CENTER *for* RETIREMENT RESEARCH *at* BOSTON COLLEGE

WHAT IS THE INSURANCE VALUE OF SOCIAL SECURITY BY RACE AND SOCIOECONOMIC STATUS?

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CRR WP 2023-14
September 2023

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Abstract

Social Security's design is known to help Black individuals and those with lower socioeconomic status due to the progressive benefit formula, but this effect is partially offset by the shorter life expectancies of these groups. However, valuing Old-Age and Survivors Insurance (OASI) solely on expected benefits neglects the program's longevity insurance value, which favors individuals facing greater uncertainty over their lifespans. This paper uses a structural model to measure the value of the program's longevity insurance for stylized households that differ by race, education, and marital status. Wealth equivalence calculations indicate that all stylized households value OASI at least as much as their lifetime OASI tax contributions. The results also indicate that Black households derive more longevity insurance value from OASI than their White counterparts. Hence, OASI increases racial equity in retirement even more than suggested by measures based on expected benefits alone.

The paper found that:

- In a simple lifecycle model, all stylized household types value OASI at least as much as their lifetime contributions to the program.
- Black households value OASI more highly than their White counterparts, both overall and in terms of excess valuation over expected benefits.
- Generally, the valuation of OASI beyond expected benefits strongly correlates with the unpredictability of longevity.

The policy implications of the findings are:

- At least in this simple model, all stylized households would be willing to pay higher FICA taxes to fund the current OASI system.
- Black households stand to lose more than White ones from proportional reductions in benefit generosity.

Introduction

Because of its progressive benefit structure, which helps those with lower lifetime earnings more, Social Security is the most important federal program for improving equity by race and socioeconomic status (SES).[1] In particular, the Old-Age and Survivors Insurance (OASI) component greatly equalizes economic outcomes in retirement. On the other hand, the nature of OASI as an annuity helps those with lower mortality probabilities, who tend to be White and high-SES.

Previous work documents some of the racial and SES disparities in the expected value of Social Security benefits. The results show that, due to lower life expectancy, Black workers and those with lower education receive lower expected lifetime benefits than Whites and those with more education, all else equal (Sanzenbacher and Ramos-Mercado 2016). In contrast, the progressive benefit formula provides greater rates of return on contributions for groups with lower lifetime earnings. Thus, Black and lower-SES workers can expect to receive more bang for every buck they put in, assuming no difference in mortality rates across groups (Clingman, Burkhalter, and Chaplain 2022b).

The literature on racial and SES disparities in OASI's expected benefits, however, neglects the insurance value of the program, which is larger when the dispersion of longevity is greater (Brown 2002). Recent work has shown that longevity dispersion is greater for Black households and those with low education, even as they have lower life expectancies than others (Sasson 2016 and Wettstein et al. 2021).

This project estimates the value of OASI, including the value of the program's longevity insurance by race, education, and marital status. The exercise involves calculating how much more wealth households would need to be as well off in a world with no OASI program as they are with the program – the "wealth equivalence" of OASI. The analysis is based on a simple lifecycle model that features survival uncertainty. The model also accounts for group-specific mortality rates, pension income, wealth, and OASI benefits, which include survivor benefits. The ratio of wealth equivalence to lifetime OASI contributions is then compared to OASI's money's worth, a measure that neglects the program's insurance value.

[1] See Kijakazi, Smith, and Runes (2019); Clingman, Burkhalter, and Chaplain (2022a).

The results show that: 1) the wealth equivalence of OASI is at least as large as the lifetime OASI payroll taxes paid for all household types, regardless of race, gender, education, or household composition, implying they all prefer a world in which OASI exists to one in which it does not;[2] 2) Black households derive more longevity insurance value from OASI than their White counterparts, implying that OASI plays a more important role in equalizing retirement security across race than what is suggested by measures based on expected benefits; and 3) singles derive more longevity insurance value than couples, who are already partially self-insured against longevity risk through intra-family resource pooling (as in Kotlikoff and Spivak 1981).

The rest of the paper is structured as follows. Section 2 discusses the literature on OASI insurance. Section 3 presents the model and the wealth equivalence measure. Section 4 discusses the data. Section 5 presents the results, and Section 6 concludes that OASI increases racial equity despite the lower life expectancy of Black beneficiaries, particularly when accounting for the insurance value of the program.

Literature

The OASI program is the primary source of income for most retirees in the United States. In 2015, 75 percent of families got 50 percent or more of their income from Social Security, with 14 percent relying on Social Security for 90 percent or more.[3] It is also an expensive program, funded by a 10.6-percent tax on almost all labor earnings in the country.[4] Since the program has such a significant role in public policy and in household well-being, it is important to assess its effectiveness.

Such assessments are commonly done in the spirit of money's worth: how many dollars can an individual expect to receive in present value for every dollar they contribute to the system?[5] Multiple papers have assessed Social Security's money's worth (for example, see Geanakoplos, Mitchell, and Zeldes 1998; and Ozawa and Kim 2001). Also, the Social Security Administration

[2] Only low-education married White households are essentially indifferent between having and not having the OASI program.
[3] Depending on the survey, the share of recipients receiving 90 percent or more of their income from Social Security is as high as 26 percent (Dushi and Trenkamp 2021).
[4] This tax rate is for employees and employers combined; each party pays 5.3 percent (U.S. Social Security Administration 2023).
[5] Similar approaches include calculating OASI's internal rate of return or "break-even" analysis for when to claim benefits.

(SSA) annually provides OASI money's worth calculations for stylized households (for example, see Clingman, Burkhalter, and Chaplain 2022a).

These assessments usually characterize households by their career-average earnings. However, earnings alone are insufficient for determining the racial impacts of the OASI program because racial differences in mortality and other household resources persist even for households with similar earnings.[6] Furthermore, all the approaches relying on the expected value of benefits neglect the *insurance* value of the program. OASI, being a life annuity, offers households protection against outliving their resources, and the value of this protection is commensurate with how unpredictable longevity is.

The standard method of assessing insurance value is through wealth equivalence: how much wealth would a household be willing to give up to move from a world without insurance to one where insurance is available. A large literature examines the insurance value of OASI using structural models. While some papers consider idiosyncratic uncertainty, such as random realizations of individual productivity or longevity (Imrohoroglu et al. 1995, Huggett and Parra 2010, and Jones and Li 2020), others consider aggregate returns and wage uncertainty (Kruger and Kubler 2006 and Olovsson 2010). Combining both idiosyncratic and aggregate uncertainty, Harnberg and Ludwig (2020) suggest that Social Security offers valuable insurance, and the program's overall insurance value exceeds the sum of the insurance value against each uncertainty in isolation. The insurance value of OASI by SES, however, has not been examined using the wealth equivalence method.

This paper merges the literatures on money's worth and wealth equivalence approaches and uses a structural model to simultaneously examine OASI's insurance value and its money's worth by SES and race.[7]

Methodology

This section details the methodology for calculating the value of OASI in two ways. The first accounts for the program's insurance value by measuring its wealth equivalence, and the second captures its money's worth.

[6] Although racial mortality gaps conditional on income may be shrinking (Chetty et al. 2023).
[7] Our methodology is similar to Wettstein et al. (2021), which simultaneously examined the insurance value and the money's worth of different types of annuities by SES and race.

The Lifecycle Model

To calculate the wealth equivalence of OASI, a lifecycle model is constructed and calibrated for stylized retired households that differ by race, educational attainment, and marital status. Two racial groups (Black and White) and two educational attainment levels (low and high) are considered. Each household is made up of either a single individual or a couple. Singles are either male or female. In couples, the spouses are assumed to be a man and a woman of the same race, education, and age. Thus, we consider 12 stylized households (8 singles by gender, education, and race; and 4 couples by education and race).

Education is defined in relative terms. That is, the classification of individuals to low- and high education is done in relation to the median education for that individual's race-gender-cohort. This follows an approach similar to Leive and Ruhm (2021) and Wettstein et al. (2021).[8] This approach accounts for possible selection on unobservable characteristics into higher education across race, gender, and cohort.

Each stylized household is assigned the OASI benefits and tax contributions, financial assets, annuitized retirement income (from defined benefit (DB) plans and annuities), and mortality rates for that type based on empirical data (see the Data and Calibration section). Households are all assumed to retire at age 65 in 2020 and live up to age 115 at most.

Households hold an initial wealth a_{65} at age 65 and aim to maximize their expected lifetime utility U facing uncertainty in the time of death. Households are assumed to have inter-temporally separable preferences and the instantaneous utility function is of the CRRA form:

$$u^j(c) = \frac{c^{1-\gamma}}{1-\gamma}\mathbb{I}[j = single] + 2\frac{(^c/_\zeta)^{1-\gamma}}{1-\gamma}\mathbb{I}[j = couple], \quad (1)$$

where j indicates the household's marital status, γ is the coefficient of relative risk aversion, ζ is the consumption equivalence scale for couples, and $\mathbb{I}[\cdot]$ is an indicator taking the value 1 if the condition is true and 0 otherwise. Assuming the household has no bequest motives, the expected lifetime utility is given by:

$$U = \sum_{t=65}^{115} \beta^{(t-65)} \left(P_t^m * \frac{{c_t}^{1-\gamma} - 1}{1-\gamma} + P_t^f * \frac{{c_t}^{1-\gamma} - 1}{1-\gamma} + P_t^{both} * 2 * \frac{(c_t/\zeta)^{1-\gamma} - 1}{1-\gamma}\right), \quad (2)$$

[8] Specifically, the educational attainment for each race-gender group is obtained by dividing respondents into those with below- and above-median educational attainment. Those with precisely median education are assigned to "high" and "low" educational attainment randomly.

where β is the household's discount factor and *t* is age. P_t^m, P_t^f, and P_t^{both} denote, respectively, the probabilities that only a male, only a female, or both spouses survive through age *t*. At any given age *t*, only one of the three probabilities takes positive values: Singles have $P_t^m > 0$ or $P_t^f > 0$ and $P_t^{both} = 0$; couples starts with $P_{65}^{both} = 1$ and in following periods remain a couple if both spouses survive ($P_t^{both} > 0$) or become a single household ($P_t^m > 0$ or $P_t^f > 0$) if one of the spouses dies. For couples, the mortality process is assumed to be independent between spouses. In terms of the model's parameters the analysis uses the following values: $\gamma = 4$, $\zeta = 1.5$, and $\beta = 0.98$.[9]

The budget constraint is described as the law of motion for assets and the liquidity constraints:

$$a_{t+1} = (1+r)\, a_t + I_t + SS_t - c_t \tag{3a}$$

$$a_t \geq 0, \forall t \tag{3b}$$

where a_t is assets at age t, *r* is the interest rate, I_t includes annuitized incomes from DB pensions and annuities, and SS_t is the household's Social Security benefits (including survivor benefits after one of the spouses dies). The model does not consider stochastic returns on assets and uses a constant interest rate of 2 percent.[10] The analysis also does not consider taxes on OASI benefits, annuity benefits, capital gains, or consumption.

The problem is solved recursively using dynamic numerical methods. Suppressing the indices for race and education, the recursive formulation for singles at age *t* is

$$V^{S,g}\left(a_t, I_t^g, SS_t^g\right) = \max_{c_t}\left\{u^{single}(c_t) + s_{g,t}\beta E\left[V^{S,g}\left(a_{t+1}, I_{t+1}^g, SS_{t+1}^g\right)\right]\right\}, \tag{4}$$

where $g \epsilon \{m, f\}$ denotes gender, I_t^g is annuitized income, SS_t^g is OASI benefits, and $s_{g,t}$ denotes the probability of surviving to the next period *t+1* conditional upon surviving through age *t* ($s_{g,115} = 0$ by assumption). Similarly, the recursive formulation for couples is

[9] The value $\zeta = 1.5$ is the OECD equivalence scale for two-adult households.
[10] This analysis does not consider the general equilibrium effects of removing the OASI program, which would affect the households' lifetime saving, the interest rates, and the bequest transfers. See Caliendo et al. (2014) for more details.

$$V^C(a_t, I_t^m, I_t^f, SS_t^m, SS_t^f) = \max_{c_t} \left\{ \begin{array}{c} u^{couple}(c_t) + s_{m,t} s_{f,t} \beta E[V^C(a_{t+1}, I_{t+1}^m, I_{t+1}^f, SS_{t+1}^m, SS_{t+1}^f)] \\ + s_{m,t}(1 - s_{f,t}) \beta E[V^{S,m}(a_{t+1}, I_{t+1}^m, SS_{t+1}^m)] \\ +(1 - s_{m,t}) s_{f,t} \beta E[V^{S,f}(a_{t+1}, I_{t+1}^f, SS_{t+1}^f)] \end{array} \right\}. \quad (5)$$

Wealth Equivalence of OASI Benefits

Using the life-cycle model constructed above, the analysis calculates the wealth equivalence of OASI for each of the 12 stylized households following the steps below:

1. We first calculate lifetime utility at age 65 for the household with OASI benefits. We denote this value by $U(a_{65})$, where a_{65} is the household's assets at age 65.
2. We repeat this calculation in a world without OASI benefits ($SS_t = 0$ for all t). We denote the lifetime utility in this world by $U^*(a_{65})$.
3. We then find an asset value W such that $U^*(a_{65} + W) = U(a_{65})$. W is defined as the wealth equivalence of OASI benefits – the amount of additional wealth at age 65 the household would have needed to be just compensated for not having the OASI benefit. This value can also be thought of as the amount an individual would be willing to pay for the existence of the OASI program.

This wealth equivalence W is then compared to the total sum of OASI payroll taxes paid by the household members throughout their working lives inflated by a risk-free rate of return, which is calculated as:

$$PVC_{65} = \sum_{t=20}^{64} (\tau_t * w_t * (1 + r)^{65-t}), \quad (6)$$

where w_t is the earnings subject to Social Security payroll taxes at age t and τ_t is the OASI portion of the payroll tax.[11] The risk-free rate r is assumed to be 2 percent per year, which is consistent with the interest rate used in the lifecycle model.[12] The ratio of the wealth

[11] Since OASI tax rates have changed through the years, to make respondents in the HRS comparable regardless of when they were born, we adjust each respondent's wages using the AWI to match a worker born in 1955 who retires at age 65 in 2020. The tax rates experienced by someone born in 1955 for each year of their working lives are then applied to each respondent's wages, including both employee and employer contributions. For tax rates, see U.S. Social Security Administration (2023).

[12] The total lifetime OASI tax can be understood as the additional amount of wealth the household would have owned at age 65 had they invested the tax payments in an IRA earning a risk-free rate each year. Using the risk-free rate, rather than alternatives such as the expected real return of a portfolio invested in some asset mix, reflects the risk-free nature of the OASI benefits.

equivalence to the lifetime total OASI tax contribution, which is referred to below as the W-to-C ratio, is calculated for each type of household. A W-to-C ratio greater than 1 means that the household values OASI benefits (including insurance value) more than what they contributed.

The Money's Worth of OASI Benefits

The money's worth of OASI is defined as the ratio of the expected present value of OASI benefits (EPVB) to the present value of the OASI tax payments. For a single household, the money's worth of OASI benefits is given by:

$$MW = \frac{EPVB_{65}}{PVC_{65}}, \tag{7}$$

$$where\ EPVB_{65} = \sum_{t=65}^{100} \frac{P_t * SS_t}{(1+r)^{t-65}}. \tag{8}$$

For couples, the money's worth of OASI is calculated using the sum of both spouses' EPVB and present value of contributions (PVC).

Both the W-to-C ratio and the money's worth measure the lifetime value of OASI benefits relative to the corresponding tax payments, while only the former accounts for the longevity insurance value of OASI and is therefore expected to be greater than the latter. Thus, comparing these two measures sheds light on the extent to which neglecting the insurance value would underestimate the value of OASI to various types of households.

Data and Calibration

Calculating the W-to-C ratio and the money's worth of OASI for the 12 stylized households requires the following information for each household: 1) Social Security benefits and tax payments; 2) household assets at age 65 and annuitized retirement income; and 3) mortality. This section describes how these model inputs are developed.

The data used to construct the stylized households' income and financial characteristics are from the *Health and Retirement Study* (HRS) linked to administrative earnings records, which contain detailed year-by-year earnings for each respondent. This combined dataset provides individuals' OASI contributions, their Average Indexed Monthly Earnings (AIME), and their other resources.

The stylized households analyzed in the lifecycle model correspond to the cohort that turned age 65 in 2020. However, using only individuals at age 65 in the 2020 wave of the HRS results in a small sample size for many household types (especially for Black households) and therefore leads to unreliable estimates of household characteristics. To address this issue, the sample used to characterize households is expanded by: 1) including individuals between the ages of 63 and 67; and 2) including additional HRS waves between 2000 and 2020 (11 waves in total). In order to make individuals who are from years prior to 2020 and at ages different from 65 comparable to the target cohort (turning 65 in 2020), their earnings are adjusted using the AWI and their assets are adjusted using the CPI.

OASI Benefits and Taxes

Using these administrative earnings records, we estimate Social Security benefits (including survivor and spousal benefits for married couples) for each person based on their lifetime earnings as if they had retired at 65. These amounts are averaged within each combination of race, gender, marital status, and education group, and then the results are assigned to the corresponding stylized household.

We then calculate lifetime OASI employee and employer contributions for each stylized household. The total OASI tax contribution's present value in 2020 dollars is calculated using equation (6) for each individual and the group means are assigned to the stylized households. The annual OASI tax rates experienced by the cohort turning 65 in 2020 over their careers are applied to all individuals, including those from the HRS data prior to 2020.

The annual OASI benefits and lifetime OASI contributions by race and SES are presented in columns (1) and (2) of Table 1. These numbers show an important intermediate result: that households pay a substantial price for the OASI system across all race, education, gender, and household composition groups. For example, an average married couple turning 65 in 2020, regardless of race or income, has paid half a million dollars or more into the system over their careers. Such an amount dwarfs the typical financial assets that households have at the eve of retirement (Biggs, Munnell, and Chen 2019).[13] Thus, the question of what beneficiaries get out of the system is of enormous importance.

[13] Households ages 55-64 had saved $136,000 in DC accounts in 2014, conditional on having any DC balances. At the same time, only about three quarters of this age group had ever contributed to a DC account.

Assets and Annuitized Income

Next, we calculate each respondent's reported assets: their total wealth comprised of housing wealth, IRA/DC wealth, and non-DC wealth,[14] and annual income from DB plans and annuities. These amounts are inflated to 2020 dollars with CPI, then averaged for each marital status-race-gender-education group.

The results are shown in columns (3) and (4) in Table 1. The comparison to lifetime OASI contributions is instructive, with most household types having contributed on average more to OASI than they had accumulated outside the OASI system in total. The only exceptions to this rule are high-education White households. This pattern further underscores that not only are the stakes high for understanding the value of OASI benefits, but these stakes are particularly high for Black and below-median education households.

Mortality

The calculation of mortality rates by race and SES follows a two-step approach used in Wettstein et al. (2021). The first step calculates annual mortality rates for each SES group in 2020 using mortality data from the *National Vital Statistics System* (NVSS) and demographic and SES information from the *American Community Survey* (ACS). The second step adjusts the annual mortality rates in 2020 for future morality improvements based on SSA's cohort mortality tables in order to obtain cohort life tables for the stylized individuals.[15]

How long a beneficiary is expected to live is a key determinant of the value of OASI. Using the cohort mortality rates estimated above, we calculate life expectancy at age 65 for Black and White individuals by gender and education. We define life expectancy of couples as the expected lifespan of the last survivor. The results are shown in the first two columns of Table 2.

As expected, White households generally have a longer life expectancy than Black ones within each gender-education group (except for low-education females, where Black and White individuals have a similar life expectancy). The racial disparity in life expectancy is larger for males (more than 2 years) compared to females (1.5 years or less). Within racial groups, a

[14] Housing wealth is the sum of all real estate wealth reported. IRA/DC wealth is the combined net balance of all IRA, Keogh and defined contribution plans. Non-DC wealth is the sum of all other wealth, including stocks, bonds, checking and savings accounts.
[15] For details on the methodology, see Wettstein et al. (2021).

substantial gap in life expectancy exists between education levels (except for Black females, where the low and high education groups have similar life expectancy). These patterns are generally consistent with the existing literature.[16]

In addition to the differences in life expectancy, racial and SES groups also differ in their *uncertainty* of longevity, which we measure by the standard deviation of lifespan calculated using the estimated mortality rates (see the last two columns of Table 2). Black and low-education individuals, who tend to have lower mean lifespan compared to their White and high-education counterparts, also face greater variance around their mean lifespans (except for low education males). The difference in lifespan uncertainty is especially large for females and couples.[17]

The disparity in the uncertainty of longevity is further illustrated in Figure 1, which shows the probability distributions of the age at death for different racial and SES groups. The lifespan distributions for Black households are more dispersed across ages compared to White ones. Interestingly, the figure shows that Black households (especially single females) are more likely to have a very short (less than 75 years) and a very long (greater than 100 years) lifespan compared to White households, reflecting higher Black mortality rates at lower ages and lower rates at higher ages.[18]

Results

Below we first describe and compare the money's worth and the W-to-C ratio of OASI calculated for the 12 stylized households. We then examine the implications of considering longevity insurance value in assessing the role of OASI in increasing economic equity by race.

[16] Substantial evidence points to large gaps in life expectancy by various dimensions of SES, such as race, income, and education (see Lleras-Muney 2005; Cutler, Deaton, and Lleras-Muney 2006; Case and Deaton 2015; Chetty et al. 2016; and Galama, Lleras-Muney, and van Kippersluis 2018). Increasingly, the evidence also points to gaps by income growing larger over time, though this tendency has not been explored in the most recent years (see Waldron 2007; Meara, Richard, and Cutler 2008; Bound et al. 2014; Sasson 2016; and Auerbach et al. 2017). At the same time, gaps by race may be shrinking (Chetty at al. 2023).

[17] Racial gaps in mortality dispersion have been previously noted by Brown (2002), Sasson (2016), and Wettstein et al. (2021).

[18] The lower mortality rates of Blacks at higher ages may be partly attributable to data quality issues. While Black individuals generally have higher mortality rates compared to White individuals, their mortality rates show a crossover at higher ages in all gender-education groups, a pattern that has long been documented in demographic literature. One possible explanation for the crossover is the "survival of the fittest" among Black individuals, while substantial evidence also shows the crossover can be attributed to the poor quality of vital statistics and Census data used to estimate Black mortality (see Elo and Preston, 1997). For lack of a well-defined alternative, the analysis here takes mortality data at face value.

Money's Worth

Table 3 shows the money's worth and the W-to-C ratio of OASI for the stylized households as well as the components used in the calculations, namely the expected present value of OASI benefits, the wealth equivalence of OASI derived from the lifecycle model, and the lifetime OASI payroll tax contribution.

As the OASI program is intended to be actuarially balanced for the general population, the money's worth ratios for the stylized households, which are characterized using group means, vary around 1 as expected, and range from 0.8 to 1.3. The results are generally comparable to the money's worth ratios for the general population calculated by SSA (Clingman, et al. 2022).

Some patterns in money's worth across groups can be observed. Females have much higher money's worth than males because they generally have lower earnings (translating to higher benefit-to-contribution ratios due to the progressive benefit formula) and higher life expectancy. In contrast, no obvious pattern in money's worth is apparent along the dimension of educational attainment. This result may be due to the fact that educational attainment is positively correlated with both earnings and life expectancy, which have opposite effects on money's worth.

Looking by race, within each combination of household type and education level, Black households have slightly higher money's worth (except for high-education single females and couples), implying the effect of their lower earnings dominates the effect of shorter life expectancy. In other words, OASI's progressivity more than compensates the average Black household for the fact that benefits are paid out as an annuity.

W-to-C Ratio and the Longevity Insurance Value of OASI

The W-to-C ratios are greater than money's worth for all household types, implying these stylized households would value OASI more than the discounted dollar values of the benefits once the longevity insurance value is accounted for (see Table 3). The implication is that all households, regardless of race, gender, education, or household composition, prefer a world in which OASI exists to one in which it does not (except for low-education White couples who are essentially indifferent). Furthermore, because W-to-C is strictly larger than 1 for almost all households, they should be willing to pay more into the system to preserve its benefits.

Several caveats, however, pertain to this result. First, the model here assumes no bequest motives, no general equilibrium effects, and no late-life liquidity shocks (such as medical or long-term care expenses), all of which would reduce the value of OASI. Second, the model assumes no rate-of-return or inflation risks; which tends to understate the value of OASI benefits since they are insulated from financial markets and are indexed for inflation.[19] Finally, the model assumes no income or capital gains taxes. The impact of this assumption could go either way.[20]

Before examining the W-to-C ratios for different racial and SES groups more closely, it is helpful to note that the difference between the W-to-C ratio and the money's worth serves as an approximate measure of the longevity insurance value of OASI in isolation of the impact of many other household characteristics on the valuation of OASI. Generally, this difference reflects the difference between individuals' willingness to pay for OASI and the expected present value of their OASI benefits, all scaled by their actual contributions to the OASI program:

$$WtoC - MW = \frac{W - EPVB_{65}}{PVC_{65}} \quad (9)$$

Any willingness to pay for OASI in excess of expected benefits must be due to some insurance value from the program. Otherwise, why would anyone be willing to pay more for OASI than they expect to receive in return?

To interpret the difference between money's worth and W-to-C, consider that the calculations of both measures are affected by two common factors: 1) lifetime earnings, which translate to OASI benefits through the progressive benefit formula; and 2) life expectancy, which determines how long the benefits last. Taking the difference of these two measures controls for these two factors and captures the impact on the value of OASI of only the factors involved in the calculation of the W-to-C ratio but not in money's worth, which include the variance of lifespan, initial wealth, and annuitized retirement income. We find that initial wealth and

[19] Another built-in limitation of the current model is that the analysis begins at age 65. A more complete lifecycle model might also incorporate wage risk, the risk that lifetime earnings might end up being low. OASI partially insures this risk, through its progressive benefit formula, and including this type of risk in the model would tend to increase valuations of OASI.

[20] The model does not consider income taxes in retirement; such taxes would impact OASI benefits, reducing the numerator of the money's worth and overall valuation of OASI. However, income taxes would also apply to earnings on investments made with the contributions in a counterfactual world without OASI, which would tend to decrease the denominator of the money's worth and thus increase the value of OASI. Furthermore, OASI benefits are partially exempt from income taxes. Hence, the complexity of the tax system and variations in its effects across households make it difficult to assess the overall effect of including taxes in the model.

annuitized retirement income have very limited impact on the value of W-to-C ratios for all stylized households,[21] thus the difference between the W-to-C ratio and the money's worth captures the variance of lifespan, which can be considered an approximate measure of OASI's longevity insurance value.[22]

The insurance value of OASI as measured by the difference between the money's worth and W-to-C ratios is especially large for singles (worth about 80 percent of total payroll tax paid on average). In contrast, couples have considerably lower W-to-C ratios which imply moderate longevity insurance values (worth 10 to 20 percent of total payroll tax paid). This pattern is consistent with Kotlikoff and Spivak (1981), who find that a substantial portion of the longevity risk can be self-insured between family members who permit other family members to enjoy their wealth after death.

Generally, the insurance values of OASI are highly correlated with the standard deviation of lifespan across groups, with a correlation coefficient of 0.76. One might have expected an even stronger correlation as the insurance value should almost exclusively reflect uncertainty in lifespan. This imperfect correlation could have two possible explanations. First, the correlation is dampened by the impacts from initial wealth and annuitized income, which also matter for W-to-C alongside longevity uncertainty, although these impacts are small. Second, the standard deviation of lifespan is not a perfect measure of the relevant uncertainty of longevity because the distributions of the age at death over 65 are heavily skewed. In fact, the specific shape of the age-at-death distribution can play an important role in the calculation of wealth equivalence through interactions with other elements in the lifecycle model, which are not fully captured by the standard deviation.[23]

[21] To examine the impact of initial wealth and annuitized income along the race dimension, the analysis recalculates the wealth equivalence for Black households giving them their White counterparts' initial wealth and annuitized income. Results suggest that the impact on racial differences in W-to-C is very small. Regardless of the size of this effect, however, the difference between W-to-C and money's worth can be interpreted as the *incremental* insurance value of OASI conditional on the prevailing levels of wealth and other substitutes for OASI's longevity insurance.

[22] Initial wealth would likely have a larger impact on the W-to-C ratio in a model including large consumption shocks in late life, such as large health or long-term care expenses. See an example of this principle in Munnell, Wettstein, and Hou (2022).

[23] A notable example is high-education Black males, who have the highest insurance value among all stylized households while the standard deviation of lifespan of this group is not the highest. This result may reflect the fact that the variation of longevity for high-education Black males is attributable to higher mortality rates at younger ages (a flatter curve in the age-at-death distribution from 65-80 in Figure 1) to a greater extent compared to other groups. As utility at younger ages is less discounted when considered from the age-65 perspective, these early years contribute more to lifetime utility in the lifecycle model, and greater longevity risk at these ages, once insured, translates to higher insurance value.

Implications of Accounting for Longevity Insurance Value for the Racial Equity of OASI

Figure 2 compares the differences between the W-to-C ratio and the money's worth of OASI across stylized households. Black households derive more insurance value from OASI than White ones within each household type-education group, which is consistent with the fact that Black households face greater longevity risk. This result suggests that OASI is an even more important factor in increasing equity in retirement security across racial groups than is suggested by the money's worth of OASI.

To make this point clearer, Table 4 shows the money's worth and the W-to-C ratio of Black households as a percentage of the respective values of their White counterparts. The money's worth ratios are quite close between the racial groups (the effects of Black households' lower earnings and shorter life expectancy on their money's worth largely offset each other, making the result close to that for White households). Once longevity insurance value is considered and the value of OASI is measured by the W-to-C ratio, Black households generally gain much more from the program.

Conclusions

OASI equalizes economic outcomes in retirement across racial and SES groups through its progressive benefit structure, while the annuity it provides works against this progressivity by increasing the expected present value of benefits for those with lower mortality rates, who tend to be White and high-SES. The value of OASI for different racial and SES groups is commonly examined based on the program's money's worth, but this approach neglects the longevity insurance value of the program, which is larger when the dispersion of longevity is greater.

To calculate how the value of OASI differs across racial and SES groups incorporating the program's longevity insurance value, this study calculates the wealth equivalence of OASI benefits from a lifecycle model for stylized households that differ by race, educational attainment, and marital status.

The results show that the wealth equivalence of OASI is at least as great as the lifetime OASI payroll taxes paid for almost all household types, regardless of race, gender, education, or household composition. This implies that they almost all prefer a world in which OASI exists to one in which it does not. Comparing the wealth equivalence with the money's worth of OASI suggests that, once insurance value is accounted for, OASI increases racial equity in retirement security even more than the money's worth of OASI benefits suggests. Looking by household types, singles of all racial and SES groups derive substantial longevity insurance value from OASI (worth about 80 percent of total payroll taxes paid on average), which generally reflects their differential uncertainty in lifespan, with Black males with high education benefiting the most. Couples generally derive much less insurance value from OASI (worth about 10 to 20 percent of total payroll tax paid) than singles as they are partially self-insured against longevity risk.

These results are essential for evaluating the disparate impact of OASI by race and SES, and can inform policymakers and academics about the distributional implications of any proposed changes to the program. In particular, across-the-board proportional reductions in generosity are likely to have particularly deleterious effects on Black and lower-SES households.

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Table 1. *OASI Benefits and Contributions, Wealth, and Annuitized Income by Race-Gender-Educational Attainment*

Household type	Education	Race	Annual OASI benefit at age 65 (1)	Lifetime contributions (2)	Assets at age 65 (3)	Annuitized income at age 65 (4)
Single male	Low	White	$19,627	$339,175	$214,225	$4,497
	Low	Black	14,055	211,196	52,320	1,652
	High	White	21,232	357,887	807,748	8,290
	High	Black	16,785	218,830	162,248	3,674
Single female	Low	White	12,718	169,818	166,061	2,536
	Low	Black	9,592	108,987	44,523	1,384
	High	White	18,477	271,986	434,640	9,690
	High	Black	15,832	200,145	140,650	7,271
Couple	Low	White	33,106	663,132	489,870	10,873
	Low	Black	27,278	462,378	181,964	5,189
	High	White	39,209	760,210	1,192,635	16,621
	High	Black	32,744	565,859	344,529	12,430

Source: University of Michigan, *Health and Retirement Study* (HRS) (2020).

Table 2. *Life Expectancy and Standard Deviation of Lifespan at Age 65 by Gender and Educational Attainment*

	Life expectancy		Standard deviation of lifespan	
	Black	White	Black	White
Single female				
Low education	85.5	85.1	11.2	9.7
High education	85.4	87.0	10.1	8.8
Single male				
Low education	80.0	82.1	9.5	9.7
High education	82.6	84.9	9.4	8.7
Couple (last survivor)				
Low education	89.1	89.3	9.3	8.0
High education	89.7	91.0	8.1	6.6

Source: Authors' calculations.

Table 3. *Comparison of Money's Worth and W-to-C Ratio of OASI by Race-Gender-Educational Attainment*

Household Type	Education	Race	Wealth equivalence (W)	PV total benefits	Lifetime contributions	W-to-C	Money's Worth	Difference
Single male	Low	White	$493,400	$269,831	$339,175	1.45	0.80	0.66
	Low	Black	344,400	170,841	211,196	1.63	0.81	0.82
	High	White	499,900	318,158	357,887	1.40	0.89	0.51
	High	Black	421,700	201,103	218,830	1.93	0.92	1.01
Single female	Low	White	322,600	197,924	169,818	1.90	1.17	0.73
	Low	Black	242,600	145,796	108,987	2.23	1.34	0.89
	High	White	459,400	303,684	271,986	1.69	1.12	0.57
	High	Black	397,900	219,083	200,145	1.99	1.09	0.89
Couple	Low	White	656,200	605,954	663,132	0.99	0.91	0.08
	Low	Black	531,800	469,792	462,378	1.15	1.02	0.13
	High	White	818,200	725,201	760,210	1.08	0.95	0.12
	High	Black	662,000	534,213	565,859	1.17	0.94	0.23

Source: Authors' calculations from HRS restricted earnings data.

Table 4. *Comparing Money's Worth and W-to-C Ratio for Blacks and Whites by Race-Gender-Educational Attainment*

Household type	Education	Black as % of White	
		Money's worth	W-to-C
Single male	Low	101%	111%
	High	103	126
Single female	Low	115	116
	High	97	115
Couple	Low	111	114
	High	80	105

Source: Authors' calculations.

Figure 1. *Age-at-Death Distribution (Density of Lifespan) by Gender and Educational Attainment at Age 65*

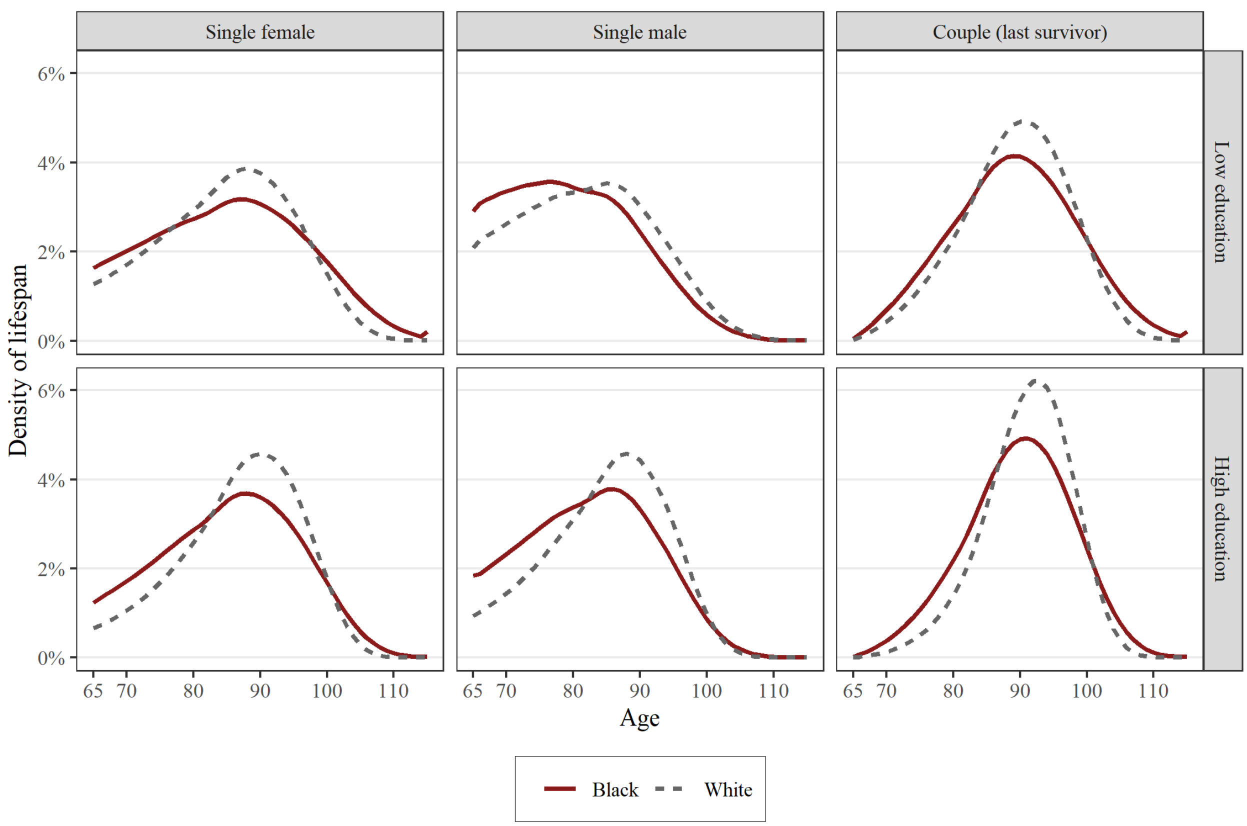
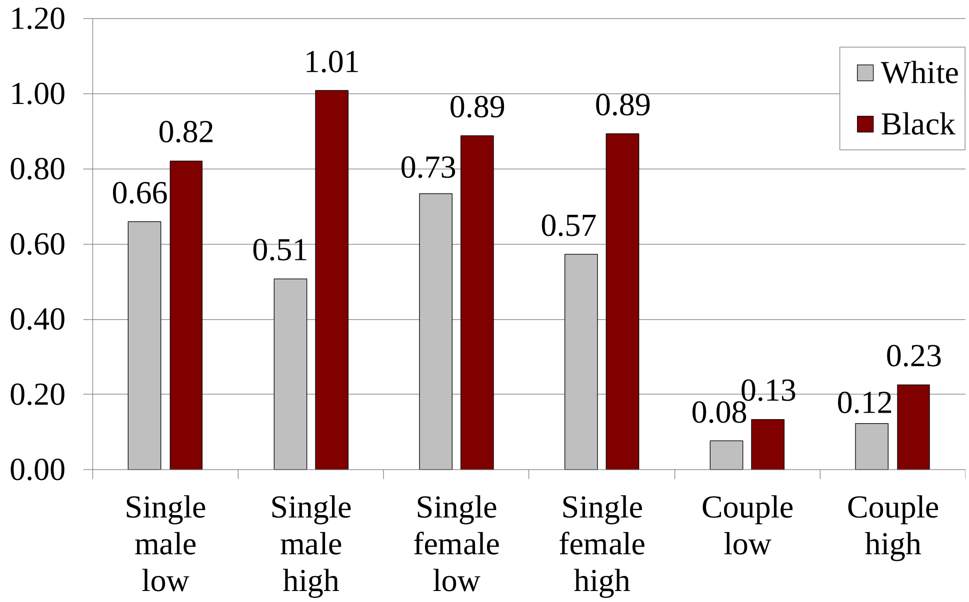


Figure 2. *Longevity Insurance Value as Measured by the Difference Between Money's Worth and W-to-C Ratio*



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