How Much Lifetime Social Security Benefits Are Americans Leaving on the Table?

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Abstract

Americans are notoriously bad savers. Large numbers are reaching old age too poor to finance retirements that could last longer than they worked. This study uses the 2018 American Community Survey to impute retirement ages for 2019 Survey of Consumer Finance (SCF) respondents. Next, we run the SCF respondents through the Fiscal Analyzer (TFA) to measure the size and distribution of forgone lifetime Social Security benefits. TFA is a life-cycle, consumption-smoothing research tool that incorporates Social Security and all other major federal and state tax and benefit policies. The program can optimize lifetime Social Security choices. We find that virtually all American workers age 45 to 62 should wait beyond age 65 to collect. More than 90 percent should wait till age 70. Only 10.2 percent appear to do so. The median loss for this age group in the present value of household lifetime discretionary spending is $182,370. Optimizing would produce a 10.4 percent increase in typical workers' lifetime spending. For one in four, the lifetime spending gain exceeds 17 percent. For one in ten, the gain exceeds 26 percent. Among the poorest fifth of 45 to 62 year-olds, the median lifetime spending increase is 15.9 percent, with one in four gaining more than 27.4 percent.

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1 Introduction

Many, if not most Americans appear to be retiring with inadequate economic resources (Munnell et al., 2015). Indeed, typical wealth holdings of new retirees suffice to cover only a few years of median U.S. household consumption.[1] It's no wonder then that some 40 percent of retirees are more than 50 percent financially dependent on Social Security and that roughly 13 percent are entirely dependent.[2] As for those in better financial shape, Social Security is often their second largest retirement resource. These financial realities make retirees' failure to maximize their lifetime Social Security benefits particularly acute, but also a potentially remediable problem. As we show, the vast majority – over 90 percent – of Americans age 45 to 62 should take their retirement benefits starting at age 70. Roughly six percent are, given current behavior, likely to do so[3] – this despite the far higher benefits available from patience. Indeed, even as the system's full retirement age increases, retirement benefits taken at age 70 remain 76 percent higher, adjusted for inflation, than retirement benefits commenced at 62.

Paradoxically, there is widespread interest in getting the most from Social Security (SS). Indeed, a vast number of popular articles, books, newspaper, and magazines as well as television, podcast, webinar, and radio shows have discussed and continue to discuss optimal Social Security benefit-collection.[4] Academics have also weighed in on this issue. Bronshtein et al. (2016) provide an excellent survey of the literature and present striking calculations. Their findings concur with ours. But their study is illustrative. It considers stylized rather than actual households, which are examined here.

This paper assesses the costs to actual American workers – respondents to the 2019 Federal Reserve Survey of Consumer Finances (SCF) – of failing to maximize their lifetime benefits (LB). It uses the Fiscal Analyzer (TFA), developed by Economic Security Planning, Inc. (ESP)[5], to determine how much lifetime discretionary spending (LDS) working respondents to the SCF will likely leave on the table by failing to optimize their lifetime benefits (LB). Note that a worker's increase in LDS from maximizing their value will rarely equal their increase in LB. The reason is federal and state income taxes, Medicare B premiums, and federal and state benefits, which can decrease or increase when a household changes its Social Security (SS) benefit-collection strategy. Indeed, we report significantly smaller, if still very large increases in LDS compared to LB.

The TFA is a detailed life-cycle consumption-smoothing program that incorporates cash-flow (borrowing) constraints, lifespan uncertainty, and all major of federal and state tax and transfer programs.[6]. In addition to state-specific tax and benefit programs, all state-specific, federal benefit-program provisions are incorporated for all 51 (including D.C.) states. TFA treats all taxes, whether nominally levied on businesses (e.g., federal corporate income taxes and employer FICA contributions) or nominally collected as premiums (i.e., the Medicare Part B premium) as taxes paid by households. It also incorporates in-kind as well as in-cash benefit programs and benefit take-up rates. In-kind

[1] See https://www.cnbc.com/2022/07/30/vanguard-how-much-americans-have-saved-for-retirement-by-age.html and https://www.bls.gov/news.release/cesan.nr0.htm.

[2] https://www.ssa.gov/news/press/factsheets/basicfact-alt.pdf.

[3] See https://money.usnews.com/money/retirement/social-security/articles/reasons-to-claim-social-security-at-age-70.

[4] In 2015, Kotlikoff co-authored a 300-page book on Social Security's rules and how best to manage them. Despite its seemingly arid content, the book became a NY Times best seller!

[5] During its decades-long construction of TFA, ESP received considerable government- and private-sector support from the Federal Reserve Bank of Boston, the Sloan Foundation, The Goodman Institute, the Searle Family Trust, the National Center for Policy Analysis, the Nation Institute of Aging, and Boston University.

[6] Our description of TFA draws almost verbatim from https://kotlikoff.net/wp-content/uploads/2019/03/The-Fiscal-Analyzer-Online-Appendix-6-13-22.pdf

benefits, such as Medicaid and Medicare, are treated as consumed in the year received. All TFA results are presented in end-of-year dollars. But before conversion to real dollars, all TFA tax and benefit calculations are made in nominal terms in accord with federal and state tax/benefit programs, which are not fully indexed for inflation.

Our methodology involves five steps. First, we use the 2000 to 2020 waves of the American Community Survey to estimate the retirement probabilities of SCF workers aged 49 to 80. These probabilities are distinguished by birth year, age, education, gender, and marital status. Second, we impute these retirement hazards to SCF workers based on their characteristics and determine, via random assignment, the age at which they will retire. Retirement is defined as working 20 or fewer hours per week. Third, we assume that workers who retire prior to age 62 start their retirement benefit at age 62. We further assume that SCF workers who retire at or after age 62, but before age 70, start their retirement benefit in the year they retire. As for workers randomly assigned to retire after age 70, we assume they start their retirement benefits at 70 since there is no gain from further delay. Fourth, we run our worker sample with their designated retirement ages through TFA with its lifetime Social Security benefit optimization turned off.[7] Fifth, we rerun the SCF workers through TFA with its Social Security benefit optimization routine turned on and calculate the increase in LDS arising from lifetime benefit optimization. We then compare differences in LDS.

To summarize our findings, ignoring cash-flow considerations, the vast majority of American workers should delay taking their retirement benefits until 70. Doing so would raise median LDS of households headed by workers age 45-62 by $182,370 or 10.2 percent. There is a major dispersion in available LDS gains. The 25th percentile LDS gain is $69,493 or 3.2 percent. The 75th percentile LDS gain is $289,893 or 17.2 percent. Among age 45-62 year olds in the bottom fifth of the resource distribution, the median lifetime spending gain from optimization is 15.9 percent, with one in four gaining more than 27.4 percent, and one in ten gaining more than 37.0 percent.

Absent SS optimization, 40.9 percent of households in this age range are cash constrained, meaning perfect consumption smoothing is infeasible, i.e., their living standard will rise in the future. With SS optimization, 68.4 percent are constrained. However, for most households age 45 to 69 the reduction in current discretionary spending associated with SS optimization is small. At the median, it's $2,714 or 7.0 percent. These findings are, however, predicated on workers smoothly starting retirement account withdrawals when they retire or at age 60 if they retire before 60. Under an extreme alternative assumption – workers waiting until 72, when required minimum distributions commence, to begin retirement account withdrawals, SS optimization entails a large and, in some cases very large, decline in current-year discretionary spending.

We proceed by describing the TFA, our method of imputing retirement, and our procedure for imputing state residency to SCF respondents. We then present our findings, consider the extent to which SCF workers can optimize Social Security, examine the associated cash-flow issues, and conclude with suggestions for future research.

1.1 The Fiscal Analyzer

The Fiscal Analyzer (TFA), deployed in Auerbach et al. (2022), Auerbach et al. (2017), Altig et al. (2019), and Ilin et al. (2022), is a life-cycle, consumption-smoothing tool that incorporates borrowing constraints and all major federal and state fiscal policies.[10] These policies are listed in table 1. Detailed

[7]The TFA's core computation engine as well as its lifetime benefit and retirement account withdrawal optimization routines are those developed by Economic Security Planning, Inc. in the course of producing its two commercial personal financial planning tools, MaxiFiPlanner.com[8] and Maximize My Social Security[9].

[10]This TFA description borrows heavily and often verbatim from Altig et al. (2020).

TFA documentation is available at Kotlikoff (2019). To abstract from preferences, TFA assumes that households smooth their living standards, defined as discretionary spending per household member adjusted for economies in shared living and the relative cost of children, to the maximum extent possible without borrowing or, if already indebted, additional borrowing.[11]

The relationship between a household's discretionary spending in year t, C_t, and its underlying living standard per effective adult, c_t, is given by

$$C_t = c_t(N + .7K)^{.642}, \tag{1}$$

where N stands for the number of adults in the household and K for the number of children. The coefficient .642 is chosen such that two adults can live as cheaply, with respect to discretionary spending, as 1.6. TFA's default assumption is perfect living-standard smoothing, although the program can be run with any desired age-living-standard path, any age-specific child-equivalency factors, and any degree of economies in shared living. The program can also be run assuming any maximum age of life. In this study, we assume a maximum of age 100.[12]

TFA inputs include marital status, birth dates of each spouse/partner, birth dates of children, current-year labor earnings, current regular and retirement account (tax-deductible and Roth) asset balances, current and projected future employer and employee contributions to each type of retirement account, retirement-account withdrawal start dates, Social Security retirement-benefit collection dates, defined benefit pensions, housing expenses, real estate holdings, household debts, rates of return on assets, and the inflation rate. All inputs not reported in the SCF are imputed. The most important such imputation, described below, is state residency.

1.2 TFA's Solution Method

The TFA jointly determines a household's annual and LDS, taxes (including Medicare Part B premiums), transfers, life-insurance premiums, and bequest paths along each of the household's potential survivor paths.[13] Non-discretionary spending on, for example, housing is taken as exogenous and obviously limits the scope for discretionary spending. Solving this problem raises the curse of dimensionality – too many variables for computational feasiblity. The state variables here comprise survivor-path-specific regular assets, taxable and non-taxable (Roth) retirement-account assets for each household head and, if relevant, spouse/partner.[14]

A second challenge is determining taxes, transfer payments, discretionary spending, and life insurance holdings for all years on each survivor paths. The third hurdle is simultaneity. Spending, life insurance amounts, and net taxes on all survivor paths are interdependent. Indeed, they are interdependent across paths since, subject to survivor-path-specific cash-flow constraints, TFA equalizes living standards (to restate, discretionary spending per household member with adjustments for the household's current demographic composition and economies in shared living) across all paths. The

[11]This behavior is consistent with Leontief intertemporal preferences defined over the household's future living standard. The TFA is designed to permit additional borrowing as specified by the researcher.

[12]As discussed below, Yaari (1965) shows that the maximum age of life and only the maximum age of life is the correct horizon for valuing pension benefits. Given current life tables (https://www.ssa.gov/oact/STATS/table4c6.html), 2 percent of Americans will live beyond age 100. Hence, one could argue for an even higher maximum age of life assumption.

[13]For a single person age 50, there are 50 survival paths since the person can die in any of the next 50 years. For a married couple each age 50 and each with maximum ages of life of 100, there are $50^2 = 2500$ such paths. An example is a husband's dying at 69 and his spouse dying at 91.

[14]These state variables are not just survivor-path-specific, but year-survivor-path-specific, i.e., we need to know the state vector along each survivor path in each future year. Take, for example, a 40 year-old couple that could live to 100. They have over 200,000 survivor-contingent regular and retirement account state variables.

fourth and final difficulty is the most demanding: The program needs to process thousands of sample observations in batch mode in finite time.

TFA's computation method (CE) handles all of these challenges. It's computation engine, provided by Economic Security Planning, Inc., overcomes the curse of dimensionality in several ways. Most important, rather than attempt to solve an incredibly complex, single dynamic program with a massive numbers of state variables, the CE posits three far simpler interdependent dynamic programs. The first smooths consumption assuming household heads and their spouses/partners, if present, reach their maximum ages of life. This dynamic program incorporates the household's cash-flow constraints, i.e., that it can't borrow or can't borrow more that it has already done in the course of smoothing its living standard per household member. The second routine determines non-negative annual life insurance needs for household heads and any spouse/partners.[15]

Iteration across the three dynamic programs entails each program taking the output of the other programs as given inputs. This is a Gauss-Seidel solution method, but applied to routines, rather than equations. To ensure precision to many decimal places, TFA employs dampening across iterations and utilizes an adaptive sparse grid method that entirely eliminates extrapolation error. Removing this error is critically important.[16]

TFA's CE overcomes the curse of dimensionality in two additional ways. First, survivor-specific paths of retirement account contributions, account balances, and withdrawals are pre-determined. Thus, although TFA's problem involves hundreds of thousands of state variables, those involving retirement accounts are pre-determined. Second, the life insurance routine is programmed to produce the same living standard path in each year as that generated in the consumption-smoothing routine.[17] To summarize, TFA uses iterative dynamic programming to jointly a) smooth each household's living standard per equivalent adult (the c_ts), subject to borrowing constraints, on its maximum-longevity path, b) calculate year-specific life insurance needs (and the requisite annual life insurance premiums that must be paid), and compute c) net taxes along its maximum-longevity path.

1.3 Confirming TFA's Solutions

Although TFA's inner workings are complex, its iterative dynamic programming and sparse-grid method permit CE convergence within seconds. TFA's solutions can be confirmed in seven ways. First, present-value lifetime budget constraints are satisfied within a dollar or two along all survival paths. Hence, apart from terminal bequests, intended and unintended, and funeral expenses, each household ends up, along each survival path, with precisely zero assets when the household ends, i.e., when the max of the maximum year of death across spouse/partners or the maximum year of death of a single household head is reached. Second, each unconstrained household's living standard (discretionary spending per effective adult) is smoothed (takes the same value) to the dollar across all

[15]The life insurance program determines annual life insurance amounts, for each potential decedent, that ensure survivors, including children, the ability to finance and, thus, enjoy the same living standard through their maximum ages of death or, in the case of children, departures from their parental homes, as they would have enjoyed had the spouse/partner/parent not passed away. If survivors can finance a higher living standard absent life insurance, TFA sets life insurance to zero.

[16]Borrowing constraints introduce kinks in the discretionary spending functions. And dynamic programming requires interpolating backwards (from year t to year t-1) over these functions. This propagates interpolation errors backwards, producing more kinks and inaccuracies in each successive function.

[17]This routine calculates and utilizes survivor-path, year-specific taxes and transfer payments. Thus, the maximum-longevity survival path in which the respondent and potential spouse/partner both live to their maximum ages of life provides the life-insurance routine annual living standard targets that the life insurance routine insures for each survivor path. The maximum-longevity survival path is, to put it euphemistically, *One ring to rule them all.*

future years. Third, for households that are constrained for one or more intervals, the living standard is smoothed in each interval. Furthermore, the living standard is higher in constrained intervals that occur later in time. Fourth, regular assets in the year before a borrowing constraint ends, via, for example, paying off a mortgage, are zero. This is a requirement of constrained consumption smoothing. To be more precise, bringing positive assets into years when the living standard is higher is inconsistent with consumption smoothing, which minimizes living standard discrepancies to the maximum extent consistent with the household's borrowing constraint. Fifth, if a spouse/partner dies leaving life insurance for the surviving spouse/partner and children, the living standard of survivors is, to the dollar, identical to what they would otherwise have experienced. Sixth, if TFA does not calculate life insurance for a spouse/partner in a given year, survivors have a higher living standard if the spouse/partner dies in that year. Seventh, a household's regular assets never fall below the amount TFA is told the household can borrow. Anyone running *MaxiFiPlanner*, the commercial parent of TFA, can readily confirm each of the above solution properties.

1.4 TFA's Taxes and Transfers

Table 1 lists the tax and transfer programs incorporated in TFA. Maximization of lifetime SS benefits will change not only those benefits, but each household's path (annual amounts) of discretionary spending along each survivor path. This, in turn, will change the household's survivor-contingent paths of assets, paths of asset income, and, thus, paths of taxes and, potentially, paths of transfer payments. As suggested above, our results incorporate all such endogenous responses to optimizing lifetime SS benefits.

Table 1: List of Tax and Transfer Programs Included in TFA

Taxes	Personal Income Tax (federal and state)
	Corporate Income Tax (federal and state)
	FICA Tax (federal)
	Sales Taxes (state)
	Medicare Part B Premiums (federal)
	Estate and Gift Tax (federal)
Transfer Programs	Earned Income Tax Credit (federal and state)
	Child Tax Credit (federal)
	Social Security Benefits (federal)
	Supplemental Security Income (SSI) (federal)
	Supplemental Nutritional Assistance Program (SNAP) (federal and state)
	Temporary Assistance for Needy Families (TANF) (federal and state)
	Medicaid (federal and state)
	Medicare (federal)
	The Affordable Care Act (ACA) (federal and state)
	Section 8 Housing Vouchers (state and county)
	Childcare Assistance (state and county)

1.5 TFA's Lifetime Social Security Benefits Optimizer

Table 2 lists each of the SS benefits included in TFA's calculations. Table 3 list the SS benefit provisions incorporated in TFA's calculation for the listed benefits. Parent benefits are the only benefits provided by Social Security that are not included in TFA. The reason? The SCF provides no information about parents. The list of provisions is relatively short. The list of regulations implementing these provisions is anything but. Social Security's Handbook contains a vast number of rules, 2,728 rules to be precise, governing its benefits. And it has hundreds of thousands of rules about its 2,728 rules over the 12 benefits in its Program Operating Manual System (POMS). These literally countless rules (POMS has no numbering system, just links between rules.) may well make SS the most complex fiscal policy yet devised by man.[18] The CE, and thus TFA's Social Security benefit optimizer, is exhaustive. It considers all legal benefit collection strategies of respondents and their spouse/partners and it does so on a monthly basis. By legal we mean all strategies permitted under Social Security rules. For example, spousal benefits that spouse X can receive on spouse Y's work record aren't available to X until Y starts collecting their retirement benefit. In the case of spouses, all strategies reference all joint collection strategies.

Table 2: Social Security Benefits Included in TFA

Retirement benefits
Spousal benefits
Divorced spousal benefits
Disability benefits
Child-in-care spousal benefits
Widow(er)s benefits
Divorced widow(er)s benefits
Child benefits
Disabled child benefits
Surviving child benefits
Father and mother benefits

Table 3: Social Security Benefit Provisions Included in TFA

Early benefit reductions for all benefit types
Delayed retirement credits
Earnings test (monthly and annual)
Adjustment of the reduction factor
Re-computation of benefits
Family benefit maximum
Combined family benefit maximum
Disabled family benefit maximum
Widow(er) benefit formulas for spouses who do/don't die before 62
RIB-LIM special widow(er) benefit formula
Windfall Elimination Provision
Government Pension Offset
All deeming rules
Retirement benefit suspension and restart provisions

[18] One measure of the system's complexity is the number of lines of efficiently written software code needed to properly apply its myriad provisions. In the CE's case, these lines of code, when printed, comprise over a ream of printing paper.

1.6 Valuing Social Security and Other Future Resource Streams and Modifying TFA for Use in this Study

In addition to understanding the system's benefits and their availability, American workers need to properly value their benefits. Unfortunately, workers are often directed to consider their life expectancy rather than their maximum age of life in evaluating LB (lifetime benefits). Consider this statement on SSA's website:

> *Your life expectancy affects your retirement planning decisions. Knowing this, helps you determine whether you should start receiving your benefits at age 62, or wait until age 70 to receive a higher payment.*[19]

Life expectancy refers, of course, to when, on average, a person will die. But no one will die precisely on time – at their expected age of death given their mortality probabilities. Each of us will die just once and our actual, as opposed to expected, age of death can be exceptionally high. Indeed, we can die at our maximum age of life. Were Americans to simultaneously live thousands of parallel lives and die at all possible ages of death consistent with frequencies determined by their mortality probabilities, and were the thousands of these hypothesized clones to leave their bequests to their surviving clones, each America would in effect constitute their own annuity insurance company. In this case, actuarial valuation of future benefits, which is implied by a focus on life expectancy, would be appropriate. But none of us is starring in *Ground Hog Day.* And just as we can't count on experiencing average automobile accident losses, average homeowners insurance losses, average health insurance losses, or average pet insurance losses, we can't count on dying years before we run out of money. Instead, economics teaches us to consider longevity risk in the same manner as we do all other risks. In particular, we need to entertain the entire range of outcomes, focusing particularly on the worst-case outcomes. When it comes to longevity risk, the worst outcome, financially speaking, is living to one's maximum age of life. Our need to concentrate on the extreme downside reflects our risk aversion. The worst case can be so bad as to render all other outcomes of secondary importance.

When it comes to longevity risk, we need to consider the financially catastrophic scenario – living as long as possible. The reason is simple. We must worry about our welfare if we do live to maximum age. This key insight – that our planning horizon must extend to our maximum age of life – underlies Menachem Yaari's seminal paper (Yaari, 1965) on the economics of life (early-death) insurance and, the opposite side of the coin, annuity (late-death/longevity) insurance. Yaari's study also clarifies how one should value future income and spending streams in the context of lifespan uncertainty. Absent a well functioning annuity market in which agents can purchase insurance against living to certain ages at actuarially fair or near actuarially fair rates, future income streams must be discounted on a non-actuarial basis, i.e., by doing simple discounting. Again, this is the opposite of what most, if not all financial companies and, indeed, SS, itself, seem to recommend. As for the appropriate real discount rate, we take, as our baseline, a 0.5 percent real return. This is roughly the average real return on long-dated Treasury Inflation Protected Securities (TIPS) observed in recent years. We also consider a 2 percent real return in our sensitivity analysis. Our assumed inflation rate, which we maintain through the analysis is 3.0 percent. Hence, our base case entails a 3.515 percent nominal return. And our sensitivity analysis assumes a 5.060 percent nominal return.

The TFA was designed to study average outcomes to study economy-wide questions. For example, Auerbach et al. (2022), which uses TFA, measures average lifetime net tax rates for households of different means within particular cohorts. That analysis averages over all survivor-path outcomes,

[19] https://www.ssa.gov/benefits/retirement/planner/otherthings.html?tl=1

which are calculated by TFA as a byproduct of determining life insurance needs. For this study, we've modified TFA to consider a single survivor path, namely the one in which the respondent and any spouse/partner live to their maximum ages of life. This modification of TFA accords precisely with Yarri's directive that rational households base their spending decisions on a non-actuarially discounted lifetime budget that a) applies simple discounting and b) treats the budget/planning horizon as the maximum age of life. However, Yarri not only shows that households will, for budgetary purposes, assume maximum longevity. He also shows that if they are not extremely risk averse households will gamble on the likelihood of dying before their maximum ages of life. Specifically, they will intentionally consume more when young knowing for sure that the cost of doing so is, conditional on continuing to live, a lower living standard when old.[20] While we follow Yaari (1965) and value SS benefits for each individual household based on the maximum life scenario, we do turn on TFA's actuarial analysis at the end of the paper for purposes of studying how SS optimization would impact SS' finance.

2 The SCF, Benchmarking, and Data Imputations

The SCF is a cross-section survey conducted every three years.[21] The survey over-samples wealthy households in the process of collecting data from, in the case of the 2019 Survey, 5,777 households.[22] These data include detailed information on household labor and asset income, assets and liabilities, and demographic characteristics.[23]

2.1 Benchmarking the 2019 SCF to National Aggregates

SCF household-weighted totals of various economic and fiscal aggregates differ from their direct counterparts in the National Income and Product Account (NIPA) and Federal Reserve Financial Accounts (FA). To assure concordance, we follow the approach outlined in Appendix A and B in Dettling et al. (2015), which benchmarks the 2016 SCF based on "conceptually equivalent" values. Specifically, we set SCF benchmark factors to ensure that SCF-weighted aggregates coincide with conceptually comparable NIPA and FA aggregates. We used FA2018 Q4 aggregates for wages, self-employment income, and assets.

Benchmarking assets and net worth reported in the SCF requires several adjustments to the Financial Accounts values. Using the approach outlined in Appendix B of Dettling et al. (2015), our first asset adjustment was to reduce SCF-reported home market value by 7.3 percent to match the 2018 Q4 Federal Reserve Financial Accounts measure. Second, we increase the SCF-reported equity

[20] TFA accommodates this behavior via the setting of its age-living standard index.

[21] This section draws heavily and often verbatim from Altig et al. (2020).

[22] The SCF combines an area-probability sample of households with a "list" sample of generally wealthier households from administrative tax records from the IRS. The SCF includes sampling weights to account for oversampling of wealthier households from inclusion of the "list" sample and for differential response rates among wealthier groups. Wealthier households have lower response rates, particularly at the highest levels. See Bricker et al. (2016). The oversampling of wealthy households allows for inference about households in the top 1 percent of the resource distribution. For the 2004 SCF, Kennickell (2007) shows that 15.8 percent of sampled households were in the top 1 percent of the net worth distribution for the U.S. with 96.4 percent of these coming from the list sample. Another 38.5 percent of the 2004 SCF-sampled households were in the bottom 50 percent of the net worth distribution with only 5.7 percent of these households coming from the list sample.

[23] Using a multiple imputation algorithm, the Fed includes each household's record in the public-use SCF dataset in five so-called replicates to account for estimation of non-reported values (item non-response) or for disclosure limitations. We use the first replicate for our analysis. Auerbach et al. (2022, 2017) report no significant differences in results across replicates.

in non-corporate businesses by 33.3 percent to match the 2019 Q3 Federal Reserve Financial Accounts estimate. Third, we increased reported retirement account assets by 11.3 percent to match the total reported for 2018 Q4 in the Federal Reserve's Financial Accounts. Table 4 details aggregate values, their sources, and our benchmark adjustments. We inflate all SCF-reported wage income by 22.3 percent to match the NIPA 2018 measure of employee compensation, and deflate all SCF-reported self-employment income by 28.4 percent to match the NIPA 2018 proprietorship and partnership income total. The fact that we need to inflate wage income and significantly deflate self-employment income to match national aggregates may reflect, in part, a tendency of SCF respondents to report wage earnings as self-employment income.

Table 4: SCF Benchmarking Adjustments and Targets

	SCF Unadjusted	Benchmarking Coefficient	SCF Adjusted	Target	% Diff
Wages	7,382[24]	1.22	9,027	9,027	0.00
Self Employment Income	2,237	0.72	1,601	1,601	0.00
Market Val. of Homes	28,048	0.93	25,992	25,877	0.44
Non Corp. Business Equity	9,795	1.33	13,055	13,055	0.00
Regular Assets	50,904	0.69	35,373	35,374	0.00
Retirement Accounts	14,307	1.11	15,923	15,824	0.62

2.2 Imputing State Residency

The public-use SCF release doesn't provide state identifiers. The non public-use SCF data does include state identifiers, but its household weights are national, i.e., not state-specific. They are, therefore, are of no value for our purposes of appropriately allocating SCF households by state. Consequently, we allocate SCF households to different states based on a statistical match to the Current Population Survey. Specifically, we sort respondents to the 2019 CPS by state into cells based on marital status, age of household head, race (white or non-white), and education (high school diploma or less, some college, college diploma). Having done so, we calculate the distribution across states of CPS households with specific cell characteristics. Next we randomly assign SCF households within their appropriate cell to one of the 51 states (including Washington D.C.) based on the CPS-determined probabilities that households in their cell will live in specific states.

2.3 Earnings Imputations

The SCF is a cross section survey. But assessing lifetime spending requires estimating future labor earnings. In additional, we need to estimate past labor earnings for each respondent and any spouse/partner to calculate these individuals' annual as well as lifetime Social Security benefits. Our imputation of labor earnings is based on prior (1967-2014) waves of the CPS. To impute annual labor earnings, we first group CPS observations by age, sex, and education. Next, we estimate annual earnings growth rates by age and year for individuals in each sex and education cell. These cell growth rates are used to "backcast" and forecast each individual's earnings history. These forecasts assume a 1 percent real growth rate in economy-wide earnings.

Past and future cell growth rates ignore earnings heterogeneity within cells. To deal with such heterogeneity, we assume that observed individual deviations in earnings from cell means are partially

[24] All values are presented in billion 2018 U.S. dollars.

permanent and partially transitory, based on an underlying earnings process in which the permanent component (relative to group-trend growth) evolves as a random walk and the transitory component is serially uncorrelated. We also assume that such within-cell heterogeneity begins in the first year of labor force participation. In particular, suppose that, at each age, for group i, earnings for each individual j evolves (relative to the change in the average for the group) according to a shock that includes a permanent component, p, and an iid temporary component, e. Then, at age a (normalized so that age 0 is the first year of labor force participation), the within-group variance will be $\alpha\sigma_p^2 + \sigma_e^2$. Hence, our estimate of the fraction of the observed deviation of individual earnings from group earnings, $(y_{i,j}^a - \bar{y}_i^a\ )$, that is permanent is $a\sigma_p^2/(a\sigma_p^2 + \sigma_e^2\ )$. This share grows with age, as permanent shocks accumulate. Using this estimate, we form the permanent component of current earnings for individual j, $\hat{y}_{i,j}^a$,

$$\hat{y}_{i,j}^a = \bar{y}_i^a + (a\sigma_p^2/(a\sigma_p^2 + \sigma_e^2))(y_{i,j}^a - \bar{y}_i^a) = (a\sigma_p^2/(a\sigma_p^2 + \sigma_e^2))y_{i,j}^a + (\sigma_e^2/(a\sigma_p^2 + \sigma_e^2))\bar{y}_i^a \qquad (2)$$

and assume that future earnings grow at the group average growth rate. Further, we make the simplifying assumption that the permanent and temporary earnings shocks have the same variance. This assumption reflects the literature (e.g., Moffitt and Gottschalk (1995), and Meghir and Pistaferri (2011)). Thus, equation (10) reduces to:

$$\hat{y}_{i,j}^a = (a/(a+1))y_{i,j}^a + (1/(a+1))\bar{y}_i^a \qquad (3)$$

For backcasting, which we need to calculate SS benefits, we assume that the earnings for individual j were at the group mean at age 0 (i.e., the year of labor force entry), and diverged smoothly from this group mean over time, so that the individual's estimated earnings t years prior to the current age a are

$$\bar{y}_i^{(a-t)} + ((a-t)/a)(\hat{y}_{i,j}^a - \bar{y}_i^a)(\bar{y}_i^{(a-t)}/\bar{y}_i^a) = (t/a)\bar{y}_i^{(a-t)} + ((a-t)/a)\hat{y}_{i,j}^a(\bar{y}_i^{(a-t)}/\bar{y}_i^a) \qquad (4)$$

That is, for each age we use a weighted average of the estimate of current permanent earnings, deflated by general wage growth for group i, and the estimated age-a, group-i mean also deflated by general wage growth for group i, with the weights converging linearly so that as we go back we weight the group mean more and more heavily, with a weight of 1 at the initial age, which we assume is age 20.

2.4 Treatment of SCF Divorcees and Widows

Unfortunately, the SCF provides no information on the earnings histories or projected earnings of former spouses. Nor does it includes any information of the earnings histories of deceased spouses or deceased ex-spouses. Consequently, we have no alternative but to treat these respondents as single in the TFA.

2.5 Using the American Community Survey to Determine Retirement Hazards

The SCF respondents are asked about their expected ages of retirement. Not all respond and those that do appear to be overly optimistic.[25] This squares with the tendency of workers in general to overestimate how long they will work. [26] As an alternative, we use the 2000 through 2020 waves of

[25] Among 45 to 62 year-old 2019 SCF male respondents, the average age of expected full retirement is 70.3 years old, calculated using sample weights. For females, the weighted self-reported full retirement age is 68.9 years old.

[26] See https://www.planadviser.com/boomers-overly-optimistic-about-work-in-retirement/

the ACS to impute retirement age based on two questions in the survey. The ACS asks respondents the number of weeks that they worked last year and the number of hours they are currently working in a typical week. We define "retired" as a person working more than 26 weeks in the previous year and working less than 21 hours a week this year.[27]

We segregate ACS working respondents by year of birth, age, gender, marital status, and education. We assume no retirement prior to age 50. Starting at 50, we classify as retired respondents who report working less than 21 hours per week in the current year, but more than 26 weeks in the previous year. This lets us calculate, for specific cohorts with particular cell attributes, sample retirement probabilities over the twenty ACS surveys. We smooth these values and use the resultant smoothed function to determine retirement probabilities. Conditional probabilities of working at age 65 and 70 for 50 year-old workers in 2020 are summarized in tables 7 and 8.

These cohort- and characteristics-specific retirement hazards are used to randomly assign retirement ages for each SCF respondent under age 80. We assume that all households retire at 80 if they haven't yet been probabilistically retired. Retirement rates for age 50 workers in 2020 and age 50 workers in 2040 are summarized in tables 5 and 6, respectively. The predicted fraction of ACS respondents working after 55 increases over time. The drivers here include higher educational achievement among successive cohorts and a rise in the fraction of fraction of working women. To be precise, within each cohort we project some, but limited, increases in retirement ages through 2040, with married 50 year-old men with four-year college degrees or more retiring at 65.9, approximately 0.6 years later than their 2020 counterparts.

Figure 1 plots our cohort-specific smoothed retirement hazard functions – the likelihood of working "full time" (more than half time) at different ages – for alternative birth cohorts. Two things are immediately clear. First, regardless of year of birth, the probability of working "full time" declines dramatically starting at age 50. Second, recent cohorts are more likely to work after age 60, but the differences are small and decrease with age.

[27]We include 20 hours as retired because many ACS respondents report exactly 20 hours. These respondents are likely earning less than SS' Earnings Test threshold and hence are likely taking SS retirement benefits.

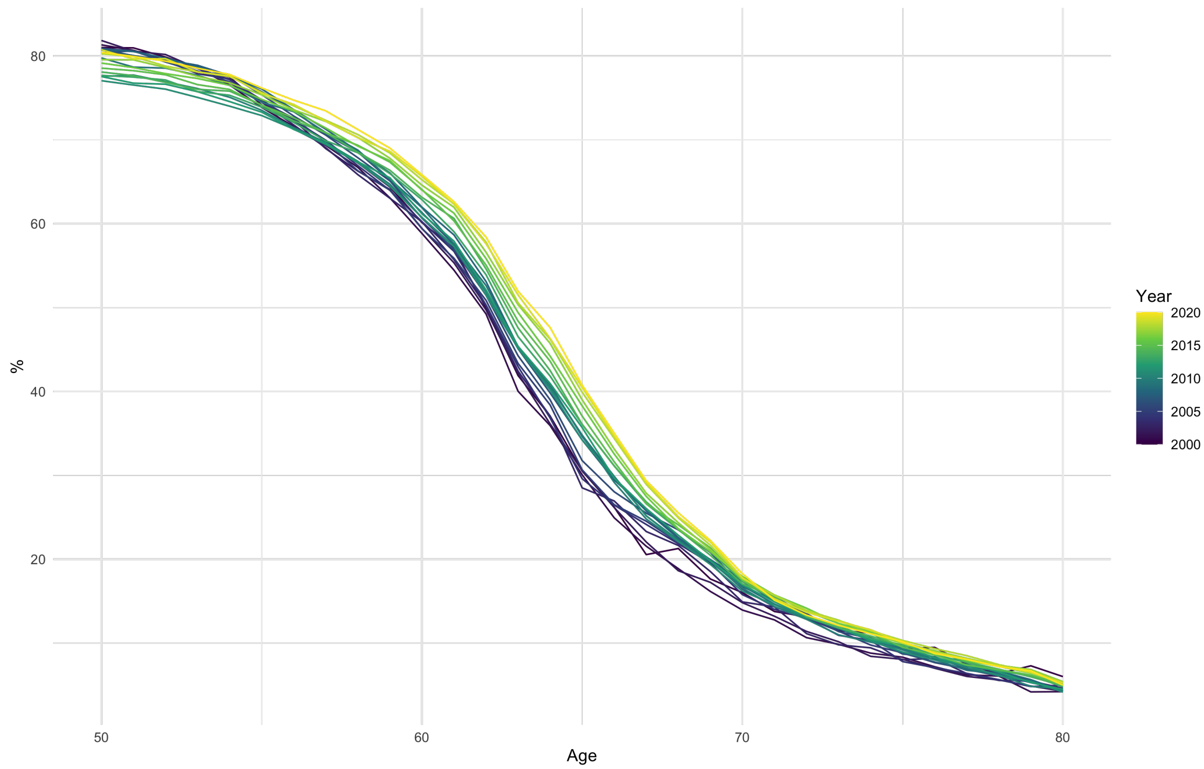

Figure 1: Fraction of Respondents Working More than 20 Hours Per Week, ACS 2000-2020

Tables 5 and 6 shows projected average retirement ages. The results, which are broken down by marital status and education, are striking. First, predicted average retirement ages are only slightly higher for future than for current age-50 workers. Second, single females with college educations are projected to "retire" roughly two years later, on average, than those with a high-school diploma or less. Third, for males, education makes little difference in average "retirement" ages holding fixed marital status. Fourth, married males "retire," on average, roughly two years later than single males across all levels of education. Fifth, males "retire" later than females with the difference in average ages falling from roughly four years to roughly two years as one moves from lower to higher levels of education.

Marital Stat.	Education	Male	Female
Single	High School or Less	63.0	59.4
	Some College	62.9	61.0
	4 yr. College or More	63.2	61.5
Married	High School or Less	64.9	58.1
	Some College	64.9	58.5
	4 yr. College or More	65.3	58.3

Table 5: Projected Average Retirement Age, Age 50 Workers in 2020

Marital Stat.	Education	Male	Female
Single	High School or Less	63.1	59.0
	Some College	62.7	60.8
	4 yr. College or More	63.3	61.7
Married	High School or Less	65.4	58.4
	Some College	65.1	58.9
	4 yr. College or More	65.9	58.5

Table 6: Projected Average Retirement Age, Age 50 Workers in 2040

Tables 7 and 8 report the probability of working "full time" at ages 65 and 70 for 50 year-old workers in 2020. The tables are quite revealing. First, holding education and marital status fixed, the chances of working "full time" are substantially higher at age 65 than at age 70. Take, for example, married males with some college education. Their chances of being "fully employed" are 56.0 percent at age 65 and 25.1 percent at age 70. Second, females are substantially less likely than males to work "full time." Third, married males are more likely to keep working "full time" than single males. And fourth, education significantly raises the likelihood of single, but not of married females working "full time."

Martial Stat.	Education	Male	Female
Single	High School or Less	44.2	24.5
	Some College	43.2	34.0
	4 yr. College or More	45.3	35.9
Married	High School or Less	56.5	17.9
	Some College	56.0	20.3
	4 yr. College or More	58.6	18.9

Table 7: Probability of Working More than 20 Hours at Age 65, Age 50 Workers in 2020

Marital Stat.	Education	Male	Female
Single	High School or Less	20.0	6.9
	Some College	17.3	11.0
	4 yr. College or More	18.4	10.5
Married	High School or Less	26.6	3.9
	Some College	25.1	4.7
	4 yr. College or More	26.5	3.9

Table 8: Probability of working more than 20 hours at Age 70, Age 50 Workers in 2020

3 Findings

This section presents our main results as well as sensitivity analyses.

3.1 Principal Findings

As indicated, we ran the 2019 SCF with TFA's Social Security benefit optimizer turned off and then with it turned on. We report all results in June 2022 dollars. Our maintained assumption, which may be overly strong, is that workers take their Social Security retirement benefit at retirement. Imputed and optimized retirement-benefit collection ages by SCF role (1 for household head, 2 for spouse/partner) are summarized in table 9. Among all 45-62 year old individuals (heads of households and spouses/partners) in the baseline, the weighted average age at which respondents start their SS retirement benefit is 66.1 and 63.6 for spouses/partners. After optimization, the average retirement-benefit collection age for household heads is 69.9 and 68.7 for spouses/partners. A large majority – 91.6 percent – of heads of households optimize SS benefits by taking benefits at age 70. A total of 99.4 percent optimize by taking benefits after age 65.

	Head of Household		Spouse/Partner		Total	
	Baseline	Optimized	Baseline	Optimized	Baseline	Optimized
Weighted Average Collection Age	66.0	69.9	63.6	68.7	65.0	69.4
Percent Collecting at 62	20.9	0.0	44.0	0.0	30.1	0.0
Percent Collecting at 70	15.1	97.9	2.8	81.9	10.2	91.6
Percent Collecting after 65	63.8	99.9	36.5	98.7	53.0	99.4

Table 9: Retirement Benefit Collection Age Distribution By Role, SCF Respondents Age 45-62

Table 10 reports the gains from optimizing Social Security for different age groups. Consider those age 55 to 62. A striking 89.0 percent of this group gain from optimizing Social Security benefit collection. The rest experience non-negative increases in lifetime benefits (LB) that come at the cost of lower lifetime non-SS benefits or higher lifetime taxes. The median LB increase for this group is 14.7 percent. The median present value increase in lifetime discretionary spending (LDS) is 9.5 percent.

The absolute median increase in LB and LDS are impressive – $181,613 and $151,962, respectively. Turn now to those age 63 to 69. A total of 84.4 percent stand to benefit from SS optimization. For those optimizing, the gain primarily arises from suspending one's retirement benefit at full retirement age and restarting it at 70. The median lifetime benefit increase is $117,090, producing a median LDS increase of $92,218. In percentage terms, the median LB and LDS increases are 11.2 percent and 6.3 percent, respectively. Social Security benefit optimization may be of particular relevance to households age 45-62 since respondents in this age group may not yet have formed rigid collection plans. An astounding 90.1 percent can gain from optimization, producing, at the median, $225,944 and $182,370 increases in LB and LDS, respectively. This corresponds to a 20.3 percent rise in LB and a 10.3 rise in LDS.

	No. obs.	Pct. Benefiting From Soc. Sec. Optimization	Median Inc. in PV Disc. Spending	Median Pct. Inc. in PV Disc. Spending	Median Inc. in PV Social Security	Median Pct. Inc. in PV Social Security
All Households	5,234	75.0	116,379	6.3	158,069	13.1
Age 21 to 44[28]	1,562	87.0	193,925	8.5	259,997	21.4
Age 45 to 62	1,916	90.1	182,370	10.2	225,944	16.7
Age 45 to 54	988	91.1	213,844	10.4	271,790	20.3
Age 55 to 62	928	89.0	151,962	9.5	181,623	14.7
Age 63 to 69	788	84.4	92,218	6.3	117,090	11.2

Table 10: The Distribution of Benefits from SS Optimization

Across all SCF households, 75 percent benefit from optimizing social security. The (weighted) median household gain is $116,379. This is an impressive figure. It represents more than two years of a typical American worker's earnings. Among 45-62 year olds, 91.1 percent benefit. And, to repeat, even among 63-69 year olds, 84.4 percent benefit – many from suspending their retirement benefit at full retirement age and restarting it at 70. Among 45-62 year olds, the weighted median LDS gain is $182,370. This represents 10.2 percent of remaining LDS and reflects a median increase in LB of $225,944.

Table 11 and table 12 report absolute and percentage increases in LB from SS optimization. The results are strikingly large. Consider, for example, workers age 55 to 62. Their median lifetime benefit increase is $181,623. And the 75th percentile value is $312,690. The corresponding median percentage increases are 14.7 and 22.9, respectively. As discussed below, higher-resource households have larger absolute LB gains, but far smaller percentage gains than lower-resource households. This explains why the household with the median absolute LB gain has a relatively small percentage LB gain.

Tables 13 and 14 show absolute and percentage increases in LDS from SS optimization at different percentile values of the increase. Clearly some households benefit far more than others, at least in absolute terms. For example, the age 55-62, 75th-percentile gain is $256,091 – more than five times the still quite large $51,678 gain for those experiencing the 25th largest increase. For those with the 99th percent highest gain, the amount is huge – $557,852. As for those who are retired or close to retiring – the 63 to 69 year olds – the gains range from $20,697 at the 25th percentile to a massive $398,213 at the 95th.

Interestingly, the absolute gains available to those age 21-44 are similar to those age 45-62. This reflects two offsetting effects. Younger cohorts have higher earnings and, therefore, a larger absolute stake in SS. On the other hand, SS benefits are further in the future and are, therefore, discounted to the present over a longer period.

Table 15 breaks down percentage gains by remaining lifetime resource quintiles. The median gain for those in the bottom quintile is 15.9 percent. It's 1.9 percent for those in the top quintile. Hence, a government Social Security optimization mandate would be highly progressive. The 75th and 90th percentile gains are 27.4 percent and 37.0 percent for the bottom quintile. For the top quintile, they are 3.3 percent and 5.2 percent.

[28] Age refers to age of head of household as defined in the SCF.

	25th	50th	75th	90th	95th	99th
Age 21 to 44	113,375	259,997	401,943	538,289	614,152	759,083
Age 45 to 62	103,550	221,722	358,723	492,525	563,154	697,918
Age 45 to 54	127,516	271,790	403,624	535,510	621,360	713,820
Age 55 to 62	86,708	181,623	312,690	438,331	513,401	641,941
Age 63 to 69	50,163	117,090	197,540	288,071	339,358	435,047

Table 11: Social Security Benefit Increase from Optimizing By Age Cohort and Percentile Outcome

	25th	50th	75th	90th	95th	99th
Age 21 to 44	9.7	21.4	34.4	37.1	37.1	37.1
Age 45 to 62	7.6	16.3	25.5	36.0	37.1	37.1
Age 45 to 54	10.2	20.3	31.5	37.1	37.1	37.1
Age 55 to 62	6.6	14.7	22.9	32.6	37.1	37.1
Age 63 to 69	4.6	11.2	14.9	20.3	23.0	26.0

Table 12: Percent Social Security Benefit Increase from Optimizing By Age Cohort and Percentile Outcome

	25th	50th	75th	90th	95th	99th
Age 21 to 44	65,931	193,925	327,715	455,460	523,113	704,072
Age 45 to 62	69,493	182,370	289,893	410,261	470,968	603,569
Age 45 to 54	88,285	213,844	334,339	447,689	516,103	651,497
Age 55 to 62	51,678	151,962	256,091	369,833	423,604	557,852
Age 63 to 69	20,697	92,218	172,879	249,633	303,863	398,213

Table 13: LDS Increase from Optimizing Social Security By Age Cohort and Percentile Outcome

	25th	50th	75th	90th	95th	99th
Age 21 to 44	3.4	8.5	13.6	18.8	22.4	29.3
Age 45 to 62	3.2	10.2	17.2	26.2	33.8	43.8
Age 45 to 54	4.5	10.4	18.2	27.2	34.6	43.6
Age 55 to 62	2.6	9.5	17.2	26.5	33.8	48.0
Age 63 to 69	1.6	6.3	13.2	22.2	30.3	39.7

Table 14: Percent LDS Increase from Optimizing By Age Cohort and Percentile Outcome

Table 16 considers how lifetime spending increases depend on our imputed retirement/benefit collection age. Clearly, those retiring earlier have substantially more to gain, both absolutely and in percentage terms, from optimizing. Compare, for example, 45-62 year-olds who retire at 62 with those who retire at 67. For the former group, there is a 19.0 percent median gain in LDS with the absolute amount equalling $291,811. For the later group, the percentage LDS median gain is 8.7 percent with the absolute increase equalling $170,306. The table also shows gains to household heads retiring at age 70 and later. Indeed, the median increase is $89,868. Since SS benefits peak when collected at age 70, these gains arise from optimization of younger spouse/partners' LB.

	Lifetime Res. Lower Threshold (Million USD)	25th	50th	75th	90th	95th	99th
Bottom	0.0	6.1	15.9	27.4	37.0	40.3	50.4
Second	1.0	6.0	13.0	20.7	27.2	31.4	43.2
Third	2.2	5.6	10.1	14.3	18.7	21.2	33.3
Fourth	4.7	2.7	6.2	10.1	13.0	15.5	18.3
Highest	15.1	0.8	1.9	3.3	5.2	5.5	8.9

Table 15: Percent LDS Increase from Optimizing By Total Lifetime Resources Quintile and Percentile Outcome, SCF Households Age 45 to 62

	Age 21 to 44			Age 45 to 62		
Imputed Retirement Age	No. obs.	Median Inc. in PV Disc. Spending	Median Pct. Inc. in PV Disc. Spending	No. obs.	Median Inc. in PV Disc. Spending	Median Pct. Inc. in PV Disc. Spending
50-59	389	242,180	14.1	229	284,445	19.7
60	41	253,654	11.2	51	319,266	21.3
61	67	344,575	13.2	67	241,177	18.9
62	62	244,579	11.0	77	291,811	19.0
63	78	258,941	12.1	115	235,609	17.1
64	76	269,922	11.2	107	216,215	13.8
65	76	241,511	9.9	122	171,773	11.7
66	98	193,379	9.0	139	173,621	10.4
67	87	164,799	6.0	122	170,306	8.7
68	92	129,210	6.0	144	151,562	6.8
69	97	69,740	3.0	136	98,585	6.0
70+	399	105,310	3.2	607	111,665	4.0

Table 16: Benefit from Optimizing Social Security By Age Cohort and Retirement Age

Table 17 considers how long household heads and, if married, spouses/partners should delay taking their retirement benefits. The optimization algorithm recommends that 18.2 percent of household heads and 36.1 percent of spouses/partners delay collection by eight years. Only 32.2 percent of household heads and 15.6 percent of spouses should commence benefits immediately upon retiring. These are cases in which collecting retirement benefits in the future increases lifetime net taxes (taxes net of benefits) by more than the increase in LB. Interestingly, about 4.3 percent of head of households and 1.2 percent of spouses can raise their lifetime spending by taking benefits earlier than their retirement ages.

Years Delayed	Head of Household Count	Head of Household Weighted %	Spouse/Partner Count	Spouse/Partner Weighted %
<0	196	4.3	32	1.2
0	617	32.2	221	15.6
1	93	4.1	41	2.1
2	73	3.3	57	3.5
3	410	18.3	241	13.9
4	140	5.7	91	5.0
5	111	4.7	265	12.6
6	94	4.1	64	4.2
7	103	5.1	98	5.8
8	398	18.2	545	36.1

Table 17: Age 45-62 Individuals By Optimal Years of Delay

Figure 2 shows the remarkable dispersion in absolute LDS increases. The increases are plotted against the household head's age. The red curve marks the median increase, which peaks at roughly $250,000 in the mid forties. At the extreme, some households experience close to a $900,000 rise in LDS. One such case with $749,511 in LDS gains is shown in table 23. In this married-household case, both spouses are high earners who retire and begin collecting their retirement benefit at ages 62 and 63. By both delaying until age 70, they increase their collective present value of SS benefits by a total of $715,678.

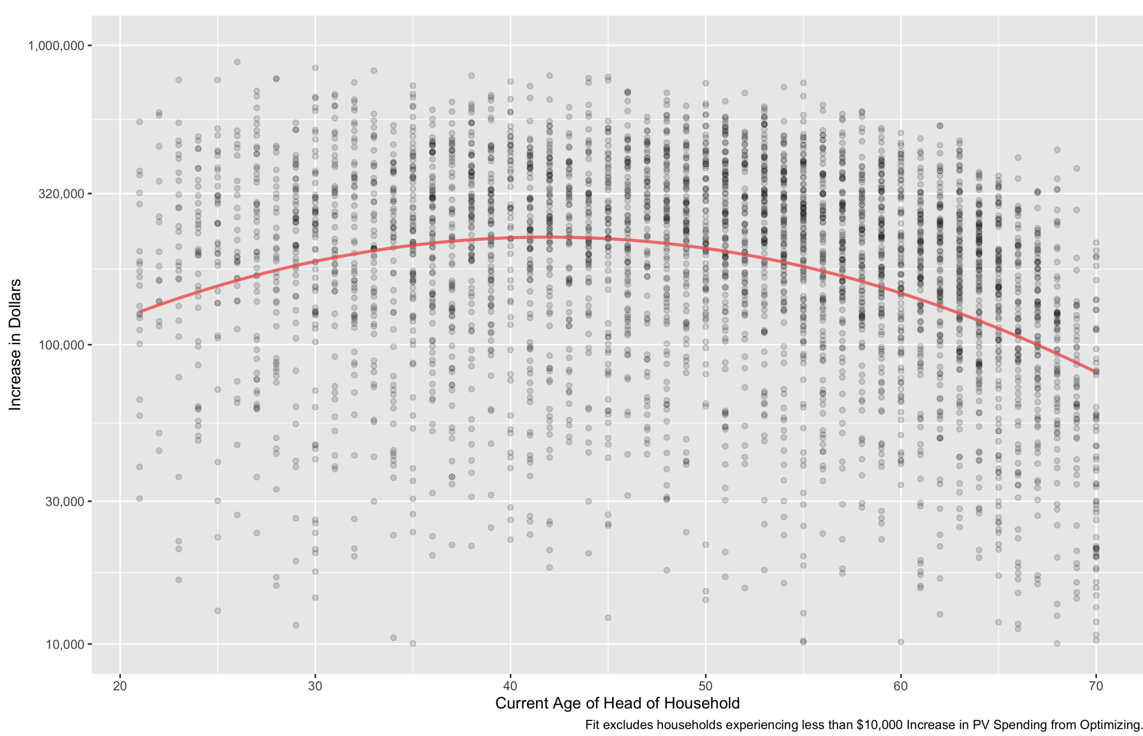

Figure 2: Increase in PV Disc. Spending From Optimizing Social Security By Age

Figure 3 displays the dispersion in optimization-based LDS increases by lifetime resources. The sample here is our age 45-62 households. Figure 4 presents the corresponding percentage increase in LDS. Again, the dispersion is the results is remarkable. But the figures convey two additional key messages. First, the middle class and rich have far more to gain in absolute terms from maximizing lifetime benefits than do the poor. Second, the poor have far more to gain in percentage terms than do the rich.

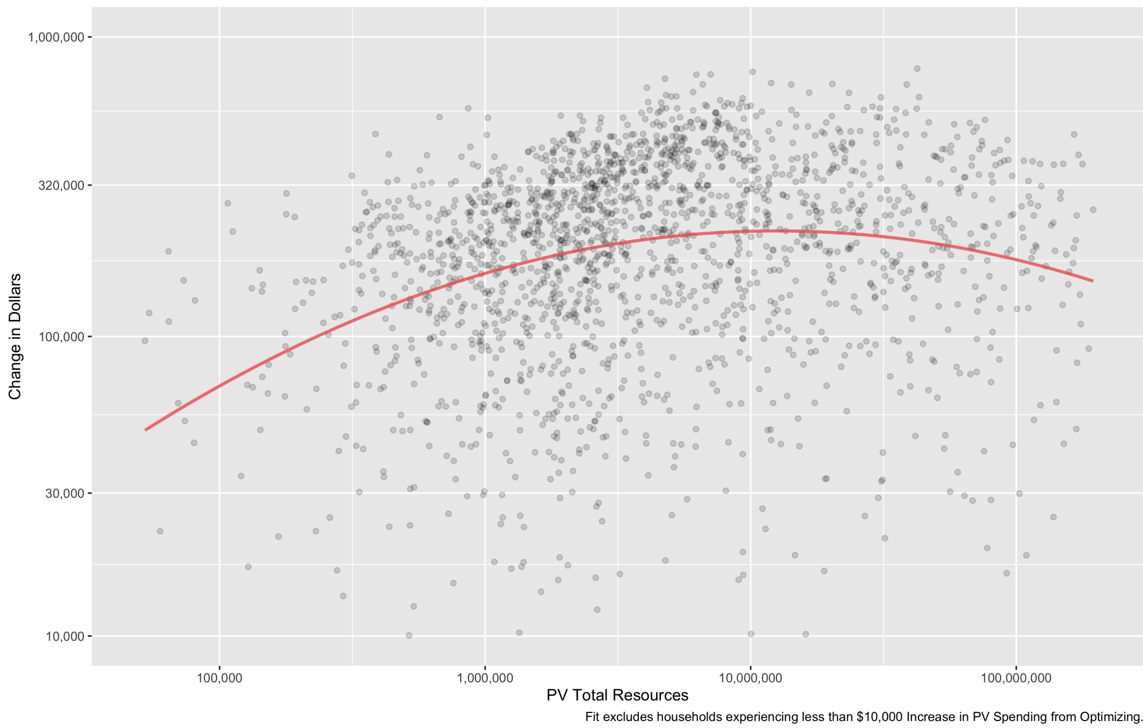

Figure 3: Increase in LDS by Lifetime Resources, Age 45-62

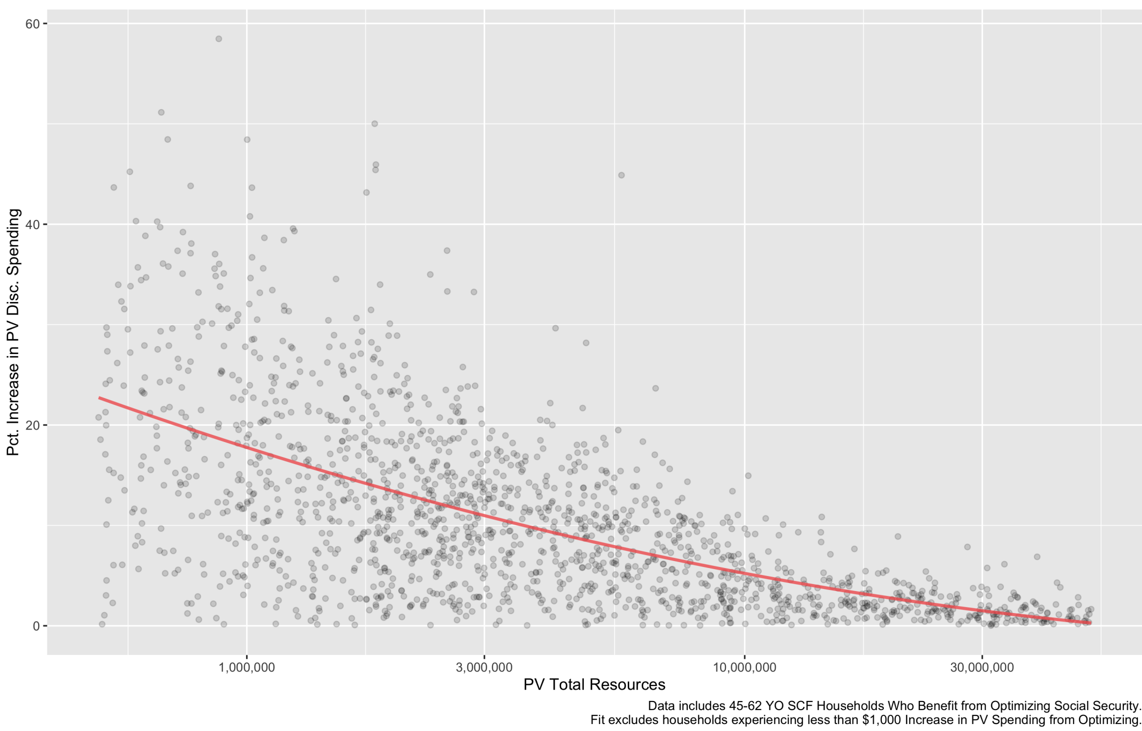

Figure 4: Pct. Increase in LDS By Lifetime Resources, Age 45-62

3.2 Cash-Flow Challenges to SS Optimization

Delaying SS benefit receipts will obviously reduce recipients' cash flows. Table 18 examines this issue. It shows the impact on current-year discretionary spending of optimization for all households and for households benefiting from optimization. Across all households that benefit, median[29] current-year spending drops by 3.3 percent, from $35,814 to $34,625. This rather small response holds for separate age groups. The largest impact on medians is among those age 63 to 69. These households experience an 8.6 percent current-year living standard decline. All other age groups also experience declines in median current-year spending. Hence, SS optimization comes, in general, at a modest short-term discretionary spending cost.

Table 19 details the share of households that are constrained in the baseline and under optimization. Across all households that benefit, 46.3 percent are constrained prior to optimization and 72.1 percent after optimization. Interestingly, these figures are somewhat lower for those age 63 to 69, at 41.1 percent and 63.5 percent, respectively.

Table 20 reports how optimization impacts the share of cash-constrained households across lifetime resource quintiles. The results are for those age 45-62. Optimization entails a major increase in the share constrained in the bottom quintile – from 67.3 percent to 95.5 percent among those that benefit from this decision. In contrast, among those in the top quintile, optimization entails essentially no change in the roughly 1 percent of households that are cash constrained.

Lower resource quintiles are more constrained both before and after optimization. When optimized, almost all of the households (94.3 percent) in the bottom 20 percent become constrained. If we look at households who actually benefit from optimization, this rate goes up to 95.5 percent. Across all households, 83.3 percent in the second resource quintile are constrained, 62.8 percent in third, and only 1.2 percent in the top 20 percent. Of the top quintile, only 1.1 percent are cash-flow constrained at all in the baseline case.

Table 21 reports the duration of cash-flow constraints. For all SCF working households, the baseline average (sample weighted, of course) duration is 9.9 years. For those enjoying a gain from optimization, the average is 9.4 years. Optimization considerably extends the length of constrained spending. For all those benefiting from optimization, the average is 9.4 years before optimization. With optimization, this figure becomes 20.9 years after. For those age 63 to 69, the addition to the length of their spending constraint is 2.7 years. For workers age 45 to 62, the average duration rises from 8.2 years to 16.9 years.

Table 22 sheds additional important light on this matter. It shows the percentage of households whose current-year discretionary spending rises as well as the percentage for whom current-year discretionary spending falls. Across all households that benefit from optimization, 45.0 percent experience an immediate rise in their spending whereas 46.8 percent experience an immediate decline, followed, when they become unconstrained, by an often major rise. These values are quite similar for other age groups.

[29]Here, as elsewhere, medians are computed incorporating sample weights.

	All SCF Households				Households Benefiting from Optimization[30]			
	Baseline	Optimized	Diff	% Diff	Baseline	Optimized	Diff	% Diff
All Households	32,772	31,854	-917	-2.8	35,814	34,625	-1,188	-3.3
Age 21 to 44	31,197	30,871	-326	-1.0	34,492	33,949	-543	-1.6
Age 45 to 62	34,335	33,439	-896	-2.6	38,696	35,982	-2,714	-7.0
Age 45 to 54	38,077	36,299	-1,777	-4.7	41,041	38,080	-2,960	-7.2
Age 55 to 62	31,177	29,418	-1,760	-5.6	34,042	33,062	-980	-2.9
Age 63 to 69	31,206	29,478	-1,728	-5.5	33,490	30,597	-2,893	-8.6

Table 18: Weighted Median Current Year Discretionary Spending by Age Cohort and Optimization Outcome

	All SCF Households			Households Benefiting from Optimization		
	Baseline	Optimized	Diff	Baseline	Optimized	Diff
All Households	46.8	65.3	18.5	46.3	72.1	25.8
Age 21 to 44	60.5	80.6	20.1	57.4	80.3	22.9
Age 45 to 62	40.9	68.4	27.5	37.1	68.6	31.5
Age 45 to 54	38.0	67.7	29.7	34.3	67.5	33.1
Age 55 to 62	44.1	69.1	25.0	40.3	70.0	29.7
Age 63 to 69	44.4	62.9	18.5	41.1	63.5	22.4

Table 19: Percent of Borrowing-Constrained Households by Age Cohort and Optimization Outcome

	All SCF Households Age 45 to 62			Households Age 45-62 Benefiting from Optimization		
	Baseline	Optimized	Diff	Baseline	Optimized	Diff
Bottom	69.5	94.3	24.8	67.3	95.5	28.2
Second	41.6	83.3	41.6	40.8	87.5	46.7
Third	27.2	62.8	35.6	25.7	64.2	38.5
Fourth	8.9	18.7	9.8	8.6	18.8	10.2
Highest	1.1	1.2	0.2	1.1	1.3	0.2

Table 20: Percent of Age 45-62 Borrowing-Constrained Households by Total Lifetime Resource Quintile and Optimization Outcome

[30] Sample contains households who see at least $100 improvement in PV discretionary spending from optimization.

	All SCF Households			Households Benefiting from Optimization		
	Baseline	Optimized	Diff	Baseline	Optimized	Diff
All Households	9.9	18.1	8.2	9.4	20.9	11.5
Age 21 to 44	13.7	29.1	15.4	11.7	29.4	17.7
Age 45 to 62	8.7	16.3	7.5	8.2	16.9	8.7
Age 45 to 54	9.6	18.3	8.7	9.0	18.8	9.8
Age 55 to 62	7.7	14.0	6.3	7.2	14.6	7.4
Age 63 to 69	8.0	10.3	2.3	7.0	9.7	2.7

Table 21: Weighted Average Cash-Flow Constraint Duration in Years

	All SCF Households			Households Benefiting from Optimization		
	Pct. Better	Pct. Unchanged	Pct. Worse	Pct. Better	Pct. Unchanged	Pct. Worse
All Households	32.4	33.9	33.7	45.0	8.1	46.8
Age 21 to 44	35.4	24.9	39.7	40.7	13.6	45.7
Age 45 to 62	39.9	15.9	44.1	45.5	4.2	50.3
Age 45 to 54	40.1	13.3	46.6	44.8	3.2	52.0
Age 55 to 62	39.7	18.9	41.4	46.3	5.3	48.3
Age 63 to 69	42.4	20.0	37.6	50.9	3.8	45.2

Table 22: Distribution of Current Year Discretionary Spending Change From Optimizing

3.3 Case Studies

Tables 23 through 24 illustrates our calculations for two sample observations. Case 1 is a very high earning couple that has, to date, saved relatively little and will retire in their early 60s. Role 1 references the household head and Role 2 the spouse/partner. This couple enjoys a $749,511 increase in lifetime benefits from SS optimization. Both spouses wait to collect until age 70. Their benefits at, for example, age 65 are zero. They'd otherwise total almost $64,000. And at age 75, when they are receiving their age-70 benefit, but for the entire year, their combined annual SS benefits are close to $110,000. This couple is unconstrained. Consequently, their discretionary spending immediately rises, in this case by $16,804 or 15.6 percent.

	Base Case	Optimized	Difference
Role 1 Age	55	-	-
Role 2 Age	50	-	-
Role 1 Retirement Age	63	63	0
Role 2 Retirement Age	58	58	0
Role 1 collection age	63	70	7
Role 2 collection age	62	70	8
Role 1 CY Employment Income	148,588	148,588	0
Role 2 CY Employment Income	428,621	428,621	0
CY Disc. Spending	107,510	124,315	16,804
PV Disc. Spending	4,795,150	5,544,661	749,511
Role 1 PV Social Security	1,048,245	1,359,841	311,596
Role 2 PV Social Security	1,104,881	1,508,963	404,082
R1 Social Security Benefit at Age 65	30,501	0	-30,501
R2 Social Security Benefit at Age 65	33,457	0	-33,457
R1 Social Security Benefit at Age 75	32,564	51,821	19,256
R2 Social Security Benefit at Age 75	33,457	58,914	25,457

Table 23: Income and Social Security Statistics, Case 1

Case 2 references a single respondent whose present value of lifetime SS benefits rises by $84,267 from optimizing. But were they to do so, their LDS would fall. The reason is the loss in Food Stamps, SSI benefits, and Section-8 housing benefits. Hence, in our study, we treat the household as optimizing by not changing their intended collection date.

	Base Case	Optimized	Difference
Role 1 Age	51	-	-
Role 2 Age	-	-	-
Role 1 Retirement Age	67	67	0
Role 2 Retirement Age	-	-	-
Role 1 collection age	67	70	3
Role 2 collection age	-	-	-
Role 1 CY Employment Income	3,319	3,319	0
Role 2 CY Employment Income	-	-	-
CY Disc. Spending	11,134	10,332	-801
PV Disc. Spending	623,631	612,144	-11,487
Role 1 PV Social Security	642,116	726,383	84,267
Role 2 PV Social Security	-	-	-
R1 Social Security Benefit at Age 65	11,611	11,611	0
R2 Social Security Benefit at Age 65	-	-	-
R1 Social Security Benefit at Age 75	15,755	19,537	3,782
R2 Social Security Benefit at Age 75	-	-	-
PV SNAP	102,258	64,854	-37,404
PV SSI	262,478	230,574	-31,903
PV Section 8	479,680	454,382	-25,298

Table 24: Income and Social Security Statistics, Case 2

4 Sensitivity Analysis

This section considers the sensitivity of our results to our assumed real discount rate and maximum age of life.

4.1 Assuming a 2 Percent Real Discount Rate

As comparison of tables 10 and 26 shows, assuming a 2 percent real (5 percent nominal) interest rate reduces the PV increase in median LDS to $99,797, roughly half the amount under our base case. The increase in median LB is $116,488. However, as shown in table 25, collection ages are largely the same as the base case, with about nine in ten (90.7 percent) respondents optimizing by collecting at age 70 and more than 99 percent optimizing by collecting after age 65.

	Head of Household		Spouse/Partner		Total	
	Baseline	Optimized	Baseline	Optimized	Baseline	Optimized
Weighted Average Collection Age	66.0	69.9	63.6	68.6	65.0	69.4
Percent Collecting at 62	21.1	0.0	44.1	0.2	30.2	0.1
Percent Collecting at 70	14.8	97.6	2.9	80.3	10.1	90.7
Percent Collecting after 65	63.4	99.9	36.5	98.6	52.7	99.4

Table 25: Retirement Benefit Collection Age Distribution By Role, SCF Respondents Age 45-62, 2 Percent Real Interest Rate

	No. obs.	Pct. Benefiting From Soc. Sec. Optimization	Median Inc. in PV Disc. Spending	Median Pct. Inc. in PV Disc. Spending	Median Inc. in PV Social Security	Median Pct. Inc. in PV Social Security
All Households	5,250	74.3	56,814	3.9	73,648	10.0
Age 21 to 44[31]	1,567	86.0	77,888	5.2	99,692	16.5
Age 45 to 62	1,926	89.5	99,797	7.0	116,488	13.6
Age 45 to 54	996	90.6	107,735	7.0	130,664	15.9
Age 55 to 62	930	88.4	90,669	7.0	100,315	12.0
Age 63 to 69	789	83.5	58,005	4.9	69,610	8.5

Table 26: Benefit from Optimizing Social Security By Household Type, 2 Percent Real Interest Rate

4.2 Lower Maximum Age of Life

Next, we rerun our optimization for lower maximum ages of life, specifically ages 80, 85, 90, and 95. In this analysis, we exclude households where a person's spouse is already older than the assumed maximum age of life. To put these alternative maximums in context, table 27 displays life expectancy by age and sex for cohorts age 45, 62, and 70 in 2022. Note that today's 45 year-old males have a life expectancy of 81.7. And today's 70 year-old males have a life expectancy of 85.4. For corresponding females, life expectancies are even higher. Hence, a maximum age of life of 80 makes no sense for the population at large. Nonetheless, we include this case, as well as a case with a maximum age of life of 80, to consider how individual households would respond were their actual maximum age of life 80 or were they to convince themselves that age 80 was their maximum age of life.

	Male		Female	
Age in 2022	Additional Life Expectancy	Estimated Total Years	Additional Life Expectancy	Estimated Total Years
45	36.7	81.7	40.4	85.4
62	21.5	83.5	24.4	86.4
70	15.4	85.4	17.6	87.6

Table 27: Conditional Life Expectancy in 2022 By Age and Gender.

As shown in Table 28, assuming a maximum age of life of 80, 12.5 percent of households age 45-62 optimize by collecting at age 70. This is slightly higher than our no-optimization baseline, which entails 10.5 percent collecting at 70. Optimization nonetheless leads to later collection for most households: across all respondents, the retirement-benefit collection age increases by a year, from a baseline of 65.1 to 66.1. In the baseline, 29.5 percent of respondents collect starting at age 62, only 8 percent should do so after optimization even when the maximum age of life is 80. With this maximum lifespan, 82.1 percent of 45 to 62 year old households will benefit from delaying collection. Hence, our findings suggest that, even if household members set an unrealistically low maximum age of life, their actual collection decisions are sub-optimal.

For maximum ages of life of 85, 90, and 95, respectively, 74.4, 86.1, and 90.4 percent, respectively, of all respondents age 45 to 62 optimize by collecting at age 70. And 94.2, 98.5 and 99.3 percent, respectively, should collect after 65. Taken together, these results suggest that the distribution of optimal collection ages is not particularly sensitive to our base case assumption of a maximum age of

[31] Age refers to age of head of household as defined in the SCF.

	Baseline	Maximum Age of Life				
		80	85	90	95	100
Weighted Average Withdrawal Age	65.1	66.1	68.8	69.3	69.4	69.4
Percent Withdrawing at 62	29.5	7.9	2.3	0.5	0.1	0.0
Percent Withdrawing at 70	10.2	12.5	74.4	86.1	90.4	91.6
Percent Withdrawing after 65	54.0	78.7	94.2	98.5	99.3	99.4

Table 28: Collection Age Distribution By Maximum Age of Life, All SCF Respondents Age 45-62

life of 100. Even if respondents only expect to live to 90, more than five-sixth of respondents should nonetheless wait until age 70 to collect, and virtually all should wait until after 65.

Unsurprisingly, LDS gains increase with maximum age of life. As shown in Table 29, at maximum ages of life of 80, 85, 90, and 95, median LDS gains from optimization for households age 45 to 62 are $9,607, $46,186, $94,352, and $138,434, respectively. The corresponding percentage median increases to LDS are 0.7, 3.1, 5.8, and 8.3 percent. Again, the base-case (maximum age of life equals 100) median percentage increase is 10.2 percent. Hence, even if household members only expect to live to 90, the median household still leaves close to $100,000 on the table.

	Median Increase in PV Disc. Spending					Median Pct. Increase in PV Disc. Spending				
Maximum Age of Life	80	85	90	95	100	80	85	90	95	100
All Households	4,535	25,332	57,148	85,055	116,379	0.3	1.5	3.4	4.9	6.3
Age 21 to 44[32]	10,031	44,369	97,803	147,977	193,925	0.4	2.2	4.8	6.9	8.5
Age 45 to 62	9,607	46,186	94,352	138,434	182,370	0.7	3.1	5.8	8.2	10.2
Age 45 to 54	11,339	54,130	108,538	161,075	213,844	0.7	3.1	5.8	8.3	10.4
Age 55 to 62	8,029	38,494	79,447	116,397	151,962	0.7	3.0	5.9	7.7	9.5
Age 63 to 69	1,229	18,571	43,225	65,692	92,218	0.1	1.6	3.6	5.0	6.3

Table 29: Benefit from Optimizing Social Security By Maximum Age of Life

The assumed maximum age of life interacts with cash flow constraints. Absent optimization, shorter assumed maximum age of life leads to greater cash flow constraints, as retirement accounts are withdrawn and spent over a shorter interval. This is shown in table 30. Assuming age 100 is the maximum age of life, 40.9 percent of households age 45 to 62 are ever constrained. Assuming a maximum age of life of 80, 49.2 percent are constrained.

As shown in table 30, cash-flow constraints arising from optimization increase with the assumed maximum age of life. Optimization increases the share of 45 to 62 year old households that are constrained by 7.3 percentage points, assuming a maximum age of life of 80. Assuming a maximum of 90, the share increases by 25.9 percentage points, only slightly lower than the increase of 27.5 percent points in our base case. The story is similar for the duration of cash-flow constraints. Optimization extends the weighted average constrain duration by 1.4 years among households age 45 to 62, assuming a maximum age of life of 80. Assuming a maximum of 90, the average constrained duration increases to 7.1 years. To recall, with a maximum age of 100, the average duration is 7.5 years.

[32] Age refers to age of head of household as defined in the SCF.

Maximum Age of Life	80			85			90			95			100		
	Base.	Opt.	Diff	Base.	Opt.	Diff	Base.	Opt.	Diff	Base.	Opt.	Diff	Base.	Opt.	Diff
All Households	51.9	57.0	5.1	49.1	65.0	15.9	47.2	65.3	18.0	46.6	65.2	18.6	46.8	65.3	18.5
Age 21 to 44	68.4	75.1	6.7	65.8	83.3	17.5	62.6	83.4	20.8	60.5	81.8	21.4	60.5	80.6	20.1
Age 45 to 62	49.2	56.5	7.3	45.9	69.1	23.2	43.9	69.8	25.9	42.6	69.2	26.5	40.9	68.4	27.5
Age 45 to 54	48.7	57.4	8.7	43.0	69.5	26.5	40.8	69.4	28.5	39.9	68.7	28.8	38.0	67.7	29.7
Age 55 to 62	49.8	55.6	5.8	49.0	68.5	19.5	47.3	70.3	23.0	45.7	69.7	24.0	44.1	69.1	25.0
Age 63 to 69	43.6	44.7	1.1	44.5	58.0	13.5	44.6	60.3	15.7	44.8	62.7	17.9	44.4	62.9	18.5

Table 30: Percent of Borrowing-Constrained Households by Age Cohort and Maximum Age of Life

Maximum Age of Life	80			85			90			95			100		
	Base.	Opt.	Diff	Base.	Opt.	Diff	Base.	Opt.	Diff	Base.	Opt.	Diff	Base.	Opt.	Diff
All Households	9.0	10.8	1.8	8.6	15.5	7.0	8.7	16.9	8.2	9.1	17.6	8.4	9.9	18.1	8.2
Age 21 to 44	14.8	18.2	3.4	13.7	27.2	13.5	13.3	29.0	15.7	13.1	29.2	16.1	13.7	29.1	15.4
Age 45 to 62	8.0	9.5	1.4	8.1	13.7	5.6	8.2	15.3	7.1	8.5	15.9	7.4	8.7	16.3	7.5
Age 45 to 54	9.5	11.7	2.1	9.1	16.3	7.2	8.9	17.6	8.7	9.4	18.3	8.8	9.6	18.3	8.7
Age 55 to 62	6.3	7.0	0.7	7.0	10.8	3.8	7.4	12.7	5.3	7.5	13.3	5.8	7.7	14.0	6.3
Age 63 to 69	3.7	3.6	-0.1	4.7	5.9	1.2	5.8	7.6	1.7	7.2	9.6	2.4	8.0	10.3	2.3

Table 31: Weighted Avg. Cash-flow Constraint In Years by Age Cohort and Maximum Age of Life

5 Budgetary Costs of Optimization

How much would it cost Social Security were all households to optimize their lifetime benefit collection decisions? To examine this question, we ran TFA adoption SS 2022 Trustees' Report (2022) assumptions, namely 1 percent real wage growth over and above age/experience-based growth, 2.4 percent inflation, and a 2.3 percent real rate of return. This analysis also considers all potential survivor paths. i.e., we follow Social Security's Trustees in doing an actuarial, rather than an individual valuation. We also include all SCF households, from age 21 through age 99. Finally, we eliminate our sample selection that excludes those with less than $5,000 in current-year discretionary spending. We do so to provide as comprehensive and representative a data set as possible. These households may have other sources of support in the short term and still be eligible for social security.

Under these assumptions, applying SCF household weights, we obtain a baseline social security benefit trajectory for SCF cases representing 126.9 million U.S. households.[33] For these households, the sum of current-year OASI benefits from the TFA is $1.03 trillion, which is slightly higher than the $0.99 trillion reported in the Trustee report. Although there are a number of reasons the figures should differ somewhat, the fact that they are close is encouraging.[34]

Optimization results are summarized in table 32. Optimizing increases the present value of remaining lifetime benefits of all SCF households from $56.4 trillion to $59.8 trillion, or about a 6 percent increase. The absolute difference – $3.4 trillion – represents the minimum increase in SS long-term fiscal gap (the system's "infinite horizon liability"), currently 61 trillion, that would arise from optimization. Assuming that workers who enter the labor force after 2022 gain a similar proportional LB through optimization, the system's unfunded liability would rise by roughly $6 trillion, i.e., by

[33]This represents over 99 percent of U.S. households as of 2020.

[34]The present value of benefits across all SCF households is $56.4 trillion. The Trustees report (SSA 2022) a $95 trillion PV in benefits, but over a 75-year window. Hence, there are people who are not in our data set – current 10 year-olds, for example – who will collect over this period.

roughly 10 percent, were all household to optimize their benefit collection through time.

	Current Year OASI Benefits	PV Baseline Benefits	PV Optimized Benefits	Diff	Pct. Diff
All Households	1.03	56.4	59.8	3.4	6.0
Age 45 to 62	-	37.8	40.7	2.9	4.9

Table 32: Total PV Benefits By Age Group in Trillion Dollars

6 Conclusion

Social Security is a critically important component of retirement-income security. Unfortunately, hundreds of millions of workers are making arguably highly inappropriate collection decisions - decisions that significantly reduce their lifetime Social Security benefits and, consequently, their lifetime spending. We find that virtually all U.S. workers age 45-62 would benefit from waiting until age 65 to collect. More than 90 percent would benefit from waiting until age 70. Yet only 10.2 percent do so, given our assumption that retirement-benefit collection begins at retirement. These age decisions are robust to alternate assumed maximum ages of life. Even assuming an unrealistically low maximum age of 85, three-quarters of workers would to best by waiting until age 70.

For those 45-62, the associated median household loss in lifetime discretionary spending is $182,370. The 75th percentile increase is $289,893. As for the 25th percentile, the gain is $69,493 – still remarkably large. These increases imply substantial percentage changes in living standards per household member. The median increase in this welfare metric is 10.4 percent. The 25th and 75th percentile increases are 3.2 and 17.2 percent, respectively.

Young as well as older workers can gain from postponing Social Security benefit collection. Such delay does, however, come at a higher cost – far more workers becoming cash-flow constrained. On the other hand, the typical temporary living standard reduction is small. A modicum of workers don't gain from waiting to collect their retirement benefits. Such workers lose benefits from other transfer programs and face higher lifetime taxes, with the present value net tax increase exceeding the gain in lifetime Social Security benefits.

The increase in lifetime spending associated with Social Security lifetime-benefit maximization is typically smaller, if not considerably smaller than the increase in lifetime benefits. The reason is our fiscal system, which limits most households' living-standard gains from optimization by extracting higher taxes and reducing non-Social Security benefits.

There is a exceptionally large dispersion in lifetime-benefit optimization gains, ranging from several thousands dollars to close to $900,000. The percentage remaining lifetime spending gains are higher, on average, for those with low incomes. Take the poorest 20 percent of 45 to 62 year-olds. Their median gain from SS optimization is 15.9 percent. And one in four of this group experience a 27.4 percent or larger increase in lifetime spending.

All this said and shown, the precise gains and cash-flow constraints are highly dependent on household characteristics. Hence, one strategy doesn't fit all. Moreover, our results may overstate the gains from Social Security optimization given our maintained assumption that workers take their Social Security benefits as soon as they retire. On the other hand, we may understate the optimization gains since we lack the data (the earnings records on ex- or deceased spouses) needed to optimize lifetime benefits for divorced spouses, widows, and divorced widows.

Finally, we estimate, using Social Security macroeconomic assumptions, a 6 percent increase in the actuarial present value of benefits owed to all current adult Americans were they all to optimize. That translates into a $3.4 trillion increase in Social Security's current colossal $61.8 trillion unfunded liability[35]. But if we assume future generations would also optimize, another $3 trillion or so could easily be added to this figure. This reflects the fact that the system's reductions for early retirement and Delayed Retirement Credits are more than actuarial fair based on current demographic and economic conditions.

Our bottom line? Social Security lifetime benefit optimization represents a clear means of improving the welfare of retirees. High-income retirees have the most in absolute terms to gain from maximizing their lifetime benefits. But low-income retirees can raise their living standards by a far higher percentage. Whether rich, middle-class, or poor, what's required is simply patience – waiting to apply for the right benefits at the right time.

[35] See https://www.ssa.gov/OACT/TR/2022/VI$_{Fi}nfinite.html$1000194

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