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Retirement, Social Security deferral, and life annuity demand

Abstract

Delaying Social Security is equivalent to purchasing an inflation-indexed life annuity; it involves forgoing current benefits in exchange for higher real benefits in the future. Although the terms for deferring retired worker benefits between ages 62 and 70 are generous, most people claim benefits well before age 70. This behavior may be related to the "annuity puzzle," i.e., the observation that individuals don't annuitize their retirement assets to the extent that economic models based on consumption-smoothing predict they should.

This paper contributes to our understanding of the annuity puzzle—and later-life wealth decumulation behavior more generally—by using discrete time hazard models to examine predictors of the joint decision to retire, claim Social Security, and annuitize other retirement resources (typically on less generous terms than those for delaying Social Security). "Parallel" strategies—simultaneously retiring and commencing Social Security or simultaneously commencing Social Security and a life annuity—have become less common over time. These strategies are associated with defined benefit pension eligibility, being subject to the Social Security earnings test (which forces affected individuals who work while receiving Social Security to delay a portion of their benefits), and poor health. The generosity of actuarial adjustment for delaying Social Security is associated with later claiming, and Medicare eligibility is associated with an increase in retirement hazard among those who have employer-sponsored health insurance that does not extend to retirees. Poor health is associated with both earlier retirement and earlier Social Security claiming. Higher real interest rates are associated with both earlier retirement and an increased propensity to start receiving a life annuity.

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1. Introduction

Choices about how to receive retirement income—whether from private saving or Social Security—have major implications for retirement security. Standard life cycle models predict that individuals will aim to smooth consumption over their lifetime and insure against longevity risk. Moreover, to accomplish the latter goal, they'll be willing to purchase life annuities even if the terms are actuarially unfair. Empirically, however, individuals don't annuitize their retirement income to the extent economic models based on consumption-smoothing predict they should (e.g., Yaari 1965; Mitchell et al. 1999; Warner and Pleeter 2001), a phenomenon sometimes referred to as the "annuity puzzle." However, while observed behavior is clearly inconsistent with standard economic models, it's difficult to determine unambiguously whether people's choices are suboptimal and driven by behavioral biases, or whether standard economic models simply do a poor job of capturing their preferences. To better understand the annuity puzzle, many studies have explored the determinants of individuals' annuitization decisions (e.g., Hurd et al. 1998; Bütler and Teppa 2007; and Mottola and Utkus 2007; Brown 2001).

A variant of the annuity puzzle shows up in the Social Security claiming decision. Social Security benefits for retired workers are based on the monthly average of the highest 35 years of earnings, indexed for economy-wide wage growth. A progressive benefit formula is applied to this monthly average, and the resulting amount is referred to as the worker's primary insurance amount (PIA). The PIA is the monthly benefit that would be payable if the worker claims at their full retirement age (which has ranged from ages 65 to 67, depending on birth year). However, benefits can be claimed at any age between 62 and 70, with an actuarial adjustment that depends on claiming age. Delaying Social Security is equivalent to purchasing an inflation-indexed annuity, because it involves forgoing current benefits in exchange for higher real future benefits for life. Although the terms for deferral are generous (e.g., Shoven and Slavov 2014a, b), most people claim benefits well before age 70 (e.g., Goda et al. 2018). A large literature has examined both optimal and observed claiming, as well as the extent to which observed claiming can be explained by factors such as income and health shocks, family composition, risk and time discounting, or misinformation.[1] More recently, Munnell, Wettstein, and Hou (2022) and Horneff, Maurer, and Mitchell (2023) have characterized *jointly* optimal Social Security claiming and annuity purchase decisions within a life cycle model. This paper complements their work by providing a detailed empirical analysis of these retirement income choices. To be more specific, I use data from the Health and Retirement Study (HRS) to examine the determinants of joint decisions to (1) delay Social Security, (2) receive other annuity income, and (3) retire.

This joint decision is significant because delays in Social Security—which require forgoing current income—can be financed either by working longer or by drawing down on other retirement assets. Drawing down on other retirement assets may require forgoing their annuitization. Moreover, there is a discrepancy in pricing between the Social Security annuity that is available through delay and private annuities. For a married primary earner (i.e., the spouse with the higher earnings), delaying Social Security is equivalent to purchasing a joint-and-survivor annuity, as the higher benefits available through delay can be passed on to the surviving spouse. For secondary earners (i.e., the spouse with the lower earnings), delaying Social Security is equivalent to buying a first-to-die annuity, as the lower earner's benefit ceases upon either the secondary earner's death or the primary earner's death (at which point the secondary earner switches to receiving a survivor benefit). For singles, delaying Social Security is equivalent to buying a single-life annuity. The actuarial adjustment is identical for all Social Security retired worker benefits (within a birth cohort); thus, all these annuities are offered on identical terms. Accordingly, Shoven and Slavov (2014a) show that married primary earners stand to gain the most from delaying Social Security, followed by single women, single men, and married secondary earners. (The gains from delay—if there are any—are small in the last category.) Improvement in life expectancy, increases in the generosity of the delayed retirement credit, and the relatively low real interest rates of the past decade have increased the gains from delay for everyone. The gains from delay were modest for those turning age 62 prior to 2000 (cohorts born in 1938 or earlier). They have significantly increased since then.

In contrast to the price of the Social Security annuity that is available through delay, the prices of privately available annuities vary according to the type of annuity, the expected payout period, and the interest rate used to discount the

1 See, for example, Shoven and Slavov (2014a,b); Meyer and Reichenstein (2010); Reichenstein and Meyer (2021); Mahaney and Carlson (2008); Sass, Sun, and Webb (2013); Coile et al. (2002); Maurer et al. (2021); Hubener, Maurer, and Mitchell (2016); Bairoliya and McKiernan (2022); and Imrohoroğlu and Kitao (2012); Gustman and Steinmeier (2015); Hurd, Smith and Zissimopoulos (2004); Glickman and Hermes (2015); Waldron (2002); Beauchamp and Wagner (2012); Goda et al. (2018); Delavande, Perry, and Willis (2006), Huang, Li, and Ross (2022); Card, Maestas, and Purcell (2014); and Haaga and Johnson (2012).

expected stream of benefits. Most obviously, the prices of retail annuities—which may be purchased using defined contribution pension balances—vary depending on mortality and interest rates. Moreover, if an annuity is derived from a defined benefit pension, employers may offer an option to receive a lump sum instead; that choice allows employees to "purchase" the annuity by forgoing the lump sum. The Internal Revenue Service (IRS) has established rules for calculating defined benefit lump sum and annuity payouts that depend on both current mortality tables and the current interest rate.[2] Regardless of whether private sector annuities are obtained from the retail market or from a defined benefit pension, joint and survivor annuities are generally more costly than single-life annuities. For defined contribution pensions, the annuity purchase decision is made by the individual account holder. For defined benefit pensions, employers determine whether to offer a lump sum and employees decide whether to accept it; thus, the annuitization decision is jointly made by the employer and employee. In a competitive labor market, however, we can expect compensation packages (including whether a lump sum option is offered) to reflect the tradeoffs employees are willing to make between pension features and wages.

The discrepancy between the pricing of the private annuities and the Social Security annuity can lead to foregone arbitrage opportunities. An individual forgoes an arbitrage opportunity when they fail to delay Social Security and simultaneously opt for a higher-priced private annuity. Bronshtein et al. (2020) show that married primary earners are almost always forgoing an arbitrage opportunity if they claim Social Security early *and* either buy a retail annuity or choose an annuity payout over a lump sum in their defined benefit pension. Arbitrage opportunities are more limited for singles but still exist, especially for single women.

2. Data and methodology

A. Data

The Health and Retirement Study (HRS) is a panel survey that is representative of the U.S. population aged 51 and older. The survey began in 1992 with an initial cohort of people aged 51 to 61 and their spouses. Follow-up surveys have been conducted every other year since then, with additional cohorts added in 1998, 2004, 2010, and 2016 to keep the sample representative of the target population. I refer to the wave in which a person's cohort entered the HRS as that person's *baseline wave*. I use data from the 1992 to 2018 waves.[3] I begin with a cleaned and harmonized version of the HRS compiled by the RAND Center for the Study of Aging. The RAND HRS contains a subset of the variables from original HRS, including demographic and socioeconomic information (age, race and ethnicity, education, and marital status); coverage by current employer defined benefit and defined contribution pensions; coverage by current employer health insurance; labor force status; Social Security claiming age (in months); the number of years worked; and self-reported health status on a scale of 1 (excellent) to 5 (poor).

Throughout the analysis, I define a life annuity as regular, monthly income from a defined benefit pension or retail annuity that will continue for as long as the respondent (and potentially the respondent's spouse) lives. While the RAND HRS includes information about whether a respondent is currently receiving income from a pension or annuity, it does not include the exact dates on which they began receiving that income. It also does not indicate whether a respondent's pension or annuity income will continue for life. Thus, I merge in variables from the original HRS containing responses to the following question for each source of pension and annuity income: *Will this payment continue for as long as you live?* This variable is available starting in the 1994 wave for up to two pensions and two annuities. I also merge in the start year and month for each of these pensions and annuities. In addition, while the RAND HRS includes information about coverage by a current employer defined benefit pension, it does not include eligibility ages, which likely influence the timing of pension claiming. Therefore, if a person indicates defined benefit coverage during their baseline wave, I merge in any baseline wave information that is provided about early and full benefit eligibility ages.[4] To help identify respondents who have private sources of retirement income, I also

2 See https://www.irs.gov/retirement-plans/actuarial-tables.

3 In 1998, the HRS was merged with another survey, the Assets and Health Dynamics (AHEAD) study, which was initially conducted in 1993 and 1995 and targeted people born before 1924 and their spouses. I drop individuals who entered the HRS as part of the 1993 AHEAD cohort. All other cohorts are potentially included in the analysis.

4 The HRS requests information on up to three current employer sponsored retirement plans in the 1992 to 1998 waves, and up to four such plans in subsequent waves. If any of these retirement plans is coded as a defined benefit pension or a combination defined benefit/contribution pension in the RAND HRS, I pull the early and full benefit eligibility ages for the corresponding pension from the raw data. If a respondent states that there is no age requirement, I set the early and full eligibility ages to zero. In cases where the early eligibility age (implausibly) exceeds the full eligibility age, or in cases where the early eligibility age is missing, I set the early eligibility age equal to the full eligibility age. For each respondent, I define the early (full) eligibility age as the minimum of all reported early (full) eligibility ages. Early and full eligibility ages are not available for the cohort that entered the survey in 2016. Instead, respondents are asked to provide the age at which they expect to start receiving benefits. I set the full and early eligibility ages to to this value.

merge in a dataset created by Gustman, Steinmeier, and Tabatabai (2014) that provides imputations of total pension wealth—including defined benefit and defined contribution pensions—for each respondent in the HRS through the 2010 wave.

I simplify the analysis by assuming that each person makes each decision—to retire, claim Social Security, and commence receiving a life annuity—exactly once. Defining the retirement and Social Security claiming ages are relatively straightforward. In each wave of the survey, respondents are asked whether they consider themselves fully retired, partially retired, or not retired. For respondents who report being retired in the current wave, the RAND HRS includes the self-reported month and year of retirement.[5] It is not uncommon for respondents to retire, go back to work, and retire again (see Maestas 2010), or to transition from partial to full retirement; moreover, there are some wave-to-wave inconsistencies in the self-reported retirement date. I resolve these discrepancies by identifying the first wave at which the respondent self-identifies as retired *and* is working fewer than 10 hours per week. I define the respondent's retirement age as the age at the retirement date provided during this wave, regardless of any subsequent return to work. The respondent's Social Security claiming age is set to the initial age of Social Security receipt, as recorded in the RAND HRS. This age encompasses not just retired worker, spousal, and survivor benefits, but also disability benefits. However, I select the sample (discussed later) to try to eliminate those who initially receive disability benefits.

Defining the life annuity start date is more involved. The raw HRS data reports the start year and month of up to two defined benefit pensions and up to two annuities. For each set of income sources (i.e., pensions and annuities), the respondent is asked to report information about the larger source first. I define the respondent's main pension start age as the start age of the larger (first reported) pension, as recorded in the first wave that this variable is present. I define the respondent's secondary pension start age similarly, based on the reported start age of the smaller (second reported) pension. The respondent's main and secondary annuity start ages are defined analogously. I then define each respondent's life annuity start age as the main pension start age if that pension is paid as a life annuity. If the main pension is not paid as a life annuity, then I look at whether the secondary pension is paid as a life annuity. If it is, then I set the life annuity start age to the secondary pension start age. If neither pension is paid as a life annuity, I look at whether the main annuity is a life annuity, and I set the life annuity start age accordingly. Otherwise, I look at whether the secondary annuity is a life annuity, and I set the life annuity start age accordingly. One limitation of the data is that these dates only reflect the date that the respondent began receiving a life annuity. That is, I cannot identify the date on which a respondent purchased a deferred annuity.

My analysis focuses on those who are eligible for, and observed to receive, Social Security retirement or survivor benefits. Thus, I begin by excluding people who have ever applied for Social Security Disability Insurance. For the remaining sample, the recorded claiming age most likely reflects the date at which their retirement or survivor benefits commenced. To focus on retirement behavior during the recent three decades, I limit the sample to those born in 1928 or later (who turned 62 in 1990 or later), and in 1950 or earlier (who turned 70 by 2020). To avoid disproportionately excluding Social Security delayers among younger cohorts (who may not be observed to claim benefits by the end of the sample), I exclude respondents who are not observed through age 68. Most eligible individuals claim by age 68. Thus, those who are not observed to claim Social Security are likely ineligible. Of those who are observed through age 68, around 3 percent are never observed to receive Social Security benefits (they report zero Social Security retirement income and have a missing claiming age) and are dropped. Although I cannot directly observe Social Security eligibility (which is based on work history), this percentage is in line with Whitman, Reznik, Shoffner's (2011) estimate that around 4 percent of the older U.S. population never receives Social Security. I further drop people whose exact Social Security claiming age is not reported (even though they report some Social Security income), as well as those whose Social Security claiming age is not between 60 (the earliest eligibility age for survivors' benefits) and 70.

This sample of eventual Social Security recipients may or may not report a retirement between the ages of 60 and 70. I drop individuals who ever report being retired with less than 10 hours of work, but who have a missing retirement age. I also drop people who do not have a valid answer to the retirement status question in any wave. Among remaining individuals, those who do not have a retirement date are assumed not to retire by the end of their time in the sample. Similarly, people in the sample may or may not report a life annuity start date. These individuals are assumed not to receive income from a life annuity. To increase the likelihood that annuitization represents a meaningful choice for these

5 If the month of retirement is missing, but a year is provided, I set the month of retirement to June.

individuals, I restrict the sample to those with some evidence of access to private defined benefit or defined contribution pensions. That includes those who ever report being covered by a defined benefit or defined contribution pension provided by a current employer, and those who have positive imputed pension wealth during any wave in Gustman, Steinmeier, and Tabatabai's (2014) imputations of pension wealth. Finally, I drop people who are not interviewed during their baseline wave (1992 for the original cohort, and 1998, 2004, 2010, or 2016 for subsequently added cohorts). Before performing the analysis, I convert the data to person-month level. In the transformed dataset, each observation represents one person at one age, in months, between 60 and the lower of 70 and the person's last observed age in the HRS. Self-reported health status—a time-varying characteristic that is reported approximately every two years, at the time of each wave—is linearly interpolated for the months between interviews and linearly extrapolated for any months before and after the sample period. Details of the sample selection and data transformation process are reported in Table 1, including observation counts and the number of respondents dropped at each step.

B. Methodology

I estimate discrete-time hazard models of retirement, Social Security claiming, and pension claiming. The dependent variables in the analysis are defined at the person-month level and include the following:

- An indicator for retirement, which takes on a value of zero before an individual's retirement age and one in the month of retirement. It is missing (and therefore excluded from the analysis) thereafter.
- An indicator for Social Security receipt, which takes on a value of zero before the month of Social Security claiming, one in the month of Social Security claiming, and missing thereafter.
- An indicator for life annuity receipt, which takes on a value of zero before an individual begins receiving a life annuity, one in the month that the individual begins receiving a life annuity and missing thereafter.

By construction, all individuals eventually begin receiving Social Security. The retirement indicator is always equal to zero for those who have not been observed to retire by the last age in the sample (either 70 or the last age at which they are surveyed). Likewise, the life annuity receipt indicator is always equal to zero for those who have not been observed to commence a life annuity. Each dependent variable, therefore, measures the probability of the relevant event occurring—retirement, Social Security claiming, or life annuity commencement—conditional on it not having occurred in the past (i.e., among the person-months still "at risk").

I also construct dependent variables measuring the joint hazard of any two of these events. The indicators for the joint hazard of retirement and claiming Social Security claiming are constructed as follows:

- An indicator for retiring and claiming Social Security at (approximately) the same time takes on a value of zero prior to the individual's retirement and Social Security claiming ages. It is set to one if the individual retires in the current month and begins receiving Social Security in either the current month or one of the following three months. It also takes on a value of one if the individual starts Social Security in the current month and retires in either the current month or one of the following three months. It is missing following either retirement or Social Security claiming.
- An indicator for retiring before claiming Social Security takes on a value of zero prior to the individual's retirement and Social Security claiming ages. It is set to one if the individual retires in the current month and does not claim Social Security in either the current month or one of the following three months. It is missing following either retirement.
- An indicator for claiming Social Security before retiring takes on a value of zero prior to the individual's retirement and Social Security claiming ages. It is set to one if the individual claims Social Security in the current month and does not retire in either the current month or one of the following three months. It is missing following Social Security claiming.

Indicators for the joint hazard of retirement and annuity commencement, as well as Social Security claiming and annuity commencement, are analogously defined.

The decisions to retire, claim Social Security, and begin receiving a life annuity are jointly determined. For example, people generally start to receive defined benefit pensions upon resigning from their job, and retirees who are liquidity constrained may claim Social Security to replace labor income. I estimate reduced-form equations by including the same set of independent variables in all regressions. These equations take the following form:

$$y_{it} = \beta X_{it} + \gamma Z_i + age_{it} + year_t + cohort_i + \epsilon_{it}$$

The dependent variable, y_{it}, may be any of those described above. I control for a baseline age-specific hazard rate through a set of monthly age dummies; the associated age-specific hazard rate for individual i at time t is age_{it}. I also include dummies for the year into which the person-month

observation falls (to control for economy-wide factors that uniformly affect hazard rates for all individuals) and the individual's year of birth (to control for factors that include life expectancy trends, that uniformly affect hazard rates for all people in a birth year).

The independent variables of interest are either time-invariant (represented by the vector Z_i) or time-varying (represented by the vector X_{it}) and include factors that might influence or be associated with the retirement, Social Security claiming, and life annuity commencement decisions. These variables can be grouped into four categories: Social Security policy variables, employer-sponsored retirement plan variables, health and health insurance variables, and demographic and economic variables.

Social Security policy variables

Social Security policies that may influence behavior relate to the rules surrounding eligibility, benefit levels, and claiming. These include the full retirement age (the age at which a worker can receive their PIA as a monthly benefit), the delayed retirement credit (the annual percent increase in benefits, relative to PIA, for delaying worker benefits beyond full retirement age), and the earnings test (which forces affected beneficiaries who continue to work to delay a portion of their benefits). Some prior studies have shown that claiming behavior has not responded much to increases in the delayed retirement credit (e.g., Benítez-Silva and Yin 2009). Instead, claiming and retirement choices tend to cluster around whatever age is designated the full retirement age (e.g., Behaghel and Blau 2012; Benítez -Silva and Yin 2009), suggesting that behavioral forces are at work. The earnings test may affect both claiming and labor supply. While the claiming delay that it forces occurs on actuarially fair or generous terms, people may misperceive the earnings test as a tax and adjust their labor supply accordingly. Prior research (e.g., Song and Manchester 2007; Friedberg 2000; Gelber et al. 2022; Gruber and Orszag 2003) suggests that the Social Security earnings test causes people to delay claiming, but that any labor supply adjustment occurs primarily on the intensive rather than on the extensive margin.

To explore these channels, I include a time-varying indicator for reaching full retirement age, as well as its interaction with the delayed retirement credit. As the delayed retirement credit is time-invariant and based on birth year, I cannot include it separately in a regression that includes birth year dummies. However, I can interact it with the time-varying indicator for reaching full retirement age. To capture the potential impact of the earnings test, I construct a variable that takes on a value of one for individuals whose age would make them subject to the earnings test for retirement benefits based on their own earnings record. This indicator is equal to one for all individuals between ages 62 and 70 in 1999 and earlier. The earnings test was eliminated in 2000 for people at or above full retirement age. Therefore, in 2000 and later, the indicator is equal to one only for those between 62 and full retirement age in 2000.

Because I control for birth cohort, monthly age, and calendar year, the estimated effect of reaching full retirement age is based on comparing people within a cohort who reach their full retirement age in different months during the same year. The effect of the delayed retirement credit is based on comparing pre- and post-full retirement age hazard rates for people who face different levels of the credit. Finally, the effect of the earnings test is based on comparing pre- and post-full retirement age hazard rates in the years before and after 2000. For those reaching full retirement age after 2000, it is also based on comparing within-cohort changes in hazard rates around the month of attaining full retirement age.

Employer-sponsored retirement plan variables

Defined benefit pensions can create sharp incentives to retire and begin receiving benefits at specific ages, while defined contribution pensions are more neutral with regard to retirement age. Thus, I include dummies for coverage by a defined benefit or defined contribution pension, as well as time-varying indicators for reaching the early or full eligibility age reported in the baseline wave. However, the causal story for these pension variables is weaker than it is for the Social Security policy variables because workers may select into employment based on unobservable characteristics that are correlated with a propensity to retire or begin receiving a life annuity at certain ages. If employers design retirement plans that reflect these individual preferences, then a comparison of pre- and post-eligibility hazard rates may overstate the impact of pension eligibility.

Health and health insurance

Prior research suggests that health shocks can cause retirement (e.g., McGarry 2004; Blundell et al. 2020), and that poor health is correlated with earlier Social Security claiming (e.g., Hurd, Smith and Zissimopoulos 2004; Glickman and Hermes 2015; Waldron 2002; Beauchamp and Wagner 2012; Goda et al. 2018; Delavande, Perry, and Willis 2006). Thus, I include an indicator for self-reporting one's health status as fair or poor (as opposed to excellent, very good, or good).

Additionally, a large literature suggests that health insurance availability can drive retirement decisions (e.g., Gruber and Madrian, 1995; Blau and Gilleskie, 2001; Nyce et al., 2013). To capture this channel, I create a set of indicators for employer-sponsored health insurance during the baseline wave. I

differentiate this coverage by whether the respondent reports that the policy covers retirees. I include in the regressions two indicators: one for no coverage by employer-sponsored health insurance, and one for coverage by employer-sponsored health insurance that does not cover retirees. The omitted category is coverage by employer-sponsored health insurance that covers retirees. I also interact these two indicators with a dummy for reaching age 65 (Medicare eligibility). If access to health insurance influences the hazard of retiring, then we would expect to see an increase in the probability of retiring after Medicare eligibility for people whose current employer-sponsored insurance does not cover retirees, compared to those whose current employer-sponsored insurance does cover retirees. The estimated impact of health insurance relies on the assumption that the latter group is a good control for the former. As with the pension eligibility indicators, if people select into jobs based on unobservable characteristics that are correlated with a propensity to retire at age 65, and if employers design benefits to suit these employees, then I will overestimate the impact of health insurance.

Demographic and economic variables

Demographic and socioeconomic controls include race, ethnicity, gender, marital status in the baseline wave, education, and education. I also construct a time-invariant indicator for whether the respondent is unlikely to be a secondary earner. The gains from delaying Social Security are greatest for married primary earners and substantial for singles; however, they are modest for secondary earners. The public use version of the HRS data does not include earnings histories for respondents, so it is not possible to identify with certainty which respondents are secondary earners. To identify those who are most likely not secondary earners, I select respondents who either report their marital status as "never married" in every wave, or whose maximum reported number of years worked (across all waves) is greater than the maximum reported number of years worked by their spouse.[6]

In addition to these individual-level variables, I include the real 10-year interest rate from the Federal Reserve Economic Database (FRED) database maintained by the Federal Reserve Bank of St. Louis. An increase in the 10-year interest rate reduces the present value of the gains from delaying Social Security. It also reduces annuity prices. Thus, delaying Social Security becomes less attractive compared to alternative investments, and drawing down on wealth to "purchase" the Social Security delay annuity becomes less attractive relative than directly annuitizing that wealth. An increase in the real interest rate may also increase the value of accumulated retirement assets (including the stream of income that can be purchased with these assets). This wealth effect may induce an individual to retire, and retiring individuals may begin receiving Social Security if necessary to meet consumption needs. As all regressions include year dummies, the estimated impact of the interest rate on behavior is based on within-year, month-to-month variation.

3. Results

Summary statistics for the person-month level dataset used in the analysis are reported in Table 2. Figure 1 shows the raw cumulative probability of receiving Social Security income and being retired broken down by age. The bands represent 95 percent confidence intervals. As expected, there is a large increase at age 62 in the fraction of people who are both retired and receiving Social Security. There is a smaller increase in the fraction of those who are retired without claiming Social Security. There is also a decrease in the fraction of people receiving Social Security without being retired, most likely because the earnings test forces those who continue to work to delay their benefits. (Those receiving benefits prior to age 62 are most likely receiving survivor benefits, which can be claimed as early as age 60.) There are smaller increases in the cumulative probability of receiving Social Security (whether accompanied by retirement or not) at ages 65 and 66, the full retirement ages for large shares of the sample. (The full retirement age was 65 for those born before 1938; it began rising after that, reaching 66 for those born between 1943 and 1954.)

To examine cross-cohort trends, Figure 2 shows the probability of both being retired and receiving Social Security broken down by whether the respondent was born before or after 1938. This "parallel" strategy—claiming and retiring at the same time—appears to be more popular in the older cohort, which experiences larger increases in this joint probability at ages 62 and 65. Figure 3 shows that for most ages between 62 and 70, the younger cohort is more likely to be working while receiving Social Security; the cross-cohort difference is particularly pronounced after full retirement age. The repeal of the post-full retirement age earnings test repeal—which went into effect in 2000, when the 1938 cohort reached age 62—could explain this difference. Finally,

6 Divorce, widowhood, and remarriage can occur. For those with multiple spouses over the sample period, I consider the maximum reported number of years across all waves and all spouses.

Figure 4 shows that the reverse—retiring without receiving Social Security—is also more common among the younger cohort, regardless of age.

Figure 5 shows the cumulative probability of starting Social Security and a life annuity. There is a large increase in the probability of receiving Social Security (with or without a life annuity) at age 62, and smaller increases at ages 65 and 66. Figure 6 shows that people born before 1938 are more likely to follow the "parallel" strategy of simultaneously starting Social Security and a life annuity. Figures 7 and 8 show that the younger cohort is more likely to decouple their Social Security and life annuity start ages. At each age, these younger individuals have a higher probability of receiving one type of income but not the other.

Table 3 shows the results from estimating the regression equation in the previous section. The top panel focuses on the Social Security policy variables. The first row of this panel suggests that reaching full retirement age significantly increases the probability of claiming Social Security. However, it does not have a statistically significant (at the 5 percent level) impact on the probability of retirement or of starting a life annuity (first three columns). The second three columns show that, among those who have not yet retired or claimed Social Security, reaching full retirement age increases the probability of claiming Social Security but delaying retirement. The last three columns suggest that, among those who have not yet claimed Social Security or started a life annuity, reaching full retirement age increases the probability of claiming Social Security and either starting or delaying/forgoing life annuity income. The second row suggests that the delayed retirement credit attenuates these effects. That is, those offered a larger delayed retirement credit experience a smaller increase in the hazard of claiming at full retirement age. For example, for those with a delayed retirement credit of 4 percent (born in 1927 and 1928), reaching full retirement age is associated with a 9.46 – (1.5)(4) = 3.46 percentage point increase in the probability of claiming Social Security at full retirement age. This increase is large relative to a mean monthly hazard of claiming Social Security of 2.3 percentage points (Table 2). For those with a delayed retirement credit of 8 percent (born in 1943 and later), reaching full retirement age has a statistically insignificant effect on claiming.[7] The third row of coefficients suggests that being subject to the earnings test reduces the hazard of starting Social Security, particularly when the individual continues to work or delays tapping into a pension. However, there is no statistically significant impact on the probability of retiring. These results are in line with previous work on the earnings test showing that while the earnings test induces delays in claiming, it likely does not affect labor supply on the extensive margin.

The second panel of Table 3 shows the relationship between the employer-sponsored pension variables and the hazards of retirement, claiming Social Security, and starting a life annuity. Those with defined contribution coverage are more likely to delay retirement and Social Security claiming, and to delay or forgo receiving a life annuity. In contrast, those with defined benefit coverage are more likely to start receiving a life annuity. Reaching the eligibility age for a defined benefit pension is associated with an increase in the probability of retiring and starting to receive life annuity income. It is also associated with an increase in the probability of claiming Social Security *and* simultaneously retiring or commencing a life annuity.

The third panel of Table 3 presents results for the health and health insurance variables. Consistent with prior research, it shows that a person covered by employer-sponsored health insurance without retiree coverage is more likely to retire upon Medicare eligibility compared to someone whose employer-sponsored health insurance covers retirees. There is no statistically significant impact on Social Security claiming or life annuity commencement unless these occur simultaneously with retirement. Also consistent with prior research, being in poor health is associated with earlier retirement and Social Security claiming.

The final panel of Table 3 presents results for the demographic and economic variables. Consistent with theoretical predictions, an increase in the interest rate increases the probability of retiring (potentially reflecting a wealth effect) as well as the probability of commencing a life annuity (possibly reflecting either a wealth effect or annuity prices). However, a higher interest rate is also associated with delaying Social Security at the time of starting a life annuity. There are also notable differences in behavior across demographic and socio-economic groups. For example, those with a college education, as well as those identified as single or likely primary earners, retire and claim Social Security later. These groups are also less likely to pursue parallel strategies (simultaneously retiring and claiming Social Security or simultaneously starting Social Security and a life annuity). A similar pattern emerges for women and people who are divorced at baseline.

7 The point estimate is 9.46 – (1.5)*8 = -2.54. Testing the hypothesis that this linear combination of parameters is zero results in a failure to reject the null.

These baseline results include singles, married primary earners, and married secondary earners. However, one may expect singles and primary earners—who are more likely to be claiming on their own work record—to be more sensitive to Social Security rules relating to worker benefits. In particular, the delayed retirement credit only applies to worker benefits; spousal and survivor benefits do not continue to grow with delay beyond full retirement age. To explore this issue further, I re-estimate the regressions in Table 3 using the sample of people who are either single or married primary earners. Table 4 shows the coefficients on the Social Security policy variables for this restricted sample. As expected, the delayed retirement credit is associated with a larger (in magnitude) effect on Social Security claiming behavior in this group.

4. Discussion and conclusion

These results can help academics and practitioners sort through alternative explanations for observed retirement income choices. Scott et al. (2021) show that for plausible parameter values, claiming Social Security early *and* not annuitizing other assets can be optimal for lower-income individuals in a life cycle model. This outcome results from a high subjective discount rate relative to the real interest rate (consistent with today's economic environment), which implies that the optimal consumption path is declining.[8] Given that low-income individuals also have a relatively high Social Security replacement rate, it is optimal to spend down any private saving early in retirement and rely entirely on Social Security. Consistent with that prediction, people with lower levels of education (associated with lower levels of lifetime income) are less likely to delay Social Security. Delaying Social Security and not annuitizing other assets could also be consistent with rational behavior; those who do this are effectively purchasing an annuity from Social Security, via the generous actuarial adjustment for delaying benefits, but declining to buy annuities in the retail market. Delaying Social Security and annuitizing private saving can also be accounted for by a strong preference for insuring against length-of-life risk. However, in a low-interest-rate environment, failing to delay Social Security and annuitizing private saving may involve forgoing an arbitrage opportunity. Consistent with that prediction, I find that use of this "parallel" strategy has declined over time (i.e., among younger cohorts), perhaps due to the shift toward defined contribution pensions, the elimination of the earnings test for those who have reached full retirement age, and the growing gains from claiming Social Security strategically. In addition, if individuals are fully rational and behave according to the life cycle model, those with the most to gain from Social Security delay (married primary earners) should be the most likely to delay Social Security and should never claim early while also annuitizing other assets. Indeed, primary earners are more likely to delay Social Security and less likely to start Social Security and a life annuity in parallel. Lower interest rates are also associated with a lower probability of starting a life annuity.

These results also have implications for the design of Social Security. A more generous actuarial adjustment for delaying Social Security effectively lowers the price of the annuity that one can purchase by delaying benefits. My results suggest that a more generous actuarial adjustment for delaying Social Security increases the probability of delaying benefits for those who have reached full retirement age. However, I find no statistically significant impact on labor supply at the extensive margin. These results are in line with Gorry, Lee, and Slavov (2023), who find that a more generous actuarial adjustment for delaying state pensions in the U.K. is associated with a lower probability early claiming; however, it has no clear causal relationship to labor supply. Similarly, consistent with previous research, while the retirement earnings test encourages delayed claiming, it is not associated with a reduction in labor supply at the extensive margin.

Finally, these results have implications for educational efforts and the framing of choices around Social Security claiming and annuitization. For example, although worker benefits increase more or less continuously with delay between ages 62 and 70, the age that is designated the full retirement age appears to have a large impact on claiming. This result is consistent with Behaghel and Blau (2012) and Benítez-Silva and Yin (2009) and suggests that "behavioral" factors might play a role in people's choices. Changing the language around claiming ages could therefore have a large impact on behavior.

8 In addition to pure time preference and mortality risk, a high subjective discount rate may result from anticipated poor health, which lowers the marginal utility of consumption (see, e.g., Goda et al. 2015; Rohwedder, Hurd, and Hudomiet 2022).

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FIGURE 1. FRACTION RECEIVING SOCIAL SECURITY AND RETIRED

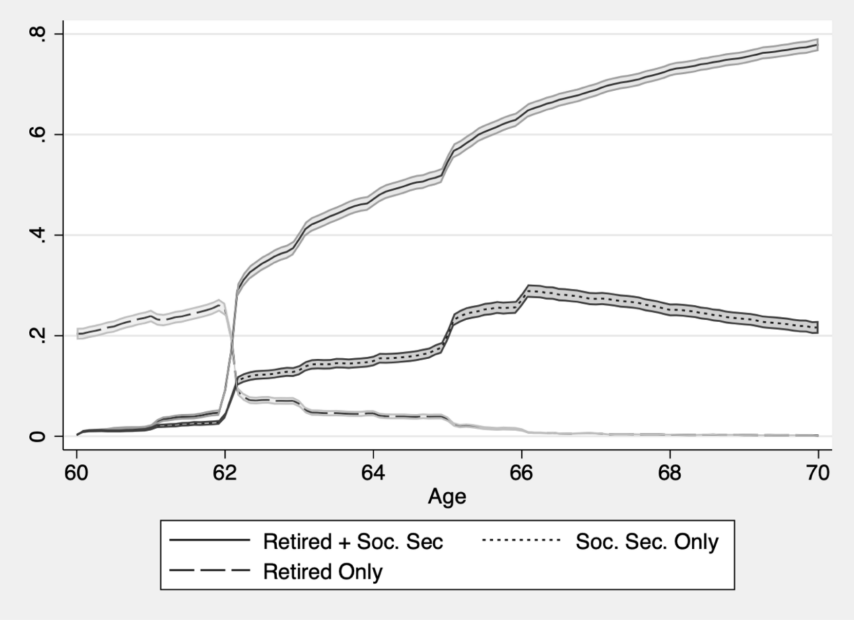

FIGURE 2. FRACTION RECEIVING SOCIAL SECURITY AND RETIRED, BY COHORT

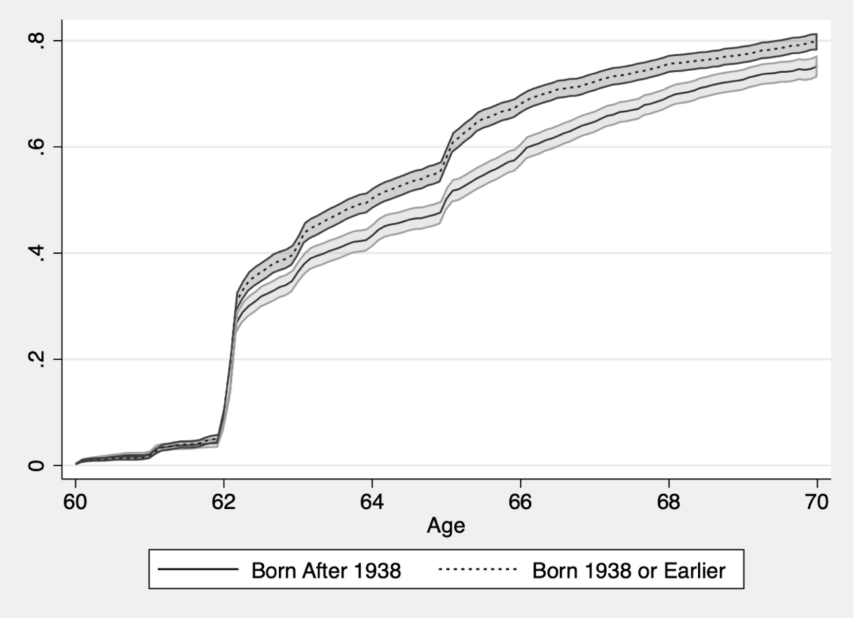

FIGURE 3. FRACTION RECEIVING SOCIAL SECURITY WHILE NOT RETIRED, BY COHORT

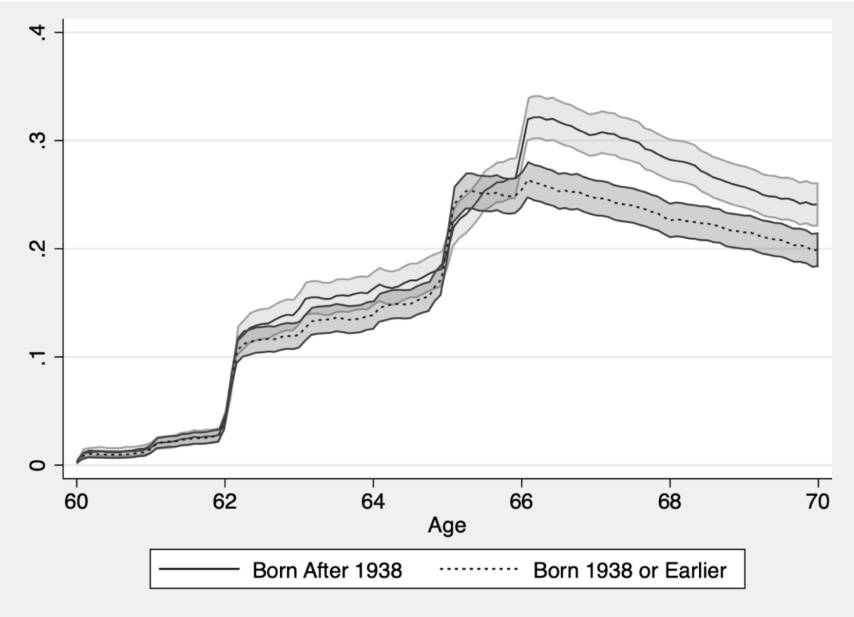

FIGURE 4. FRACTION RETIRED WHILE NOT RECEIVING SOCIAL SECURITY, BY COHORT

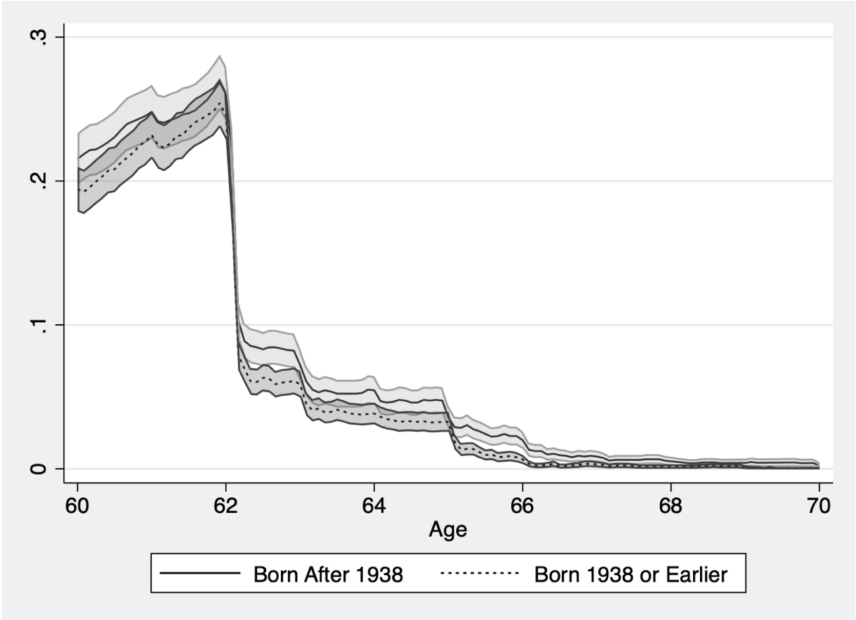

FIGURE 5. FRACTION RECEIVING SOCIAL SECURITY AND LIFE ANNUITY

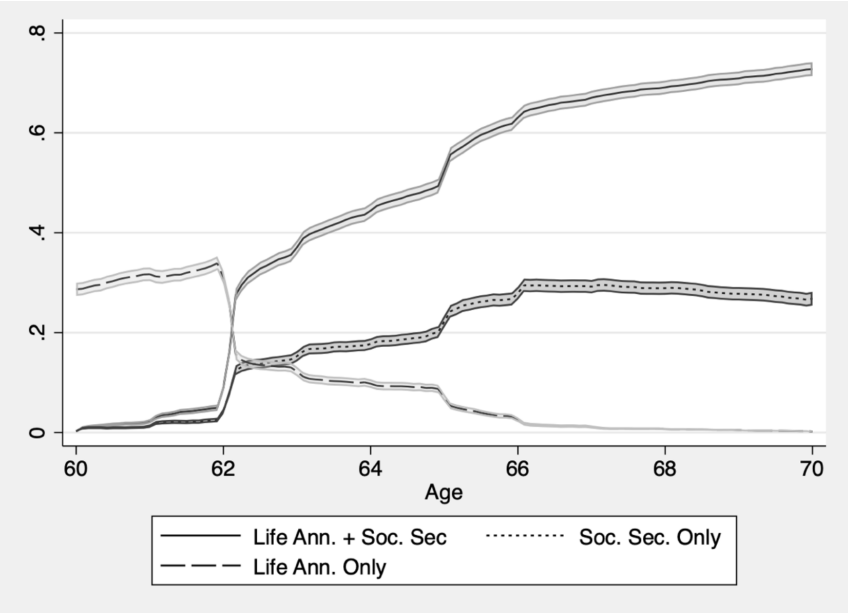

FIGURE 6. FRACTION RECEIVING SOCIAL SECURITY AND LIFE ANNUITY, BY COHORT

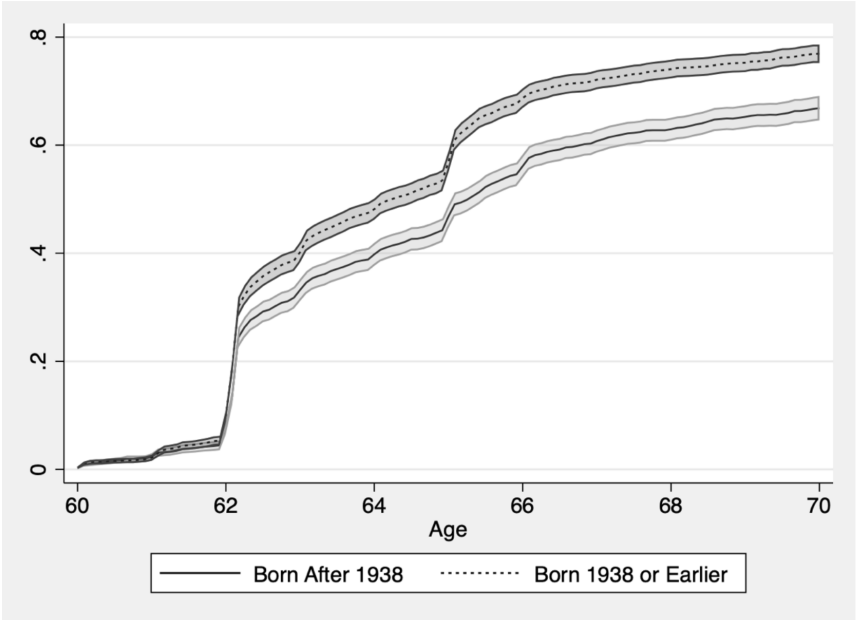

FIGURE 7. FRACTION RECEIVING SOCIAL SECURITY WITHOUT LIFE ANNUITY, BY COHORT

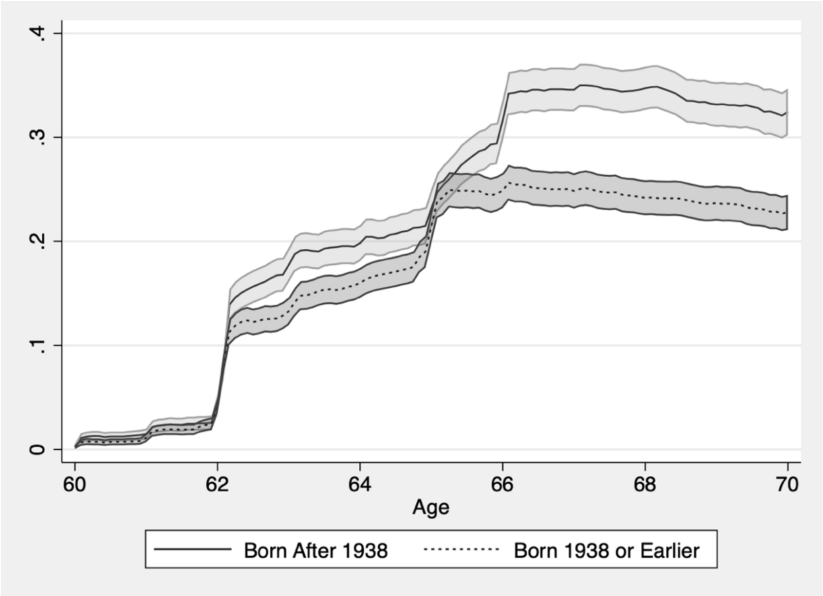

FIGURE 8. FRACTION RECEIVING LIFE ANNUITY WITHOUT SOCIAL SECURITY, BY COHORT

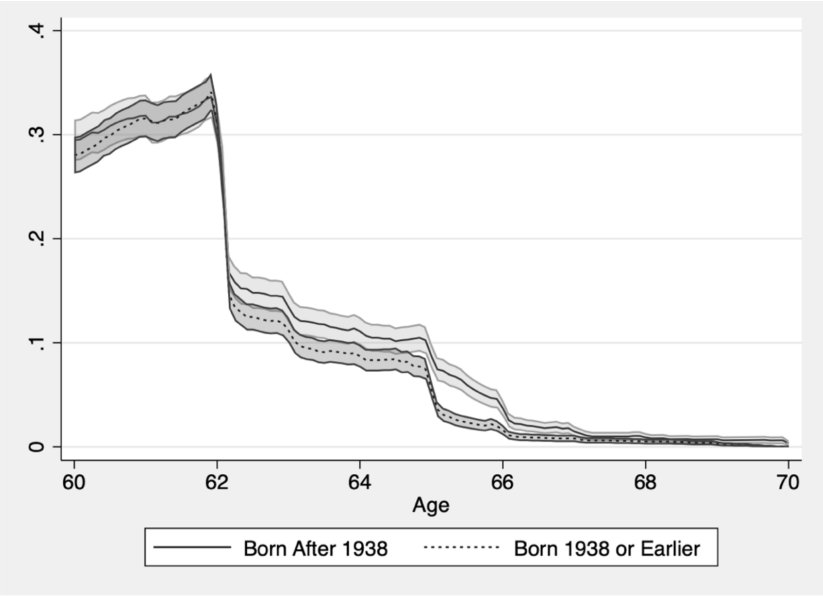

TABLE 1. SAMPLE SELECTION

Step	Dropped	Respondents
Initial observation count		34,007
Drop if any disability episodes	7,171	26,836
Drop if born before 1928 or after 1950	12,292	14,544
Drop if not observed through age 68	3,775	10,769
Drop if never report social security income and missing claiming age	314	10,455
Drop if missing social security claiming age	940	9,515
Drop if social security claiming age <60 or ≥71	397	9,118
Drop if retired but missing retirement age, or retirement status never valid	212	8,906
Drop if ever report pension/annuity income but start age missing	1,055	7,851
Drop if not interviewed in baseline wave	539	7,312
Drop if no evidence of defined benefit or defined contribution pension	2,600	4,712
Step	**Respondent-months**	
Convert to person-month level and drop if age <60 or ≥71		564,038

TABLE 2. SUMMARY STATISTICS

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Social Security Policy Variables					
Reached Full Retirement Age	564,038	0.46	0.50	0.00	1.00
Delayed Retirement Credit (% of PIA)	564,038	6.48	1.15	4.00	8.00
Subject to Earnings Test	564,038	0.42	0.49	0.00	1.00
Employer Sponsored Pension Variables					
Has Defined Benefit Pension	564,038	0.84	0.37	0.00	1.00
Has Defined Contribution Pension	564,038	0.72	0.45	0.00	1.00
Eligible for Early Retirement	564,038	0.37	0.48	0.00	1.00
Eligible for Full Retirement	564,038	0.31	0.46	0.00	1.00
Health and Health Insurance Variables					
No Employer-Sponsored Health Insurance	564,038	0.27	0.44	0.00	1.00
Employer Sponsored Health Insurance with Retiree Coverage	564,038	0.58	0.49	0.00	1.00
Employer Sponsored Health Insurance without Retiree Coverage	564,038	0.15	0.36	0.00	1.00
Poor Health (Self-Reported)	564,038	0.14	0.35	0.00	1.00
Demographic and Economic Variables					
Female	564,038	0.44	0.50	0.00	1.00
Married at Baseline	564,038	0.79	0.41	0.00	1.00
Divorced at Baseline	564,038	0.13	0.33	0.00	1.00
Widowed at Baseline	564,038	0.04	0.20	0.00	1.00
Never Married at Baseline	564,038	0.03	0.18	0.00	1.00
Unknown Marital Status at Baseline	564,038	0.00	0.07	0.00	1.00
White Race	564,038	0.83	0.38	0.00	1.00
Black Race	564,038	0.14	0.34	0.00	1.00
Other Race	564,038	0.03	0.18	0.00	1.00
Hispanic Ethnicity	563,917	0.06	0.24	0.00	1.00
Primary Earner or Single	564,038	0.57	0.50	0.00	1.00
College Educated	564,038	0.50	0.50	0.00	1.00
Interest Rate	564,038	2.09	1.01	-0.17	4.97
Age	564,038	64.50	2.88	60.00	70.00
Year of Birth	564,038	1,937.95	5.43	1,928.00	1,950.00
Current Year	564,038	2,002.90	6.12	1,988.00	2,019.00
Dependent Variables					
Retire	259,587	0.011	0.102	0.00	1.00
Start Social Security	203,804	0.023	0.150	0.00	1.00
Start Life Annuity	248,946	0.008	0.090	0.00	1.00
Retire and Start Social Security	164,318	0.007	0.085	0.00	1.00
Retire Before Starting Social Security	164,318	0.004	0.062	0.00	1.00
Start Social Security Before Retiring	164,318	0.012	0.108	0.00	1.00
Retire and Start Life Annuity	182,486	0.005	0.071	0.00	1.00
Retire without Life Annuity	182,486	0.006	0.074	0.00	1.00
Start Life Annuity without Retiring	182,486	0.004	0.060	0.00	1.00
Start Social Security and Life Annuity	142,717	0.006	0.075	0.00	1.00
Start Social Security without Life Annuity	142,717	0.013	0.115	0.00	1.00
Start Life Annuity before Social Security	142,717	0.005	0.067	0.00	1.00

TABLE 3. HAZARD OF RETIREMENT, SOCIAL SECURITY CLAIMING, AND LIFE ANNUITY COMMENCEMENT (FULL SAMPLE)

	Retire	Start Social Security	Start Life Annuity	Start Social Security and Retire	Retire and Delay Social Security	Start Social Security and Delay Retirement	Start Social Security and Life Annuity	Start Social Security and Delay (or Forgo) Annuity	Start Life Annuity and Delay Social Security
Social Security Policy									
Reached FRA	0.000963	0.0946***	0.00950*	0.0217	0.0110*	0.0842***	0.0400***	0.0565**	-0.00176
	(0.00608)	(0.0275)	(0.00566)	(0.0134)	(0.00611)	(0.0248)	(0.0149)	(0.0256)	(0.00603)
Reached FRA * DRC	0.00112	-0.0150***	-0.000152	-0.00132	-0.00191	-0.0155***	-0.00423	-0.0112**	2.61e-05
	(0.000937)	(0.00551)	(0.000847)	(0.00261)	(0.00125)	(0.00496)	(0.00302)	(0.00500)	(0.00107)
Subject to Earnings Test	-0.00138	-0.128***	-0.000705	-0.0159**	-0.00500	-0.119***	-0.0174**	-0.110***	-0.000356
	(0.00229)	(0.0157)	(0.00210)	(0.00734)	(0.00330)	(0.0144)	(0.00856)	(0.0141)	(0.00271)
Employer-Provided Benefits									
Has DB	-0.000477	-0.00246***	0.00395***	-0.000232	-0.000549	-0.00185**	0.00220***	-0.00666***	0.00216***
	(0.000483)	(0.000907)	(0.000348)	(0.000519)	(0.000372)	(0.000771)	(0.000394)	(0.000862)	(0.000342)
Has DC	-0.00439***	-0.0117***	-0.00630***	-0.00464***	-0.00265***	-0.00382***	-0.00499***	-0.00322***	-0.00339***
	(0.000652)	(0.000832)	(0.000722)	(0.000650)	(0.000516)	(0.000670)	(0.000654)	(0.000788)	(0.000646)
Eligible for Early Pension	0.00484***	-0.00158	0.00525***	0.00229***	0.00205***	-0.00362***	0.00299***	-0.00405***	0.00182***
	(0.000822)	(0.000983)	(0.000903)	(0.000718)	(0.000557)	(0.000682)	(0.000711)	(0.000777)	(0.000679)
Eligible for Full Pension	0.00146	0.00617***	0.00248**	0.00240**	0.00140*	0.00175*	0.00292***	0.00230**	0.00239***
	(0.000990)	(0.00124)	(0.00111)	(0.000934)	(0.000713)	(0.000924)	(0.000986)	(0.00105)	(0.000871)
Health and Health Insurance									
Medicare * No ESHI	-0.00145*	0.00746	-0.00213***	-4.48e-05	-0.000916	0.0107*	-0.00178	0.0201***	-0.000597
	(0.000831)	(0.00666)	(0.000639)	(0.00290)	(0.00125)	(0.00635)	(0.00287)	(0.00724)	(0.00146)
Medicare * ESHI without RHI	0.00239**	-0.00390	-1.82e-05	0.00666**	0.000529	-0.00996**	0.00555*	-0.00390	-0.000146
	(0.00113)	(0.00525)	(0.000869)	(0.00307)	(0.00136)	(0.00499)	(0.00326)	(0.00540)	(0.00155)
Poor Health	0.00316***	0.00222**	-0.000823	0.00179**	0.000318	0.000561	0.000616	0.00155	-0.000613
	(0.000677)	(0.00103)	(0.000527)	(0.000699)	(0.000497)	(0.000830)	(0.000616)	(0.000987)	(0.000531)

TABLE 3. HAZARD OF RETIREMENT, SOCIAL SECURITY CLAIMING, AND LIFE ANNUITY COMMENCEMENT (FULL SAMPLE) CONTINUED

	Retire	Start Social Security	Start Life Annuity	Start Social Security and Retire	Retire and Delay Social Security	Start Social Security and Delay Retirement	Start Social Security and Life Annuity	Start Social Security and Delay (or Forgo) Annuity	Start Life Annuity and Delay Social Security
Demographic and Economic									
Female	-0.00115**	0.00129	-0.00202***	-0.000846*	-0.000146	0.00198***	-0.00146***	0.00292***	-0.00170***
	(0.000485)	(0.000828)	(0.000449)	(0.000495)	(0.000381)	(0.000712)	(0.000470)	(0.000770)	(0.000423)
Divorced at Baseline	-0.00241***	-0.00362***	-0.000501	-0.00142**	-0.00102**	-0.000518	-0.00131**	-0.00251**	8.49e-05
	(0.000623)	(0.00103)	(0.000560)	(0.000638)	(0.000488)	(0.000896)	(0.000584)	(0.000999)	(0.000551)
Widowed at Baseline	-0.00259**	0.000768	-0.00107	0.000258	-0.00171**	0.00196	0.000370	0.000608	-0.00141*
	(0.00102)	(0.00215)	(0.000922)	(0.00120)	(0.000751)	(0.00153)	(0.00107)	(0.00177)	(0.000841)
Never Married at Baseline	-0.000426	-0.00208	-0.000406	0.000973	-0.00101	-0.00218	0.000133	-0.00187	-0.000580
	(0.00135)	(0.00206)	(0.00120)	(0.00141)	(0.000910)	(0.00148)	(0.00125)	(0.00180)	(0.00102)
Unknown Marital Status at Baseline	-0.00147	0.000323	-0.00296*	-0.00339	0.000190	0.00394	-0.00482***	0.00689	0.000829
	(0.00263)	(0.00424)	(0.00161)	(0.00236)	(0.00224)	(0.00379)	(0.000947)	(0.00423)	(0.00240)
Black Race	-0.000350	-0.00293***	-0.000600	-0.000909	0.000298	-0.000918	-0.000851	-0.000941	-0.000929*
	(0.000657)	(0.00108)	(0.000604)	(0.000658)	(0.000505)	(0.000891)	(0.000647)	(0.000922)	(0.000545)
Other Race	-0.00327***	-0.00285	-0.000761	-0.00266**	-0.000858	0.000807	-0.00311***	-0.000288	0.000128
	(0.000957)	(0.00221)	(0.000882)	(0.00107)	(0.000769)	(0.00168)	(0.000782)	(0.00198)	(0.000853)
Hispanic Ethnicity	0.00284***	-0.00493***	-0.00128*	0.000868	0.00144**	-0.00669***	-0.00200***	-0.00284*	-0.000708
	(0.000972)	(0.00160)	(0.000712)	(0.000960)	(0.000728)	(0.00132)	(0.000773)	(0.00147)	(0.000639)
Primary Earner or Single	-0.00301***	-0.00213***	-0.000698	-0.00123**	-0.00123***	0.000447	-0.00103**	-0.00164**	-0.000306
	(0.000510)	(0.000828)	(0.000452)	(0.000531)	(0.000406)	(0.000705)	(0.000493)	(0.000770)	(0.000439)
College Educated	-0.00224***	-0.00581***	1.73e-05	-0.00294***	-0.000193	-0.00275***	-0.00217***	-0.00414***	0.000459
	(0.000421)	(0.000658)	(0.000392)	(0.000439)	(0.000324)	(0.000568)	(0.000413)	(0.000633)	(0.000380)
Interest Rate	0.00248***	-0.000635	0.00199***	0.000858	0.000457	-0.000300	-0.000160	-0.000843	0.00166***
	(0.000733)	(0.00114)	(0.000675)	(0.000750)	(0.000543)	(0.000874)	(0.000683)	(0.00106)	(0.000600)
Observations	259,587	203,718	248,825	164,318	164,318	164,318	142,631	142,631	142,631
R-squared	0.008	0.092	0.009	0.019	0.002	0.070	0.017	0.065	0.003

Notes: Standard errors clustered by individual. All regressions also include monthly age dummies, year dummies, and birth year dummies.
*** p<0.01, ** p<0.05, * p<0.1

TABLE 4. HAZARD OF RETIREMENT, SOCIAL SECURITY CLAIMING, AND LIFE ANNUITY COMMENCEMENT (SINGLES AND PRIMARY EARNERS)

	Retire	Start Social Security	Start Life Annuity	Start Social Security and Retire	Retire and Delay Social Security	Start Social Security and Delay Retirement	Start Social Security and Life Annuity	Start Social Security and Delay (or Forgo) Annuity	Start Life Annuity and Delay Social Security
Reached FRA	0.00103	0.117***	0.00522	0.0305*	0.00163	0.0836***	0.0379**	0.0722**	-0.00928
	(0.00815)	(0.0354)	(0.00813)	(0.0174)	(0.00677)	(0.0303)	(0.0188)	(0.0322)	(0.00759)
Reached FRA * DRC	0.00134	-0.0180**	0.000851	-0.00250	-0.000270	-0.0154**	-0.00345	-0.0147**	0.00154
	(0.00124)	(0.00717)	(0.00120)	(0.00341)	(0.00134)	(0.00606)	(0.00374)	(0.00635)	(0.00130)
Subject to Earnings Test	0.000744	-0.144***	0.00183	-0.0159	-0.000679	-0.128***	-0.0156	-0.128***	0.00453
	(0.00294)	(0.0216)	(0.00289)	(0.00979)	(0.00351)	(0.0188)	(0.0110)	(0.0191)	(0.00316)
Observations	156,034	119,063	134,240	98,760	98,760	98,760	81,010	81,010	81,010
R-squared	0.009	0.094	0.011	0.020	0.003	0.074	0.019	0.067	0.004

Notes: Standard errors clustered by individual. All regressions also include independent variables shown in Table 4, monthly age dummies, year dummies, and birth year dummies.
*** p<0.01, ** p<0.05, * p<0.1

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