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Trends In Male Labor Force Participation And Retirement: Some Evidence On The Role Of Pensions And Social Security In The 1970's And 1980's

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ABSTRACT

This paper estimates the effects on steady state retirement by men of changes in pension plans and social security in the 1970's and 1980's. Work incentives associated with pension coverage and plan characteristics are calculated primarily from the 1969-79 Retirement History Study and the 1983 and 1989 Surveys of Consumer Finances. Simulations with a structural retirement model suggest that the long run effects of changes in pension plans and social security account for about a quarter of the reduction in full-time work by men in their early sixties, but none of the trend for those age 65.

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I. Introduction.

The trend to lower labor force participation by older males is one of the strongest labor market trends witnessed in recent years.[1] In 1947, almost 55 percent of married males over 65 were in the labor force, but by 1985 that figure had fallen below twenty percent, thus reducing the participation rate of this group by almost two-thirds in the post war period. For those age 55 to 64, the trend started later. As late as 1957, 90% of married males between 55 and 64 were still in the labor force. But by 1985 the figure had fallen below two-thirds.[2]

There are many potential and not mutually exclusive contributions to this trend. First, real wages have been increasing, particularly in the period before 1980. Over extended periods of time, workweeks have grown shorter and the period in retirement has grown longer as living standards have increased. Secondly, pensions and social security have changed in recent decades in ways which may be expected to encourage early retirement. Indeed, Quinn, Burkhauser and Myers (1990, p. 233) conclude that "Circumstantial evidence points to our public and private retirement income systems as likely influences [to earlier retirement]." Third, the disability program grew more generous, particularly before 1980, and this might have encouraged earlier

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[1]The labor force participation for older women exhibits little discernable trend (Anderson, Gustman and Steinmeier, 1994). For that reason, and because the Retirement History Study, which we use to gather information on pensions at the beginning of the 1970's, lacks a representative sample of women, our analysis is confined to analyzing trends in labor force participation and retirement of men.

[2]These statistics are derived from the Current Population Survey, Bulletin 2307, Table C-10 and the Statistical Abstract of The U.S., 1991, Table 641. There is some evidence that the trend levelled off in the late 1980's. Based on CPS data, the labor force participation rate for 55 year old men was 79% in 1985 and 81% in 1991. Over the same period, the rate for 60 year old men rose from 66% to 67%, and for 65 year olds, it remained the same at 26%. Since early 1991, though, retirement rates have again been increasing.

retirement by older less healthy workers. Fourth, preferences for retirement may have changed, perhaps because younger cohorts did not grow up in the same environment as older cohorts, or because opportunities for leisure have multiplied and made retirement more attractive.[3] Fifth, as argued by Peracchi and Welch (1994), the structure of jobs may have shifted in such a manner as to emphasize jobs with typically lower retirement ages. Other explanations involving health insurance and other factors are also possible.

As suggested by the title, this paper is concerned with assessing how important pensions and social security have been in the trend toward earlier retirement. More specifically, the paper attempts to assess how the changes in social security and pensions during the 1970's and 1980's have permanently changed retirement behavior. By permanent change, we mean changes from one steady state to another, in contrast to transitory change, which reflects behavior as individuals adapt to changed circumstances. Transitory change may still be important over a limited period of time. As an example, the large unanticipated increase in the level of social security benefits during the 1970's increased assets of older workers and may well have induced some of them to retire earlier than they otherwise would have (Ippolito, 1990). However, transitory changes eventually die out, and it is the permanent effects which remain.

The analysis of the paper begins with a dynamic structural model which has previously been shown to track the peaks and valleys of retirement reasonably well.[4] Using this model, the

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[3]Changes in the price of leisure might generate a similar effect. See, for example, the work of Dora Costa (1996).

[4]The model is in Gustman and Steinmeier (1994a). Table 5 of that paper shows that the model does a good job of reproducing the observed retirement patterns of the original RHS cohort. For instance, the model predicts 12.0 percent of workers to retire from full-time work at age 62 and 22.0 percent at age 65, vs. 12.9 percent and 20.0 percent in the observed data.

retirement behavior of a random sample of individuals is estimated using the social security and pension plans typical for 1989. The results give the pattern of retirement ages reflecting a steady state for 1989 pensions and social security. Further simulations are done with the same individuals, using the same preferences and the same wage paths as before, but substituting the pension plans and social security rules typical of earlier periods. These simulations indicate how these same people would have chosen their retirement ages had they instead been subject to the earlier pension and social security plans. The difference between the simulations using the earlier plans and those using the 1989 plans suggest how much retirement behavior has been permanently affected by changes in the plans.

It should be clear that our analysis is not meant to explain the full change in retirement behavior in the 1970's and 1980's, but just that part of the change that is attributable to the permanent effects of changes in pensions and social security. The remainder of the change must be due to changes in wages, preferences, transitory effects, and the other factors listed at the beginning of this section. An alternative and perhaps more convincing way to conduct this analysis would be to estimate an all-encompassing model which would explain the complete change in retirement ages. In the context of such a model, it would tell the relative importance of pensions and social security in changing retirement. However, the kind of dynamic stochastic model necessary to investigate transitory effects and the effects of disability programs has yet to be estimated. Also, the data do not contain much information on the timing of the changes in pension plans that would be necessary for a stochastic analysis. Finally, to model changes in preferences as more than a residual is a daunting and controversial task. For all of these reasons, we forego an all-encompassing model and instead use a non-stochastic but dynamic structural

model to analyze just the permanent effects of changes in pensions and social security on retirement.

There are two main sources of data used in this study. The Retirement History Study (RHS) indicates the nature of pension plans in 1969, which is at the beginning of the period of study. It is also used to estimate the preference parameters which form the basis of the simulations. The Survey of Consumer Finances (SCF), which gathered detailed pension plan descriptions from employers in 1983 and 1989, serves the same purpose at the end of the period of study. This study also supplies the representative individuals used in the simulations, as discussed above.

When we estimate the permanent effect on retirement of changes in pensions and social security during the 1970's and 1980's, we find that this permanent effect is negative and equal to about a quarter of the observed reduction in retirement for individuals between the ages of 55 and 62. The remaining three quarters of the observed reduction is, by implication, due to changes in wages, preferences, transitory effects, and other causes. For the group older than 65, these other causes account for all of the trend toward increased retirement. This is because a central thrust of pension and social security policies has been not to increase retirement, but to make it more attractive to work beyond 65. These policies include a substantial increase in the social security delayed retirement credit for work retirement beyond age 65, and the recent requirement that pensions cannot deny service years to workers on the basis of age. These policies by themselves would encourage work and reduce retirement in the over-65 group, were they not overwhelmed by other factors working in the opposite direction.

The next section presents the analytical framework, introducing the structural retirement

model that will be used for the simulations. Section III describes the simulations and specifies how we calculate the appropriate budget constraints for the simulations. In Section IV we report the results of the simulations and calculate the percentage of the trend that can be explained by the permanent effect of changes in pensions and social security. Section V analyzes the robustness of the findings, and Section VI contains some concluding remarks.

II. The Analytical Framework.

The analysis of the role of pension and social security changes in fostering retirement trends begins with a previously estimated structural retirement model.[5] The lifetime utility function for the model is given by

$$U = \sum_t \left[\frac{1}{\alpha} C_t^{\alpha} + e^{X_t\beta + \epsilon} \frac{L_t^{\delta} - L_f^{\delta}}{1 - L_f^{\delta}} \right]$$

where C_t is consumption at time t and L_t is leisure at time t. Total available time (and hence leisure in retirement) is normalized to 1, and L_f is the amount of leisure at full-time work. This implies that $(L_t^{\delta}-L_f^{\delta})/(1-L_f^{\delta})$ will always be 0 for full-time work and 1 for retirement. ϵ determines the disutility of work, and δ determines the relative disutility of partial retirement work.[6] In the utility function, both ϵ and δ are taken to be individual fixed effects. X_t is a

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[5]Gustman and Steinmeier (1994a). This model is a modest variation of the one described in Gustman and Steinmeier (1986a and b).

[6]If δ is near unity, the disutility of partial retirement work is proportional to the amount of work, but if δ is low, the disutility of part-time work will be much lower than for full-time work. In the latter case, partial retirement should occur more often and for a longer period of time.

vector of variables influencing the value of leisure. Age is one of the variables included in X_t; a positive coefficient on age implies that the utility of leisure vs. work is gradually increasing as the worker ages, which in turn eventually induces retirement.

Parameter estimates for the utility function are obtained when utility is maximized subject to the opportunity set computed for the RHS population. The opportunity set is specified to include incentives from the wage in the full-time job (W_{ft}), the wage in a partial retirement job (W_{pt}), and accruals from the pension (P_t) and from social security (B_t). B_t reflects the social security rules in effect at the time, including those governing spouse and survivor benefits, the earnings test, the delayed retirement credit, and benefit recomputation, as they separately apply to each individual according to year of birth. Accruals in any given year are the change in the present value of benefits which occur if the individual works during that year.

The budget constraint is thus:

$$\sum_t d^t C_t = \sum_t d^t \left[W_{ft} N_{ft} + W_{pt} N_{pt} + P_t + B_t \right]$$

where the left hand side is total discounted expenditures, and the right is total discounted income. N_{ft} and N_{pt}, which measure work in the full-time and partial retirement jobs, respectively, are mutually exclusive outcomes, and the value of L_t in the utility function equals $1 - \max(N_{ft}, N_{pt})$.

Wages in the main job increase with experience and tenure in the job, but once the individual leaves the job he cannot return. Thus, if the individual retires from the main job and subsequently decides to return to work, he must take a secondary job. The wages in the

secondary job are lower, reflecting that the individual has much lower tenure in that job.[7] Pension payments are received from a main job, either after the individual retires from that job or after he reaches the starting age for the pension, whichever is later. The calculation of pension and social security benefits is discussed further in the next section.

Each year, the individual chooses how much to consume and whether to work full-time, part-time or not at all. The model is estimated for males in the Retirement History Survey for whom data is available through 1979. The terms ϵ and δ in the utility function are assumed to come from distributions $f(\epsilon) = N(0, \sigma_\epsilon)$ and $f(\delta) = \gamma e^{\gamma}$, $\delta \leq 1$. The parameters of the utility function are $\alpha, \gamma, \sigma_\epsilon$, and the elements of β.

The maximum likelihood estimation procedure is based on the fact that for a given set of values for the parameters of the model, an observed set of retirement decisions by a particular individual is consistent with only a limited range of values for the stochastic variables.[8] To calculate the probability that an individual i would have chosen an observed retirement sequence S_i, we find the set of values of δ and ϵ which would have caused the individual to have followed the observed retirement sequence S_i. Because this set depends on the presumed values of β, let

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[7] As a first approximation we assume that wages in the secondary job depend on experience, but not on tenure in that job. Making wages depend on tenure in the secondary job would considerably increase calculations with very little increase in realism, since tenure in secondary jobs will never be very long.

[8] In calculating the range of δ and ϵ which are consistent with the retirement decisions for a particular individual, we solve the model over the entire life cycle and allow assets to be determined endogenously, rather than starting the model at the first year of observation and taking initial assets as predetermined. This strategy avoids using (noisy) asset levels in the estimation and permits us to obtain parameters based only on labor market outcomes, conditional on the incentives created by wages for full and part-time work, pensions and social security. Implicitly, it assumes that financial transactions are consistent with the life cycle model.

this set be denoted $\Omega_{S_i}(\beta)$. The probability that the stochastic variables would have taken on values that generated the sequence S_i is:

$$Pr_i(S_i;\ \theta) \ = \ \iint_{\Omega_{S_i}(\beta)} f(\delta,\ \epsilon;\ \gamma,\ \sigma_\epsilon^2,\ \alpha)\ d\epsilon\ d\delta$$

where θ is a vector of all of the parameters to be estimated (β, γ , σ_ϵ^2 and α) and f is the joint probability density of δ and ϵ. The likelihood function of the sample is calculated as the product of the probability for each observation in the sample,

$$\mathcal{L}(\theta) \ = \ \prod_{i=1}^{N} Pr_i(S_i;\ \theta)$$

This model was estimated in Gustman and Steinmeier (1994a), and the maximum likelihood estimates for the model are reproduced here in Table 1.[9] The standard errors and the associated t-statistics are estimated using the Berndt-Hall-Hall-Hausman algorithm, and they suggest that the parameters are estimated quite precisely.

In addition to the non-stochastic nature of the model, there are a some other limitations worth mentioning. One is that it assumes perfectly operating markets. If capital markets are imperfect, say because some low wage workers are liquidity constrained, then the model will be incorrect. Analogously, if insurance markets are imperfect, then risk aversion will play a role in retirement decisions that has not been modeled. The model also assumes that all individuals are

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[9]In the model, retirement is assumed to occur between the ages of 55 and 75. Some RHS respondents had already retired at the beginning of the survey, but this "left censoring" is accommodated in the estimation procedure by choosing values of δ and ϵ which are consistent with retirement at any age before the respondent's age at the beginning of the survey. Other respondents had not retired by the date of the last survey. This "right censoring" is accommodated by choosing values for δ and ϵ that imply retirement after the last observed age.

fully informed and understand the need to save for retirement, contrary to some of the evidence from the savings literature.[10] Finally, the data from which the model is estimated are subject to error, most importantly in the fact that information on pensions comes from a small number of questions administered to the respondents themselves.

III. Description of the Simulation Procedure

The simulations begin with a sample of individuals for whom the explanatory variables are derived. These explanatory variables include the full-time and part-time wage paths over time, pension and social security accruals, and the value of the variables in the vector X. Next, for each individual, 1000 random values of δ and ϵ are drawn. For each draw, the model is solved using the preference parameters in Table 1, yielding the time paths of consumption and labor supply. The probability that the individual will be retired at any given age R_i is taken to be the proportion of the simulations in which the individual is retired at that age.

The sample of individuals comes from the 1989 Survey of Consumer Finances. This sample includes all males in the survey who were 30 to 55 years old at the time of the survey. To construct the earnings histories, a wage equation is fit to go through the individual's observed 1989 annual wage. The wages are adjusted for a 5.1% nominal growth rate of general wages, consistent with the latest Social Security Alternative II assumptions.[11] The part-time wage is imputed from the full-time wage using a regression of the part-time/full-time wage ratio on a set

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[10]For an overview of the pension, savings and retirement literature, see Gustman and Juster (1996).

[11]The estimated wage equation is shown in Appendix Table 1. The appendix is available on request.

of explanatory variables for a subsample for which both wages are observable. Health problems are introduced randomly according to a simple probit equation, and wages are adjusted accordingly after the onset of a health problem.[12]

Pension and social security accruals are calculated from the pension plan descriptions in the SCF and the social security rules in effect in 1989. To find the accrual for any particular year, the present value of benefits is calculated twice, once including that year's earnings and once excluding them. The accrual, which is the present value of the increase in benefits attributable to that year's work, is simply the difference between these two amounts.

In order to analyze the role of pensions and social security on trends in labor force participation, we redo the simulations using the same individuals, the same wage paths, and the same preferences, varying only pensions and social security by using the pension plans and/or social security rules from earlier years. Plans from earlier years are matched to the 1989 SCF pension-covered respondents using gender, union status, firm size, industry, occupation, and wage level category.[13] It is important to note that it is the pension plans and social security rules that are matched, not the values of these benefits. For instance, if a 1969 pension specifying a benefit of 1.2% times service times salary, collectable at age 62, is matched to a 1989 SCF respondent, this benefit formula is applied to the SCF respondent's wages in order to calculate the pension accruals.

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[12]The estimated probit on health status is shown in Appendix Table 2.

[13]There are two firm size categories, four industry categories, three occupation categories, and ten wage categories. If an exact match is not found, variables are aggregated until a match is found, but in no instance is a union pension aggregated with non-union pension in an effort to find a match. If multiple matches are found, the simulation is run multiple times and the outcomes weighted appropriately.

In conducting this analysis, there is an important data issue which must be addressed. The 1989 SCF asked respondents for the names and addresses of their employers, and the survey asked these employers for the summary plan descriptions of the pension plans. The pension values and accruals are calculated from these summary plan descriptions. The 1969 pension values and accruals come from the Retirement History Survey (RHS). That survey asked the respondents information about their pension plans but did not try to collect information from their employers. The problem is that values calculated from summary plan descriptions are likely to be considerably more accurate than values calculated from the much less detailed questions asked of respondents. In trying to track the effects of pensions over time, comparing respondent-reported pensions to summary plan descriptions risks introducing systematic bias into the analysis.

Fortunately, this problem can be overcome by using pensions from the 1983 Survey of Consumer Finances. The 1983 SCF questionnaire contained enough questions on pensions so that pension values can be calculated which are comparable to those calculated from the RHS. The 1983 SCF also collected summary plan descriptions, from which pension values can be calculated which are comparable to those calculated from the summary plan descriptions in the 1989 SCF. Therefore, we analyze the 1969 to 1989 trend in two parts. The part from 1969 to 1983 is analyzed by comparing the effects of the 1969 self-reported pensions as reported in the RHS to the 1983 self-reported pensions as reported in the SCF. The part from 1983 to 1989 compared the 1983 summary plan descriptions to the 1989 summary plan descriptions. This strategy avoids the possibility of bias which would otherwise arise if we compare self-reported

pensions with summary plan descriptions.[14]

The summary plan descriptions typically contain formulas for normal retirement, early retirement, and deferred vested retirement. There may be several formulas for each benefit of interest, depending on the participant's age, years of service, dates of service, and other factors. The summary plan descriptions thus allow fairly precise calculation of benefits. The self-reported information, by contrast, is more limited. Both the RHS and the 1983 SCF ask about the early and normal retirement ages and the level of benefits the respondent would be eligible to receive.[15] To calculate accruals, it is necessary to assume that the yearly pension benefit can calculated as

$$b = g * r(R)\ S\ W_f$$

where b is the actual annual benefit, g is the generosity factor, R is the age at retirement, S is years of service, W_f is the final wage, and r(R) is a reduction factor for early retirement.[16] The reduction factor is equal to unity if the individual retires on or after the normal retirement date;

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[14]An alternative procedure would be to ignore the 1989 summary plan descriptions and to use self-reported pensions for the entire period. However, pension section of the 1989 SCF questionnaire is considerably less detailed than in 1983, so much so that pension values can not be calculated from the 1989 self-reported information which would be comparable to the 1969 RHS values or the 1983 SCF self-reported values.

[15]If the individual was already eligible for full benefits at the time of the first interview, the RHS did not ask him the early retirement age. For individuals who had normal retirement ages in the 58-62 range, but who were younger than that at the time of the initial interview (and hence who did report their early retirement age), the most common situation was that the early retirement age coincided with the normal retirement age. Hence, this pattern was assumed for anyone who was already over the normal retirement age when first interview in 1969.

[16]This assumes that all plans are of the defined benefit type. This assumption is much more reasonable at the time of the RHS than it is today. In 1977, about 90 percent of covered workers in firms with 100 or more employees had a defined benefit plan as their primary plan. By 1987, the figure had fallen to about two thirds. See Turner and Beller (1992), Table 4.10.

otherwise it is calculated by using the annual reduction rates from Hatch et al. (1981) in conjunction with the normal, early, and actual retirement dates reported by the respondent. Since the respondent provides information about b, S, W_t, and the normal and early retirement ages, the generosity factor can be recovered as a residual. The generosity factor then allows us to calculate benefit that would be available at alternative retirement dates.

The effects of changes in social security may be similarly analyzed. The main difference between the analysis of social security and the analysis of pensions is that the rules for calculating social security benefits are known and do not have to be elicited from either the respondents or their employers. The social security rules are relatively simple: calculate an average of earnings, use this average in a formula which gives the basic benefit available at the normal retirement age, and adjust the basic benefit up or down if the recipient begins to collect these benefits before or after the normal retirement age. The value of social security is the present discounted value of the benefits. Spouse and survivor benefits, whose value depends on the basic benefit, are also available and are included in the calculations. The social security rules have undergone several important changes between 1970 and 1989. Average earnings are now computed using indexed earnings rather than nominal earnings, and the number of years counted in the average has increased. Also, both the normal retirement age and the benefits for those retiring past that age are being increased for younger cohorts.[17]

In summary, there will be three sets of simulations to analyze the effects of changes in pensions and social security on retirement. One set will compare the effects of 1969 pensions

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[17]For a discussion of the individual effects of each of these change in social security rules on retirement outcomes, see Gustman and Steinmeier (1985).

with those of 1983 pensions, using the respondents description of the pensions in the RHS and SCF. A second will compare the effects of 1983 pensions with those of 1989 pensions using the summary plan descriptions in the SCF. The third will compare the effects of the 1970 social security rules with those of the 1989 rules.[18] All of these simulations will use the same individuals, the same wage paths, and the same preferences, varying only pensions and/or social security rules.

IV. Simulating The Effects of Changes in Pensions and Social Security

Changes in Pension Incentives.

The most important factors in the way pensions influence retirement are the early and normal retirement ages. The distribution of these ages for 1969-1989 is reported in Table 2. In this table, there is clearly a very sharp trend toward earlier retirement ages in pension plans during the earlier period. According to the self reported data on the left side of the table, only forty percent of the RHS sample report that they would qualify for early retirement by age 60, whereas three fourths of those in the 1983 SCF sample so report. With regard to the normal retirement age, less than 20% of the RHS respondents qualify before age 65, while seventy percent of the 1983 SCF sample reports that they would be able to receive normal retirement

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[18]In the earlier time period, we use the rules that were in place for individuals who turned 62 in 1970, which was approximately the median for the RHS cohort. Because the individuals in the simulation are members of the SCF sample and because the social security benefits in 1970 were specified in nominal dollars, inflation would have made the benefits very small (relative to wages) if the 1970 formulas were applied to the nominal amounts of the SCF sample. To correct this temporal mismatch, the social security amounts (including the earnings test amounts) were scaled up so that they represented the same fraction of income as the original amounts would have represented to an individual who turned 62 in 1970.

benefits before 65.[19]

Comparing the data on early and normal retirement ages in the later period, we see that the trend in incentives moderated in the 1980's.[20] More workers were eligible for early retirement benefits before age 55 in 1989 than 1983 (24% vs. 18%), but fewer workers were eligible for normal retirement before 65 (46% vs 57%). Thus the differences in plan retirement ages between 1983 and 1989 are not uniformly in the direction of earlier retirement.[21]

Along with the increased provision for earlier retirement ages, there have been clear changes in the rate at which pensions accrue.[22] Comparing the RHS with the 1983 SCF at specific ages reveals that the median values of accruals are relatively close at age 50 and again at age 65. At age 60, however, the pension accrual as a fraction of wages is 14 percentage points lower in the SCF than in the RHS (24.2 percent vs. 10.1 percent), and at age 62 it is almost 23

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[19]RHS respondents were covered on average for a shorter fraction of the employment period than were the SCF respondents, which may in turn affect the reported early and normal retirement ages to the extent that these depend on years of service. However, unreported simulation results suggests that even a five year difference in years of service translates into a small difference in the probability of full-time work.

[20]For another discussion of changes in pensions between 1983 and 1989 using the SCF, see Samwick (1993).

[21]Notice that the self reported early and normal retirement ages in 1983 are lower than in the firm reported data. In an earlier study, we attributed the discrepancies to optimism by a few individuals who expect to be able to retire earlier than their plans suggest (Gustman and Steinmeier, 1989), but the summary plan descriptions may also be a source of error to the extent that they are out of date. These discrepancies in large part motivate our decision not to compare directly the 1969 self-reported HRS pensions directly with the 1989 SCF summary plan descriptions.

[22]Appendix tables 3, 4, 5 and 6 provide detailed information on changes in pension values and accruals.

points lower (25.1 percent vs. 2.4 percent).[23] These differences correspond to the younger early and normal retirement ages in the SCF pensions relative to the RHS pensions.

Retirement Effects of Changes In Pension Plan Provisions

The top two lines in Table 3 indicate the differences in simulated full-time labor force participation that would occur as a result of differences in pensions over the period. The table includes individuals who are covered by pensions, which amounts to about two thirds of the sample. Recall that the differences in this table are changes in steady state participation rates, and that the simulations involve the same sample of SCF respondents, the same wages, and the same preferences. There would of course be transitory differences which would occur as one group of pensions is substituted for another, but transitory differences are not captured in these simulations. However, later in the paper we will argue that these transitory differences are probably not large.

Row 1 of Table 3 indicates that the pensions reported in 1983 would have led to a 2.2 percentage point lower full-time participation rate at age 60 than would the pensions reported in 1969. The comparable figure at age 62 is 5.1 percentage points, and at age 65 it is 1.7 percentage points. These results are undoubtedly the consequence of the self-reported early and normal retirement being lower in the 1983 SCF than in the RHS.

The second line in the table compares the effects of the pensions calculated from the summary plan descriptions in the 1983 SCF with those calculated from the 1989 SCF. This comparison indicates much smaller differences in full-time participation by pension covered

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[23]These ages refer to the age at the end of the year's work. Thus, age 65 is the year the individual turns 65 and hence, for most RHS pensions, becomes eligible for normal retirement benefits.

workers, and the differences are not in a uniform direction. Using the 1989 pensions rather than the 1983 pensions, full-time work is not much different before age 65, but at age 65 (and beyond) full-time work is noticeably higher with the later pensions. The lack of difference before age 65 is not unexpected, given the fact that the early retirement age changed very little between 1983 and 1989 in the summary plan descriptions, and the average normal retirement age remained exactly the same. The increased work at 65 probably occurs because age-discrimination laws increasingly prevented pensions from capping service years or wages at age 65, as had commonly been done before. From the simulations, but not reported in Table 3, we find that the percentage of workers who are fully retired appears to be approximately the same using the two sets of pensions, with the increase in full-time work after 65 appearing to come mainly at the expense of partial retirement.

Effects of Changes in Pension Coverage

The third line of Table 3 considers the effects of changed coverage. To obtain a more or less consistent estimate of how pension coverage has changed over time, we use data from the Panel Study on Income Dynamics (PSID). In particular, we are interested in comparing pension coverage for those retiring around 1970 to the coverage for those retiring around 1990. These two cohorts would have been born around 1910 and 1930, respectively. Unfortunately, the cohorts born around 1910 would have been mostly retired during the PSID, while the cohort born around 1930 would have been mostly still working. This presents a problem when we try to make direct comparisons of the pension coverage rates of these two cohorts.

To overcome this problem, we use information of the cohort born around 1920. This cohort was mostly retired in the latter years of the PSID, and the pension recipiency rates can be

compared to the 1910 cohort. In the beginning years of the PSID, however, the 1920 cohort was mostly working, and pension coverage rates in their jobs can be compared to the 1930 cohort. To compare the pension coverage of the 1910 cohort with that of the 1920 cohort, we examine what percentage of respondents in each cohort reported pension income at age 67.[24] The data from the PSID indicate that pension coverage is 18 percent lower for those born in 1910 than in 1920 (59.2% vs. 72.3%). To assess changes between the 1920 cohort and the 1930 cohort, we look at pension coverage at age 55. The data suggest that these two coverage rates are almost identical (.694 vs. .698). Thus, we conclude that pension coverage for the 1910 cohort, which retired around 1970, was about 18 percent lower than for the 1930 cohort, which retired around 1990.

To assess how this lower coverage rate would have affected labor force participation, we modified the original simulations (involving the same SCF respondents and their wages, and using the same preferences as before) by randomly deleting pension coverage for 18 percent of pension covered workers. The results of these simulations are reported in the table. They indicate that relative to the coverage around 1970, the 1990 coverage would have induced full-time work that was 0.3 percentage points lower for pension covered workers. The corresponding differences at ages 62 and 65 are -0.7 and -1.6 percentage points, respectively. These results reflect the fact that age 62 and beyond, the typical pension has a negative accrual rate.

Effects of Changes In Plan Type

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[24]In this section, a "cohort" refers to individual born within two years of the date mentioned. Thus, the 1910 cohort refers to individuals born 1908-1912, and the 1920 cohort refers to those born 1918-1922.

One other trend of note is the trend away from defined benefit plans.[25] A trend away from defined benefit plans would mitigate their effect on reducing the retirement age. The reason is that most defined contribution plans provide little or no incentives to retire at any particular age.[26] To the extent that the trend to defined benefit plans is due to changes in plan type within industries, our simulations have already captured its effect. Previous work has suggested that changes in plan type within industries account for about half of the trend away from defined benefit plans, with the remaining half accounted for by changes the industrial distribution of employment.[27] The simulations in row 4 of Table 3 are meant to capture the effect of the remaining part of the change toward defined contribution plans.

Over the period of analysis, defined benefit plans declined from about 90 percent of total plans to about 71 percent. In order to estimate the effect on retirement ages, we begin with a simulation in which all of the 1989 DB plans are converted to DC plans of the same present value at the age of retirement. The results of this simulation represent the difference between 71 percent defined benefit plans and 0 percent defined benefit plans. We take the difference between 90 percent defined benefit plans and 71 percent to be about a quarter of the difference

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[25]The decline in relative importance of defined benefit plans is well documented (Gustman and Steinmeier, 1992). We also have good evidence that those plans that have closed are in small firms and among the less generous plans. Most large defined benefit plans remain in place, but most of the growth of pensions is in defined contribution plans (Kruse, 1995).

[26]Although in theory defined contribution plans can be designed to affect the marginal reward to work, an analysis of the pension accrual profiles for DC plans in the SCF indicates that in fact there is very little variation in the value of the pension accrual by age.

[27]In Gustman and Steinmeier (1992) we show that about half of the trend to defined contribution plans is due to changing industry mix, while the other half is due to a change in preferences for DC plans. Ippolito (1995) confirms our results and argues that much of the trend to DC plans is due to the arrival of a superior innovation, the 401(k) plan.

between 71 percent and 0 percent. Looking only at the change in the industrial distribution of employment component of the trend toward defined contribution plans reduces the difference half again, to one eighth of the simulated difference between 71 percent defined benefit plans and 0 percent. These calculations suggest that full-time work is 0.3 percentage points higher at age 60 because of the effect of the different mix of industries on the probability of defined contribution plans. At age 62, it is 0.6 percentage points higher, and at age 65 it is 1.4 percentage points higher.

Overall Retirement Effects of Changes in Pensions.

Row 5 of Table 3 sums up the differences in full-time labor force participation which would occur if workers were covered by the 1989 pensions rather than the 1969 pensions. The differences in rows 1-5 are among pension covered workers only. Because not all workers are covered by a pension, row 6 multiplies these effects by two thirds to indicate the differences in full-time labor force participation by all men. The net result is that full-time labor force participation by all men would be 1.3 percentage points lower at age 60 under the 1989 plans compared to the 1969 plans, 3.7 percentage points lower at age 62, but due to the increase in incentives for work after 65 in the 1989 plans, 1.4 percentage points higher at age 65.

Effects of Changes in Social Security

In addition to the role of private pensions, there have been significant changes in social security between 1969 and 1989. Turning to Table 4, the results in row 3 indicate that full-time work before age 65 would have been lower under the 1989 social security rules than under the 1969 rules, but work at age 65 and more would have been higher. The predicted differences are that full-time participation at age 60 would have been 2.1 percentage points lower under the 1989

rules, 2.4 percentage points lower at age 62, and 5.6 percentage points higher at age 65.

The lower work before age 65 results from changes in the way the average wage, which determine benefits, is calculated. For social security, the average wage is computed over a fixed number of years, and if the individual has more years of earnings than the number used in the average, only the highest years are used. Legislation in 1977 changed the calculation from an average of unindexed earnings to an average of indexed earnings. This change means that when current earnings replace previous earnings in the average, the year that is replaced is higher using the 1989 rules because it is indexed. As a result, the replacement does not increase the average as much using the 1989 rules as it does using the 1969 rules. Furthermore, the average in 1989 is based on more years of earnings, which further dilutes the effect of the additional earnings using the 1989 rules.[28] The smaller increase in average earnings results in a smaller increase in benefits and correspondingly lower incentives to continue working using the 1989 rules rather than the 1969 rules.

After age 65, there is a second change in the rules which more than offset the effects discussed in the previous paragraph. In 1969, if benefits were lost to the earnings test after age 65, there was no adjustment to future benefits. This created a strong incentive to retire at age 65 if the individual had not already done so. However, under the 1989 rules, a significant adjustment is made to future benefits, which made it more attractive to continue working past age

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[28]The increase in benefits by including the current year's earnings in the benefit calculations is called the "recomputation effect." Blinder, Gordon and Wise (1980, Table 3) estimate that when nominal earnings are used in the average wage formula, current earnings increase the present value of future benefits by 54 percent of those earnings. After the 1977 law switched to using indexed earnings, the recomputation effect fell by about a third, and then fell by half again as the number of years used in the formula increased from 16 years for a 60 year old in 1970 to 35 years for a 60 year old in 1990.

65.[29] Consistent with the change in incentives, the percentage of the labor force that retires exactly at 65 in the simulations is dramatically lower under the 1989 rules, at 14.3 percent vs. 20.5 percent under the 1969 rules.

Contributions of Pensions and Social Security To The Trend In Retirement

What we have estimated so far is the permanent effects of changes in pension formulas and social security rules on retirement. We can now evaluate how much of the trend toward earlier retirement can be accounted for by these permanent effects. Row 1 of Table 4 indicates the change in full-time labor force participation over the 70's and 80's as reported in the CPS. Row 2 summarizes Table 3 and reports the permanent effects of using 1989 pensions rather than 1969 pensions. Row 3 reports the differences attributable to social security, as discussed in the previous section. Row 4 sums rows 2 and 3 to calculate the differences in the effects of the 1989 pension plans and social security rules relative to the 1969 plans and rules. The final row of the table computes the fraction of the observed change in participation rates that can be attributed to the permanent effects of the changes in pensions and social security. Together, these effects account for about 25% of the trend towards lower full-time labor force participation at ages 60 and 62. However, the changes in pensions and social security alone would have led to an increase in full-time labor force participation at age 65, rather than the decline that is observed.[30]

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[29]The 1989 rules specify that a year's foregone current benefits increase future benefits by between 3 and 8 percent, depending on the birth cohort. For the simulated population, which is 30 to 55 years old in 1989, the adjustment is closer to 8 percent. An adjustment of this magnitude offsets completely (on an actuarial basis) any foregone current benefits.

[30]It might be argued that the figures for age 65 include some individuals who are working a few months past their birthday (perhaps until the end of the calendar year). However, the reduction in labor force participation at age 66 is almost as great as at age 65.

Both sets of figures suggest that the bulk of the reduction in full-time work must be accounted for by the other factors mentioned in the introduction. The permanent effects of pensions plan changes and changes in social security rules account for only 25 percent of the trend before age 65, meaning that 75 percent must be accounted for by other factors. More compellingly, work after 65 declined despite pension and social security policies which were designed to increase it. In 1969, employers could freeze pension benefits at age 65, and foregone social security benefits after age 65 were lost for good. By 1989, employers were required to credit service after 65 in calculating pension benefits, and foregone social security benefits after age 65 were actuarially offset by increased future benefits. The fact that work after age 65 decreased significantly despite these changes is compelling evidence that other factors, including increased real wages, changes in disability insurance, increased preferences for earlier retirement, changes in the structure of jobs, and transitory effects of the changes in pensions and social security, were at work.[31]

Other evidence leads us to conclude that the transitory effects of pension and social security changes was not a large factor in the trend towards earlier retirement. The most dramatic changes in pensions and social security appear to have come in the 1970's. That was the decade with major reductions in the early and normal retirement ages of pensions and

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[31]For instance, Bound and Waidmann (1992) estimate that the increase in the disability insurance roles can account for up to a quarter to a third of the twenty percent decline in participation of 55-64 year old men between the World War II and the late 1980s. They argue that because the number reporting themselves as disabled has increased over time, and true health status has not changed, the rise in the number of reported disabled must be because of the changes in disability programs, and the additional number of self reported disabled today come from the ranks of those who, in the absence of a more favorable disability program, would be currently employed rather than retired.

increases in pension values, and also with major (and largely unintended) increases in the generosity of social security benefits. Both of these changes created windfall gains in the value of retirement assets. The transitory effects should have been most pronounced for those nearing retirement age, since their savings patterns would not have anticipated these windfalls. This means that they approached retirement age with far more assets than they anticipated, which should have encouraged earlier retirement. For younger cohorts, e.g. those retiring during the 1990's, these windfalls occurred much earlier in the life cycle, and these cohorts would have had time to adjust their savings rates to reflect the windfalls. As a result, their savings nearing retirement would be closer to what they would have been without the windfalls, and the early retirement patterns of the older cohorts should have been reversed. Although the retirement rates did level off from the middle 1980's to the early 1990's, they have since been increasing again, rather than decreasing as they would have been if transitory effects of pensions and social security were the major factors in the 1969-1989 increase in retirement.

V. Robustness Of Findings

In order to investigate the robustness of our findings, we examine the stability of the results relative to the parameters of the utility function. In the preceding portion of the paper we used utility function parameters that were estimated using data from the Retirement History Study, covering a cohort born from 1906 to 1911. For an alternative simulation, we use parameters estimated with data for the husbands who were included in the National Longitudinal Study of Mature Women (NLS) and reported in Gustman and Steinmeier (1994b). The women in this survey were born from 1923 to 1937. Their husbands on average were born a few years

earlier, making the husbands on average over twenty years younger than men in the RHS cohort, and retired a decade or two later than the RHS respondents. These simulations thus allow us to examine the effect on the results presented in the preceding section of using preferences from a younger cohort.

The utility function estimated with the NLS data differs from the one estimated with the RHS data in that the possibility of partial retirement is not included among the outcomes. Consistent with our earlier tables, retirement is defined as not working full-time. The estimated parameters are noticeably different from the parameters estimated from the RHS, which is compatible with the hypothesis that tastes may have changed.[32] These parameters indicate that the utility of leisure increases more rapidly than in the RHS estimates, which suggests that retirement will be less sensitive to economic incentives such as pensions and social security. One possible reason for this is that the younger cohorts really are less sensitive to economic incentives in choosing when to retire, but another possible reason is greater measurement error in the NLS. In that survey, all labor market information about the husband, including details of the husband's pension plan, are obtained from the wife, who is the primary survey respondent. Measurement error will likely increase the number of mismatches between economic incentives and retirement choices, and mismatches will make it appear that the respondents are less sensitive to economic incentives than they in fact are. As a consequence, measurement error may cause an underestimate of the effects of economic incentives on retirement choices.

The results of the simulations with the NLS utility function parameters are reported in Table 5. The changes in retirement outcomes due to changes in pension plan formulas and social

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[32]The parameters of the utility function used in the simulation are reported in Appendix Table 8.

security are, by and large, lower when the utility function estimated with NLS data is used. At age 60 the change in participation due to changes in plan formulas and changes in social security is about two thirds as large when estimated with the utility function from NLS data than as it is when estimated with the utility function from RHS data. Both at age 62 and at age 65, the change is only about a third as large. These results suggest that, if anything, the estimates using the RHS are upper bounds.

VI. Conclusions.

This study has considered the trends in pensions and social security and investigated the permanent effects of those trends on trends in labor force participation and retirement among older workers. The study focuses on the strengthening of pension incentives to retire earlier, especially for workers under 65, and on changes in social security that reduced work incentives for younger workers. Also considered were increases in pension coverage, which strengthened the incentive to retire early, and the trend away from DB plans, which was just building through the 1980's, and somewhat mitigated the incentive to retire early.

Simulations with a structural retirement model suggest that changes in pensions and social security have led to a long-term increase in retirement that can account for about a quarter of the total trend to earlier retirement observed for those in their early sixties from the late 1960s and into the 1980s. Pension and social security changes do not account for the reduced labor force participation by those age 65. Analysis of the robustness of the findings suggests that if anything, our estimate that changes in pensions and social security can account for about a quarter of the trend to earlier retirement for those in their early sixties is an overstatement, rather

than an understatement.

This means that factors other than pensions and social security have probably led to the increased retirement observed over the 1970's and 1980's. Most tellingly, retirement over 65 has increased despite changes in pensions and social security specifically designed to make it more attractive for these workers to continue working. These other factors which may have played a major role in increasing retirement include rising real wages, changes in disability insurance, changes in tastes for retirement, and changes in the industrial distribution of jobs.

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Table 1
Structural Retirement Model Estimates

	Variable	Coefficient	t-Statistic
α	Exponent of Consumption	0.09	2.42
γ	Parameter for δ	0.27	56.65
σ_e	Standard deviation of ϵ	1.11	65.85
β_0	Constant in linear term	0.07	2.40
β_1	Coefficient of age[†]	0.26	65.34
β_2	Coefficient of health	0.67	19.97
β_3	Coefficient of vintage[††]	0.12	9.81
Number of Observations		3283	
Log Likelihood		-9750.97	

Source: Gustman and Steinmeier (1994a)
[†] The actual variable is (Age - 62).
[††] The actual variable is (Vintage - 9).

Table 2
Distribution of Early and Normal Retirement Ages for Defined Benefit Plans

A. Early Retirement Ages

	Self Reported		Summary Plan Descriptions	
Age	RHS	83 SCF	83 SCF	89 SCF
<55	2.6	38.2	19.2	23.9
55	11.8	23.5	61.2	53.2
56	0.1	1.3	1.3	1.3
57	4.6	2.0	2.5	1.8
58	2.1	2.5	1.3	1.8
59	0.6	0.3	0.7	1.0
60	18.9	5.1	9.8	13.7
61	0.4	1.7	0.7	0.3
62	32.3	11.7	2.1	1.9
63	0.7	2.0	0.1	0.2
64	1.9	0.7	0.1	0.0
65	23.5	11.2	1.2	1.1
>65	0.3	0.0	0.0	0.0
Average	60.9	52.9	55	54.3

B. Normal Retirement Age

<55	0.7	22.3	5.8	7.8
55	0.7	13.4	7.6	6.6
56	0.0	1.8	0.7	1.6
57	3.7	1.9	0.9	2.2
58	0.8	2.5	1.9	1.8
59	0.6	0.3	0.9	1.3
60	3.1	4.1	11.5	6.8
61	0.0	2.2	1.6	0.5
62	4.6	17.8	24.5	16.3
63	3.7	2.0	1.3	0.9
64	0.5	1.0	0.8	0.7
65	73.1	26.0	42.6	53.5
>65	8.4	4.6	0.0	0.0
Average	64.2	58	61.7	61.7

Table 3: Predicted Differences In Full-Time Labor Force Participation Among Pension Covered Workers Due To Changes In Pensions

Source of Difference:	Age 60	Age 62	Age 65
	Differences Among Pension-Covered Workers		
Plan Changes, RHS vs. 1983 SCF	-2.2	-5.1	-1.7
Plan Changes, 1983 vs. 1989 SCF	+0.2	-0.3	+4.0
Changes In Pension Coverage	-0.3	-0.7	-1.6
Interindustry Changes In Plan Type	+0.3	+0.6	+1.4
All Changes In Pensions	-2.0	-5.5	+2.1
	Differences Among All Workers		
All Changes In Pensions[1]	-1.3	-3.7	+1.4

[1] Changes in full-time labor force participation associated with changes in pension status in rows 1 to 5 pertain only to pension covered workers. In row 6 the changes in participation due to changes in pensions have been multiplied by .67 to convert to figures for the entire labor force.

Table 4: Percentage of Trend In Full-Time Labor Force Participation Explained By Changes In Pensions and Social Security, 1969 - 1989

Source of Difference:	Age 60	Age 62	Age 65
Actual Differences From CPS Data[1]	-13.9 %	-24.8 %	-17.3 %
Changes In Pensions, Adjusted for Pension Coverage	-1.3	-3.7	+1.4
Social Security Changes	-2.1	-2.4	+5.6
Changes In Pensions and Social Security	-3.4	-6.1	+7.0
Percentage of Actual Difference Explained By Changes In Pensions and Social Security	24 %	25 %	na

[1]This row refers to the changes from 1970 to 1989.

Table 5
Effect of Utility Function On Difference In Full-Time Labor Force Trend
Explained by Changes In Pension Formulas and In Social Security

Years of Comparison	Difference in Participation Rates Predicted With Utility Function Estimated From: Retirement History Study	Husbands From National Longitudinal Study of Mature Women
RHS vs. 1983 SCF Pensions		
Age 60	-2.2%	-1.5%
Age 62	-5.1	-2.0
Age 65	-1.7	-0.7
1983 vs 1989 SCF Pensions		
Age 60	0.2	-0.6
Age 62	-0.3	-0.6
Age 65	4.0	0.5
1970 vs 1989 Social Security		
Age 60	-2.1	-0.5
Age 62	-2.4	0.2
Age 65	5.6	3.2

Appendix Tables: To Be Made Available Upon Request

Appendix Table 1

Wage Equation from 1989 SCF
Dependent variable is the log of the wage in 1989

Variables	Coefficient	t-statistic
Constant	1.818	5.69
Experience (times 10^{-1})	0.138	1.40
Experience^2 (times 10^{-2})	-0.028	-2.23
Education	-0.084	-2.06
Education^2 (times 10^{-1})	0.065	4.37
Experience times education (times 10^{-2})	0.100	1.96
Married	0.095	1.70
Bad health	-0.164	-2.66
Black	-0.267	-4.10
Pension covered	0.355	8.90
R^2	0.38	
Number of Observations	1039	

Appendix Table 2

Health Status Probit From SCF
Dependent variable is the presence of a health problem

Variables	Coefficient	t-statistic
Constant	-2.325	-19.25
Age	0.025	11.82
Black	0.424	3.55
Log Likelihood	-1024.72	
Number of Observations	2426	

Appendix Table 3
Median Accruals for Defined Benefit Plans by Age

	Age 50	Age 55	Age 60	Age 62	Age 65
			Pension Accruals (1000's of $)		
Self-Reported					
RHS	3.8	5.8	7.0	7.2	-0.5
1983 SCF	5.0	3.7	2.8	0.7	-0.4
Firm-Reported					
1983 SCF	2.8	2.7	0.8	-2	-5.9
1989 SCF	3.9	3.7	0.8	-2.5	-5.8
			Pension Accrual / Wage (percent)		
Self-Reported					
RHS	12.0	18.9	24.2	25.1	-1.9
1983 SCF	14.1	11.7	10.1	2.4	-1.6
Firm-Reported					
1983 SCF	9.1	9.3	3.5	-6.9	-22
1989 SCF	11.5	11.5	3.4	-8.5	-22.2

Appendix Table 4
Median Accruals for Defined Benefit Plans by Eligibility Status

	Before ER Age	Plans With ER			Plans w/o ER	After NR Age
		ER Age	ER Age-NR Age	NR Age	NR Age	
			Pension Accrual (1000's of $)			
Self-Reported						
RHS	7.5	8.1	8.2	8.5	12.1	-0.3
1983 SCF	6.4	6.2	7.4	8.5	9.7	0.3
Firm-Reported						
1983 SCF	3.4	9.8	2.7	2.0	33.5	-2.8
1989 SCF	4.3	14.6	2.9	0.6	65.5	-2.8
			Pension Accrual / Wage (percent)			
Self-Reported						
RHS	25.1	27.7	26.4	29.7	41.2	-1.1
1983 SCF	18.5	17.4	22.0	25.5	29.1	1.2
Firm-Reported						
1983 SCF	10.8	25.8	10.3	8.2	101.5	-9.2
1989 SCF	13.2	37.4	10.2	2.3	182.8	-10.8

Appendix Table 5
Median Values of Defined Benefit Plans

	Age or Date							
	Age 50	Age 55	Age 60	Age 65	Age 70	1989	ER Age	NR Age
	Pension Value (1000's of $)							
Self-Reported								
RHS	33	58	98	151	179	8	107	151
1983 SCF	54	91	125	153	178	13	69	122
Firm-Reported								
1983 SCF	28	61	87	97	80	5	70	100
1989 SCF	39	87	119	132	115	9	90	128

Appendix Table 6
Median Value of Defined Contribution Plans

	Age 50	Age 55	Age 60	Age 65	Age 70	1989
			Pension Value (1000's of $)			
1983 SCF	66	87	102	116	132	17
1989 SCF	54	73	88	102	117	19
			Pension Value / Current Wage (ratio)			
1983 SCF	2.07	2.71	3.26	4.04	4.82	0.50
1989 SCF	1.73	2.26	2.78	3.40	4.12	0.69
			Pension Value / Cumulative Wages (percent)			
1983 SCF	9.4	10.5	10.7	10.9	11.0	7.8
1989 SCF	9.1	9.2	9.3	9.6	9.6	8.1

Appendix Table 7A
Simulation Retirement Outcomes with RHS Pensions
and with Self-Reported 1983 SCF Pensions

	Percent in Work/Retirement Categories					
	Full-Time Work		Partially Retired		Fully Retired	
	RHS	SCF	RHS	SCF	RHS	SCF
Age						
55	99.7	99.3	0.2	0.4	0.1	0.3
56	99.2	98.7	0.4	0.7	0.4	0.6
57	98.6	97.8	0.6	1.0	0.8	1.2
58	97.5	96.3	1.0	1.5	1.5	2.2
59	95.7	94.1	1.6	2.3	2.7	3.7
60	92.2	90.0	2.5	3.5	5.2	6.6
61	88.3	85.1	3.5	4.8	8.2	10.2
62	82.2	77.1	5.0	7.0	12.8	15.9
63	74.7	69.0	6.6	8.8	18.7	22.1
64	66.4	59.6	8.0	10.6	25.6	29.8
65	47.4	45.7	13.2	13.5	39.4	40.8
66	36.0	35.5	14.6	14.3	49.4	50.2
67	26.2	26.3	15.0	14.5	58.8	59.2
68	18.0	17.0	14.6	14.3	67.4	68.7
69	11.7	11.0	13.5	13.0	74.8	76.0

Appendix Table 7B
Simulation Retirement Outcomes with 1983 and 1989
Firm-Reported SCF Pensions

	Percent in Work/Retirement Categories					
	Full-Time Work		Partially Retired		Fully Retired	
	1983	1989	1983	1989	1983	1989
Age						
55	99.5	99.5	0.3	0.3	0.2	0.2
56	98.9	98.9	0.6	0.6	0.5	0.5
57	97.9	97.9	1.0	1.0	1.1	1.1
58	96.3	96.3	1.7	1.8	2.0	2.0
59	93.5	93.6	2.9	2.9	3.6	3.5
60	88.3	88.5	4.8	4.8	6.9	6.7
61	82.7	82.9	6.7	6.6	10.6	10.6
62	74.5	74.2	9.2	9.5	16.3	16.3
63	65.9	65.2	11.2	11.9	22.9	22.8
64	56.1	55.5	13.3	13.9	30.6	30.6
65	37.2	41.2	20.8	18.0	42.1	40.8
66	28.7	31.5	20.4	18.7	50.9	49.9
67	20.6	22.6	19.5	18.5	59.9	59.0
68	13.7	15.0	18.1	17.6	68.2	67.5
69	8.8	9.6	15.9	15.7	75.3	74.8

Appendix Table 7C
Simulation Retirement Outcomes with 1970 and 1989
Social Security Rules

	Percent in Work/Retirement Categories					
	Full-Time Work		Partially Retired		Fully Retired	
	1970	1989	1970	1989	1970	1989
Age						
55	99.6	99.5	0.3	0.3	0.1	0.2
56	96.0	98.9	0.5	0.6	0.6	0.5
57	98.0	97.9	0.9	1.0	1.1	1.1
58	96.8	96.3	1.3	1.8	1.9	2.0
59	94.4	93.6	2.2	2.9	3.4	3.5
60	90.6	88.5	3.4	4.8	6.0	6.7
61	85.6	82.9	4.9	6.6	9.5	10.6
62	76.6	74.2	7.1	9.5	16.3	16.3
63	67.2	65.2	8.9	11.9	24.1	22.8
64	56.1	55.5	10.5	13.9	33.4	30.6
65	35.6	41.2	10.3	18.0	54.1	40.8
66	26.8	31.5	9.4	18.7	63.7	49.9
67	18.9	22.6	8.2	18.5	72.9	59.0
68	12.4	15.0	6.7	17.6	80.9	67.5
69	6.0	9.6	4.7	15.7	89.2	74.8

Appendix Table 8
Structural Retirement Model Estimates Using NLS Data

	Variable	Coefficient	t-Statistic
α	Exponent of Consumption	-1.355	-2.35
σ_e	Standard deviation of ϵ	3.427	3.72
β_0	Constant in linear term	-18.350	-11.32
β_1	Coefficient of age[†]	0.650	3.24
β_2	Coefficient of health	1.974	3.04
β_2	Coefficient of vintage[††]	0.127	2.28
Number of Observations		3283	
Log Likelihood		-9750.97	

Source: Gustman and Steinmeier (1994b)
[†] The actual variable is (Age - 55).
[††] The actual variable is (Vintage -30).