SOCIAL SECURITY AND THE JOINT TRENDS IN LABOR SUPPLY AND BENEFITS RECEIPT AMONG OLDER MEN

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Abstract

Using data from the Current Population Surveys, we find an increase in the fraction of older American men who worked without receiving Social Security retirement benefits and a decline in the fraction of men who claimed benefits without working during the period 1980-2006. Using bivariate probit regressions, we find that an increase in Social Security's normal retirement age decreased labor force participation rate regardless of benefits receipt status; that an increase in the delayed retirement credit increased benefit receipt regardless of labor force status; and that labor force participation and claiming Social Security benefits are strongly and negatively correlated.

1. **Introduction**

The baby boom cohorts are rapidly approaching retirement age, which will exert unprecedented pressure on the Social Security system and Medicare. However, another recent shift – the increase in older-age workers who elect to extend their work lives and delay receipt of retirement benefits – is also key to any national policy consideration. Most recent data indicate that older men's labor force participation rate is increasing and their Social Security retirement benefit receipt rate is decreasing. Particularly, since the mid-1990s, the fraction of men who work without receiving benefits has risen, while the fraction of men who claim benefits without working has declined. Data from the Current Population Surveys show that among men aged 62-74 in 1996, about 26% worked and 81% received Social Security benefits, while about 10% worked without claiming retirement benefits and 65% received benefits without working. In 2006, more older men worked (about 32%) and fewer received benefits (about 76%). Over the ten years, the fraction of men who worked without receiving retirement benefits increased from 10% to nearly 15%, and the fraction of men who received retirement benefits without participating in the labor force decreased from 65% to 58%. These changing patterns impact the dynamics of contributions to and benefit payments from the Social Security fund, and should be considered when projecting future reserves.

In 1983, in efforts to improve the solvency of the Social Security system, Congress enacted a range of changes that affected existing and future beneficiaries, non-beneficiary workers, and employers in the taxation of incomes, eligibility and calculation of benefits, and other parameters that are to influence an individual's benefits claim and employment decisions at later adulthood. Three changes of the 1983 amendments have been the focus of recent retirement research (e.g., Song and Manchester, 2009). First, the normal retirement age (NRA), which had been 65 since the inception of the Social Security system, was increased for those born in 1938 or later. Second, the delayed retirement credit (DRC) increased monthly benefits for those who elected to delay receipt beyond normal retirement age. The DRC raises monthly benefits for individuals for each month that they delay their receipt of benefits after reaching their normal retirement age, and it rises from 3 percent for those born in 1924 or earlier to 8 percent for those born in 1943 or later. Thus, the DRC increased for workers born in 1925 or later. In 1990, the marginal tax rate was reduced from 50% to 33%; the threshold above which earnings will be taxed increased from $11,280 in 1995 to $12,500 in 1996 and $15,500 in 1999; and finally, the

earnings test was eliminated in 2000. All of these changes target those aged 65-69. The rise in elderly labor force participation, which began in the mid-1990s after a long-term decline (Costa, 1998; Quinn, 1997; Gustman and Steinmeier, 2006), has been at least partly attributed to these changes, which effectively increased economic incentives in Social Security for later retirement (Friedberg, 2007). However, the concomitant decline in the rate of Social Security retirement receipt is less well understood. Recent studies indicate that the loosened earnings test encouraged the rate of the benefit receipt while exerting a positive but small effect on the labor force participation.

The objective of this study is to obtain a better understanding of older men's changing retirement behavior and the composite effects of incentives created by various features of the Social Security Act. Using data from the 1980-2007 Current Population Surveys (CPS), we identify and explain the trends in the labor force participation and Social Security benefit receipt of men aged 62 to 74. We examine four groups: those who worked without receiving benefits, those who worked and received benefits, those who received benefits but did not work, and those who neither worked nor received benefits. We look at how the group proportions shift from 1980 to 2006, and to what extent these shifts can be explained by changes in the Social Security program. We use reduced-form bivariate probit regression models to estimate composite effects on the joint outcome (benefit receipt and employment) of changes to the Social Security retirement earnings test, the delayed retirement credit, and the normal retirement age.

Studying the joint outcomes of Social Security (SS) benefit receipt and employment among older Americans is important to planning for the future viability of the Social Security program, projecting labor supply, and creating policies on retirement financing. In the early and mid-1980s, seminal structural models of the simultaneous decisions of SS benefit receipt and employment, and the impact of Social Security on both decisions, were developed by Zabalza, Pissarides and Barton (1980) and by Burtless and Moffitt (1985). Many individuals claimed SS benefits as soon as they became eligible over the period 1982-1991, when the benefits claim rate was rising. However, the benefits claim rates have been declining since the mid-1990s, and whether these models are applicable to the more recent trend of declining benefit receipt is subject to further analysis. Understanding what keeps Social Security beneficiaries in the labor force and what induces the elderly to delay benefits claim is of increasing importance to retirement financing policy. Workers not claiming benefits represent net contributions to Social

Security fund, and non-working beneficiaries represent net outflows. Changes in the fractions of these two groups directly affect the ability of the Social Security fund to meet future demand.

The importance of analyzing the effects of all three of these changes in Social Security program – normal retirement age (NRA), retirement earnings test (RET), and delayed retirement credit (DRC) – is warranted for two reasons. These three program features were designed to interact and induce a simultaneous and synergetic effect. And individuals eligible for Social Security benefits must consider the consequences of all three program features when making choices about employment and benefit receipt.

2. Previous Literature

The Social Security Amendments of 1983 were enacted by Congress to address the solvency of the Social Security system. They introduced a range of changes that affected existing and future beneficiaries, non-beneficiary workers, and employers in the taxation of incomes; eligibility and calculation of benefits; and other parameters that were intended to influence eligible participants' benefits claims and employment decisions. Three of these changes have been previously explored in retirement research (e.g., Song and Manchester, 2009) and are the focus of this research as well. First, the normal retirement age (NRA) was increased from 65 for those born in 1937 or earlier, in two-month increments for every birth year, reaching age 66 for those born in 1943. The increased NRA effectively began in 2003 when the 1938 birth cohort turned 65. The purpose of a higher NRA is to delay benefits claims.

Second, the delayed retirement credit (DRC) was increased – a change also intended to delay benefits claims. Monthly benefits were increased for eligible participants who delayed their receipt of benefits after reaching NRA. DRC increased in half-percent-point increments for every two birth years, from 3 percent per year for those born in 1924 or earlier to 8 percent in 2003 for those born in 1943 or later. Thus, the DRC increased for workers born in 1925 or later, effectively starting in 1990 when the 1925 birth cohorts reached their NRA of 65. It is important to note that no change was made to the Social Security benefit eligibility criteria, and the entitlement age of early benefits claim, which remains 62. However, since the monthly benefit for the early claimant is reduced based on the number of months prior to the claimant's NRA, raising the NRA effectively enlarges the penalty for early claiming.

Third, the retirement earnings test (RET) was changed to allow for broader earnings eligibility among those at or above their NRA. The offset was decreased from $1 for every $2 of earnings above the exempt threshold to $1 for every $3. Also, the threshold for benefits eligibility increased steadily in the period 1980-1999, and was repealed altogether in 2000 for those at or above their NRA. These changes in the RET were intended to encourage continued employment among the age-eligible by liberalizing the threshold for benefits receipt related to wage earnings. This change had the potential to increase both inflows to the Social Security system through a rise in employment of the age-eligible and outflows through a rise in benefits receipt among older wage earners.

These changes in Social Security program features were clearly designed to provide economic incentives for delaying claims for Social Security retirement benefits. Changes in the DRC and RET affect labor force participation decisions through income as well as substitute effects (see Friedberg, 2000, for an excellent description for the former and Pingle, 2006, for the latter). Since the NRA defines the point of the budget constraint where it displays a kink, an increase in the NRA naturally alters the budget constraint to promote labor market activity and discourage benefits claiming.

A number of studies have analyzed the effects of Social Security program rules on labor force participation and benefits claim. As surveyed in Krueger and Meyer (2002), many earlier studies relied primarily on cross-sectional variations in benefits amount, with inconclusive results. Recent studies of how changes in RET parameters have affected the labor supply of older Americans have employed quasi-experimental research designs, using the fact that these changes affected some age groups but not others (Friedberg, 2000; Gruber and Orszag, 2003; Loughran and Haider, 2005; Engelhardt and Kumar 2007; Song and Manchester, 2007). The labor supply effect of changes to the earnings threshold for retirement benefits also has been observed in other countries (Baker and Benjamin, 1999, for Canada; Disney and Tanner, 2002, for the United Kingdom). With the exception of Gruber and Orszag, results are consistent with theoretical predictions that liberalizing the earnings test increases labor supply, though the magnitudes are found to be small and present in men only. Michaud and Soest (2007) found an upward revision in the expectation of working past age 65 among men following the 2000 repeal of the RET. Pingle (2006) found that the increase in the DRC exerted a positive effect on older men's labor supply. These two studies are reduced-form analyses, and structural modeling analysis leads to

similar conclusions. In 1991, Gustman and Steimeier predicted a strong labor force response to the then-possible 2000 repeal of the earnings test using simulations based on structural modeling. In 2009, Gustman and Steimeier reported that the changes in Social Security benefits increased labor force participation by those aged 65 to 67.

In terms of benefits claiming, several recent studies have investigated the effects of Social Security program changes, particularly, the removal of the RET in 2000. These studies found that the elimination of the earnings test accelerated benefit receipt among the age eligible (Gruber and Orszag, 2003; Engelhardt and Kumar, 2007; Song and Manchester, 2007), but exerted little influence on when younger workers expected to claim benefits (Michaud and Soest, 2007). Song and Manchester (2009) found that the 2000 removal of the earnings test increased the probability of benefits claiming among those at or near their NRA, and that the increase in NRA decreased the probability of earlier (at age 62) benefits claiming.

Our study improves upon these past studies in two significant ways. First, we create a new and more comprehensive description of retirement behavior by focusing jointly on benefit receipt and labor force participation. Second, we use a more comprehensive summary of economic incentives created by Social Security, simultaneously analyzing how the increases in the DRC and the NRA and the liberalization and elimination of the RET for certain age groups have together affected retirement outcomes. As in other recent studies, we are able to exploit the age-specificity of Social Security parameters that naturally create treatment (age-eligible) and control (age-exempt) groups, and to use a quasi-experimental research design that supports causal interpretations of estimation results.

3. Data and Methods

To conduct our cross-sectional analysis of labor force participation, we used the 1981-2007 March Supplements to the Current Population Surveys (CPS), which gather data on labor supply and Social Security retirement income in the previous calendar year. Thus, the sample period spans 1980 through 2006. We started with 1980 data because this is the first wave in which CPS recorded the receipt of Social Security retirement income separately from Railroad Retirement payments, survivors' payments, or disability income. We used two dichotomous dependent variables: labor force participation status, with 1 indicating participation and 0 otherwise; and Social Security benefits receipt status, constructed from the CPS variable of the

amount of Social Security income received in the previous year, with 1 indicating receipt and 0 otherwise. We sampled men, aged 62 to74 in each year, obtaining 175,353 person-year observations with valid labor force participation status and Social Security retirement receipt data from the pooled CPS, 1981-2007 (covering the period 1980-2006). In terms of age groups, we had 49,255 observations for men aged 62-64, 70,451 observations for ages 65-69, and 55,649 for ages 70-74.

To estimate the composite effects of the Social Security program changes on the joint outcome of benefits receipt and employment, we construct three variables that capture variations in the RET (in the threshold below which earnings are not taxable), the DRC, and the NRA, using the published data from the Social Security Administration. The lower panel of Figure 1 displays the year-specific earning limit during the period of 1980-2007 separately for older adults of ages 62-64 and ages 65-69, and the upper panel shows the birth-year-specific DRC and NRA for the birth cohorts of 1910-1960. Clearly there is a smooth upward trend in the earnings limit for the age 62-64 group. The trend of the earnings limit for the age 65-69 group, upward overall, became steeper beginning in 1996 and disappeared (or became infinite) with the repeal of the RET in 2000.

Our empirical strategy in estimating the composite Social Security effects on retirement behavior is to model responses for different age groups of the older population to the SS program changes. The variations in Social Security's parameters for RET, DRC, and NRA during the past 20 years are large and exogenous to individuals' retirement decisions, thus serving as a source of identification. These variations are also age-specific in that they affect some age groups but not others, thus serving as an additional source of identification and enabling a treatment-control comparison. A key advantage of this approach is that no structural assumptions are imposed on the underlying estimates in obtaining the effects of program changes, and the effects of these changes on the joint retirement outcomes of benefit receipt and employment can be examined directly.

We employ a bivariate probit regression model to estimate the joint behavioral responses in labor force participation and retirement benefit receipt – two dichotomous outcomes that result from simultaneous decisions influenced by the same common unobserved factors. We use two equations, the first for labor force participation, the second for retirement benefit receipt:

$$\Pr(lfp_{it}=1|X_{it})=\Phi\left(\beta_{1l}drc_i+\beta_{2l}el_{it}+\beta_{3l}nra_i+X_{it}'\alpha_l+\sum_k\gamma_{kl}\delta_k+\sum_m\pi_{ml}\tau_m\right)$$
$$\Pr(ss_{ait}=1|X_{it})=\Phi\left(\beta_{1s}drc_i+\beta_{2s}el_{it}+\beta_{3s}nra_i+X_{it}'\alpha_s+\sum_k\gamma_{ks}\delta_k+\sum_m\pi_{ms}\tau_m\right) \quad (1)$$

where subscript *i* refers to the individual and *t* year; *X* denotes individual characteristics, such as race, ethnicity, education, marital status, and residential region; *drc* denotes the delayed retirement credits that are applicable to individuals based on their birth year; *el* denotes the year-specific, age-group-specific threshold for the retirement earnings test in current dollars; *nra* denotes the normal retirement age based on the birth year; δs are unrestricted age dummies; and τ_s are year dummies. The error terms in the two equations are assumed to be correlated with coefficient, ρ, a parameter to be estimated. Of interest are Social Security program rules and their parameters, β_{1l}, β_{2l}, β_{3l} in the labor force participation equation and β_{1s}, β_{2s}, β_{3s} in the Social Security benefit receipt equation. Particularly, we calculate the marginal effect of *drc*, *el*, and *nra* on the probability of each of the four joint outcomes.

Three sources of variation allow for the identification of the coefficients for three program parameters. They are between age-group variations, within age-group across-time variations, and between birth-cohort variations. The differential applicability of the RET provides the between age-groups variations. For example, the RET is applicable only to those in the 62-69 age group (those aged 70-74 are exempt), and affected the 65-69 age group only prior to 2000, when the RET was repealed. The variations in earning limits for specific age groups in any given year create within-age-group temporal variations. The variation across time in normal retirement age and delayed retirement credit allow the between birth-cohorts variations.

By including unrestricted age and year dummies in regression (1), we control for secular differences across ages and across time to parse out the impacts of the Social Security program on retirement behavior, assuming that all age groups follow an identical trend. To examine differential age trends in SS effects on the joint retirement outcomes, an ideal specification is to allow for fully non-parametric age-group-specific time effects. Such a specification is infeasible because the differential changes between age groups over time in the RET, DRC, and NRA are sources of identification for the parameters of interest. A feasible approach is to check the sensitivity of the specification to the inclusion of linear or quadratic time trends that are age-group-specific.

An important determinant of labor force participation is regional or local labor market conditions beyond the nationwide macroeconomic conditions, which are accounted for by the inclusion of unrestricted year dummies. To account for labor market differences across states, we replace residential region dummies in (1) with unrestricted state-of-residence dummies, assuming that all age groups are identically affected by the state-level labor market conditions. To account for differential location effects by age, we examine the sensitivity of the specification to the inclusion of state-specific fixed-effects that are age-group-specific.

4. Results

4.1. Descriptive analysis

Table 1 presents the sample means of key variables used in the regression analysis, by age group, over the study period. Among the men in the 62-64 age group, about 41% worked and 60% received retirement benefits; the DRC averaged 4.94 percentage points, the NRA averaged 65.15 years, and the EL (earnings limit, based on age and year, in current dollars) averaged $8,032. About 88% of the men aged 62-64 are white, 59% are veterans, 80% are married with 10% divorced, 5% widowed and 5% never married; approximately 20% are college graduates, 16% have some college, 33% are high school graduates. Among the age 65-69 group, about 25% participated in the labor force and 87% are retirement benefit recipients; their average delayed retirement credit is 4.24 percentage points, normal retirement age is 65.03 years, and their average earnings limit is $9,549 during the years the earnings test is effective on them. About 88% of them are white and 59% are veterans; an average of 79% are married, 8% divorced, 8% widowed, and 5% never married; and around 19% are college graduates, 15% attended college, and 32% are high school graduates. Among the age 70-74 group, the average labor force participation rate is 16% and the retirement benefits claiming rate is over 92%; the average delayed retirement credit is 3.62 percentage points, normal retirement age is uniformly 65 years, and there is no earnings limit applicable to these individuals. About 90% are white and 57% are veterans; and around 77% are married, 7% divorced, 12% widowed, and 4% never married. Approximately 18% of them graduated from college, 15% attended college, and 31% graduated from high school.

As shown in Figure 2, the entire sample of men, age 62-74, exhibits some clear demographic trends over the period of 1980-2006. The most remarkable is the shift toward higher education. The fraction of these older men having less than high school education declines steadily from 53.2% in 1980 to 18.3% in 2006. Similarly, the proportion of college graduates more than doubled in the period, from 11.8% in 1980 to 27.3% in 2006. Concomitant increases are seen in the proportions of those who are high school graduates and those who have some college education. Equally notable are the increase in the proportion of divorced men and the decrease in the proportion of married men. For example, in 1980 only 5.5% of the older men were divorced; by 2006 this fraction had more than doubled, to 11.7%. The proportion of white men in the sample declined slowly over the period, from 89.8% in 1980 to 86.1% in 2006. The proportion of military veterans exhibits an inversed U-shape during the same period, starting at 36.7% in 1980, reaching the highest of 69.1% in the mid-1990s, and falling to 46.0% in 2006.

4.2. Joint trends in the labor force participation and benefit receipt

The long-term trends in rates of labor force participation and benefit receipt for the entire sample of men are presented in Figure 3. From 1980 to the mid-1990s, the labor force participation rate was relatively stable at about 26%-27%, after which the rate showed a steady upward trend, rising from 25.7% in 1995 to nearly 32.7% in 2006. The benefit receipt rate exhibits a similar pattern but in the opposite direction, remaining steady from 1980 to 1995 at about 82%-83%, then slowly declining from 83.4% in 1995 to 75.5% in 2006.

Figure 4 presents trends in rates of labor force participation and benefit receipt by age group over the study period. While the trends in labor force participation are similar across all three age groups, the post-1995 rate increase is more pronounced among the two older groups of men than the 62-64 group, rising 4.8 percentage points, or 30%, among the 70-74 age group; 5.9 percentage points, or 25%, among the 65-69 age group; and 4.4 percentage points, or 20%, among the 62-64 age group. For rates of benefit receipt, however, much of the decline seen in the entire sample is concentrated among the youngest age group – which represents the early recipients. The rate of benefit receipt for those 62-64 dropped 10.9 percentage points, or 17%, over the period, while rates for the 65-69 group declined 3.9 percentage points, or 4%, and the 70-74 age group declined 5.1 percentage points, or 5%.

Trends in joint retirement behavior – that is, labor force participation and retirement benefit receipt combined in four categories – are shown in Figure 5, with age-specific trends presented in Figure 6. These four joint trends look relatively stable up to the mid-1990s, after which all exhibit notable deviations. The most noteworthy are the polarized changes that occur in the fractions of non-working beneficiaries and non-beneficiary workers. Within a decade, the fraction of non-working beneficiaries shows a 15% decline, from 67.5% in 1995 to 57.9% in 2006, while the fraction of non-beneficiary workers shows a 54% gain, from 9.8% in 1995 to 15.1% in 2006. As shown in Figure 6, the 1995-2006 decline in the fraction of non-working beneficiaries is highest in the 62-64 age group, at about 18%, and similar in the other two age groups, among which the fraction declined about 10%. The rise in the proportion of non-beneficiary workers from 1995 to 2006 is substantial in all three age groups: the 70-74 age group shows a dramatic increase of about 170% (from 1.5% in 1995 to 4.1% in 2006); the 62-64 and 65-69 age groups each exhibit about a 30% increase (or 8.7 and 1.7 percentage points, respectively). From 1995 to 2006, the fraction of the entire sample of older men (ages 62-74) who were working beneficiaries increased 11%, from 15.8% in 1995 to 17.6% in 2006. However, the changes vary by age group, with a decline of about 13% for those 62-64, and an increase of about 20% for those 65-69 and 70-74.

The joint trends in labor force participation and benefit receipt evidence extensive variation since the mid-1990s, during which time three key program parameters of Social Security took major effects. We also see substantial variations across age groups, which were subject to differential parameters in the program rules for the same period. To account for these trends and variations, we estimated the differential effects of changes in the Social Security program on the joint work and benefit outcomes of our age groups via a formal regression analysis.

4.3. Impact of Social Security program on the joint outcomes in labor supply and benefit receipt

4.3.1 Main Results

Table 2 presents the bivariate probit estimations of the two equations (1) – for labor force participation (LFP) and Social Security benefit receipt (SSB) – with the coefficients and the marginal effects calculated at the sample means. In the baseline estimates, the coefficients for DRC and NRA in the labor force participation equation are negative and significant, while the

coefficient for EL is positive but insignificant; the coefficient for DRC in the benefit receipt equation is positive and significant, while the coefficients for NRA and EL are negative, and insignificant in the former and significant in the latter. The correlation between the error terms in both the labor force participation and benefit receipt equations is strongly negative, -0.51, and highly significant.

Turning to the marginal effects of these program parameters on the joint outcomes, we have several findings of note (see Table 2, columns 3-6). First, a higher DRC leads to an increase in the probability of claiming benefits with or without working: a one percentage point increase in DRC yields an increase in the likelihood of benefit receipt of 0.95 percentage point for the working and 2.10 percentage points for the nonworking, and both estimates are significant. The marginal effect of an increase in DRC on the probability of not claiming benefits is negative regardless of labor force participation, yielding a reduction of 1.41 and 1.64 percentage points for workers and nonworkers, respectively, and both estimates are also significant. Second, a one-year increase in NRA leads to a significant 3.39 percentage-point reduction in the probability of working and claiming benefits, and a significant 1.67 percentage-point increase in the probability of neither working nor claiming benefits. Third, an increase in the EL has negligible or no effect on all joint outcomes of labor force participation and benefit receipt.

Next, we check the sensitivity of the baseline estimates to the inclusion of age-group-specific secular trends in labor force participation and benefit receipt that are separate from the economic incentives provided by the changes in Social Security program parameters. (See panel B of Table 2.) Under the age-group-specific quadratic trend specification, both linear and quadratic trend terms are highly significant for all age groups in both the labor and benefit equations. The 62-64 age group has an initial decline and then a rising rate for labor force participation, and an initial rising and then declining rate for benefit receipt. Both the 65-69 and the 70-74 age groups have an initial rise followed by a decline in the rate for labor force participation, and an initial decline followed by a rising rate for benefit receipt. Since the specification with quadratic trends that are age-specific is more flexible than the baseline, we consider it our preferred model. The main results from this model are summarized as follows. An increase in DRC influences all four joint outcomes, increasing the likelihood of claiming benefits with or without working by 1.31 and 1.19 percentage points, respectively, and decreasing the likelihood of non-claiming with or without working by 1.00 and 1.49 percentage points,

respectively. An increase in NRA also exerts influence on the likelihood of all joint outcomes except working without claiming, yielding a 4.38 percentage-point decline in the chance of working and claiming, a 3.51 percentage-point increase in the chance of not working while claiming, and 1.63 percentage-point increase in the chance of neither working nor claiming. Changes to the earnings limit appear to have no effect on any of the four joint outcomes after we account for the age-group-specific quadratic trends.

4.3.2. Robustness Checks

Next we performed checks of the sensitivity of our main results to slightly varying identification sources. Three sources of variation allow for identification of the coefficients of the Social Security program parameters: between age-group variations, within age-group across-time variations, and between birth-cohort variations. A primary identification source is the variation in Social Security program parameters that target different age groups. The age 65-69 group is the primary target for these program changes – individuals in this group were exposed to the largest variations in the incentives for delaying benefit receipt and participating in the labor market, while the age 70-74 group experienced the slightest changes in these incentives, and the age 62-64 group fell in the middle. To check the robustness of our main results, we repeat the estimation using the preferred model with different subsets of the study sample. Table 3 presents the marginal effects of Social Security program parameters when the study sample comprises of individuals age 62-69 (panel A) and age 65-74 (panel B). Overall, our main results are stable whether or not we exclude the 62-64 or the 70-74 age groups. When we exclude the age 70-74 group, we find an increase in the size of the effects of DRC and NRA compared with the main results, probably because the changes in these two parameters were not designed to affect the 70-74 age group. When we exclude the age 62-64 group, we find a reduction in the effect of DRC and an increase in the effect of NRA compared with the main results. This is probably because an increase in DRC would be a strong inducement to those in the 62-64 age group, who may be still planning for retirement, while an increase in NRA (to above age 65) would motivate little change in this younger group's retirement behavior. And, as with the 70-74 year olds, the 62-64 year olds are not the primary targets of the changes in SS parameters, which are targeted to those in the 65-69 age group. These stronger effects of program changes are shown in Table 3 (panel

C), where we see a substantial increase in the magnitude of the effect of NRA, DRC, and EL on all four work-benefit receipt outcomes.

We perform additional specification checks, and our main results are robust. We control for a finer set of geographic effects by replacing the Census region or division of residence indicators with the state-of-residence indicators, to better account for state-level variations in labor market conditions. Furthermore, our results are robust to the inclusion of the linear trend interacted with state-of-residence indicators, which accounts for state-specific trends that might influence the labor force participation and retirement benefits receipt behaviors.

4.3.3. Heterogeneity in Responses to Social Security by Educational Attainment

To further refine our results, we examine the potential heterogeneity by educational attainment in the effects of changes in the Social Security program parameters on the four employment-benefit receipt combinations. The results are displayed in Table 4. There is a clear education gradient in the distribution of the four joint outcomes. Over the study period, the average proportion of men both working and receiving benefits increases with educational attainment; the percentage is 12.5% among high school dropouts, 16.2% among high school graduates, 19.7% among those with some college education, and 22.3% among college graduates. The average proportion of men working without receiving benefits also increases with education, rising steadily from 5.1% among high school dropouts to 17.5% among college graduates. The average fraction of men who receive benefits without working decreases steadily with educational attainment, from a high of 75.8% for high school dropouts to a low of 52.2% for college graduates.

The behavioral responses to Social Security's changes in DRC, NRA, and EL tend to be more pronounced among men at either end of the education spectrum – high school dropouts and college graduates – than for those with a high school degree or some college attendance. But clear education gradients are also seen. The effect of DRC on the fraction of men receiving benefits with or without working exhibits a strong education gradient, with its strongest effect found among college graduates and its weakest among high school dropouts. For example, an increase in delayed retirement credit reduces the probability of working without claiming benefits, and its effect is a 0.73 percentage point among high school dropouts, a 0.94 percentage point among high school graduates, and 2.95 percentage points among college graduates. DRC

also reduces the probability of neither working nor claiming benefits, and its effect is 1.12 percentage points among high school dropouts, 1.23 percentage points among high school graduates, and 3.18 percentage points among college graduates. The effect of delayed retirement credit on the outcome of both working and claiming is concentrated among college graduates.

The effects of an increase in normal retirement age are seen only among those without high school degrees or those with college degrees. The extension of NRA leads to a large and significant 13.35 percentage-point reduction in the proportion of college graduates who both work and receive benefits, and has no effect among those without a college degree. The increased NRA has about the same degree of positive effect on the proportion who receive benefits without working among high school dropouts and college graduates, at about 7.8 percentage points, and has no effect among those who graduated from high school but have no college degree. While a change in NRA reduces the fraction of those who work without claiming benefits among high school dropouts, it increases the fraction of those neither working nor claiming among college graduates.

Changes to the SS earnings limit have a small effect solely among high school dropouts. Higher EL negligibly increases the probability of working and claiming, and decreases the probability of not working with or without claiming among high school dropouts. Given both the relatively low threshold for the EL and the tendency for high school dropouts to have lower earnings than those with more education, it is plausible that older men without a high school diploma would be the most sensitive to an increase in the SS earnings limit, and adjust through labor force participation.

4.3.4. Heterogeneity in Responses to Social Security by Marital Status

Finally, we examine the potential heterogeneity by marital status in the effects of changes in the Social Security program parameters on the four employment-benefit receipt combinations. The results are presented in Table 5. We see an important difference in the distribution of the four joint outcomes by marital status. Nearly 17.7% of married men worked and claimed benefits, a proportion that decreases to 14.5% among divorced men and to 11%-12% among single or widowed men. The fraction of those working without claiming benefits is similar among married, divorced, and single men, and at around 9%, but is much lower in widowed men, at about 4%. Similarly, the proportion of those claiming benefits without working is stable

across married, divorced, and single men at around 66%, but much higher among widowed men at nearly 77%. The percentage of men neither working nor claiming is similar across all marital statuses.

The increase in DRC had generally positive effects on the proportion of men working and claiming benefits, ranging from 2.55 percentage points among widows and 3.25 percentage points among singles, to 5.51 percentage points among divorced men. But it had no effect among married men. DRC exerts a negative effect on the outcome of neither working nor claiming benefits, but the size of the effect varies by marital status: about 1.13 percentage points among married men, 2.11 percentage points among those divorced, 4.18 percentage points among singles, and 3.34 percentage points among widows. Our findings indicate that the increase in DRC had opposite effects on the outcomes of working without claiming and claiming without working between married and divorced men: the probability of working without claiming increases by 1.85 percentage points among divorced men and decreases by 1.15 percentage points among married men, while the probability of claiming without working decreases by 5.25 percentage points among divorced men and increases by 1.69 percentage points among married men.

We find the increase in normal retirement age to affect married men only, with a negative impact on the outcome of working and claiming, and a positive impact on the outcome of neither working nor claiming. Last, we find the change in earnings limit to have an effect only among divorced men, with a positive effect on the outcome of working and claiming and a negative effect on neither working nor claiming.

5. Discussion

Our analysis leads to two findings regarding our original research objectives. First, the fraction of men who participated in the labor force and delayed benefits receipt rose from the mid-1990s through 2006, while the fraction of men who received benefits without working declined in this period. We also saw a steady increase over the study period in the proportion of men who both worked and received benefits, with a jump starting in 2000. Second, Social Security's parameters for DRC, NRA, and EL are important determinants of the joint outcomes of labor force participation and benefit receipt, which are strongly and negatively correlated. Raising the DRC increased the likelihood of benefit receipt regardless of labor force status, and

reduced the probability both of working without claiming and of neither working nor claiming. An increase in NRA reduced labor force participation regardless of benefits receipt status: it decreased the probability of working and claiming, and it increased the probability both of not working and claiming and of neither working nor claiming. Higher earnings limits generally increased the likelihood of benefit receipt; however, this effect disappeared when age-group-specific quadratic trends are taken into account.

Our results generally support those from previous studies, but we also have some novel findings. Consistent with the literature (Friedberg, 2000; Loughran and Haider, 2005; Song and Manchester, 2006) on the labor supply effects of changes to the earnings test, we find that an increase in the earnings limit encourages labor force participation among men with lower educational attainment and who are divorced, albeit to a negligible degree. Unlike some previous studies (e.g., Gruber and Orszag, 2003; Song and Manchester, 2006), which find positive effects of EL on benefits receipt, we find mixed effects. Several factors may contribute to our departure from the literature. First, unlike these studies, we take into account labor force participation, which is found to be negatively correlated with benefit receipt. Second, we examine the prevalence of benefit receipt along with labor force participation, while Song and Manchester (2006) focus on the incidence of benefit receipt. Third, while these studies focus on the effect of a single large change in earnings limit – the 2000 repeal of the earnings test for the age 65-69 group – we examine the gradual increase in the earnings limit over many years and differentially across age groups. Finally, we consider the effects from two other program parameters, DRC and NRA, which are correlated with EL and designed to influence employment and benefit receipt decisions. Consequently, this study relies on a wider range of identification sources than these previous studies.

In regard to delayed retirement credit, unlike Pingle (2006), who finds that rising delayed retirement credit increases labor force participation, we find a mixed effect, where DRC exerts a positive impact on the joint outcome of working and receiving benefits, but a negative impact on working without receiving benefits. Several factors may contribute to this difference in the findings. Again, we consider the outcomes of both benefit receipt and labor force participation, and we consider the effects of three Social Security program parameters, not just the DRC. Also, we use the CPS data while Pingle uses the Survey of Income and Program Participation (SIPP), and trends in the labor force participation rate among men aged 65-69 in the SIPP shows a

substantial deviation from that in the CPS data. Notably, the SIPP data show an abrupt surge in the labor force participation rate in the mid-1990s, a surge that is clearly absent in the CPS samples. Finally, we employ a wider variety of identification sources than Pingle (2006) in examining the effects of these program parameters, and our study samples range in age from 62 to 74, while Pingle's study samples are age 65-69.

To elaborate on the last point, we are able to replicate Pingle's results using the CPS data and a specification similar to Pingle's. In this analysis, we perform a probit regression of labor force participation status on DRC and NRA (both as continuous variables) among men aged 65-69, controlling for single-year age, survey year, region of residence, and educational attainment, linear and quadratic trend terms. We find that the coefficient for DRC is positive and significant, and the coefficient for NRA is negative and significant. The marginal effect of DRC is a significant increase of 1.97 percentage points in labor force participation, compared with an increase of 1.60 percentage points in Pingle's with comparable specifications. With the inclusion of the age 62-64 and 70-74 groups, the marginal effect of delayed retirement credit reduces to 1.22 and 1.19 percentage points, respectively, and becomes insignificant at the conventional level in the former.

Our study has several limitations. One limitation is that in the CPS, the respondent's age was recorded as of March while the labor supply and Social Security income measures refer to the previous year. To address the potential for age-group misclassification resulting from this data limitation, we take a conservative approach in which we discard those cases (e.g., for ages 62, 65 and 70) for which ambiguity exists about the earnings test and delayed retirement credit parameters facing respondents in the previous year. We find our main results are stable in this conservative approach. Another limitation is that the CPS does not record the year of birth, and we calculate the year of birth as the difference between survey year and recorded age. We recognize that the misclassification of birth year that is possible in this approach would potentially bias the estimates on the effects of changes in DRC and NRA, which are birth-cohort-specific. However, because the cross-cohort changes in DRC and NRA are relatively small, we expect the magnitude of potential bias to be small. A third limitation is that we use data on respondents' marital status and region or state of residence recorded at the survey year, but we perform the regression analyses using age and Social Security program variables that refer to the previous year.

The credibility of the causal interpretation of the estimates depends on the appropriateness of controls. Given the 2000 repeal of the earnings test, and the increases in DRC and NRA that target the 65-69 population, we use the 62-64 and 71-74 age groups as controls in estimating the impacts of those changes on retirement outcomes, assuming that only those in the 65-69 age group were affected (treated) by these program changes. Although some studies have shown that the 62-64 and 71-74 age groups may also be affected by these program changes, which might challenge the appropriateness of their serving as controls to the 65-59 population (Stewart, 1995; Friedbreg and Webb, 2006), our robustness analysis shows that our main results are stable to the inclusion or exclusion of the younger and older age groups, lending support to the notion that the spillover effect might be insignificant.

6. Conclusion

This study expands the literature on the impact of Social Security retirement benefit parameters on the labor force participation and benefits receipt of older populations. First, in assessing the effects of the economic incentives created by Social Security program rules, it is critical to recognize that individuals approach work-benefit receipt decisions simultaneously, thus a focus on one decision ignoring the other is incomplete in the assessment of the program effect. The strong yet diverging trends in the distribution of the outcomes of working and receiving benefits amplify the importance of gaining a better understanding of what drives each outcome and joint outcomes.

Second, in examining the behavioral responses to various economic incentives created by Social Security program rules on labor force participation, benefits receipt, or both, it is essential to recognize that these program rules are designed to act concurrently, if not synergistically – and thus research that focuses on solely one or two parameters will yield an incomplete understanding of how the broader Social Security program affects retirement behavior.

Third, it is important to recognize the existence of differential retirement behaviors and differential program effects across demographic subpopulations. Particular attention should be paid to the educational attainment gradient in the impact of Social Security parameters on retirement behavior, and possibly on income and wealth in later adulthood. Our findings indicate that the effects of changes in the Social Security delayed retirement credit, normal retirement age, and earnings limit vary in their magnitude and direction across age group, education, and

marital status among our sample of older men. Our findings are based on reduce-formed analysis, and an assessment of the mechanisms through which the observed behavioral responses take effect is beyond the scope of this study. The heterogeneity of program effects – particularly the education gradient – suggests the influences of factors not controlled in this study. For example, these factors might include preferences for work, capacity to work, and perceptions of mortality risks and the security of future retirement benefits. These factors may vary among older Americans with differing levels of education, and exert important effects on labor force participation and benefits receipt that are beyond the effects of the economic incentives created by the Social Security programs.

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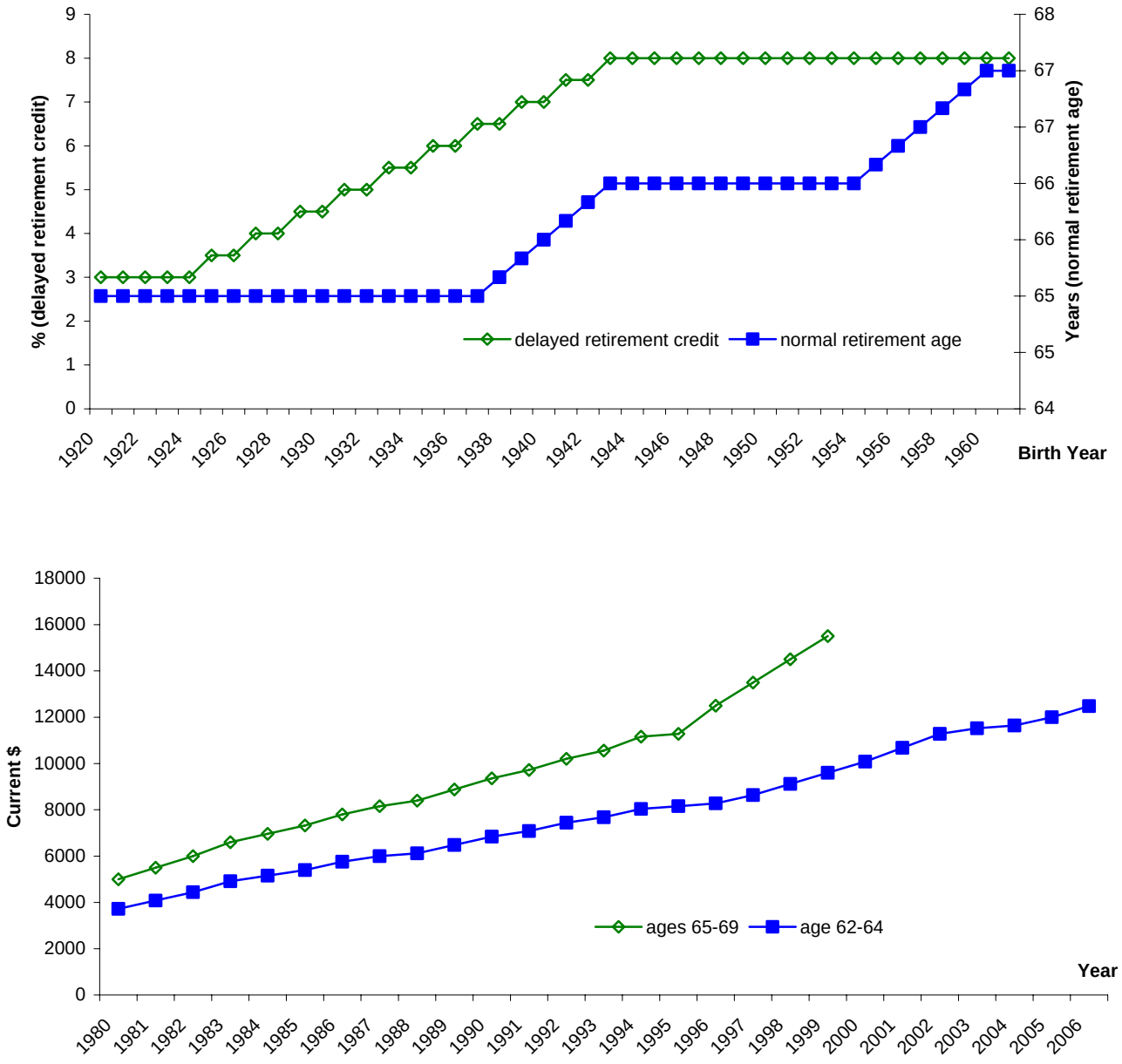
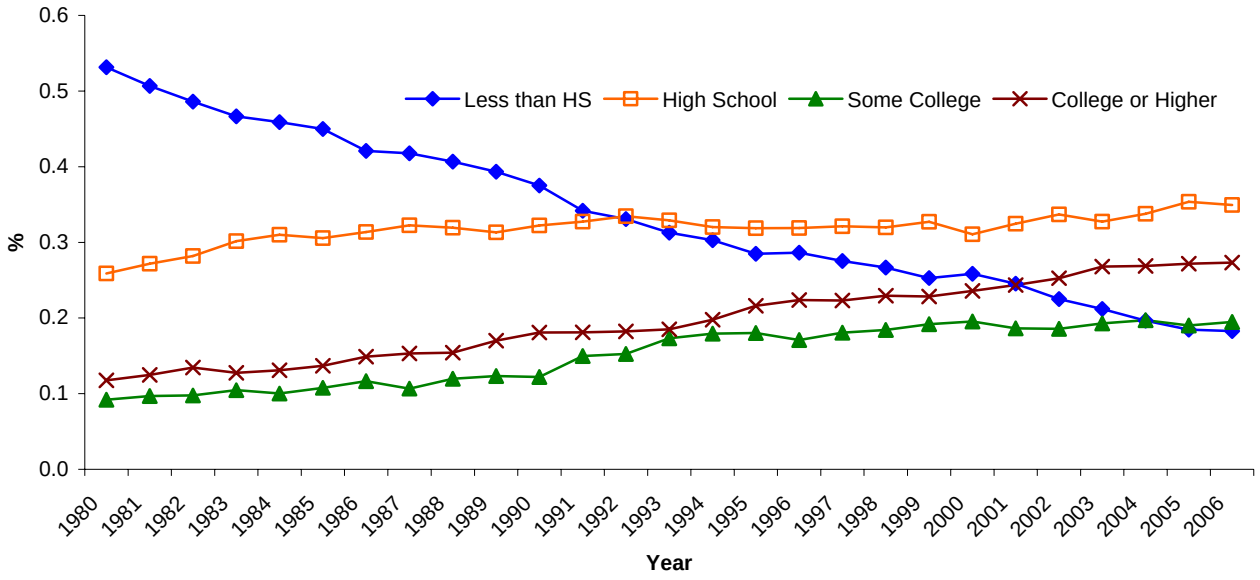
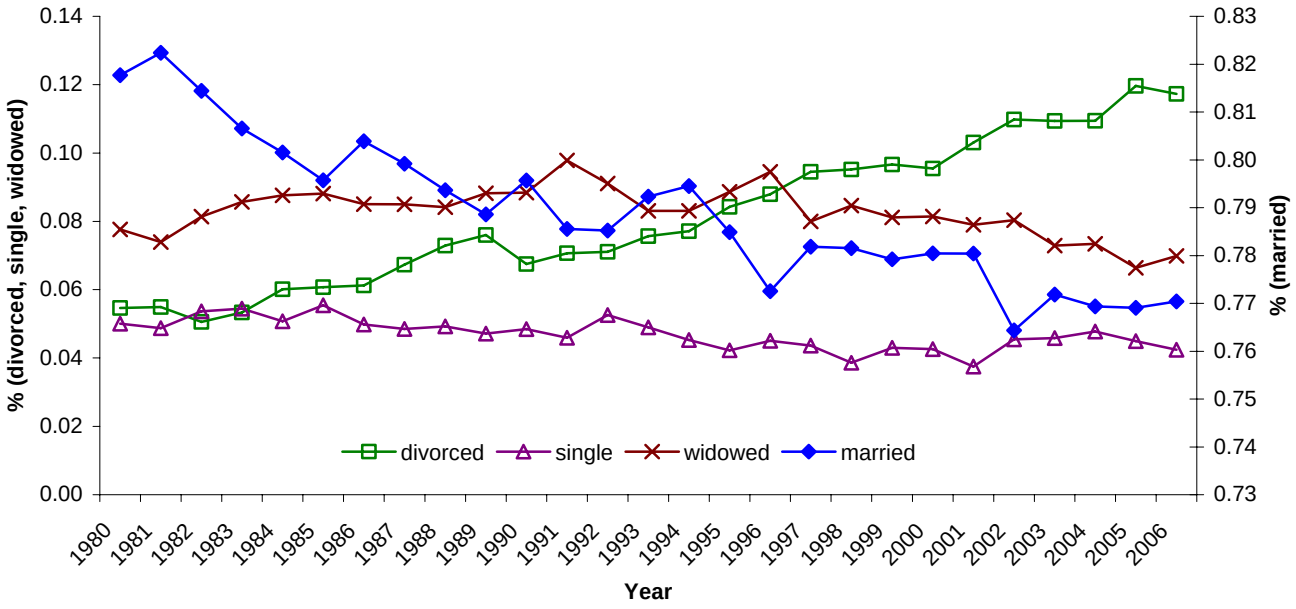
Figure 1: Cross-year, cross-age-group variations in Social Security program rules of delayed retirement credit, normal retirement age, and earnings limits over 1980-2006

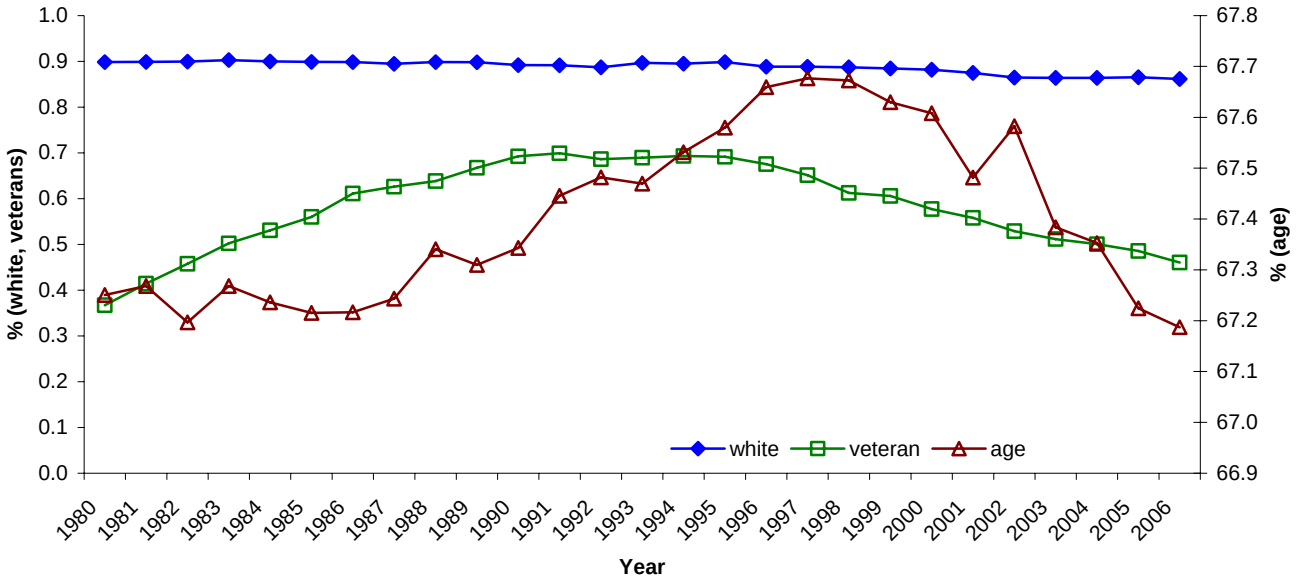


Notes: Data source: Social Security Administration http://www.ssa.gov/.

Figure 2: Demographics of the 62-74 male population over 1980-2006

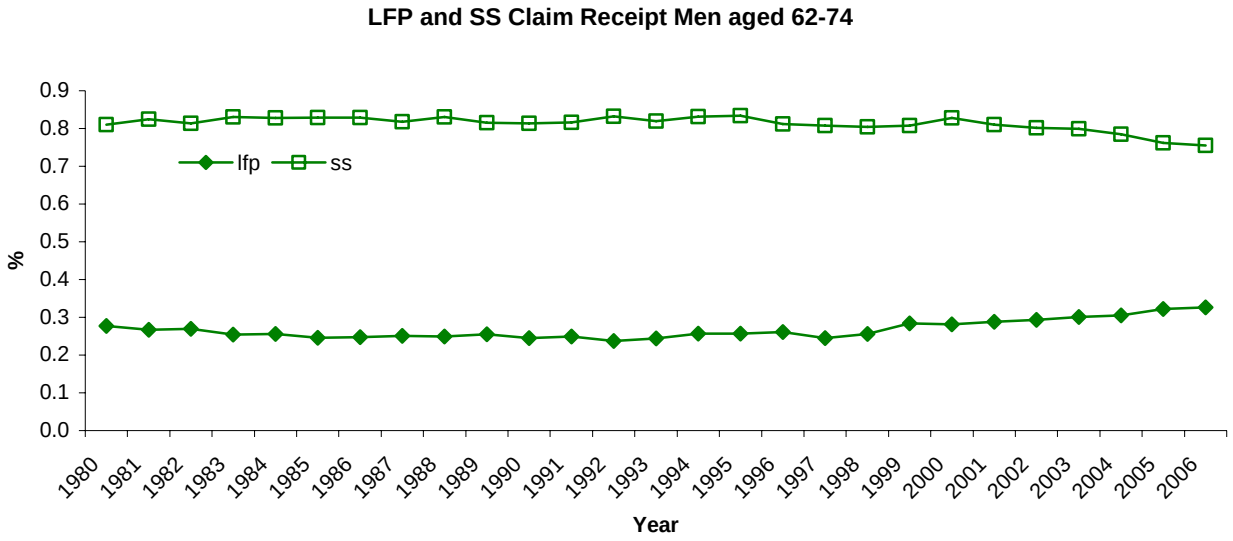






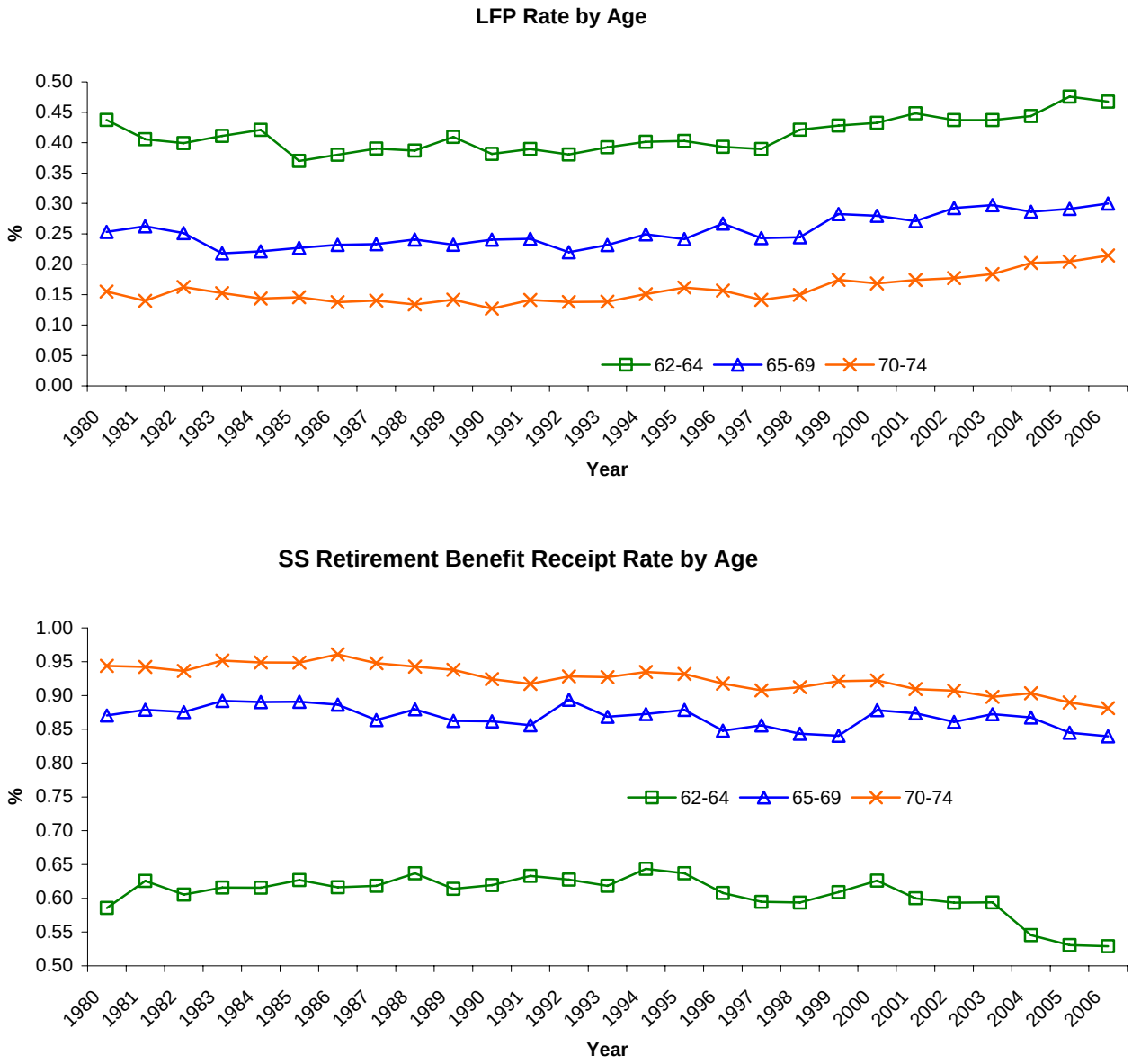
Notes: Presented are the yearly population averages of key demographic variables among men aged 62-74 over the period of 1980-2006 using the Current Population Surveys, adjusting for personal weights to account for the complex survey designs.

Figure 3: Trends in labor force participating and Social Security benefit receipt rates among men aged 62-74



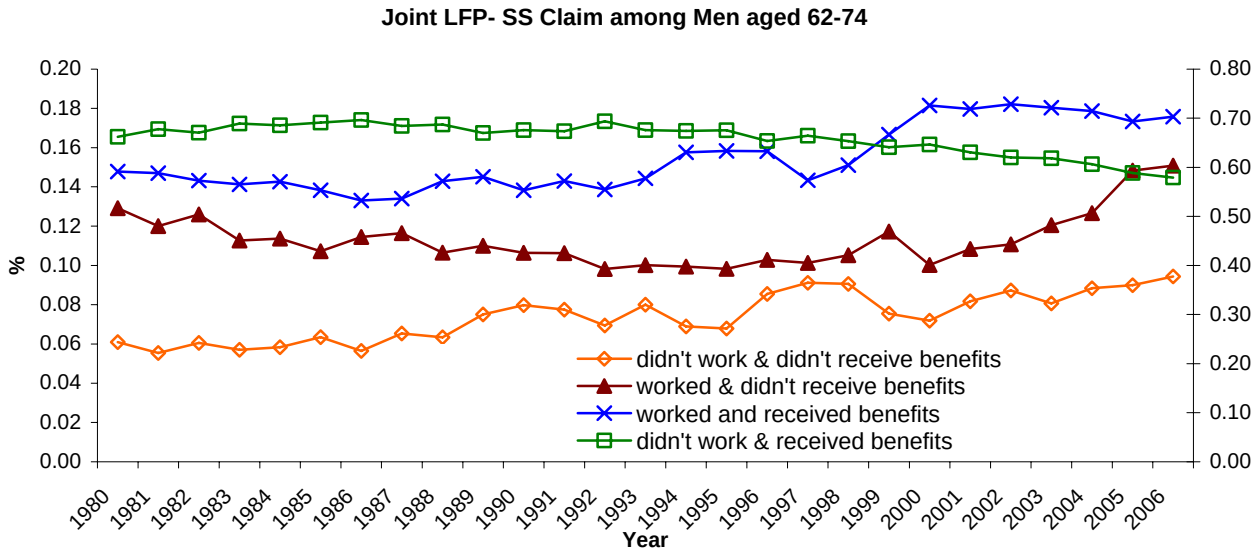
Notes: Presented are the yearly population averages of labor force participation rate (*lfp*) and Social Security retirement benefits receipt rate (*ss*) among men aged 62-74 over the period of 1980-2006 using the Current Population Surveys, adjusting for personal weights to account for the complex survey designs.

Figure 4: Trends in the older men's labor force participation and Social Security retirement benefits receipt rates by age groups



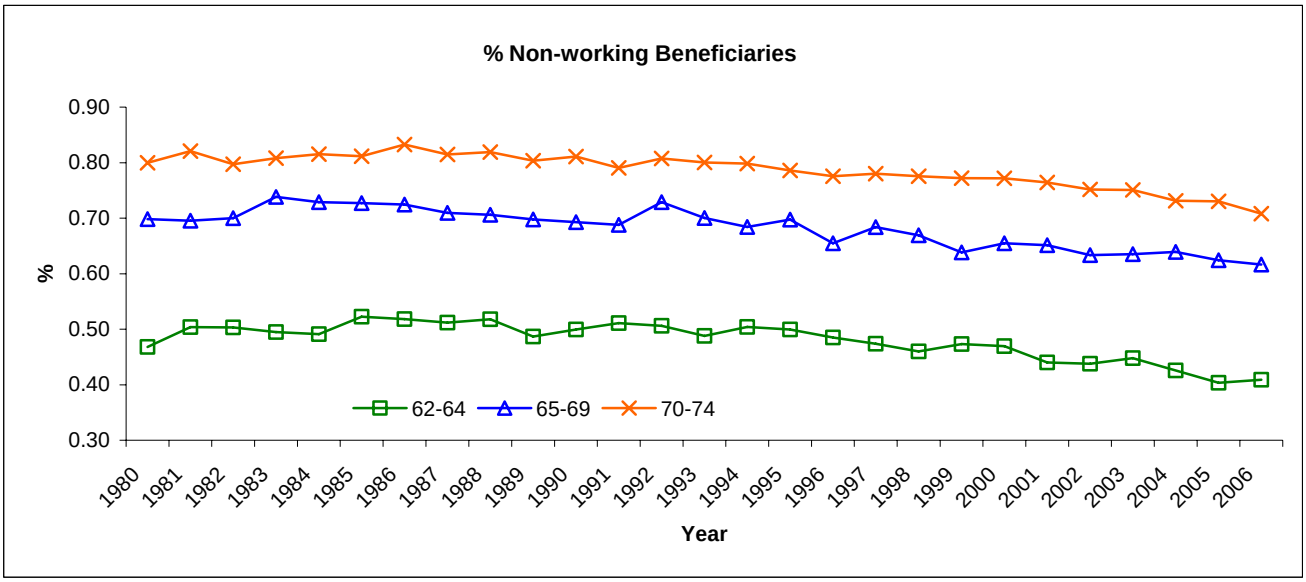
Notes: Presented are the yearly population averages of labor force participation rate and Social Security retirement benefits receipt rate of men in three age groups – 62-64, 65-69, and 70-74 – over the period of 1980-2006 using the Current Population Surveys, adjusting for personal weights to account for the complex survey designs.

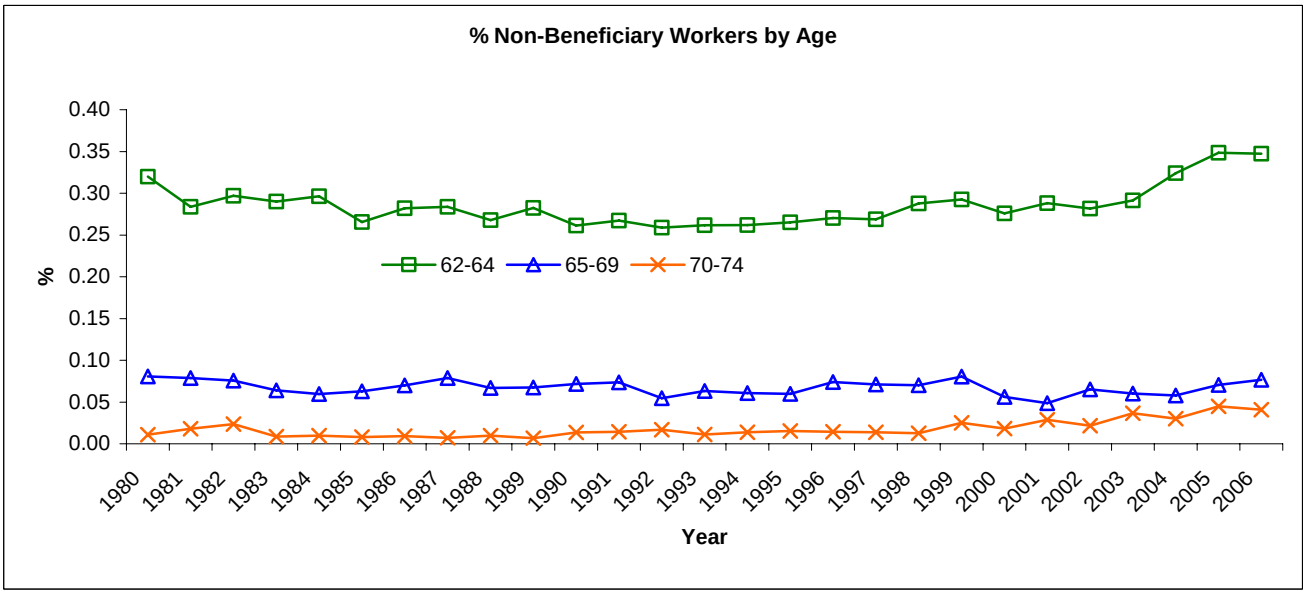
Figure 5: Trends in the joint outcomes in labor force participation and Social Security retirement benefit receipt statuses among men aged 62-74

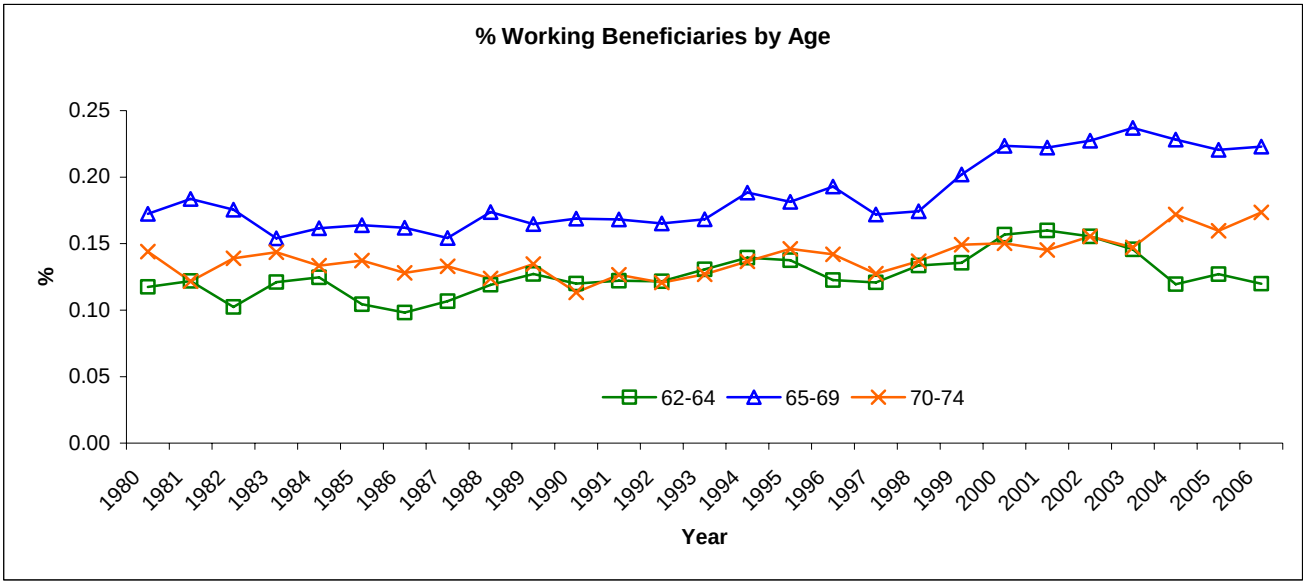


Notes: Presented is the yearly population averages of the rates of the joint outcomes in labor force participation status and Social Security retirement benefits receipt status among men aged 62-74 over the period of 1980-2006 using the Current Population Surveys, adjusting for personal weights to account for the complex survey designs.

Figure 6: Joint Trends in the LFP and Benefit Receipt by Age Group







Notes: Presented are the yearly population averages of the rates of three joint outcomes in labor force participation status and Social Security retirement benefits receipt status – receiving benefits without working, working without receiving benefits, and working and receiving benefits – among men of different age groups – 62-64, 65-69, and 70-74 – over the period of 1980-2006 using the Current Population Surveys, adjusting for personal weights to account for the complex survey designs.

Table 1: Means of demographics, labor force participation, and benefit receipt by age groups

	Age 62-74	Age 62-64	Age 65-69	Age 70-74
Labor force participation status	0.2684	0.4138	0.2541	0.1587
SS retirement benefits receipt status	0.8120	0.6042	0.8679	0.9243
Delayed retirement credit	4.2422	4.9448	4.2428	3.6245
Normal retirement age	65.0543	65.1524	65.0290	65.0000
Earnings limit ($1,000)	8.8082	8.0324	9.5492	-
White	0.8871	0.8808	0.8842	0.8963
Veteran	0.5831	0.5857	0.5944	0.5665
Marital status: married	0.7881	0.7979	0.7946	0.7713
Marital status: divorced/separated	0.0826	0.1003	0.0814	0.0685
Marital status: widowed	0.0826	0.0503	0.0778	0.1168
Marital status: single	0.0468	0.0515	0.0463	0.0434
Education: less than high school	0.3296	0.2867	0.3308	0.3655
Education: high school graduates	0.3189	0.3287	0.3219	0.3067
Education: some college	0.1537	0.1631	0.1539	0.1450
Education: college graduates	0.1978	0.2215	0.1933	0.1827
Age 62	0.0949	0.3386	-	-
Age 63	0.0914	0.3263	-	-
Age 64	0.0938	0.3350	-	-
Age 65	0.0880	-	0.2194	-
Age 66	0.0837	-	0.2088	-
Age 67	0.0790	-	0.1970	-
Age 68	0.0759	-	0.1893	-
Age 69	0.0744	-	0.1855	-
Age 70	0.0711	-		0.2230
Age 71	0.0666	-	-	0.2088
Age 72	0.0633	-	-	0.1985
Age 73	0.0601	-	-	0.1883
Age 74	0.0579	-	-	0.1814
Residence region 1	0.0527	0.0529	0.0527	0.0527
Residence region 2	0.1568	0.1562	0.1559	0.1584
Residence region 3	0.1613	0.1651	0.1609	0.1585
Residence region 4	0.0720	0.0694	0.0729	0.0730
Residence region 5	0.1948	0.1923	0.1941	0.1979
Residence region 6	0.0626	0.0641	0.0627	0.0612
Residence region 7	0.1010	0.1016	0.1012	0.1003
Residence region 8	0.0578	0.0560	0.0585	0.0585
Year 1980	0.0319	0.0331	0.0323	0.0304
Year 1981	0.0321	0.0333	0.0327	0.0303
Year 1982	0.0328	0.0346	0.0337	0.0300
Year 1983	0.0333	0.0345	0.0337	0.0319
Year 1984	0.0342	0.0354	0.0357	0.0314
Year 1985	0.0351	0.0374	0.0354	0.0327
Year 1986	0.0355	0.0373	0.0359	0.0332
Year 1987	0.0365	0.0378	0.0371	0.0347
Year 1988	0.0370	0.0375	0.0379	0.0356
Year 1989	0.0370	0.0372	0.0388	0.0346
Year 1990	0.0380	0.0376	0.0394	0.0366
Year 1991	0.0379	0.0358	0.0397	0.0373
Year 1992	0.0378	0.0369	0.0374	0.0390

Year 1993	0.0368	0.0358	0.0364	0.0383
Year 1994	0.0377	0.0365	0.0368	0.0400
Year 1995	0.0379	0.0350	0.0387	0.0394
Year 1996	0.0375	0.0334	0.0386	0.0398
Year 1997	0.0371	0.0337	0.0367	0.0407
Year 1998	0.0373	0.0336	0.0374	0.0404
Year 1999	0.0377	0.0353	0.0374	0.0402
Year 2000	0.0382	0.0353	0.0383	0.0405
Year 2001	0.0385	0.0380	0.0379	0.0398
Year 2002	0.0394	0.0395	0.0364	0.0430
Year 2003	0.0392	0.0412	0.0365	0.0407
Year 2004	0.0401	0.0417	0.0389	0.0401
Year 2005	0.0414	0.0455	0.0401	0.0394
Year 2006	0.0421	0.0472	0.0405	0.0398
Sample size	168,367	47,200	67,623	53,544

Notes: Presented are the population means of key variables by age groups in columns. All variables are dichotomous except delayed retirement credit (in percentage points), normal retirement age (in years), and earnings limit (in $1,000). The earnings limit is calculated among individuals during the years the earnings test as applicable to them. Both year and age refer to the year prior to the survey year. Personal weight is used to adjust for complex survey design. Data source is the Current Population Surveys.

Table 2: Baseline estimates of Social Security program on joint outcomes of labor force participation and benefit receipt

	Coefficients		Marginal Effects			
Outcomes	**LFP**	**SSB**	**LFP-yes SSB-yes**	**LFP-yes SSB-no**	**LFP-no SSB-yes**	**LFP-no SSB-no**
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: No trends						
Delayed retirement credit	-0.0143	0.1264 ***	0.0095 ***	-0.0141 ***	0.0210 ***	-0.0164 ***
	(0.0107)	(0.0121)	(0.0027)	(0.0016)	(0.0035)	(0.0016)
Normal retirement age	-0.1086 ***	-0.0657 *	-0.0339 ***	-0.0008	0.0181	0.0167 ***
	(0.0354)	(0.0384)	(0.0085)	(0.0116)	(0.0116)	(0.0051)
Earnings limit ('10,000)	-0.0002	0.0009 ***	0.0000	-0.0001 ***	0.0002 ***	-0.0001 ***
	(0.0002)	(0.0002)	(0.0000)	(0.0000)	(0.0001)	(0.0000)
Correlation parameter ρ	-0.5079 ***					
	(0.0045)					
Panel B: Quadratic trends						
Delayed retirement credit	0.0096	0.1034 ***	0.0131 ***	-0.0100 ***	0.0119 **	-0.0149 ***
	(0.0182)	(0.0207)	(0.0045)	(0.0028)	(0.0057)	(0.0028)
Normal retirement age	-0.1606 ***	-0.0361	-0.0438 ***	-0.0076	0.0351 *	0.0163 **
	(0.0563)	(0.0616)	(0.0136)	(0.0085)	(0.0185)	(0.0082)
Earnings limit ('10,000)	0.0003	0.0007	0.0001	-0.0001	0.0000	-0.0001 *
	(0.0004)	(0.0005)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Trend	-0.0377 ***	0.0183 ***				
	(0.0060)	(0.0065)				
Trend * Age 65-69	0.0208 ***	-0.0143 **				
	(0.0062)	(0.0068)				
Trend * Age 70-74	0.0156 **	-0.0126				
	(0.0071)	(0.0084)				
$Trend^2$	0.0014 ***	-0.0014 ***				
	(0.0003)	(0.0003)				
$Trend^2$ * Age 65-69	-0.0008 ***	0.0005 *				
	(0.0003)	(0.0003)				
$Trend^2$ * Age 70-74	-0.0005 ***	0.0004				
	(0.0003)	(0.0003)				
Correlation parameter ρ	-0.5078 ***					
	(0.0045)					

Notes: Presented are the coefficients estimates in columns (1)-(2) and marginal effects estimates in columns (3)-(6) with standard errors in parentheses among men aged 62-74 over the years of 1980-2006 using specification (1) in Panel A, and specification (1) plus quadratic trends terms in Panel B. *LFP* refers to labor force participation, and *SSB* refers to Social Security benefit receipt; both are dichotomous variables. Joint outcomes such as "*LFP-yes, SSB-yes*" refer to the joint outcome of working and receiving benefits, "*LFP-yes, SSB-no*" refer to the joint outcome of working without receiving benefits, and the remainders are defined similarly. Variables "Age 65-69" and "Age 70-74" are indicators whether the respondent was aged between 65-69 and 70-74, respectively. *Trend* refers to a linear time trend defined as *year – 1980*, and $Trend^2$ is the quadratic term of the trend. ***: significant at 1%; **: significant at 5%; *: significant at 10%.

Table 3: Specification checks using subgroup analysis by age groups

	Coefficients		Marginal Effects			
Outcomes	**LFP**	**SSB**	**LFP-yes SSB-yes**	**LFP-yes SSB-no**	**LFP-no SSB-yes**	**LFP-no SSB-no**
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Age 62-69						
Delayed retirement credit	0.0184	0.1081 ***	0.0199 ***	-0.0199 ***	0.0117	-0.0182 ***
	(0.0247)	(0.0275)	(0.0062)	(0.0064)	(0.0086)	(0.0042)
Normal retirement age	-0.1903 ***	-0.0720	-0.0585 ***	-0.0591 ***	0.0381 *	0.0291 ***
	(0.0638)	(0.0702)	(0.0161)	(0.0130)	(0.0223)	(0.0105)
Earnings limit ('10,000)	0.0001	0.0005	0.0001	-0.0001	0.0000	-0.0001
	(0.0000)	(0.0005)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Correlation parameter ρ	-0.5764 ***					
	(0.0047)					
Panel B: Age 65-74						
Delayed retirement credit	0.0277	0.1197 ***	0.0135 ***	-0.0057 ***	0.0070	-0.0148 ***
	(0.0221)	(0.0260)	(0.0053)	(0.0018)	(0.0065)	(0.0030)
Normal retirement age	-0.2504 ***	0.2051 **	-0.0489 **	-0.0214 ***	0.0841 ***	-0.0138
	(0.0840)	(0.0958)	(0.0221)	(0.0069)	(0.0248)	(0.0109)
Earnings limit ('10,000)	0.0005	0.0012 **	0.0002	-0.0001	0.0000	-0.0002 **
	(0.0005)	(0.0006)	(0.0001)	(0.0000)	(0.0002)	(0.0001)
Correlation parameter ρ	-0.3267 ***					
	(0.0069)					
Panel C: Age 65-69						
Delayed retirement credit	0.0442	0.1376 ***	0.0229 ***	-0.0090 **	0.0051	-0.0191 ***
	(0.0326)	(0.0381)	(0.0085)	(0.0039)	(0.0105)	(0.0046)
Normal retirement age	-0.3002 ***	0.1926 *	-0.0628 **	-0.0318 ***	0.1021 ***	-0.0075
	(0.0955)	(0.1085)	(0.0249)	(0.0111)	(0.0304)	(0.0132)
Earnings limit ('10,000)	-0.0002	0.0018 ***	0.0001	-0.0002 **	0.0003	-0.0002 ***
	(0.0005)	(0.0006)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Correlation parameter ρ	-0.4016 ***					
	(0.0082)					

Notes: Presented are the coefficients estimates in columns (1)-(2) and marginal effects estimates in columns (3)-(6) with standard errors in parentheses over the years of 1980-2006 using specification (1) plus quadratic trends terms among men with varying age groups – age 62-69, 65-74, and 65-69, in Panel A, B, and C, respectively. ***: significant at 1%; **: significant at 5%; *: significant at 10%. See notes in Table 2.

Table 4: Heterogeneity of results using subgroup analysis by educational attainment

	Coefficients		Marginal Effects			
Outcomes	**LFP**	**SSB**	**LFP-yes SSB-yes**	**LFP-yes SSB-no**	**LFP-no SSB-yes**	**LFP-no SSB-no**
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Less than high school						
Sample mean						
Delayed retirement credit	-0.0240	0.0936 **	0.0011	-0.0073 **	0.0173 *	-0.0112 **
	(0.0333)	(0.0367)	(0.0068)	(0.0032)	(0.0092)	(0.0048)
Normal retirement age	-0.2442 **	0.2060	-0.0369	-0.0258 **	0.0776 **	-0.0149
	(0.1218)	(0.1257)	(0.0240)	(0.0116)	(0.0340)	(0.0159)
Earnings limit ('10,000)	0.0026 ***	0.0007	0.0006 ***	0.0001	-0.0005 *	-0.0002 *
	(0.0009)	(0.0010)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Correlation parameter ρ	-0.4602 ***					
	(0.0087)					
Panel B: High school						
Sample mean						
Delayed retirement credit	-0.0013	0.0934 **	0.0090	-0.0094 **	0.0127	-0.0123 **
	(0.0326)	(0.0370)	(0.0079)	(0.0048)	(0.0104)	(0.0048)
Normal retirement age	-0.0803	-0.0460	-0.0243	-0.0008	0.0137	0.0115
	(0.0980)	(0.1076)	(0.0231)	(0.0142)	(0.0316)	(0.0138)
Earnings limit ('10,000)	-0.0007	0.0003	-0.0001	-0.0001	0.0001	-0.0001
	(0.0004)	(0.0008)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Correlation parameter ρ	-0.5219 ***					
	(0.0079)					
Panel C: Some college						
Sample mean						
Delayed retirement credit	0.0142	0.0778	0.0131	-0.0082	0.0213	0.0060
	(0.0470)	(0.0559)	(0.0131)	(0.0080)	(0.0185)	(0.0161)
Normal retirement age	0.0793	0.0324	0.0179	0.0094	-0.0187	-0.0259
	(0.1314)	(0.1477)	(0.0352)	(0.0220)	(0.0442)	(0.0452)
Earnings limit ('10,000)	-0.0011	-0.0001	-0.0003	-0.0001	-0.0003 *	0.0003
	(0.0010)	(0.0011)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
Correlation parameter ρ	-0.5083 ***					
	(0.0114)					
Panel D: College or higher						
Sample mean						
Delayed retirement credit	0.0397	0.1915 ***	0.0449 ***	-0.0295 ***	0.0165	-0.0318 ***
	(0.0401)	(0.0459)	(0.0120)	(0.0100)	(0.0146)	(0.0068)
Normal retirement age	-0.3685 ***	-0.1679	-0.1335 ***	-0.0085	0.0797 *	0.0623 ***
	(0.1135)	(0.1262)	(0.0328)	(0.0281)	(0.0416)	(0.0184)
Earnings limit ('10,000)	0.0002	0.0018 *	0.0004	-0.0003	0.0002	-0.0003 **
	(0.0008)	(0.0010)	(0.0003)	(0.0002)	(0.0003)	(0.0001)
Correlation parameter ρ	-0.5465 ***					
	(0.0091)					

Notes: ***: significant at 1%; **: significant at 5%; *: significant at 10%. See notes in Table 2.

Table 4b: Heterogeneity of results using subgroup analysis by marital status

	Coefficients		Marginal Effects			
Outcomes	**LFP**	**SSB**	**LFP-yes SSB-yes**	**LFP-yes SSB-no**	**LFP-no SSB-yes**	**LFP-no SSB-no**
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Married						
Delayed retirement credit	-0.0172	0.0952 ***	0.0059	-0.0115 ***	0.0169 **	-0.0113 ***
	(0.0202)	(0.0233)	(0.0052)	(0.0032)	(0.0067)	(0.0030)
Normal retirement age	-0.1416 **	-0.0652	-0.0438 ***	-0.0027	0.0282	0.0184 **
	(0.0631)	(0.0696)	(0.0159)	(0.0098)	(0.0209)	(0.0089)
Earnings limit ('10,000)	0.0001	0.0004	0.0001	-0.0000	0.0000	-0.0001
	(0.0004)	(0.0005)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Correlation parameter ρ	-0.5157 ***					
	(0.0050)					
Panel B: Divorced						
Delayed retirement credit	0.2355 ***	0.0098	0.0551 ***	0.0185 *	-0.0525 **	-0.0211 *
	(0.0693)	(0.0774)	(0.0159)	(0.0112)	(0.0226)	(0.0123)
Normal retirement age	-0.0817	-0.0652	-0.0257	0.0001	0.0083	0.0172
	(0.1775)	(0.1906)	(0.0393)	(0.0285)	(0.0582)	(0.0294)
Earnings limit ('10,000)	0.0012	0.0028 *	0.0006 *	-0.0002	0.0002	-0.0005 **
	(0.0014)	(0.0016)	(0.0003)	(0.0000)	(0.0005)	(0.0002)
Correlation parameter ρ	-0.5313 ***					
	(0.0155)					
Panel C: Single (never married)						
Delayed retirement credit	0.0857	0.1604 *	0.03251 *	-0.0069	0.0162	-0.0418 **
	(0.0905)	(0.0895)	(0.0181)	(0.0138)	(0.0288)	(0.0187)
Normal retirement age	-0.4198	0.0498	-0.0790	0.0462	0.0941	0.0311
	(0.2879)	(0.2800)	(0.0537)	(0.0456)	(0.0956)	(0.0547)
Earnings limit ('10,000)	-0.0011	0.0019	-0.0000	-0.0003	0.0006	-0.0003
	(0.0022)	(0.0022)	(0.0004)	(0.0003)	(0.0007)	(0.0005)
Correlation parameter ρ	-0.4567 ***					
	(0.0222)					
Panel D: Widowed						
Delayed retirement credit	0.0604	0.2332 ***	0.0255 *	-0.0107 *	0.0186	-0.0334 ***
	(0.0691)	(0.0750)	(0.0135)	(0.0059)	(0.0186)	(0.0097)
Normal retirement age	-0.2853	0.2075	-0.0448	-0.0352	0.0840	-0.0141
	(0.2499)	(0.2638)	(0.0463)	(0.0223)	(0.0704)	(0.0322)
Earnings limit ('10,000)	0.0018	0.0003	0.0004	0.0001	-0.0003	-0.0001
	(0.0017)	(0.0018)	(0.0003)	(0.0001)	(0.0005)	(0.0002)
Correlation parameter ρ	-0.4010 ***					
	(0.0191)					

Notes: ***: significant at 1%; **: significant at 5%; *: significant at 10%. See notes in Table 2.

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