Income categories**

