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Zeewan Lee[1] and Manita Rao[2]

Abstract
How well individuals optimize the timing of their Social Security (SS) claims can influence their financial wellbeing. In this paper, we evaluate the impact of Social Security claiming timing on older adults' financial outcomes by constructing an Optimization Failure (OF) index, which measures the difference between optimal and observed claim timing. The analysis uses data from the Health and Retirement Study (1992 to 2020) linked to restricted Social Security Administration records and Working Trajectories data. The empirical strategy utilizes the OF index as the main predictor and a two-stage least square approach to estimate the effect of sub-optimal SS claiming (OF index) on financial wellbeing using several indicators including liquid savings, retirement assets, housing wealth, and total wealth. We find that sub-optimal claiming is associated with decline in real estate and total wealth, while also reducing liquidity constraints in the post-claiming period. We also find that these links are more prominent among sub-optimal early claimers compared with those claiming sub-optimally late.

Keywords: social security, retirement wealth, household savings, aging, financial security
JEL: J26, H55, J14, D8

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1. Introduction

The United States has a rapidly aging population. More than four million Americans turned 65 in 2024 alone, the highest ever in U.S. history (Doonan & Kenneally, 2024; Vandenbroucke, 2019). Yet, as the youngest of the baby boomer generation enter retirement and the share of retiree households increases, there is growing concern that older households with inadequate retirement savings may experience financial insecurity after retirement (Doonan & Kenneally, 2024). These demographic shifts coupled with a shrinking tax base that has put pressure on Social Security funding have made the financial security of older adults an urgent policy problem. Further, the way Americans saved for retirement transitioned in the early 1980s from traditional Defined Benefit pensions to Defined Contribution plans. This transition has made personal savings an increasing share of post-retirement income that complements retirees' Social Security income (Favreault & Steuerle, 2012; Sheshinski & Caliendo, 2021).

Social Security benefits received through the Social Security Old Age and Survivors Insurance (OASI) program plays a central role in meeting the income needs of retirees. In 2024, 67 million individuals received Social Security benefits including 52 million retired workers and dependents of retired workers, 6 million survivors of deceased workers, and 9 million disabled workers and dependents of disabled workers (Bieber, 2024; U.S. Social Security Administration, 2023). While OASI benefits remain the most stable source of income for all retirees, it is particularly important to the financial wellbeing of low- and moderate-income households that are more likely to have limited retirement savings (NAS et al. 2022).

Yet, the adequacy of OASI benefits to meet retirees' financial needs has raised concerns amid a shrinking tax base required to finance the Social Security system. An important factor that affects retirees' Social Security benefits is their claiming decisions. More specifically, while

individuals often decide on the initial Social Security claiming time that maximizes monthly benefits, identifying an 'optimal claiming time' can be a more complicated decision that depends on a variety of factors such as estimating total lifetime Social Security wealth—which in turn depends on their survival probabilities and discount rates. In theory, identification of the optimal claiming timing would also require knowledge of how claiming decisions could affect other dimensions of household finances such as liquid assets and retirement wealth in order to assess monthly income that individuals can expect to receive during retirement. Despite the complexity of the claiming decision, there is limited research on whether older adults claim Social Security optimally and how deviations from optimal claiming affect financial well-being after retirement.

In this study, we address this gap in the literature by constructing a new Social Security claiming Optimization Failure (OF) index that measures the difference between actual initial claiming timing and optimal claiming timing. We undertake a multistep approach to construct the index; the OF index is generated by (1) identifying individuals' optimal claiming timing based on the year that maximizes lifetime Social Security wealth as a function of monthly benefits, work trajectories, discount rates, and expected mortality rate, (2) measuring the temporal distance between optimal and observed claiming timing and, (3) distinguishing index values that show whether the sub-optimality resulted from observed Social Security claiming occurring *before* or *after* optimal claiming timing. Finally, we use the index as the main predictor to assess how failure to optimize Social Security claiming timing impacts several indicators of financial well-being including liquid saving, private pension assets, real estate wealth, and total wealth.

Data is drawn from the Health and Retirement Study (HRS). The HRS is a nationally representative biennial panel survey of individuals aged 50 or older, conducted since 1992. We link the HRS data to restricted *Social Security Administration (SSA) data* containing records of

past annual earnings and *Working Trajectories data* which provide information on each individuals' monthly labor force status. We use these linked datasets to calculate individuals' monthly Social Security benefits and lifetime Social Security wealth for each possible initial claiming age, and from these we compute our Optimization Failures (OF) index as the temporal distance between optimal and actual claiming time. To account for endogeneity stemming from unobserved characteristics that could affect optimization of Social Security claiming timing and post-retirement wealth, we estimate panel two-stage least squares models that instrument for the OF index using individuals' subjective mortality expectations and confidence in receipt of Social Security benefits.

Our findings provide a more nuanced understanding of the extent to which sub-optimal Social Security claiming transmits to post-claiming financial wellbeing. Our main finding shows that individuals' sub-optimal claiming timing is associated with lower real estate wealth and total wealth in the years following the initial claiming. Yet, these individuals are also less likely to have liquidity constraints, indicating that sub-optimal claiming increases financial stress associated with long-term wealth (i.e., real estate and total wealth) but reduces liquidity-related financial strain among retirees. At the same time, we find optimization failure does not have a significant effect on private pension wealth in post-claiming years. In addition, we find that these adverse financial outcomes are more pervasive among individuals that claim earlier than the optimal claiming age (hereafter "early claimers"), and are less significant for individuals that claim later than the optimal claiming age (hereafter "late claimers"). In analyses of the effect of sub-optimal claiming on disaggregated wealth outcomes including liquid and semi-liquid assets, and housing and non-housing wealth, we find that sub-optimal claiming has a significant negative effect on non-housing real estate wealth, while the effect on other sub-categories is not statistically significant. We also

find that the negative link between the suboptimal claiming and post-retirement total wealth prevails even in analysis of wealth net of mortgages and other forms of debt.

This study contributes to the literature on Social Security, household financial decisions, and retirement wealth. Previous research shows that a substantive majority of individuals claim Social Security benefits before reaching the Full Retirement Age (FRA), i.e., the reference age for which benefits are calculated (Gustman et al., 2016; Haaga & Johnson, 2012; Shoven et al., 2018), and that the initial claiming time affects Social Security wealth (Aguila & Lee, 2022; Coile & Gruber, 2007; Shoven et al., 2018). Yet, there is limited research on how such claiming decisions affect other dimensions of household finances and older adults' financial wellbeing during retirement. This paper extends these lines of research by constructing a new OF index that calculates the temporal distance between optimal and actual claiming timing—based on Coile and Gruber (2001, 2007)'s methodology to compute Social Security *peak value* retirement incentive. The OF index allows us to distinguish individuals that claim sub-optimally early from those claiming sub-optimally late, and to compare their post-claiming financial well-being—a question not yet explored in the literature.

The rest of this paper is organized as follows: The 'Background' section provides details of the federal Social Security Old Age and Survivors Insurance program, including policy details, program benefits and a review literature on the factors that influence Social Security claiming decisions. The 'Data and Methods' section presents the data used in the paper and the describes the methodology used to construct the OF index, instruments, and the main outcomes of interest. The 'Estimation' section describes our empirical strategy. The 'Results' and 'Discussion' sections present and consider implications our results. The final section concludes.

2. Background: Drivers of Social Security Claiming Decisions

The Social Security program was enacted in 1935; its trust fund, which pays out benefits to eligible workers, was established in 1940. The Old Age and Survivors Insurance (OASI) program of the Social Security Administration is one of the primary sources of retirement income in the United States. In 2024, 67 million people or 1 in 5 U.S. residents received Social Security benefits, including 55 percent of all women and 45 percent of all men at least 60 years of age (Bieber, 2024). The average replacement rate of Social Security monthly benefits (i.e., the percentage of pre-retirement income replaced by income from Social Security benefits) is between 40 and 60 percent. The rates are higher for lower-income households than for higher-income ones, i.e., lower-income households rely more on Social Security benefits to replace pre-retirement income than higher-income households (Holmes 2023; Bieber 2024).

When individuals claim Social Security is a major life decision that can affect how they fare financially after retiring from the labor force. This is because individuals' monthly Social Security benefits and the lifetime Social Security wealth are determined in part by the timing of their initial claim. Social Security rules stipulate that once individuals have worked for at least 10 years (or earned 40 quarterly credits), they are eligible to receive Social Security benefits and can start claiming as soon as they reach the early retirement age (ERA), currently set at age 62. For individuals who claim at their ERA or sometime between their ERA and their FRA (currently set at age 67 for those born in 1960 or later, the monthly benefit is reduced by a specific amount for the number of months remaining until the FRA). For individuals who make their initial claim after the FRA, the monthly benefit is increased by a specific amount for each month after the FRA until they reach age 70. Recipients cannot increase their monthly benefit any further after age 70 (U.S.

Social Security Administration 2019a). Once initiated, the monthly benefits are provided until death.

Optimally, an individual would choose an initial claiming date that maximizes the amount they paid over their lifetime, i.e., their lifetime Social Security wealth. Choosing such a date depends on knowledge of the rules as well as actuarial assumptions. The claiming dates—and the extent of reduction in the SS monthly benefits associated with early claiming—are not actuarially fair: as Knoll and Olsen (2014) note, for those born after 1960, the monthly benefit amount for those claiming at the ERA is nearly 30 percent lower than that for those claiming at the FRA. Such differences provide an incentive for delaying the initial claim.

In deciding when to make their initial claim, individuals should, in theory, consider not only the amount of monthly benefits but also their *lifetime Social Security wealth* (i.e., the total amount accumulated since initial contributions to Social Security until death). Lifetime Social Security wealth depends on the monthly benefit amount, re-distributive features embedded in the benefits formula,[2] individuals' discount rates, and survival probabilities that can vary by cohort, gender, and race or ethnicity (Aguila et al., 2021; Aguila and Lee, 2022; Coile & Gruber, 2007).[3] Delaying initial claim past one's ERA and up until age 70 will, as noted earlier, increase monthly benefits. Nevertheless, considering the lifetime Social Security wealth, *delaying past the optimal time* for an initial claim may result in lower total lifetime Social Security wealth, as individuals claiming at older ages have fewer remaining years in which to receive benefits.

There is limited research on factors that influence individuals' sub-optimal claiming as well as their impacts on financial well-being. We hypothesize that sub-optimal early and late Social

[2] The redistributive features in the benefits formula include indexing of the Average Indexed Monthly Earnings (AIME) and the kinks in the Primary Insurance Amount (PIA) (Crystal et al. 2017).
[3] See **Section 3.3** for more information.

Security claiming may have distinct effects on older adults' financial wellbeing. Despite the potential drawbacks to claiming Social Security sub-optimally, an enduring puzzle in the literature is the persistence of such behaviors among beneficiaries. Prior research shows that a significant number of older adults claim Social Security benefits as early as possible, thereby forgoing a substantial amount in annuitized Social Security income (Seiter and Slavov 2023; Munnell and Soto 2005; Benitez-Silva and Heiland 2008; Coile et. al. 2002). Nearly 40 percent of older households claim Social Security benefits at the ERA and 72 percent claim it sometime after the ERA but before the FRA (Armour & Knapp, 2021), suggesting these households collected lower monthly benefits and had reduced lifetime Social Security wealth by *not* delaying their initial claiming.

Why would individuals engage in suboptimal claiming behaviors? A widely found reason in previous research pertains to experiencing unexpected financial strains. These strains could result from changes in an individuals' economic circumstances or from changes in macroeconomic conditions such high unemployment or an economic downturn. For instance, studies that evaluate the impact of the Great Recession on Social Security claiming behavior find an uptick in older adults claiming early, reversing the downward trend in preceding years. The high unemployment during the Great Recession reversed the trend of decline in early claiming—leading to a significant increase in the share of older adults claiming Social Security earlier than the FRA, whereby early claiming rose from 12 percent in 2008 to 20 percent in 2009 (Johnson et al., 2013).[4] Other macroeconomic factors that affect the timing of initial claims for Social Security include wealth

[4] While the recession coinciding with the COVID-19 pandemic also reduced employment, with employment among persons 62 to 70 years of age decreasing 10.7 percent, it did not lead to increased early claiming of Social Security benefits, because the financial shock was mediated by enhanced unemployment insurance coverages under the Coronavirus Aid, Relief, and Economic Security (CARES) Act and the American Rescue Plan in 2020-2021 (Goda et al., 2023).

shocks such as drop in housing values that generates a decline in overall household wealth (Huang et al., 2022), cyclical unemployment (Haaga & Johnson, 2012), or structural displacement from the labor market (Card et al., 2014).

Apart from macroeconomic factors, circumstances at the individual level that cause financial pressures could also influence early claiming of Social Security. Unexpected financial constraints for individuals or households such as having large, unexpected expenses due to a financial or medical emergency can lead to suboptimal claiming behaviors. For instance, households that are liquidity-constrained or in poverty close to their retirement years could be more likely to claim sub-optimally early in order to utilize income from Social Security to ease their financial strain (Engelhardt et al., 2022; J. B. Shoven et al., 2018; Slavov, 2023). Research also shows that, unlike lower-income households that claim early due to financial stress, wealthier households are more likely to claim early when they have bequest motives (Coile et al., 2002).

Adverse health could also induce early claiming. Specifically, health-related concerns at work are important drivers of Social Security claiming decisions: Individuals in physically demanding jobs are more likely to claim Social Security sub-optimally early (Glickman & Hermes, 2015). In addition to actual or diagnosed health conditions and physical strains caused by working conditions, *subjective* health evaluations as well as longevity expectations can also affect the timing of initial Social Security claiming. For instance, individuals with lower *subjective* survival probabilities tend to claim benefits early so as to increase the duration over which they can collect monthly benefits (Delavande et. al., 2006; Glickman and Hermes, 2015; Hurd et al., 2004).

Compared to early claiming, sub-optimally late claiming behaviors are less explored in the literature. This could be because the concept applies to *lifetime Social Security wealth* as opposed to *monthly Social Security benefits*: While there is no reduction in the monthly benefits even when

individuals start claiming past the FTA, the lifetime accumulation of Social Security wealth (i.e., a sum of all the annuities one is to collect until death) could reduce past a certain optimal claiming time. The few existing studies that provide empirical evidence on factors that influence late claiming suggest that individuals' *de-valuation of annuitized benefits* influence late claiming behavior. While canonical theory in economics suggests that annuities have insurance value (Mitchell et al., 1999), empirical research finds that individuals with lower preference to annuitize are more willing to delay Social Security claiming if there is an option for Social Security wealth to be paid as an actuarially fair lump sum (Maurer et al., 2018, 2021; Maurer & Mitchell, 2021). Other studies suggest that individuals who claim sub-optimally late are often wealthier (Glickman & Hermes, 2015; Komp et al., 2010), and therefore less likely to face liquidity or other financial constraints that drive early claiming behavior. Some studies suggest that *non-financial factors,* such as a strong preference for work over leisure or retirement (Hakim, 2004; Komp et al., 2010), and the desire to synchronize claiming and retirement with a spouse (Gustman & Steinmeier, 2000; Moen et al., 2006) could influence late claiming behavior.

In addition to these factors, research in behavioral economics suggests that factors such as reference dependence (e.g., existing status quo), framing, and information processing errors can drive sub-optimal early or late claiming. Lalive et.al. (2023) find that older Swiss adults initially claim public pension benefits based on *self-perceived notions* of 'normal' claiming timing which often does not align with optimal timing (i.e., one that maximizes lifetime Social Security wealth). Brown et al. (2016) note that individuals are heavily influenced by how the timing of the initial claim is framed*:* Individuals who responded strongly to a narrative that explained the 'value of delaying claiming' based on whether the sum of additional monthly payments offsets benefits foregone during the delay period being more likely to claim Social Security approximately 15

months later, compared to respondents who were more responsive to the alternative frame that stated facts related to changes in monthly benefits associated with claiming time.

A small but growing stream of literature explores the influence of financial foresight and financial literacy on individuals' claiming behaviors. For example, Liebman and Luttmer (2012) find that older workers who received information about Social Security eligibility, claiming, and annuitized income were 4 percentage points more likely to delay claiming and postpone retirement than those that did not receive this information. In a related study, Smith (2006) found that individuals who claimed Social Security benefits earlier than FRA were less likely to engage in other long-term financial planning activities and experienced unexpected drops in consumption at the time of retirement, indicating that the claiming decision could have resulted from limited financial foresight.

In sum, Social Security claiming behavior and the potential for sub-optimal claiming could result from financial, non-financial, and behavioral factors as well as irrational errors and limited financial literacy. In this paper, we empirically explore whether such underlying characteristics and conditions affect other dimensions of older adults' post-claiming financial outcomes by assessing how sub-optimal claiming decisions impact financial well-being among retirees. In theory, if individuals implicitly trade off different forms of wealth to maximize lifetime utility and smooth lifetime consumption, then the factors that affect Social Security claiming should also affect post-retirement financial outcomes.[5] In other words, under the assumption of substitutability between Social Security and other forms of retirement wealth (Aguila, 2011; Diamond &

[5] For instance, an extensive literature has examined this relation between private savings and pension benefit changes to estimate elasticity of pension wealth and household savings (Aguila, 2011; Diamond & Hausman, 1984; Lachowska & Myck, 2018; Lindeboom & Montizaan, 2020). A key finding of this research is that individuals alter savings and claiming behavior in response to several short-term and long-term savings considerations that deviate from expectations of standard lifecycle savings models.

Hausman, 1984; Lachowska & Myck, 2018; Lindeboom & Montizaan, 2020), individuals who fail to optimize claiming timing and accumulate lower Social Security lifetime wealth could have higher accumulations of other forms of wealth. An alternative theory is that individuals' claiming decisions are constrained by limited financial literacy and short savings horizons leading to lower accumulation of all forms of wealth including liquid assets, pension wealth and real estate wealth in pre-retirement years—causing increased financial strain in post-claiming years. We test each of these theories by evaluating the extent to which sub-optimal Social Security claiming behavior is associated with alternate forms of household wealth including liquid assets, pension wealth and real estate wealth. To test the first theory—proposing a substitution between Social Security wealth and non-Social Security wealth—we test the hypothesis that sub-optimal claiming is associated with higher non-Social Security wealth. Conversely, under the second theory—emphasizing financial constraints and limited foresight—we test the hypothesis that sub-optimal claiming is associated with lower non-Social Security wealth.

3. Data and Methods

3.1. Data

The study uses data from the Health and Retirement Survey (HRS), linked to administrative data from the Social Security Administration and data on Working Trajectories.[6] The HRS is a nationally representative biennial panel survey of adults aged 50 or older and their spouses. The HRS data include information on household income, wealth, health, labor force participation, and

[6] The Social Security Administration data is available as a restricted datafile linked to HRS, while the Working Trajectories data is available as a public HRS-linked data contributed by Dudel (2018).

retirement expectations. The HRS also includes a wide array of demographic characteristics of respondents and their spouses. We analyze 15 waves of HRS data from 1992 to 2020.

We link the HRS data to restricted individual-level administrative data from the *Social Security Administration (SSA)*. SSA administrative data contain detailed records of respondent annual earnings, as well as on the *annual earnings cap* on which Social Security taxes are paid and benefits calculated (U.S. Social Security Administration 2019a; Social Security Administration, n.d.).[7] We use this information from Social Security administrative records to calculate each HRS respondent's Social Security monthly benefits and lifetime Social Security wealth, which are used to compute the Optimization Failure index and generate each individual's optimal Social Security claiming age.

We also link the HRS to the *Working Trajectories dataset*,[8] which provides information on HRS respondents' monthly labor force status. We use this information to estimate Social Security wealth that reflects individuals' unique employment gaps. After linking the Working Trajectories data to the HRS for the years 1992 through 2020, we project the working trajectories of respondents beyond year 2020 by applying similar patterns of employment gaps observed from 1992 through 2020 to every 29-year bandwidth beyond 2020, following the imputation approach in Aguila and Lee (2022).[9] The projection of future earnings and future employment patterns are used to calculate lifetime Social Security wealth.

[7] The earnings caps are year-specific (e.g., $137,700 in 2020). For earnings above the cap, individuals do not pay Social Security taxes and hence have no additional Social Security benefits (Social Security Administration, n.d.).
[8] This dataset was a contributed data that was built on the HRS. More information on the data is provided at https://hrsdata.isr.umich.edu/data-products/working-trajectories-hrs
[9] While we do not expect the observed working patterns of past years to exactly match their future patterns, we believe this is a better estimation approach than one widely used in the past Social Security wealth calculations, which assumes that everyone works continuously in all future years.

Our sample includes respondents 62 to 85 years of age receiving OASI monthly benefits,[10] for whom we have information on post-claiming wealth. For respondents who started claiming benefits in the middle of the analysis period, we included only waves from the time of claiming. Of 179,479 person-wave observations across 15 waves between 1992 and 2020, 70.7% have had linked records in the SSA administrative data. For the remaining 29.3% with missing records, we impute past earnings using methods established in previous research (e.g., Aguila et al. 2021).

To facilitate panel analyses, from 179,479 person-wave observations of individuals between ages 62-85 from 1992 to 2020 (15 waves) in the HRS data, we dropped 3,830 respondents for having responded only once across the waves and removed 51,990 person-wave observations of individuals that never worked and did not contribute to Social Security. We also dropped 85,307 person-wave observations for individuals that did not initiate Social Security claiming—either because these respondents were (1) not yet retired, (2) retired but below age 62, the earliest possible claiming age, or (3) retired and above age 62 but had yet to meet the eligibility criteria because of fewer working years. After removing 115 observations for missing covariates, our final sample consists of 38,237 person-year observations. The median response rate per individual is 4 waves out of the 15 waves in our sample, with approximately 3,400 unique individuals per wave.

3.2. Outcome Variables

Our main outcome of interest is financial well-being. We measure this construct using four indicators of post-claiming household finance that together provide a comprehensive picture of older individuals' financial well-being: liquid assets, wealth in pension accounts (hereafter 'pension wealth'), real estate wealth, and total wealth.

[10] Individuals in our sample had contributed to Social Security during their working years and were eligible to receive the benefits. The Social Security benefit eligibility implied that the individuals in our sample worked and contributed to the social security for at least 40 three-months quarters, or 10 years (Gustman and Steinmeier, 2000). The earliest receipt could take place at the Early Retirement Age (ERA) of 62.

Liquid assets are essential to meeting unexpected and regular expenses. Lack of liquid savings can destabilize household finances and increase reliance on debt. However, not all forms of liquid assets are equally easily accessible in times of need: Some assets could be tied up in investments and others maybe in a checking account that can be accessed as needed. To assess the relative impact of sub-optimal claiming on these different characteristics of liquid assets, we categorize liquid wealth into two sub-categories: *fully liquid assets*, measured as the sum of balances in checking, savings, and money market accounts, and *semi-liquid assets*, measured as the total value of stocks, mutual funds, and investment trusts.

The second outcome—private pension wealth—is defined as the total amount of retirement wealth accumulated in an individuals' different retirement accounts. We measure pension wealth as the sum of total balances in *Defined Contribution accounts* (including Defined Contribution, Individual Retirement and Keogh accounts), *Defined Benefit accounts* (including annuities from employer pension plans), and *other pension savings* (sum of value of Certificates of Deposit, government savings bonds, treasury bills, and bond funds). We also create separate variables for Defined Contribution balances, Defined Benefit pensions, and other pension savings to evaluate differences in the impact of sub-optimal claiming across different types of accounts given the unique characteristics of each type of account. We exclude Social Security benefits from retirement wealth to avoid conflation between this outcome measure and the independent variable.

The third outcome—real estate wealth—is measured as the sum of all *housing* and *non-housing real estate wealth*. We also create two separate variables for these sub-categories: housing wealth and non-housing real estate wealth. We calculate housing wealth as the total value of primary- and secondary- residence less mortgage and other home loans. Non-housing real estate

wealth is calculated as the value of land investments, rental real estate, partnerships, ownership in real estate investment trusts, commercial and industrial properties net of loans and mortgage.

Lastly, we calculate total household wealth as the sum of all wealth variables (liquid, pension, and real estate) as well as annual salary income for those who are still working even after having started claiming Social Security benefits.[11] We create two variations of this variable—(1) total wealth net of all household debt and (2) total wealth net of real estate wealth to get a more complete picture of financial well-being. All wealth measures are converted into 2020 US dollars to adjust for inflation using the Consumer Price Index. All wealth variables are winsorized at the 5th and 95th percentiles (i.e., top-code and bottom-code values outside the 5th and 95th percentiles) to exclude outliers (Beaumont & Rivest, 2009).

3.3. Optimization Failure Index

The Optimization Failure (OF) Index measures the arithmetic difference between (1) the optimal initial claiming timing that maximizes lifetime Social Security wealth and (2) the actual initial claiming timing observed and recorded in the HRS data linked to SSA administrative records. In generating the OF index, we follow the approach by Coile and Gruber (2001, 2007) to calculate individuals' lifetime Social Security wealth based on monthly benefits, discount rates, and gender- and race- specific survival probabilities.

To create the index, first, we calculate *monthly Social Security benefits* by (1) identifying each individuals earnings trajectory by imputing past missing earnings and projecting future earnings up to the maximum age of 120, following the approach of Coile and Gruber (2001,

[11] Approximately 15-20 percent of the person-wave observations started claiming the SS benefits but were still working in the 2010s. See Table 2 for more information.

2007),[12,13] (2) summing each respondents' 35 highest years of capped earnings (used to calculate the *Average Indexed Monthly Earnings* or AIME),[14] and (3) applying a nonlinear function.[15] These calculation procedures are used to compute the *Primary Insurance Amount* (PIA), i.e., the monthly benefit an individual would receive if they were to retire at the FRA. Then, using the pre-determined percent deductions for every year of early claiming (before FRA) and increasing for every year of delayed claiming, we compute monthly benefits for each possible retirement age from the current year *t* until the time the respondent would reach age 120.

Next, using the PIA for each individual, we calculate lifetime Social Security Wealth (SSW_t) as the expected net present value of a worker's Social Security benefits received until death if retiring/claiming at age t, appropriately discounted and accounting for distinct gender- and race-specific survival probabilities, following the specification in Aguila et al. (2021).[16]

More specifically, the OF index which leverages the calculation of lifetime Social Security wealth proceeds as follows: We calculate individuals' lifetime Social Security wealth to be collected if initial claim were to be at ages $t, t+1, t+2 \ldots T$ where T is age 120. Using this approach, we identify the *optimal age* at which each individuals' lifetime Social Security wealth will be maximized. Finally, the index is constructed by measuring the difference between optimal age, computed as described above, and actual age at which an individual claims Social Security.

[12] The imputation of missing earnings was necessary because not every HRS respondent was matched to his or her SSA administrative records—containing earnings history—as some respondents did not give their consent to be linked. For individuals with missing earnings history via the SSA and still listed as 'working' during the HRS analytic period of 1992-2020, we imputed past earnings using the multiple imputation method following the existing literature (e.g., Aguila et al., 2021; Aguila and Lee, 2022).

[13] While projecting earnings up to age 120 may sound unrealistic, the projections converged to near zero in the actual Social Security benefits/wealth calculation as we took into account individuals' survival probabilities at each age.

[14] The Social Security Administration uses 35 highest annual earnings to calculate AIME.

[15] The nonlinear function summed the following three portions of the AIME: (1) 90 percent of the earnings up to the first threshold or bend-point, (2) 32 percent of the remaining earnings up to the second threshold, and (3) 15 percent of the remainder. The full list of thresholds or bend-points that vary by year can be found at the Social Security Administration webpage (U.S. Social Security Administration n.d.).

[16] Further details of the calculation procedures can be found in equation (2) of Aguila et al. (2021).

Positive index values are indicative of initial claims that are earlier than optimal claiming and negative values indicate claims that were later than the optimal claiming. We then transform the index into *absolute values* to assess the impact of the *extent* of sub-optimal Social Security claiming behavior, irrespective of whether it occurred earlier (positive values) or later (negative values) than optimal, on post-claiming financial outcomes.[17]

For the purpose of empirical specification, the value of the OF index is *time-invariant* across the analytic period: Because both optimal and actual timing of claiming are fixed for individuals, the OF index captures variations across individuals. We also use the OF index to create binary indicators for whether respondents claimed sub-optimally early and sub-optimally late. These indicators help us identify whether and how each group is subject to different factors that affect their initial claiming and post-claiming financial outcomes.

Figure 1 shows the distribution of actual claiming age (Panel A) and optimal initial claiming age (Panel B) for the sample. The y-axis shows the number of individuals that claimed Social Security at each age. Panel A indicates that actual claiming ages vary substantially, ranging from between 62 to 76 years. Panel B shows that, while ages 67-68 are the optimal claiming age for most respondents in our sample, there is some variation between respondents due to differences in age at which individuals enter the workforce, employment patterns, and earned income. Yet, the wide range of actual initial claiming age accounts for most of the variations in the OF index.

[Figure 1]

Figure 2 shows the distribution of the OF index by birth cohorts for individuals born before 1941, between 1942-1947, between 1948-1953, and between 1954-1959. For each of these cohorts,

[17] When we compare the sub-optimal early and late claimers, we separate them into subsamples—with both groups' extent of suboptimality shown as positive values in the OF index.

we present the claiming distribution for the full sample (Panel A), the early sub-optimal claiming sample (Panel B), and the late sub-optimal claiming sample (Panel C). The x-axis is the number of years of suboptimal claiming, positive values are early-claimers, and negative values are late-claimers. The distribution of the OF index shows that across all individuals, early claiming is more prevalent than late claiming although younger cohorts are more likely to claim sub-optimally early compared to older cohorts (i.e., they are more likely to have positive OF index scores). Interestingly, we find that the oldest cohort, individuals born before 1941, are the most likely to claim either extremely early or extremely late (as shown by the long left tail on the x-axis). In contrast, younger cohorts (individuals born between 1948-1953 or 1954-1959), have higher shares of late claimers.

[Figure 2]

3.4. Covariates

We include a rich set of covariates in all empirical models including the following demographic characteristics: age and its quadratic polynomial, gender (indicator for being male), race (indicators for Whites, Black, and other racial group), years of education, marital status (indicator for married or having a partner), and household size. We also include a binary variable for whether respondents are in the labor force after claiming Social Security benefits to account for the fact that, while the initial claiming of Social Security benefits often coincides with retirement for many individuals, OASI rules do *not* explicitly require retirement for an individual to claim benefits (Lalive et al., 2023). For these individuals' annual salary income is added to total wealth (outcome variable).

We also include several indicators of individuals' financial status: binary indicators for receipt of private pension benefits, Medicare coverage, and employer-sponsored retiree health

insurance coverage.[18] We also control for the natural logarithm of out-of-pocket medical expenses, average 6 year pre-claiming total wealth (i.e., liquid assets and housing wealth, less debts) which is time-invariant over the analysis period.[19] All wealth and expenditure variables are adjusted to 2020 U.S. dollars using the Consumer Price Index. The empirical specifications also include year and Census region (Northeast, Midwest, South, West, and Other) indicators to account for year- and region-specific conditions as well as region-specific time trends. Finally, we instrument the OF index in the 2-stage least square estimations, using data on: (a) respondents' subjective mortality expectation that they would not survive to ages between 85 and 100 measured on a scale from 0 (lowest mortality expectation) to 100 (highest),[20] and (b) respondents' expectation about the sustainability of the Social Security system, i.e., their expectation that Social Security benefits would be reduced in the next 10 years measured on a scale from 0 (lowest) to 100 (highest likelihood). More details are provided in the next section.

4. Estimation

Our empirical strategy uses two estimation approaches – a panel random effects model and a 2-stage Least Square model. The panel random effects model is specified as follows.

$$Wealth_{\mathrm{irt}} = \beta_0 + \beta_1 OF_{ir} + \boldsymbol{X}_{irt}\beta_2 + \gamma_t + \delta_r + \gamma_t \cdot \delta_r + \epsilon_{irt}\,, \qquad (1)$$

[18] Such coverage may be provided by current employers if a respondent is still working or past employers for those with past employers who provide post-retirement coverage.
[19] We refrained from utilizing the total wealth of a single year prior to retirement because wealth could fluctuate across time, and possibly make a single year's wealth unrepresentative of an individual's pre-retirement wealth.
[20] As HRS contained questions on expected survival probabilities, we subtracted them from 100 to calculate the expected mortality (i.e., the probability to be not alive at age X). The wording for the survival question was "What is the percent change you will be alive at age (85, 90, 95, 100)?". The target age depended on respondents' age. For individuals below age 75, the question used age 85. For respondents aged 75-79, it used 90. For individuals 80-84, it used 95.For those between ages 85-89, the target age was 100.

where the outcome variable ($Wealth_{irt}$) measures one of four post-claiming financial outcomes —liquid assets, private pension wealth, real estate wealth, and total wealth—for individual i in Census region r at time t—observed in periods *after* initial claiming of Social Security benefits. The coefficient β_1 estimates the effect of sub-optimal Social Security claiming measured by the Optimization Failure index (OF_{ir}) on financial well-being. The model also includes the vector $\boldsymbol{X}_{ijt}$ of covariates which includes the following sociodemographic characteristics and financial status: age and its quadratic polynomial, gender, race, years of education, marital status, household size, labor force status, 6-year average pre-claiming wealth, natural log of out-of-pocket medical expenses, indicators for receipt of private pension benefits, Medicare coverage, and employer-sponsored retiree health insurance coverage. Also included are year fixed-effects (γ_t), geographic region fixed effects (δ_r), and their interaction to account for year- and region-specific macroeconomic conditions as well as regional time trends. Standard errors were clustered at the household level.

One concern in estimating the impact of Optimization Failure on wealth outcomes is reverse causality. It could be argued that individuals' wealth could dictate the timing of initial claiming of Social Security benefits and, in turn, the extent of optimization (i.e., the OF index scores). To account for this, we take advantage of the panel structure in our data by measuring financial outcomes strictly *after* individuals initiate Social Security claiming. This empirical strategy allows us to rule out reverse causality and provides precise estimates of suboptimal claiming behavior on post-retirement outcomes. In other words, to the extent that post-claiming financial outcomes have limited influence on accurate assessment of 'optimal' claiming timing, we are able to reduce bias from reverse causality. Another concern stems from unobserved individual-level characteristics that could systematically affect both the extent of optimization

failure and post-retirement wealth. We address this form of endogeneity by estimating panel two-stage least squares (Panel-2SLS) models specified as follows,

$$OF_{ir} = \theta_0 + \boldsymbol{Z}_{irt}\theta_1 + \boldsymbol{X}_{irt}\theta_2 + \gamma_t + \delta_r + \gamma_t \cdot \delta_r + \upsilon_{irt}\,, \quad (2)$$

$$Wealth_{\text{irt}} = \beta_0 + \beta_1 \widehat{OF_{ir}} + \boldsymbol{X}_{irt}\beta_2 + \gamma_t + \delta_r + \gamma_t \cdot \delta_r + \epsilon_{irt}\,, \quad (3)$$

where equation (2) is the first stage specification that instruments the Optimization Failure index (OF_{ir}) with the vector $\boldsymbol{Z}_{irt}$ which includes two instruments: respondents' mortality expectations between ages 85-100 and perceived likelihood of reduced Social Security benefits in the next 10 years (i.e., uncertainty about receiving Social Security benefits). The two instruments are chosen based on empirical evidence that subjective mortality (Beauchamp & Wagner, 2020; Hurd et al., 2004; Shu & Payne, 2013) and uncertainty about the Social Security system (Delavande & Rohwedder, 2011; Gustman & Steinmeier, 2015) influence Social Security claims decisions.[21] Equation (3) is the second stage specification where the predicted values of $\widehat{OF_{ir}}$ are used as a regressor to estimate effect on post-claiming wealth outcomes ($Wealth_{\text{irt}}$). Both equations include the same set of covariates ($\boldsymbol{X}_{ijt}$) and fixed effects as in equation (1). Standard errors are clustered at the household level.

The $\widehat{OF_{ir}}$ is constructed using instruments in vector $\boldsymbol{Z}_{irt}$. Under the assumption that $E(\upsilon_{irt}|\boldsymbol{Z}_{irt}) = 0$, $\widehat{OF_{ir}}$ is uncorrelated with the error term, $E\left(\epsilon_{irt}\middle|\, \widehat{OF_{ir}}, \boldsymbol{Z}_{irt}\right) = 0$. We perform exogeneity tests of the OF index by conducting the post-estimation Durbin-Wu-Hausman test (Durbin, 1954; Hausman, 1978; Wu, 1973). We also evaluate strength of the instruments using the

[21] At the same time, it is unlikely that the two factors directly affected the post-retirement wealth outcomes such as real estate wealth or liquid assets.

first-stage F-statistic from the panel-2SLS models and by conducting the Sargan-Hansen test (Hansen, 1982; Sargan, 1958).

In addition to estimating Panel-2SLS models using the total sample, we estimate models separately for subsamples of sub-optimal early claimers ('early OF'), and sub-optimal late claimers ('late OF'). These subgroup analyses provide insights into potentially different ways early versus late sub-optimal claiming behavior influences financial well-being. Further, we decompose the main wealth outcomes into sub-categories to provide a deeper understanding of the relation between sub-optimal claiming behavior and older adults' financial outcomes. As mentioned previously, we decompose liquid assets into fully liquid assets (savings readily available in the form of cash or in a bank account) and semi-liquid assets (savings, such as investment stocks, that were cash-equivalent and could be converted into cash when needed). Private pension wealth is decomposed into balance in Defined-Contribution accounts, balance in Defined-Benefit accounts, and savings in other retirement accounts such as IRA/Keogh. We decompose real estate wealth into housing wealth (i.e., the net value of primary and secondary residences) and non-housing real-estate wealth (i.e., the net value of rental housing, land contracts, and other real estate holdings). Finally, total wealth is decomposed into net wealth (total wealth less household debt) and net non-real estate wealth (total wealth less real estate wealth and household debt). We also test for heterogeneity across demographic characteristics by estimating Panel-2SLS models for subsamples of respondents based on gender (male, female), ethnicity (White, African American, and Other), educational attainment (high school diploma, bachelor's degree, graduate degrees or higher), and birth cohort (born before 1930, between 1931-1941, between 1942-1947, and after 1948). For all specifications, we conduct robustness checks by winsorizing outcome variables at

the 1st and 99th percentile.[22] We also use an inverse hyperbolic sine (IHS) transformation of outcome variables to compress right-skewed outcomes and include observations with zero values.

5. Results

5.1. Descriptive Statistics

Table 1 summarizes our sample characteristics which includes the full sample of 38,237 person-year observations as well as the subsamples of individuals claiming sub-optimally early (early-OF), sub-optimally late (late-OF), and optimally across 15 waves between 1992-2020. Across all samples, the standard deviations for all wealth variables are quite large suggesting, as expected, substantial variation among households in liquid assets, private pension wealth, real estate wealth, and total wealth. An interesting observation is that individuals claiming later than optimal have greater wealth in all categories except defined-benefits pensions. Across the total sample, we find that, on average, optimization failure is 4 years which indicates that individuals deviate from their optimal claiming timing (early or late) by approximately 4 years.

[Table 1]

The mean age in the sample is 71, sub-optimal late claimers are older than sub-optimal early claimers. Our sample consisted of more male than female respondents. The gender distribution of sub-optimal early claimers is similar to that of the total sample, but 80 percent of sub-optimal late claimers are male. Whites are almost 90 percent of the full sample and the subsample of sub-optimal early claimers. Among sub-optimal late claimers, 67 percent are White,

[22] Our main estimations used wealth variables winsorized at the 5th and 95th percentile.

and 33 percent are Black.[23] Nearly all respondents are married or partnered, and average household size is 2 persons. All claiming groups have an average of 13 years of education. As **Table 2** shows, a sizeable share of respondents are still working after initiating Social Security claiming, although this proportion has decreased over time. More than one-fifth of sub-optimal late claimers are still in the labor force (see **Table 1**).

[Table 2]

Average pre-claiming total wealth is about $600,000 for the full sample and for the sub-optimal early claimers subsample, while the average wealth for the sub-optimal late claimers sample is higher—$840,000, on average. A third of the sample are receiving private pension benefits and 90 to 100 percent have Medicare coverage, which is unsurprising given our sample consists of adults aged 62 or older. About half the individuals in the sample have retiree health insurance coverage through a former employer. Some interesting divergences between sub-optimal early and late claimers are presented in the following section.

5.2. Social Security Claiming Optimization Failure and Post-Retirement Wealth

Table 3-1 and **Table 3-2** show the main finding on the effect of sub-optimal Social Security claiming on the four dimensions of post-claiming wealth (i.e., liquid assets, private pension wealth, real estate wealth, and total wealth). **Panel A** of Table 3-1 displays results from panel random-effects (RE) estimations and **Panel B** shows results from the first and second stage of panel-2SLS estimations. Year fixed-effects, Census region fixed-effects, and region-specific time trends were included in all estimations but are not shown in the tables.

[23] The HRS survey pool includes a nationally representative sample of all ethnic groups, with a slight oversampling of Hispanics (Ofstedal and Weir, 2011).

[Table 3-1]

[Table 3-2]

Panel A of **Table 3-1** indicates that one additional year of sub-optimal claiming as measured by the OF index is associated with a statistically significant decrease of $3,452 in liquid assets (column 1). While the drop in liquid assets is present for both sub-optimal early (column 2) and sub-optimal late (column 3) claimers, it is statistically significant only for early claimers. Similarly, one year of suboptimal claiming is associated with a $7,742 drop in private pension wealth for the full sample (column 4), with the drop being greater and statistically significant for sub-optimal early claimers (a reduction by $13,198, column 5) and not significant for late claimers (column 6). Results from the second-stage panel-2SLS estimation in **Part B** show noteworthy departures from those in **Part A**, in that the panel-SLS results show that the OF index does not have a statistically significant effect on liquid assets or private pension wealth for the full sample, the early-OF or late-OF subsamples.

Panel A in **Table 3-2** shows results from Panel RE estimations for real estate wealth and total wealth. We find that an additional year of sub-optimal claiming is associated with a statistically significant drop in real estate wealth of $5,912 for the full sample (column 1) and by $7,934 for the sample of sub-optimal early claiming (column 2). In the case of total wealth, sub-optimal Social Security claiming is associated with a $20,155 decrease for the full sample (column 4) and by $30,801 for the sample of sub-optimal early claimers (column 5). The effect on real estate wealth and total wealth is not significant for sub-optimal late claimers. In the panel-2SLS results shown in **Panel B** of **Table 3-2**, optimization failure is associated with a $101,303 decrease in real estate wealth for the full sample by (column 1) and by $101,045 for the early-OF subsample (column 2).

We also find that optimization failure is associated with decline in total wealth. On average, across the three samples (i.e., full sample, early-OF and late-OF subsamples), optimization failure leads to between $200,000 and $250,000 lower total household wealth although the effect is statistically significant only for the full sample (a reduction of $219,212, column 4). An important finding is the difference in the magnitude of the effect of the OF index between the RE results (Panel A) and the panel-2SLS results (Panel B). In the panel-2SLS models that account for endogeneity of Social Security claiming behavior, we find that sub-optimal claiming is associated with larger decreases in both real estate wealth and the total wealth than shown in the RE estimations—indicating that sub-optimal claiming on wealth can have pervasive effects on overall household wealth through lower real estate wealth.

For all panel-2SLS estimations, shown in **Table 3-1** and **Table 3-2**, we conduct the Durbin-Wu-Hausman test of exogeneity (Durbin, 1954; Hausman, 1978; Wu, 1973) and reject the null hypothesis of exogeneity of the OF index which indicates the suitability of the instrumental variables approach (2SLS). The first stage's chi-squared tests (i.e., analogous to the F-test in cross-sectional estimations) suggest that the instruments—higher mortality expectations at ages 85-100 and lower trust in sustainability of the Social Security system—are strong predictors of the extent of optimization failure (i.e., OF index) and are associated with higher probability of sub-optimal early claiming. As an alternative test for the goodness of instruments, we conduct the Sargan-Hansen test (Hansen, 1982; Sargan, 1958), and the results confirm the validity of the instruments. Based on these results, our preferred specification is the panel 2-SLS models.

In terms of findings from the inclusion of covariates in the estimated models, our findings indicate that non-White respondents as well as those with lower educational attainment, larger households, and lower total wealth prior to initial Social Security claiming have fewer liquid

assets, private pension wealth, real estate wealth, and total wealth in post-claiming years. Surprisingly, we find that male respondents have lower real estate wealth and lower total wealth compared to females while respondents who are married or partnered have higher real estate wealth than those who are single, widowed, or divorced. While those still in the labor force have lower private pension wealth, real estate wealth, and total wealth—suggesting that these could be contributing factors to whether individuals work after initial Social Security claiming—their prolonged participation in the labor force has no effect on liquid assets. As expected, individuals with private pension accounts and employer-sponsored retiree health insurance have higher pension wealth and total wealth in post-claiming years. Lastly, we observe that individuals with higher out-of-pocket medical expenses have higher liquid assets, real estate wealth, and total wealth.

5.3. Decomposing Sub-Optimal Social Security Claiming and Financial Wealth

Table 4 present results from Panel-2SLS estimations for the effect of optimization failure on sub-categories of post-claiming financial outcomes. All models include covariates, time fixed-effects, region fixed-effects, and region-specific time trends in the estimation (not shown in table). Across all financial outcomes, the first-stage results in Table 4 are consistent with those shown in Tables 3-1 and 3-2.

[Table 4]

We find that suboptimal claiming is not associated with a statistically significant drop in the both fully liquid (columns 1-3) and semi-liquid assets (columns 4-6), as well as all disaggregated private pension wealth outcomes, i.e., Defined Contribution pensions (columns 7-9), Defined Benefit pensions (columns 10-12), and other private pension wealth (columns 13-15). In contrast, we find stronger effect of sub-optimal Social Security claiming on sub-categories of

real estate wealth. Between housing and non-housing real estate wealth, the results indicate a statistically significant negative effect of sub-optimal Social Security claiming only on non-housing real estate wealth (Table 4, Columns 19-21), but with no significant effects on real estate wealth (Table 4, Column 16-18). Th effect size indicates that each additional year of sub-optimal claiming is associated with a $54,421 drop in non-housing real estate wealth for the full sample (column 19), and by $50,613 for subsample of sub-optimal early claimers (column 20). The result for late claimers is not statistically significant. The effect of sub-optimal claiming on housing real estate wealth (columns 16-18) is negative but not statistically significant for all three samples.

In analyses that decompose total wealth, we find that sub-optimal Social Security claiming is associated with a statistically significant drop in total household wealth net of household debt. For the full sample, suboptimal claiming is associated with nearly $226,800 lower household wealth (column 22), and by $200,000 for the subsample of sub-optimal early claimers (column 23). There is no significant effect on total wealth of sub-optimal late claimers. We also find that sub-optimal Social Security claiming has no significant effect on total wealth net of housing wealth and household debt for all three groups. These results indicate that the effects of the OF index on total wealth occurs primarily through its impact on non-housing real estate wealth, which is consistent with our earlier results. Similarly, the divergence between subsamples of suboptimal early and late claimers remain consistent across all disaggregated outcomes—with only the wealth outcomes of early-claimers' significantly affected by claiming optimization failures.

To further examine heterogeneous effects of sub-optimal Social Security claiming we analyze the effect for subsamples by gender, race, educational attainment, and birth cohort. Second-stage results from the Panel-2SLS estimations are shown in **Table 5**. Covariates, time fixed-effects, region fixed-effects, and region-specific time trends are included in the estimations

but are not shown in the table. We find that Social Security claiming optimization failure is associated with a statistically significant decrease in pension wealth among males and among those born after 1948. There are significant negative links between OF and post-retirement real estate wealth among males, Whites, those with no more than high school education, and those born from 1942 to 1947.

[Table 5]

Lastly, we conduct robustness tests by estimating panel-2SLS models using three sets of post-claiming wealth outcomes: (1) raw outcomes without any treatment of skewness, zeroes, negative values, or outliers, (2) outcomes that use the inverse hyperbolic sine (IHS) transformation, and (3) outcomes winsorized at 1st and 99th percentiles.[24] The second-stage results are displayed in **Table 6**. Covariates and fixed effects are included in the estimations (not shown in the table). Across the different transformations of outcomes and across different robustness checks, we find that the effect of sub-optimal Social Security claiming on liquid assets, real estate wealth, and total wealth are generally consistent with findings in earlier specifications—except for the IHS-transformed liquid assets (column 2), real estate wealth (column 23), and total wealth (column 32). Notably, the robustness tests reveal that sub-optimal Social Security claiming is associated with lower Defined Contribution wealth—a finding not observed in previous specification. Overall, results from the robustness tests are highly convergent with those presented in earlier tables. We discuss the implications of our results in the following section.

[Table 6]

[24] Of note, our default outcomes in **Tables 3-1, 3-2,** and **4** were Winsorized at 5th and 95th percentiles. To avoid confusion, we refer to them as 'default outcomes'.

6. Discussion

Social Security claiming is amongst the most important financial decisions that older households make. It can determine not only the income that individuals receive from Social Security but can also potentially influence financial well-being in the years following initial claiming. Our study fills an important gap in the literature on retirement and household financial decision making by addressing a question that has received little attention—the impact of sub-optimal claiming decisions on older adults' financial outcomes. We construct a novel OF index using multiple data sources including data from HRS linked to administrative records from the Social Security Administration and the Working Trajectories dataset to identify the 'optimal' claiming age at which each individual would receive maximum lifetime Social Security benefits. We then compute the OF index as the deviation of observed claiming age from the 'optimal' claiming age. The empirical strategy uses the OF index to predict post-claiming financial well-being using several indicators that together provide a comprehensive picture of older adults' financial outcomes. A key concern with estimating the impact of sub-optimal Social Security claiming on financial outcomes is potential endogeneity from the extent of sub-optimal claiming. We address this source of endogeneity by employing a panel-2SLS strategy that instruments the OF index with pre-claiming longevity expectations and confidence in receipt of Social Security benefits.

Our findings indicate that Optimization Failure is associated with lower real estate wealth and total household wealth in post-claiming years. This speaks to a stream of literature which shows that older individuals are increasingly relying on real estate wealth as well as private savings to finance their retirement (Bohn, 2002; Mudrazija & Butrica, 2017; Poterba, 2014). Interestingly, we find sub-optimal Social Security claiming is not linked to liquid assets or private pension

wealth. Investigating these findings further by dividing the sample into sub-optimal early and late claimers and decomposing financial outcomes into sub-categories, we find that sub-optimal Social Security claiming has stronger effects on adverse financial outcomes among the early claimers, but not late claimers. In other words, for sub-optimal early-claimers, Optimization Failure which is associated with lower Social Security wealth is linked to decline in other forms of wealth (real estate and total wealth). Between the two possible directions of the theoretical link between the OF and post-claiming wealth discussed in the background section) between older individuals' financial constraints result in insufficient wealth across multiple dimensions. This effect appears to outweigh the potential substitutability between different forms of retirement wealth. While exploration of drivers of such behaviors is beyond the scope of this paper, previous literature in this area identify several factors that potentially contribute to older adults' financial insecurity including unexpected macroeconomic shocks such as economic recessions (Johnson et al., 2013), cyclical/structural unemployment (Card et al., 2014; Haaga & Johnson, 2012), personal or household financial stress (Engelhardt et al., 2022; J. B. Shoven et al., 2018; Slavov, 2023), deteriorating health preventing work or other activities (Delavande et. al., 2006; Glickman and Hermes, 2015; Hurd et al., 2004), and limited financial literacy (Liebman and Luttmer, 2012).

Our results that sub-optimal claiming is not associated with lower liquid wealth imply that income from Social Security eases liquidity constraints. This is an important function of Social Security income—driving early Social Security claiming, as evidenced in the prior literature (Engelhardt et al., 2022; J. B. Shoven et al., 2018; Slavov, 2023). Our findings further show that sub-optimal claiming is *not* significantly linked to private pension wealth—suggesting that individuals do not implicitly substitute between forgone Social Security wealth and private pension wealth. The absence of substitution, observed, between Social Security and other forms of pension

savings could stem from behavioral biases such as rational inattention to contributions to other pension accounts based on expected Social Security benefits. Individuals may find it difficult to make rational trade-offs between their Social Security accounts and other pension accounts. Another possibility is that HRS respondents' savings in private pension are largely unaffected by their Social Security wealth optimization: Despite a mass transition from Defined-Benefit to Defined-Contribution (e.g., 401(k)) pension in the private sector seen in the past decades (Favreault & Steuerle, 2012), the shift applies mainly to the current working-age population and *not yet to the recipients over age 60* that comprise the majority of our HRS sample (Munnell, 2023).[25] Defined-Benefit pension schemes have predetermined benefits and are largely unaffected by savings decisions individuals make over the duration of their careers (i.e., contributions to Social Security).

Between sub-optimal early and late claimers, we observe the adverse effects of suboptimal Social Security claiming primarily among the former group. More specifically, individuals claiming sub-optimally early are more likely to have lower liquid assets, lower non-housing real estate wealth as well as total wealth. The lack of effect among late-claimers may stem partly from the relatively small number of late claiming individuals in our sample. Another possible explanation is that early and late claimers engage in suboptimal claiming for different reasons. If we were to assume that initial Social Security claiming that dictates the extent of OF coincides with retirement timing for many individuals in the United States (Lalive et al., 2023), early claimers may decide on their retirement timing and their initial Social Security claiming timing based on financially-driven reasons (e.g., present-day liquidity constraints, health problems,

[25] As seen in the report by Munnell (2023), most of recipients in 2023 continue to receive a much larger portion of their retirement income from Defined-Benefit pensions rather than from 401(k) withdrawals. This is not surprising, given that 401(k) started in the 1980s, most of current HRS recipients have not spent their entire careers covered by 401(k) plans, and they are not required to start drawing down their pension balances until early 70s.

limited financial literacy/foresight) (Glickman & Hermes, 2015; Knoll & Olsen, 2014; Maurer & Mitchell, 2021)—which would, in theory, have an influence on post-claiming financial well-being. In contrast, late-claimers may delay retirement and initial claiming due factors like strong preference to continue working for non-financial gratifications such as mental stimulation, a sense of purpose in life, and other psychological satisfaction (Komp et al., 2010; Nemoto et al., 2020; Sewdas et al., 2017; Tur-Sinai et al., 2024). In this case, late claimers' timing of retirement or initial claiming—dictating the extent of OF—will not be strongly associated with post-claiming financial outcomes.

Results from analyses that decompose financial outcomes indicate that sub-optimal Social Security claiming has a statistically significant negative effect on non-housing real estate wealth and total household wealth net of household debt—but not on sub-categories of liquid assets and private pension wealth. The fact that the effect of suboptimal Social Security claiming is significant only for non-housing real estate wealth and not for housing real estate wealth may be explained by the differences in the fundamental purpose of housing- and non-housing wealth. In contrast to housing wealth—calculated primarily based on the value of the primary residence—that is often tied to personal use ('residing'), non-housing real estate wealth (e.g., land investments, rental real estate, commercial and industrial properties) is primarily considered to be for the purpose of investment and profit making . Given these differences in the core purpose of these assets, our results confer with existing research that evidences a higher elasticity of non-housing wealth to changes in wages, savings, and consumption, compared to housing wealth (Bostic et al., 2009; Kishor, 2007; Márquez et al., 2013).

Our findings from heterogeneity analyses suggest that sub-optimal Social Security claiming is associated with negative financial outcomes for males, White individuals, those with

high school education or less, and individuals from younger birth cohorts. Explaining the reason for these differences is beyond the scope of this paper, and we defer the task tof exploring these mechanisms for future research. Our robustness checks which use different transformations of the outcome variables reveal that the significant effect of OF on financial outcomes depend on the extent of the skewness of the outcome variables. In particular, the effect of suboptimal Social Security claiming timing on defined-contribution pension wealth, and housing real estate wealth are significant in specifications that use the IHS transformation which compresses individuals with near zero values, suggesting that these effects could be driven by individuals at the *lower tail of the distribution*.

Our research has limitations. First, the results for sub-optimal late claimers should be read with caution because of the low sample size for this group. The instruments we employ are strong predictors of the OF index for the full sample and the subsample of sub-optimal earlier claimers, but are weaker for the late claimers sample. This can be partly attributed to the smaller sample size of sub-optimal late claimers (N=2,449) compared to sub-optimal early claimers (N=35,597). Regardless, using stronger instruments could improve the predictive power of sub-optimal Social Security claiming on older adults' post-claiming impact of Social Security claiming decisions on post-claiming financial outcomes.[26] Future research should explore alternative instruments that can predict why individuals fail to optimize Social Security claiming timing. Second, our research falls short of empirically testing the possible mechanisms that drive the divergent of sub-optimal Social Security claiming on financial outcomes of different subgroups (i.e., early- versus late-claimers). We defer this task for future research.

[26] While we tested the goodness of the instruments with the 2SLS first-stage's F-statistic and the Sargan-Hansen test, our private pension wealth outcome may be, in theory, linked to individuals' mortality expectations—i.e., one of our current instruments. Better instruments should be able to predict the OF index while not directly affecting any of the post-retirement wealth outcomes.

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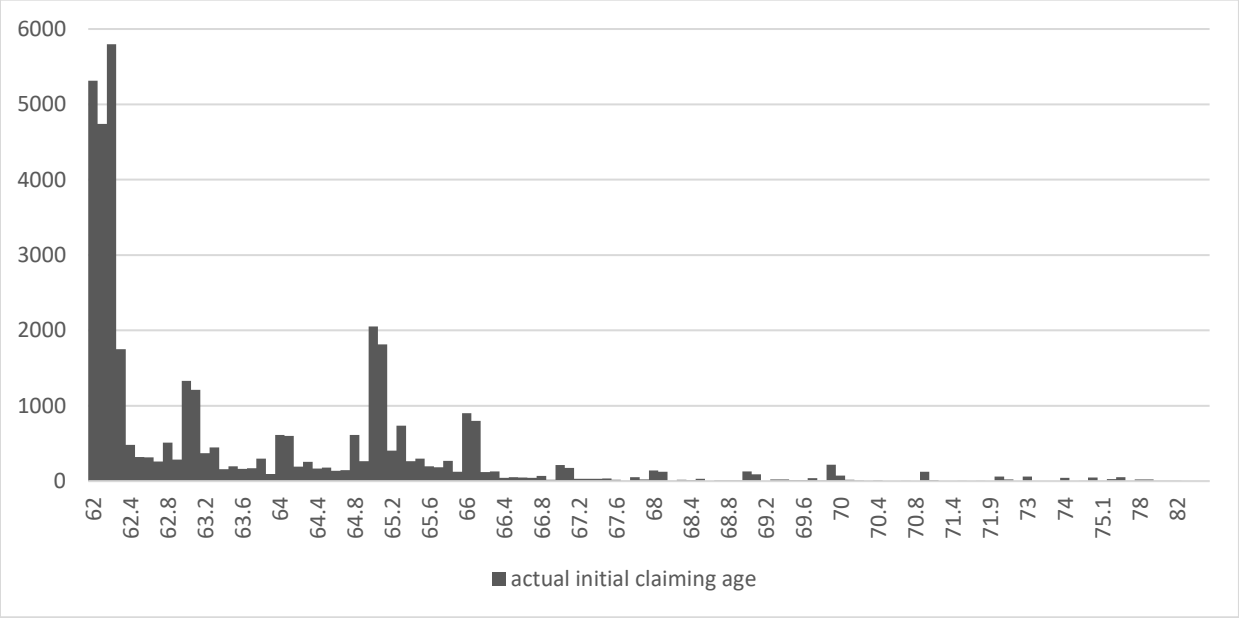
Figure 1 Actual and Optimal Initial Claiming Age

Panel A: Actual Claiming Age



Panel B: Optimal Claiming Age

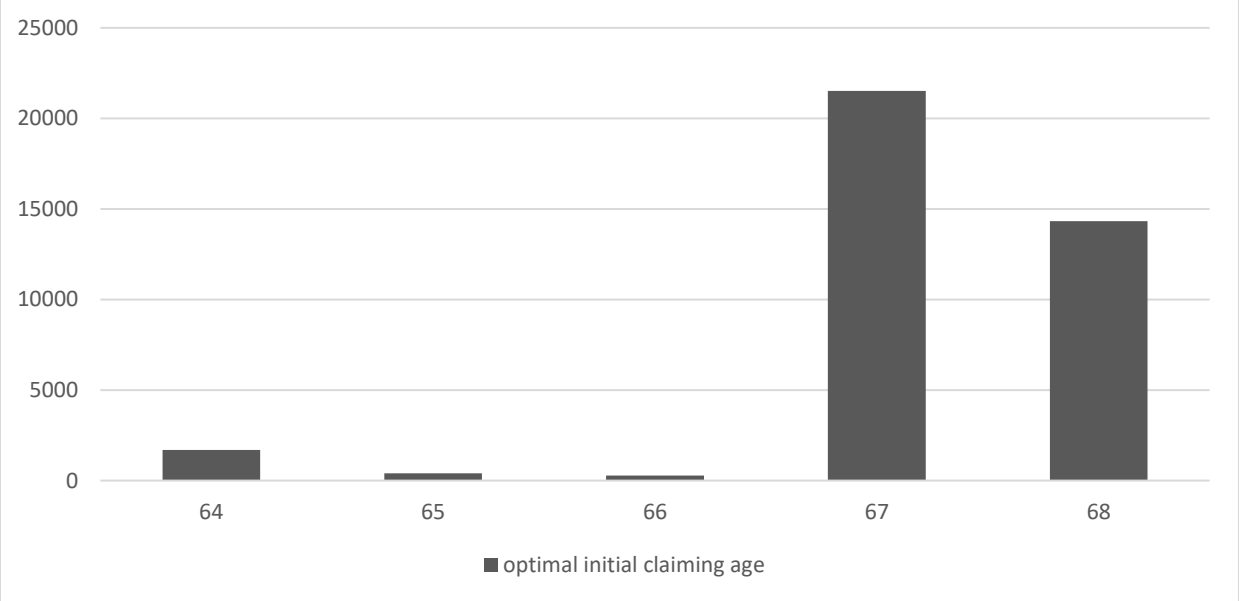
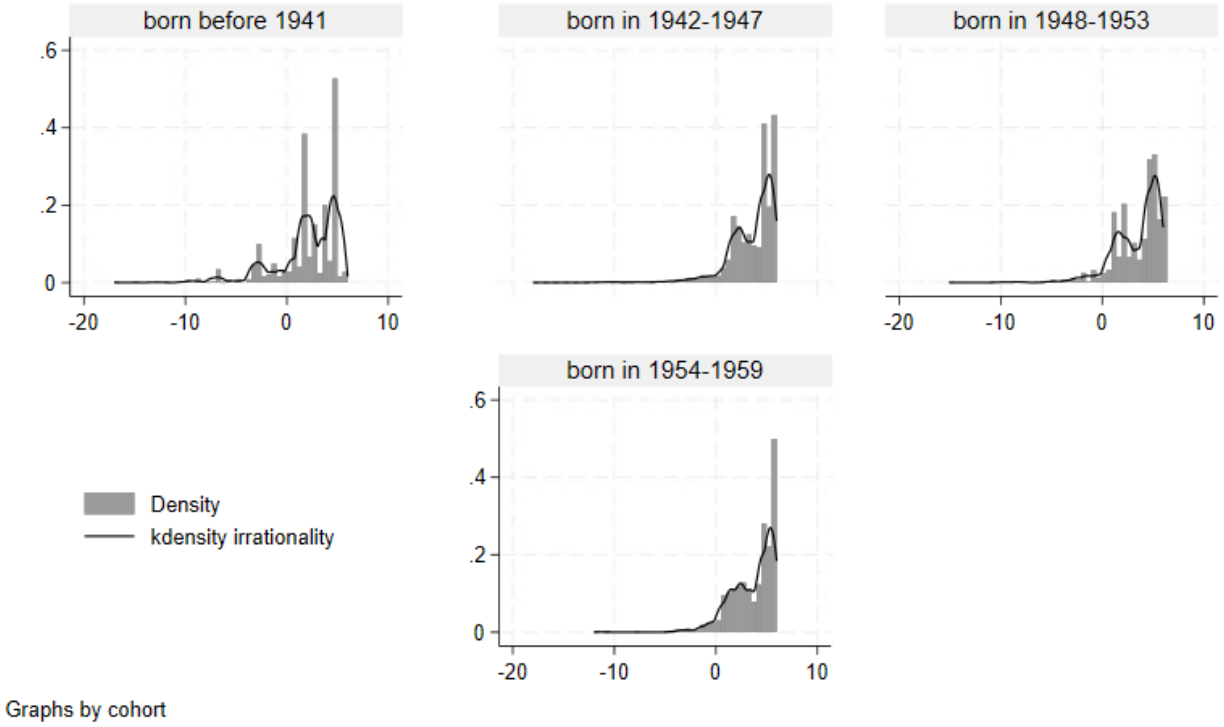
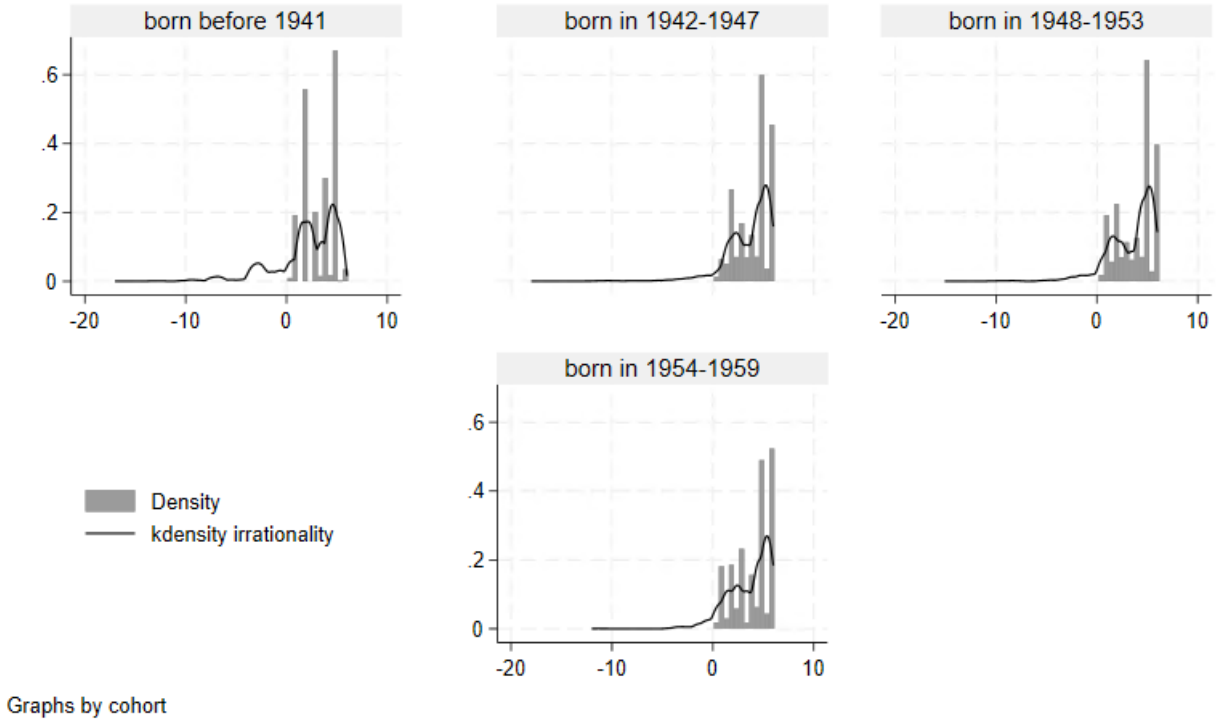


Figure 2. OF Index Scores by Birth Cohorts

Panel A: Total sample



Panel B: Subsample who claims sub-optimally early



Panel C: Subsample who claims sub-optimally late

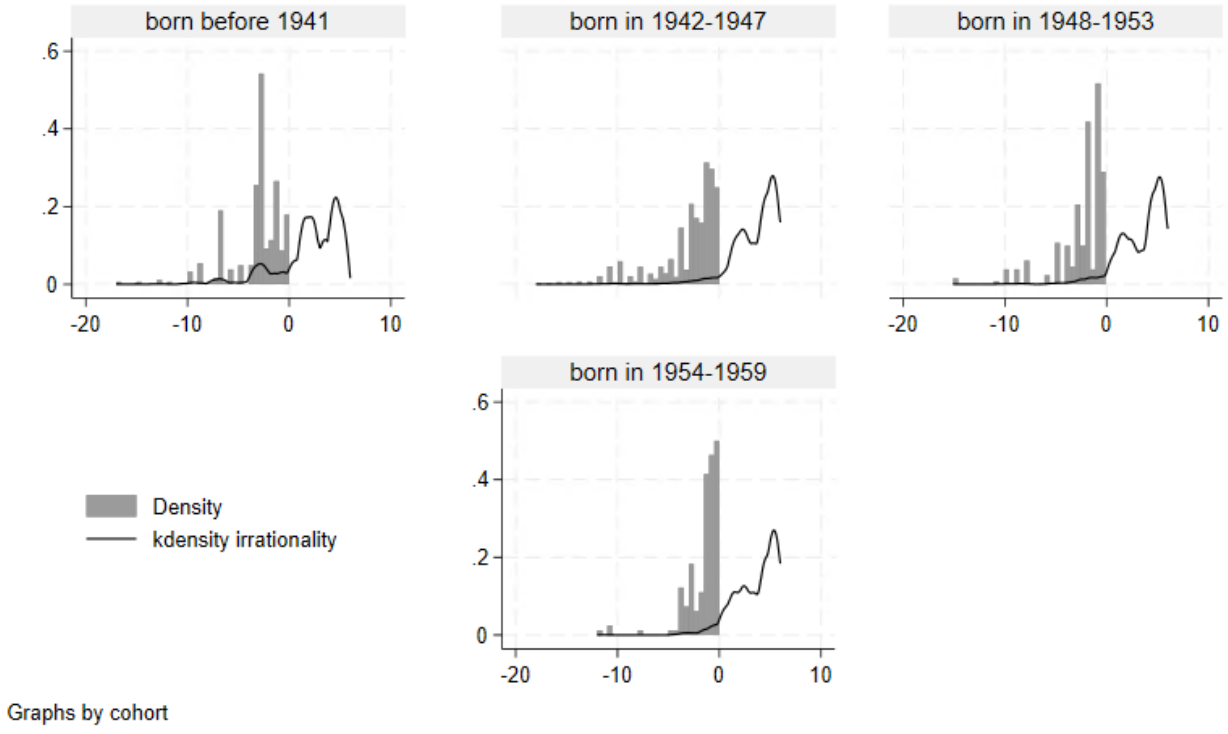


Table 1. Summary Statistics

	total mean or perc. (st. dev.)	early OF mean or perc. (st. dev.)	late OF mean or perc. (st. dev.)	optimal mean or perc. (st. dev.)	t-test early vs late	t-test early vs opt	t-test late vs opt
POST-RETIREMENT FINANCIAL WELL-BEING							
liquid asset^	100591.09	99344.62	115744.69	138597.80	***	***	***
	(175442.31)	(173463.11)	(197451.44)	(223679.80)			
liquid asset, full^	33433.75	33077.53	38036.74	40804.45	***	**	***
	(51076.05)	(50606.39)	(56622.77)	(59454.81)			
liquid asset, semi^	60161.94	59402.04	68660.26	92818.97	***	***	***
	(140565.51)	(139166.77)	(155691.41)	(182819.70)			
pension wealth^	197537.25	195958.93	214003.67	280559.70	***	***	***
	(288194.86)	(285257.93)	(321463.06)	(356719.40)			
pension wealth, DC^	136038.07	134403.10	156116.09	183310.30	***	***	***
	(227780.17)	(225201.44)	(259188.51)	(257426.80)			
pension wealth, DB^	12665.65	12696.73	11982.33	15634.39	*	**	*
	(18229.49)	(18184.80)	(18592.69)	(21291.07)			
pension wealth, others^	33418.92	33411.53	31649.01	57490.85	-	***	-
	(72327.38)	(72176.69)	(72323.49)	(93542.01)			
real estate wealth^	258483.08	255996.48	292094.73	290947.10	***	*	***
	(270899.58)	(267462.57)	(313758.92)	(284929.90)			
real estate wealth, housing^	211931.39	210655.64	229261.62	227488.50	***	-	***
	(199989.29)	(198213.66)	(223968.16)	(193603.70)			
real estate wealth, non-housing^	33999.11	33127.70	45340.53	50984.57	***	***	***
	(93362.97)	(91879.07)	(110606.32)	(113582.50)			
total wealth^	604416.32	597044.82	696137.53	802207.40	***	***	***
	(666973.31)	(656953.96)	(780418.80)	(813108.20)			
total wealth, less debts^	599841.03	592564.33	690169.72	797818.10	***	***	***
	(667823.56)	(657826.55)	(781228.71)	(813485.80)			
total wealth, non-housing, less debts^	318820.14	315434.29	359391.96	429636.20	***	***	***
	(318820.14)	(442308.98)	(510271.61)	(543916.20)			
SOCIAL SECURITY CLAIMING TIMING							
OF index (absolute value)	3.92	4.00	2.95	0.00	***	***	***
	(1.76)	(1.60)	(2.93)	(0.00)			
COVARIATES							
age	71.02	70.76	74.70	72.01	***	***	***
	(5.57)	(5.53)	(4.89)	(5.27)			
male (1 yes, 0 no)	61.26	59.93	79.62	73.30	***	***	***

	(48.72)	(49.00)	(40.29)	(44.36)			
race					-	-	***
White	87.19	88.69	66.80	69.11	***	***	***
	(33.42)	(31.68)	(47.10)	(46.33)			
Black	10.66	9.04	32.71	30.89	***	***	***
	(30.86)	(28.67)	(46.92)	(46.33)			
Other	2.15	2.28	0.49	0.00	***	**	***
	(14.50)	(14.91)	(6.98)	(0.00)			
couple (1 yes, 0 no)	94.73	94.81	93.63	93.19	**	-	**
	(22.35)	(22.18)	(24.43)	(25.25)			
years of education	12.70	12.70	12.72	13.45	-	***	-
	(3.12)	(3.08)	(3.63)	(3.72)			
household size	2.36	2.35	2.42	2.29	***	-	***
	(0.89)	(0.89)	(0.98)	(77.32)			
in labor force (1 yes, 0 no)	12.07	11.70	17.15	16.23	***	*	***
	(32.58)	(32.14)	(37.70)	(36.97)			
total wealth, before initial SS claiming +	603555.71	585609.25	836810.87	957473.30	***	***	***
	(1195706.05)	(1093846.26)	(2165228.41)	(1505291.00)			
receives pension (1 yes, 0 no)	36.63	36.68	35.69	40.31	-	-	-
	(48.18)	(48.19)	(47.92)	(49.18)			
out-of-pocket health expenditures +	3853.81	3861.75	3808.64	2953.76	-	-	-
	(9397.77)	(9451.35)	(8906.93)	(3863.13)			
medicare coverage (1 yes, 0 no)	88.23	87.38	100.00	96.86	***	**	***
	(32.22)	(33.21)	(0.00)	(17.49)			
emp. retiree health insurance coverage (1 yes, 0 no)	51.73	52.26	44.59	45.03	***	**	***
	(49.97)	(49.95)	(49.72)	(49.88)			
Census region							
NorthWest	14.62	14.34	18.13	23.04	***	***	***
	(35.34)	(35.05)	(38.53)	(42.22)			
MidWest	25.78	25.93	23.40	28.27	-	-	***
	(43.75)	(43.83)	(42.34)	(45.15)			
South	42.25	42.23	42.67	40.84	-	-	-
	(49.40)	(49.39)	(49.47)	(49.28)			
West	17.34	17.49	15.80	7.85	*	***	**
	(37.86)	(37.99)	(36.48)	(26.97)			
INSTRUMENTS							
mortality expectation (0-100 (highest mort.))	49.72	49.77	49.36	46.25	-	-	-

	(30.56)	(30.46)	(31.88)	(31.22)			
expect SS benefits to be lowered in the next 10 years (1-100 (most likely))	56.04	56.34	51.39	58.13	***	-	***
	(30.44)	(30.01)	(31.66)	(35.73)			
N	38237	35597	2449	191			

+ converted to 2020 dollars

^ converted to 2020 dollars, Winsorized outliers (<5th percentile and >95th percentile)

Notes: The two-way t-tests are significant at the following levels: *p<0.1 **p<0.05 ***p<0.01

Table 2. Respondents who initiated Social Security claiming but are still working, by year

	1992	1994	1996	1998	2000	2002	2004	2006	2008
not working	53	186	531	986	1,424	1,938	2,339	2,705	2,790
(%)	34.64	46.62	59.40	59.25	66.05	69.89	73.23	75.69	77.61
working	100	213	363	678	732	835	855	869	805
(%)	65.36	53.38	40.6	40.75	33.95	30.11	26.77	24.31	22.39
Total	153	399	894	1,664	2,156	2,773	3,194	3,574	3,595

	2010	2012	2014	2016	2018	2020	Total
not working	2974	3,008	2,903	2,728	2,459	2,421	47,815
(%)	79.80	82.03	84.00	84.22	84.79	85.07	77.01
working	753	659	553	511	441	425	8,792
(%)	20.2	17.97	16.00	15.78	15.21	14.93	22.99
Total	3,727	3,667	3,456	3,239	2,900	2,846	38,237

Notes: Those who are 'not working' can be fully-retired, disabled, out of labor force for unspecified reasons, or unemployed.

Table 3-1. Social Security Claiming Optimization Failures and Post-Retirement Wealth

	(1)	(2)	(3)	(4)	(5)	(6)
Y:	liquid asset			pension wealth		
sample:	total	early OF	late OF	total	early OF	late OF
PART A: Panel Random Effects Estimation						
OF index	-3451.531***	-3521.363***	-2841.401	-7743.995***	-13197.569***	-2614.558
	(951.540)	(1148.811)	(2084.302)	(1474.324)	(2057.009)	(2596.255)
Covariates	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes
N	38237	35597	2449	38237	35597	2449
PART B: Panel IV Estimation						
OF index	-19011.920	-12989.273	-84088.720	-53437.240	-51710.130	-36610.782
	(23036.690)	(24543.472)	(87049.674)	(47328.181)	(54487.070)	(86002.270)
age	-10391.691	-7444.762	12507.750	12364.870	14917.061*	41525.760
	(11931.234)	(6338.902)	(45716.900)	(8565.321)	(7798.431)	(34114.93)
age sq.	79.906	58.262	-5.851	-122.092**	-147.185***	-272.956
	(79.355)	(41.338)	(245.741)	(56.604)	(49.111)	(174.698)
male (1/0)	-20823.053	-15745.770	-50958.121	-45800.510	-47001.280	5033.317
	(25013.751)	(26379.100)	(75703.731)	(51370.692)	(58606.600)	(78421.22)
race (reference= White)						
Black (1/0)	-72240.970**	-61153.520**	-128190.200***	-176936.400***	-174566.900***	-187956.100***
	(29914.281)	(30564.961)	(41379.951)	(55126.211)	(65403.170)	(40781.172)
other (1/0)	-6816.804	-11994.010*	37658.113	-58494.280***	-63103.550***	27097.621
	(7074.004)	(6818.918)	(136306.700)	(14270.722)	(13513.431)	(130998.600)
years of education	9970.796***	9926.318***	7635.873	21283.830***	20380.592***	25237.931***
	(1703.935)	(1770.527)	(5954.137)	(3691.219)	(3990.480)	(6051.473)
couple (1/0)	4009.073	4495.038	-23304.090	3867.585	3593.896	12625.870
	(4768.802)	(5020.332)	(30244.100)	(6755.612)	(7137.801)	(17850.411)
household size	-6385.585***	-3528.319***	8795.736	-2372.924*	-2912.458**	36.319
	(874.138)	(764.107)	(12024.800)	(1278.508)	(1255.139)	(9485.99)
in labor force (1/0)	-17520.690	-9130.508	-16369.600	-25325.170***	-27997.350***	3615.033
	(15176.871)	(7966.338)	(11688.392)	(7125.594)	(9674.402)	(12575.553)
pre-claim total wealth	0.048***	0.057***	0.025***	0.061***	0.073***	0.027***
	(0.007)	(0.006)	(0.009)	(0.009)	(0.009)	(0.008)
receives pension benefits (1/0)	3325.236	1492.812	-5017.115	17740.830***	18687.180***	13254.970
	(2391.934)	(2120.019)	(11939.390)	(2858.724)	(2978.622)	(14227.040)
out-of-pocket medical	715.698***	343.343***	407.870	117.297	157.647	481.982

expense, natural log						
	(146.222)	(113.003)	(722.099)	(170.465)	(177.136)	(653.355)
Medicare coverage (1/0)	-8781.037	-2405.63	-	-9611.823	-7887.488	-
	(10358.460)	(5377.094)	-	(6827.237)	(6722.016)	-
emp-sponsored retiree health insurance (1/0)	5570.849	6880.011**	4623.671	30426.130***	30190.220***	65088.460**
	(3419.084)	(3211.053)	(29150.290)	(5747.739)	(5641.204)	(29925.413)
FIRST STAGE (Y=OF index)						
Prob. SS benefits will be lowered (0-100)	0.002**	0.002***	0.004	0.002***	0.002***	0.004
	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)
Mortality expectation at ages 85-100 (0-100)	0.001***	0.001***	0.001	0.003***	0.001***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes
Durbin-Wu-Hausman test						
p-value	0.000	0.000	0.000	0.000	0.000	0.000
chi-sq	258.830	100.490	5792.390	964.060	867.890	479.560
Goodness of Instruments						
first-stage prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
Sargan-Hansen prob>chi2	0.909	1.000	0.069	1.000	1.000	0.070
N	38237	35597	2449	38237	35597	2449

Notes: Part A displays results from the panel random-effects estimation, while Part B shows the second stage results from the panel-2sls estimation. Dependent variables are dimensions of post-claiming wealth. Year fixed-effects, Census region fixed-effects, as well as their interactions (region-specific time trends) are included in all estimations but are not shown above. Standard errors are clustered at the household level. Because sub-optimal late claimers all have Medicare coverage, its coefficient is not estimated.
**p<0.1 **p<0.05 ***p<0.01*
Source: Authors' calculations using the HRS, 1992-2020.

Table 3-2. Social Security Claiming Optimization Failures and Post-Retirement Wealth

	(1)	(2)	(3)	(4)	(5)	(6)
Y:	real estate wealth			total wealth		
sample:	total	early OF	late OF	total	early OF	late OF
PART A: Panel Random Effects Estimation						
OF index	-5912.416***	-7933.774***	-1411.079	-20154.996***	-30801.628***	-9228.632
	(1397.707)	(1805.593)	(2853.308)	(3296.344)	(4374.799)	(6833.703)
Covariates	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes
N	38237	35597	2449	38237	35597	2449
PART B: Panel IV Estimation						
OF index	-101303.300**	-101045.503**	-75458.820	-219212.633**	-190702.100	-242849.400
	(41589.912)	(52517.060)	(112203.700)	(103335.730)	(121916.001)	(271930.300)
age	7251.274	13418.770	57229.051	5850.239	16789.190	107577.110
	(9901.648)	(8152.578)	(40628.211)	(18613.900)	(15693.590)	(91446.610)
age sq.	-60.721	-112.734**	-333.116	-83.566	-179.9251*	-555.842
	(65.991)	(51.542)	(220.409)	(123.656)	(98.489)	(501.512)
male (1/0)	-104811.200**	-107538.633*	-4544.763	-212480.706*	-190388.901	-75220.954
	(44947.030)	(56289.370)	(101255.600)	(111986.606)	(130999.400)	(245951.900)
race (reference= White)						
Black (1/0)	-182860.811***	-184898.303***	-123963.200***	-501232.700***	-466122.100***	-503041.100***
	(49785.772)	(63613.190)	(53369.863)	(120665.301)	(145007.400)	(140952.800)
other (1/0)	-11992.234	-18461.550	36817.970	-79401.270**	-100512.411***	2082.521
	(18036.680)	(17491.863)	(180915.921)	(37699.89)	(34261.880)	(402889.300)
years of education	8884.501***	7911.318**	17652.21**	42427.710***	41347.533***	56563.531***
	(3190.872)	(3705.730)	(7710.159)	(8148.881)	(8911.578)	(19933.050)
couple (1/0)	18836.201**	16449.733*	24485.400	22847.700	20293.861	38677.411
	(9005.618)	(9678.409)	(28704.383)	(17258.781)	(18049.422)	(65744.050)
household size	-4651.128***	-4629.797***	-4324.539	-9081.321***	-9532.647***	2315.494
	(1692.743)	(1569.868)	(14130.373)	(2932.912)	(2657.144)	(27298.131)
in labor force (1/0)	-19983.670**	-18790.561*	1653.664	-34831.680**	-35843.440**	17116.891
	(9213.646)	(9742.939)	(16409.441)	(13722.922)	(16898.441)	(36635.260)
pre-claim total wealth	0.091***	0.106***	0.053***	0.228***	0.271***	0.119***
	(0.012)	(0.012)	(0.015)	(0.028)	(0.026)	(0.035)
receives pension benefits (1/0)	-1471.825	-420.600	-6294.417	16705.650***	18667.890***	-3624.305
	(2514.331)	(2503.683)	(14289.060)	(5419.643)	(5396.589)	(35795.730)
out-of-pocket medical expense, natural log	593.539***	391.293**	2491.556**	1102.291***	747.658**	6657.566**

	(200.667)	(189.57)	(1100.786)	(387.056)	(349.380)	(2627.414)
Medicare coverage (1/0)	-16378.020**	-10788.951	-	-26704.990**	-16775.310	-
	(7709.951)	(6733.845)	-	(13468.501)	(11998.460)	-
emp-sponsored retiree health insurance (1/0)	1149.353	5211.831	-38065.570	30222.090**	39114.822***	1452.313
	(6043.499)	(5891.575)	(36436.183)	(13652.311)	(12808.321)	(92317.770)
FIRST STAGE (Y=OF index)						
Prob. SS benefits will be lowered (0-100)	0.002***	0.002***	0.003	0.002***	0.002***	0.003
	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)
Mortality expectation at ages 85-100 (0-100)	0.001***	0.001***	0.001	0.001***	0.001***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes
Durbin-Wu-Hausman test						
p-value	0.000	0.000	0.000	0.000	0.000	0.000
chi-sq	4644.110	4468.200	2376.790	3676.570	2595.900	4111.930
Goodness of Instruments						
first-stage prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000
Sargan-Hansen prob>chi2	1.000	1.000	0.100	1.000	1.000	0.090
N	38237	35597	2449	38237	35597	2449

Notes: Part A displays results from the panel random-effects estimation, while Part B shows the second stage results from the panel-2sls estimation. Dependent variables are dimensions of post-claiming wealth. Year fixed-effects, Census region fixed-effects, as well as their interactions (region-specific time trends) are included in all estimations but are not shown above. Standard errors are clustered at the household level. Because sub-optimal late claimers all have Medicare coverage, its coefficient is not estimated.

**p<0.1 **p<0.05 ***p<0.01*

Source: Authors' calculations using the HRS, 1992-2020.

Table 4. Social Security Claiming Optimization Failures and Post-Retirement Wealth (Sub Categories)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Y:	full liquid assets			semi liquid assets			DC pension wealth		
sample:	total	early OF	late OF	total	early OF	late OF	total	early OF	late OF
OF index	-4291.314	-842.876	-29434.120	-17167.800	-16334.810	-13503.650	-53864.431	-63511.710	-15269.441
	(7652.738)	(7085.546)	(28340.160)	(17525.801)	(19946.671)	(39669.653)	(46022.922)	(57183.211)	(65510.713)
FIRST STAGE (Y=OF index)									
Prob. SS benefits will be lowered (0-100)	0.001**	0.002***	0.004	0.002***	0.002***	0.004	0.002***	0.002***	0.004
	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)
Mortality expectation at ages 85-100 (0-100)	0.001**	0.001***	0.001	0.001***	0.001***	0.001	0.002**	0.001***	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Covariates	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	38237	35597	2449	38237	35597	2449	38237	35597	2449

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Y:	DB pension wealth			other pension wealth			real estate wealth: housing		
sample:	total	early OF	late OF	total	early OF	late OF	total	early OF	late OF
OF index	-875.976	-1396.845	176.055	6206.191	8080.610	-7283.530	-30803.950	-30356.691	-1614.795
	(2107.330)	(2420.763)	(4057.846)	(9355.537)	(10834.900)	(18951.700)	(29485.500)	(35283.751)	(61871.360)
FIRST STAGE (Y=OF index)									
Prob. SS benefits will be lowered (0-100)	0.002***	0.002***	0.004	0.002***	0.002***	0.004	0.002***	0.002***	0.003
	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)
Mortality expectation at ages 85-100 (0-100)	0.001***	0.001***	0.001	0.001***	0.001***	0.001	0.001***	0.001***	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Covariates	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	38237	35597	2449	38237	35597	2449	38237	35597	2449

	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
Y:	real estate wealth: non-housing			total wealth, less debts			total wealth (non-real estate), less debts		
sample:	total	early OF	late OF	total	early OF	late OF	total	early OF	late OF
OF index	-54421.890**	-50613.390***	-56082.600	-226825.800**	-199445.100*	-229654.800	-110360.700	-83832.040	-144433.501
	(21585.770)	(18829.691)	(58616.87)	(104907.100)	(124174.800)	(263085.701)	(68497.573)	(75071.942)	(170655.400)
FIRST STAGE (Y=OF index)									
Prob. SS benefits will be lowered (0-100)	0.001**	0.002***	0.004	0.002***	0.002***	0.003	0.002***	0.002***	0.003
	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)
Mortality expectation at ages 85-100 (0-100)	0.001***	0.001***	0.001	0.001***	0.001***	0.001	0.001***	0.001***	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Covariates	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	38237	35597	2449	38237	35597	2449	38237	35597	2449

Notes: For all estimations, we reject the null hypothesis of exogeneity of our OF index based on the Durbin-Wu-Hausman test.

Table 5. OF and Post-Retirement Wealth: Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PANEL A:												
Y:	liquid asset											
subgroups:	gender		race			education			birth cohort			
	male	female	White	Black	Other	high school	B.A.	grad	cohort 1	cohort 2	cohort 3	cohort 4
OF index	-35446.86	-12691.64	3618.84	-27086.73	15590.63	-58587.03	1597.96	59534.62	110993.14	-136345.33	-49517.30	11418.703
	(41481.74)	(23957.80)	(18102.50)	(46198.52)	(11497.38)	(42135.44)	(27159.45)	(89973.78)	(174994.46)	(94437.04)	(40851.40)	(30079.117)
Cov,	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	23423	14814	30805	4007	3425	27574	6759	3904	2020	28588	4292	3337
PANEL B:												
Y:	pension wealth											
subgroups:	gender		race			education			birth cohort			
	male	female	White	Black	Other	high school	B.A.	grad	cohort 1	cohort 2	cohort 3	cohort 4
OF index	-107455.48*	-84992.84	-49102.09	152525.51	45406.49	-101916.75	-51638.60	130830.37	-24710.70	15871.78	-78712.41	-123103.008*
	(61284.94)	(58790.22)	(33761.98)	(140883.39)	(28926.43)	(67884.80)	(51978.33)	(227068.53)	(155401.59)	(106357.17)	(85292.96)	(70170.446)
Cov,	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	23423	14814	30805	4007	3425	27574	6759	3904	2020	28588	4292	3337
PANEL C:												
Y:	real estate wealth											
subgroups:	gender		race			education			birth cohort			
	male	female	White	Black	Other	high school	B.A.	grad	cohort 1	cohort 2	cohort 3	cohort 4
OF index	-128939.79**	-65785.10	-73463.65**	-205817.79	-99168.71	-206230.29**	-11176.09	-12714.14	-139669.01	-293794.39	-140933.798*	-5872.769
	(58269.56)	(41587.71)	(29636.54)	(220989.38)	(79063.09)	(89267.75)	(41099.36)	(103281.38)	(202681.59)	(257995.42)	(79896.810)	(47679.585)

Covariates	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	23423	14814	30805	4007	3425	27574	6759	3904	2020	28588	4292	3337

PANEL D:

Y:	total wealth											
subgroups:	gender		race			education			birth cohort			
	male	female	White	Black	Other	high school	B.A.	grad	cohort 1	cohort 2	cohort 3	cohort 4
OF index	-263843.64**	-180362.64	-14420.71**	43133.59	22742.82	-372974.77**	-101571.87	72575.67	29522.02	-502099.14	-168821.514	-131622.437
	(133319.93)	(120094.75)	(70345.70)	(186848.54)	(72165.55)	(168759.64)	(98173.63)	(298673.32)	(321453.75)	(407525.70)	(175644.152)	(114912.858)
Covariates	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE, region FE, region time-trends	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	23423	14814	30805	4007	3425	27574	6759	3904	2020	28588	4292	3337

Notes: *Birth cohorts are grouped into the following categories: 1, the oldest cohort born before 1930; 2, those born between 1931-1941; 3, those born between 1942-1947 during the World War II; 4, born after 1948.*

Table 6. OF and Post-Retirement Wealth: Default, IHS, and Winsorized Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	liquid asset			full liquid asset			semi liquid asset		
Outcome:	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)
OF index	40885.71	-1.99***	1566.64	17228.87	-1.42**	-4045.11	23068.98	-1.76	-7986.61
	(64874.05)	(0.66)	(33588.66)	(20816.69)	(0.57)	(10578.48)	(58253.70)	(1.09)	(29877.68)

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
	pension wealth			DC pension wealth			DB pension wealth			other pension wealth		
Outcome:	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)
OF index	-139252.00	-1.08	-71518.20	-185220.07**	-1.53*	-91907.15	2901.08	-0.72	-1112.91	34541.83	-1.01	17706.542
	(87470.84)	(0.76)	(63742.88)	(79281.88)	(0.92)	(69702.64)	(9768.32)	(0.54)	(2626.64)	(33249.86)	(0.73)	(16778.577)

	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
	real estate wealth			real estate wealth: housing			real estate wealth: non-housing		
Outcome:	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)
OF index	-198097.15***	0.23	-136609.36**	-78841.97*	0.16	-45131.99	-150087.17**	-2.89***	-88534.07**
	(75318.45)	(0.63)	(56540.25)	(43274.59)	(0.96)	(40465.68)	(68838.74)	(1.07)	(35113.24)

	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)
	total wealth			total wealth, less debts			total wealth (non housing), less debts		
Outcome:	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)	raw	IHS	winsorized (1th, 99th)
OF index	-298076.73**	-0.52	-198854.31	-304178.44**	-0.99*	-204544.51	-110923.40	-2.00*	-71254.05
	(150232.05)	(0.37)	(130556.71)	(150873.86)	(0.56)	(132216.10)	(119673.60)	(1.08)	(84425.74)

Notes: N=38237. Raw outcomes are neither Winsorized nor undergone IHS transformation.. For all estimations, included are covariates, time fixed-effects, region fixed-effects, and region-specific time trends.