CENTER for RETIREMENT RESEARCH at BOSTON COLLEGE

THE VALUE OF ANNUITIES

Gal Wettstein, Alicia H. Munnell, Wenliang Hou, and Nilufer Gok

CRR WP 2021-5
March 2021

Center for Retirement Research at Boston College
Hovey House
140 Commonwealth Avenue
Chestnut Hill, MA 02467
Tel: 617-552-1762 Fax: 617-552-0191
https://crr.bc.edu

Gal Wettstein is a senior research economist at the Center for Retirement Research at Boston College (CRR). Alicia H. Munnell is director of the CRR and the Peter F. Drucker Professor of Management Sciences at Boston College's Carroll School of Management. Wenliang Hou is a quantitative analyst with Fidelity Investments and a former research economist at the CRR. Nilufer Gok is a research associate at the CRR. This research was supported by funding from the TIAA Institute. The content, findings, and conclusions are the responsibility of the authors and do not necessarily represent the views of TIAA, the TIAA Institute, or Boston College.

About the Center for Retirement Research

The Center for Retirement Research at Boston College, part of a consortium that includes parallel centers at the National Bureau of Economic Research, the University of Michigan, and the University of Wisconsin-Madison, was established in 1998 through a grant from the U.S. Social Security Administration. The Center's mission is to produce first-class research and forge a strong link between the academic community and decision-makers in the public and private sectors around an issue of critical importance to the nation's future. To achieve this mission, the Center conducts a wide variety of research projects, transmits new findings to a broad audience, trains new scholars, and broadens access to valuable data sources.

Center for Retirement Research at Boston College
Hovey House
140 Commonwealth Ave
Chestnut Hill, MA 02467
Tel: 617-552-1762 Fax: 617-552-0191
https://crr.bc.edu

Affiliated Institutions:
The Brookings Institution
Mathematica – Center for Studying Disability Policy
Syracuse University
Urban Institute

Abstract

Annuities could benefit retirees, but these products can also be costly. Yet, despite significant changes in factors that can affect annuity pricing and value, the money's worth of individual annuities in the United States has not been addressed in the research literature in 25 years. This paper revisits this topic to: 1) identify underlying pricing trends as interest rates and mortality rates have declined; 2) evaluate new products, such as deferred and indexed annuities; and 3) explore the implications of the divergent trends in mortality by socioeconomic status (SES). The analysis involves not only calculating the present value of payments relative to premiums but also estimating the welfare gains from such longevity insurance. The results show that money's worth and wealth equivalence have remained stable over time despite dramatic changes in mortality and interest rates; that deferred annuities provide better longevity insurance than immediate annuities and, therefore, involve higher premiums; and that growing gaps in mortality across SES groups yield widening gaps in the value of immediate annuities across racial and educational groups.

Introduction

As policymakers, financial services firms, and individuals turn their attention to the decumulation phase of retirement saving, the potential role for annuities is gaining increased attention. These products, by pooling longevity risk and generating mortality credits, allow a higher level of income and insurance against premature exhaustion of assets than other drawdown strategies. However, these products can also be costly. Mitchell et al. (1999) found that in 1995 a random 65-year-old individual received annuity payouts per dollar of annuity premium of between 76 cents and 79 cents.

In the past 25 years, however, major changes have occurred that could affect the value of retail annuities.[1] The increase in life expectancy and decline in interest rates increase the present value of a given stream of lifetime income. The rising gap in life expectancy by socioeconomic status (SES) has broadened, potentially reducing the annuity payout for the average person (see Chetty et al. 2016 and Sasson 2016). And insurers reacting to these changes likely changed their pricing, resulting in ambiguous changes in the value of annuities. Similarly, new annuity offerings, such as deferred and price-indexed annuities, could also have changed the picture.[2] This paper starts by revisiting the money's worth calculation to: 1) identify underlying trends in pricing over the past 25 years; 2) calculate the expected payoff of new products; and 3) explore the implications of the divergent trends in mortality by SES. Money's worth alone, however, does not capture the value of longevity insurance. Hence, the paper proceeds to a utility analysis asking how much wealth would make a person indifferent between having access to the annuity product and not having access (for example, one might need only 0.85 as much wealth in a world

[1] This analysis focuses on retail annuities, rather than annuities offered within tax-advantaged plans such as 4019(k)s or 403(b)s. Several studies have estimated the money's worth of longevity insurance since 1995, but mainly in an international context. For example, see Finkelstein and Poterba (2002), Cannon and Tonks (2009, 2016), and Aquilina et al. (2017) in the U.K. market; Milevsky and Shao (2011), and Boyer et al. (2019) in Canada; Kaschützke and Maurer (2011) in Germany; Bütler and Stefan (2011) in Switzerland; Cannon et al. (2015) in the Netherlands; and Fong, Lemaire, and Tse (2011) in Singapore. Some work in the U.S. context has assumed actuarially fair annuities; for example, see Brown (2002). However, given that the pricing of annuities in practice is sensitive to context such as mortality rates, interest rates, and regulation, such studies do not directly answer the money's worth question in the U.S. private market.

[2] The deferred annuities considered here are purchased with a single premium at age 65 but begin to pay out only at age 85. They are thus a more comparable product to the immediate annuities we consider than the Advanced Life Deferred Annuities with survivor benefits and inflation adjustment considered in Gong and Webb (2010). Typical indexed annuities considered are misleadingly named, in that they are not indexed to prices. Rather, these annuities are single-premium immediate annuities whose payouts escalate at a fixed 3 percent per year.

with annuities to be as well off as in a world without annuities).[3] Typically, the insurance value of such products makes them worth buying even if their money's worth ratio is less than one.

The major results for the full population are the following. First, despite dramatic changes in mortality and interest rates over the past 25 years, annuity providers have reduced their monthly payouts so that the money's worth of immediate annuities has remained stable. Second, on a money's worth basis, indexed annuities have a slightly lower expected value relative to immediate annuities, and deferred annuities have a *substantially* lower expected value. Finally, the welfare analysis shows that for immediate annuities the wealth equivalence has remained constant over time and that the new products provide enough insurance to offset their relatively high premiums.

Looking across demographic groups, higher-educated individuals can expect substantially greater returns per dollar of premium than less-educated individuals. Furthermore, this education gradient has grown over time. Large racial differences in money's worth are also found, even conditional on relative education. In terms of utility, all groups are found to benefit from longevity insurance, although Blacks appear to benefit somewhat more than whites. This pattern reflects greater uncertainty in time of death for Blacks, leading to high valuation of longevity *insurance* despite a lower life *expectancy*.

The paper is structured as follows. The first section describes the underlying data used in this study. The second section explains the methodology in the money's worth calculation, the utility framework for the insurance value analysis, and the estimation of mortality by SES group. The third section shows the result of the time trend of the money's worth and the wealth equivalence of the various longevity insurance products for the general population. The fourth section analyzes how the money's worth and wealth equivalence of immediate annuities vary by SES group and how those differences have changed over time. The last section concludes that money's worth and wealth equivalence have remained surprisingly stable; that deferred annuities provide better longevity insurance than immediate annuities, which compensates for their higher premiums; and that wide gaps in mortality by SES yield wide and growing gaps in the value of immediate annuities across racial and educational groups.

[3] For example, see Mitchell et al. (1999).

Data

The money's worth analysis requires three types of data: 1) annuity prices, such as market quotes of the annual payout in return for a $100,000 premium; 2) expected mortality at each age; and 3) expected interest rates.

Annuity Price Data

For annuity prices, market quotes come from the Annuity Shopper archives.[4] The data include quotes for immediate annuities, deferred annuities, and indexed annuities from about a dozen insurers annually between 1986 and 2020.[5] For years with more than one market survey, the analysis uses the survey covered in the July issue. The market quotes for various products are collected by age and gender.[6]

The types of products for which Annuity Shopper collects quotes are fairly standardized. For immediate annuities, the product is a straightforward single premium immediate life annuity that begins to pay out shortly after purchase (typically between one month and one year later). These payments continue for as long as the annuitant lives and then cease.[7]

The quotes for indexed annuities refer to an immediate annuity as above, but with payouts increasing by 3 percent each year at the anniversary of the purchase. Therefore, such annuities should not be thought of as protecting against inflation (which may increase by more or less than 3 percent per year), but rather as offering a convenience for consumers, absolving them of the need to save some of their early payouts in anticipation of future expected inflation.

Finally, the deferred annuity variant envisions a single premium paid at age 65, with payouts starting at age 85. Such products can be paired with survivor benefits, inflation protection, or some refund in case of early death; the current analysis focuses on the base product with no further provisions for survivors or inflation.

Figure 1 shows the average market quotes of non-qualified immediate annuities for 65 year olds by gender from 2001-2019. The general trend for both groups is downward. The pattern for indexed and deferred annuities is similar and can be found in the Appendix.

---

[4] The data are publicly available at immediateannuities.com, the website associated with Annuity Shopper.

[5] Quotes for indexed annuities are only available starting in 2007. Data on deferred annuities are available starting in 2013.

[6] Both qualified and non-qualified annuity quotes are collected but, for the purpose of this study, the results are shown using only non-qualified quotes. Most immediate annuities sold are non-qualified (Zaiken et al. 2016).

[7] Annuities with guaranteed period payments (e.g., payments that continue for 10 years even if the annuitant dies before then) are available. Likewise, annuities with survivor benefits that continue to pay out for the life of a spouse are also marketed. This paper does not analyze either of these classes of products.

Mortality Data

The mortality data include cohort mortality rates both for the general population and by SES group. The rates are based on the intermediate mortality assumptions from the 2020 *Social Security Trustees' Report*.[8] Figure 2 shows the general population life expectancy at age 65 over the past twenty years. Life expectancy at 65 for both men and women increased by roughly 1.5 years over the period.

The calculation of mortality rates by SES also required mortality data from the *National Vital Statistics System* (NVSS) and population data from the *American Community Survey* (ACS) for demographics, such as gender, race/ethnicity, and education.

Rate of Return Data

Finally, the discount rates used in this project are based on the yields on BAA-rated corporate bonds and yields of Treasury bonds by various maturities.[9] The data are retrieved from publicly available records at the Federal Reserve Bank of St. Louis.

Methodology

This section details the methodology for calculating the money's worth of different annuity products. It then proceeds to explain the approach for calculating the wealth equivalence of these products. Finally, it explains how mortality is estimated for different populations for use in the money's worth and welfare analyses by demographic group.

Money's Worth

The money's worth (MW) of an annuity is the ratio of the expected present value (EPV) of payouts from the annuity to its premium. Calculating the EPV of payouts for an individual at age t_0, denoted as EPV_{t_0}, requires three components: 1) the annuity payout amount A_t at each age t; 2) the survival probability $P_{t_0,t}$ from age t_0 to t; and 3) the discount rate, calculated as the

[8] The life tables used for the *Trustees' Report* are shared by the Office of the Chief Actuary at the U.S. Social Security Administration.
[9] BAA-rated corporate bonds are typically used by commercial insurers to price annuities.

product of i_k, the nominal short-term rates in the k periods from age t_0 to t. The equation below defines an annuity's money's worth:[10]

$$MW = \frac{EPV_{t_0}}{Premium}, where\ EPV_{t_0} = \sum_{t=t_0}^{t=T} \frac{A_t * P_{t_0,t}}{\prod_{k=t_0}^{k=t}(1+i_k)}.$$

Several variations of the components are considered. First, the annuity payout amount A_t might not be constant over time. For example, the payout of deferred annuities is zero at first, while the payout of indexed annuities increases every year at a constant rate, π, so that $A_t = A(1+\pi)^{t-t_0}$.

Second, the survival probability $P_{t_0,t} = \prod_{j=t_0}^{j=t-1}(1-q_j)$ (where q_j is the probability of dying at age j) will reflect the mortality of the general population or specific SES groups.[11]

Finally, to reflect realistic returns, this paper follows Mitchell et al. (1999) and uses a discount factor based on the term structure of BAA-rated corporate bonds. This calculation involves two steps: 1) using the term structure of yields on Treasury bonds to estimate expected future risk-free rates; and 2) adding a risk premium equal to the difference between the yield of BAA-rated corporate bonds and the yield of Treasury bonds with ten years to maturity.[12] The annual rates beyond thirty years are assumed to be the same as year thirty.

Calculating the Insurance Value of a Longevity Insurance Product

Money's worth calculations neglect the important insurance value of annuities. Therefore, utility analysis is used to account for this dimension. The analysis asks how much wealth a consumer with access to the insurance product would need to be as well off without access to any annuity product – that is, the wealth equivalent to having an insurance contract.

The first step in calculating equivalent wealth is to solve for the optimal lifetime consumption profile for a rational agent without annuities in a typical dynamic stochastic

[10] The analysis here assumes no taxes are due on the annuity payout. This assumption is made for simplicity, since the tax liability on annuities would vary across individuals and would greatly complicate the analysis.
[11] For the general population, survival probabilities are taken directly from the Social Security Administration cohort life tables. For mortality by SES groups, the analysis estimates mortality as explained below. To improve accuracy, this analysis makes the calculation on a monthly, rather than annual, basis assuming the probabilities are the same for each month within the same year.
[12] The assumption here is that the risk premium is constant at all maturities.

optimization model, which has been widely used in the literature.[13] The agent is assumed to have a constant relative risk aversion (CRRA) utility function $U_t = \frac{{C_t}^{1-\gamma}-1}{1-\gamma}$, where γ is the risk aversion parameter and also the degree of intertemporal substitution in consumption. γ is assumed to be 2 (as in Mitchell et al. 1999).

The individual holds initial wealth W_{t_0} and must decide how much to consume at each age t while facing the survival probability p_t. Therefore, the optimization problem is to maximize lifetime utility V_{t_0} in the following equation, where β is the individual's discount rate (assumed to be 0.03, as in Mitchell et al. 1999):[14]

$$V_{t_0} = \sum_{t=t_0}^{t=T} \beta^{(t-t_0)} * U_t * p_t$$

and the budget constraint is:

$$W_{t+1} = (W_t - C_t) * (1 + r_t),$$

where the rate of return r_t is equal to the short-term rate i_t in the money's worth calculation. The optimal consumption path $\{C_t\}$ is used to calculate expected lifetime utilities $\bar{V}$.

The next step is to ask what amount of initial wealth $\widetilde{W}_{t_0}$ the individual would require to reach the same expected lifetime utilities $\bar{V}$ if this person used their wealth to purchase the annuity contract being considered. The revised budget constraint is:

$$W_{t+1} = (W_t + A_t - C_t) * (1 + r_t),$$

where A_t is the annual annuity payout amount at each age t. Therefore, the decrease from the initial wealth W_{t_0} in the baseline to the annuity equivalent wealth $\widetilde{W}_{t_0}$ is used as the measurement of the insurance value for the annuity policy.[15] This difference is expressed as a share of starting wealth, such that the equivalent wealth of no annuitization is 1 by definition, and the smaller the share of initial wealth required for indifference, the better the annuity product.

Assessing the annuitization options requires some assumption about the share of initial assets that are annuitized. For immediate annuities (both nominal and indexed), the assumption

[13] For example, see Ameriks et al. (2011); Brown and Warshawsky (2013); and Horneff, Maurer, and Mitchell (2020).
[14] This formulation assumes no bequest motive.
[15] The analysis does not allow for the purchase of multiple products simultaneously.

is that all assets are annuitized. This assumption yields the optimal outcome for consumers with no bequest motives and no consumption shocks who, therefore, have no need for liquidity and no desire to bequeath any assets (Yaari 1965).

For deferred annuities, full annuitization is nonsensical. Such a strategy would leave households with no consumption between ages 65 and 85 and enormous annual income thereafter. Instead, the assumption is that households annuitize 20 percent of their initial assets.[16]

Mortality by SES

The analysis repeats the money's worth calculations above for different SES groups, defined by the intersection of race/ethnicity and education level, for both men and women.[17] Hispanics display very different patterns of mortality by education (the Hispanic "mortality paradox;" see, for example, Ruiz, Steffen, and Smith 2013). The analysis here, therefore, focuses on non-Hispanic whites and Blacks.[18]

The first step is to generate period life tables by SES, which requires categorizing people by education tercile based on their cohort, gender, and race.[19] This approach accounts for the variation in education across racial and gender groups and within groups over time.[20]

Education terciles do not neatly correspond to absolute educational attainment. For example, the middle tercile could include a mix of those with only a high school degree, those

[16] This assumption generally follows recent literature such as Horneff, Maurer, and Mitchell (2020) and Munnell, Wettstein, and Hou (forthcoming).

[17] These groups are parallel to those analyzed in Brown (2002). The methodology used here is very similar to that used in Leive and Ruhm (2021). Those authors examine life expectancy up to age 64; our analysis is complementary in considering life expectancy at age 65.

[18] Full results for Hispanics are available upon request.

[19] Education coding changed in the NVSS in 2003, and the change was adopted by different states at different times. For consistency, all education was coded in both the ACS and NVSS records to correspond to the number of completed years of education. In the post-2003 NVSS, where education was classified by category rather than completed years, the following recoding was assumed: 8th grade or less=8; 9th-12th grade, no diploma=11; high school or GED=12; some college=13; associate's degree=14; bachelor's degree=16; Master's degree=18; doctorate or professional degree=21. In the ACS, the recoding was: no schooling=0; nursery-4th grade=4; 5th-8th grade=8; 9th grade=9; 10th grade=10; 11th grade=11; 12th grade=12; one year of college=13; two years of college=14; three years of college=15; four years of college=16; five or more years of college=17. While this recoding necessarily entails some error in assigning precise years of education, this error is likely to have a minimal effect on the assignment to education tercile, which is the measure of education used in the analysis.

[20] Failing to account for this selection may lead to spurious results (Dowd and Hamoudi 2014). The solution chosen here follows Bound et al. (2014).

with some college, and those with a college degree. Therefore, the mortality rates for the middle tercile reflect the weighted average for each of the educational groups included in the tercile.[21]

Next, age-specific mortality rates for each demographic group defined by gender, race, and education are calculated year by year with the following formula:

$$q_{x,i,j} = \frac{d_{x+1,i}}{l_{x,i}}, \tag{1}$$

where *j* represents year, i represents each demographic group, $l_{x,i}$ is the number of individuals alive in group i at age x using ACS data, and $d_{x+1,i}$ is the number of individuals in group i who die between age x and age $x+1$ using the NVSS data. To correct for small cell size, the analysis adjusts the age-specific mortality rates using the Gompertz-Makeham formula below (see Brown et al. 2002 and Sanzenbacher and Ramos-Mercado 2016):

$$\mu_{x,i,j} = \alpha_{i,j} * e^{x * \beta_{i,j}} + \gamma_{i,j}. \tag{2}$$

Mortality μ at age x for group i in year j is determined by: 1) the initial level of mortality $\alpha_{i,j} > 0$; 2) the rate of aging $\beta_{i,j} > 0$; and 3) the level of age-independent mortality $\gamma_{i,j} \geq 0$. Thus, the mortality rate q at age x for group i in year j can be estimated by the formula:

$$q_{x,i,j} = 1 - s_{i,j} * g_{i,j}^{(c_{i,j}^{(x+1)} - c_{i,j}^{x})} \tag{3}$$

where $s_{i,j} = e^{-\gamma_{i,j}}$, $g_{i,j} = e^{-\frac{\alpha_{i,j}}{\beta_{i,j}}}$, and $c_{i,j} = e^{\beta_{i,j}}$.

The last step is to transform the SES period life tables into the cohort tables. This calculation uses the Social Security Administration's cohort mortality table for the general population as its base and applies the same future improvement in mortality to all SES groups.[22]

Money's Worth and Wealth Equivalence for the Full Population

The results for the trends in the money's worth for the full population, for each of the three annuity products, are described below. Subsequently, the results on wealth equivalence for all three products are discussed.

[21] Technically, some of the individuals in borderline education groups were randomly assigned to each of the relevant consecutive terciles in proportion to the share of each group required to be in the terciles.
[22] This methodology is developed in Brown (2002).

Money's Worth over Time

Figure 3 shows the money's worth for an immediate annuity at age 65 over the past 20 years, which has fluctuated around 0.80. The expected value of the annuity is roughly equal for men and women, since providers account for gender in their pricing. The estimates for 2001 are very close to those found by Mitchell et al. (1999) for 1995 of 0.756 for men and 0.785 for women.[23] This steadiness in the money's worth value is the result of two opposing forces. On the one hand, longevity improvement and declining interest rates increase the expected value of every dollar of annuity income. On the other hand, as noted earlier, the annuity payments for a given premium have been declining (see Figure 1).

Substantial year-to-year variation in money's worth is observable in the data. In the 2001-2019 period, the money's worth ratio has oscillated between 0.76 and 0.87 for men and 0.77 and 0.86 for women. At least some of this variance is due to sampling variation, primarily of the quotes surveyed by annuityshopper.com, with additional variance contributed by the underlying mortality and interest-rate estimates.[24] For neither men nor women is the time trend in money's worth significantly different from 0 ($p=0.58$ and $p=0.23$ for men and women, respectively). Therefore, the essentially flat trend is the more robust finding of this analysis.

Figures 4 and 5 show the money's worth for annuities with a 3-percent annual escalation and deferred annuities with payments starting from age 85, respectively. Again, the money's worth for such products has remained relatively stable, albeit with some variation year-to-year. As above, this variation is hard to disentangle from estimation errors; thus, the flat trend in these values is more noteworthy.

The money's worth of nominal immediate annuities is consistently slightly higher than for annuities with a 3-percent escalation – roughly 3 cents for both men and women on average. This discrepancy cannot be construed as a risk premium for protection against unexpected

[23] For men, Mitchell et al. (1999) report similar numbers going back to 1985, although the number for 1985 is somewhat lower, at 0.704, than later estimates for the same year.

[24] These latter two sources of variation are less likely to be sampling variation and more likely to be driven by modeling assumptions. For mortality, the numbers in this full-population analysis are taken directly from the Social Security Administration's life tables, which rely on a very large sample of nearly the entire U.S. population. Year-to-year variation here may be due to the application of future mortality trends to younger cohorts; changes in these assumed trends may lead to differences across years. For the interest rate estimates, the numbers are not sampling-based, but rather rely on the actual rates on U.S. Treasury bonds of different maturities; variation in these numbers that might drive year-to-year changes in money's worth might be due to changes in the yield curve over time (which would reflect real changes in money's worth) or due to the interpolation between returns on bonds of different maturities (which is an artifact of the structure of standard Treasury bond maturities).

inflation, since the products have a fixed escalation of benefits, regardless of inflation. Rather, the lower money's worth of these indexed annuities likely reflects a convenience fee that consumers pay to avoid the hassle of smoothing a fixed annuity in real terms by saving some of the high-value early payments to adjust for rising prices in later years.[25]

The money's worth of deferred annuities is the most constant over time of the three annuities studied. Interestingly, it is *substantially* lower than for both types of immediate annuities. This finding may seem surprising, given the enthusiasm for such products among both academics and annuity providers (e.g., Horneff, Maurer, and Mitchell 2020 and Munnell, Wettstein, and Hou Forthcoming).[26] The enthusiasm, however, is not based on the money's worth of deferred annuities, but rather on the combination of their insurance value and the possibility that they might prove more attractive to consumers than immediate annuities because of the lower up-front cost. Therefore, the next step is to look at the insurance value of these various annuity products as measured by equivalent wealth.

Wealth Equivalence of Annuity Products over Time

Annuities are an insurance product to insure against longevity risk. So, the expected return of an annuity contract is not a reasonable measure of that contract's value to consumers. Rather, the appropriate question is how much wealth consumers would need to be as well off without annuitizing any of their assets as they would be with annuitization at age 65. For convenience, this value is expressed as a share of the initial wealth. If annuities improve welfare, the consumer's required wealth with an annuity product will be lower than without. And the less wealth required, the more valuable the product.

Figures 6, 7, and 8 show the wealth equivalence of immediate annuities, immediate annuities with a 3-percent escalation, and deferred annuities that begin paying out at age 85, respectively. These numbers are calculated for all years in which data for each product is available, and separately by gender.

[25] Because inflation has consistently run below 3 percent over the past two decades, the indexed annuities analyzed here represent an *increasing* payment in real terms over time. If expected, this pattern should have resulted in some compensation to consumers for backloading payments, with the attendant risk of mortality (on the consumer's side) and default (on the provider's side). In reality, this effect seems to be swamped by the convenience surcharge for the escalating products.

[26] Low estimates of money's worth for deferred annuities echo results from a decade ago on related Advanced Life Deferred Annuities with survivor benefits analyzed in Gong and Webb (2010).

As with money's worth, the wealth equivalence of these products shows virtually no time trend. The interesting result is the value of the wealth required compared to no annuitization.

The value to consumers of both types of immediate annuities is similar. Across all years, the average wealth equivalence of nominal immediate annuities is 0.86 for men and 0.91 for women. The parallel numbers for indexed annuities are 0.85 and 0.89. However, the wealth equivalence (or insurance value) of deferred annuities is appreciably greater than that of the immediate annuities; this finding is in sharp contrast to the relatively low *expected value* of deferred annuities. Across years, the average wealth equivalence of deferred annuities is 0.77 for men and 0.73 for women.[27]

The high insurance value for deferred annuities stems from their unique focus on protecting against longevity tail risk: the small probability of living a very long time. The results indicate that for such protection, consumers are willing to bear a large decline in expected value. Indeed, the only way such products can coexist with immediate annuities is if they offer some large value to consumers to compensate for their higher price. The results on wealth equivalence show that the high price of deferred annuities is justified by the value accorded the consumer and compensates insurers for the greater risk they bear.

All these results pertain to the average individual of each gender. Gender, of course, is accounted for by insurers when setting premiums. However, both money's worth and insurance value may vary across individuals along dimensions that are not priced by annuity providers. The analysis now turns to considering how the uniform pricing of annuities across these dimensions may impact how worthwhile different annuity products are to different individuals.

Money's Worth and Insurance Value of Annuities by Socioeconomic Status

This section describes the analysis of immediate annuities' value for different SES groups. First, estimates of mortality by SES are shown. Then, the results for money's worth by

[27] The comparison of wealth equivalence of immediate and deferred annuities is dependent on certain modeling assumptions. First, 20-percent annuitization in the deferred annuity case is unlikely be optimal whereas 100-percent allocation to an immediate annuity is optimal, so the assumption on the allocation of wealth to the different annuity options will lead to an *understatement* of the relative value of deferred annuities. Second, the assumptions of no bequest motive and no consumption shocks obviate the need for liquidity – one of the benefits offered by the deferred annuity (see Munnell, Wettstein, and Hou forthcoming). A third consideration works in the other direction: the model does not account for the market risk on non-annuitized assets to which consumers are exposed in the case of deferred annuities but not immediate annuities. All three considerations are not relevant for money's worth calculations but would impact the relative wealth equivalence of the products. Future work can assess these differences more carefully.

SES are presented. These are followed by results on the wealth equivalence of immediate annuities by SES.

Mortality by SES

A key determinant of the money's worth of an annuity stream is how long the stream is expected to last – that is, how long the annuitant is expected to live.[28] Based on the procedure for determining cohort mortality rates described above, we calculated life expectancy at age 65 for non-Hispanic Blacks and whites of both genders, by education tercile. Figures 9a and 9b show the 2019 values for these groups.

The pattern reflects the existing literature. At each level of education and for both men and women, whites live longer than Blacks (except for low-education women, where Blacks and whites have similar life expectancy). And within racial groups, a substantial gap in life expectancy exists between the educational groups (e.g., Case and Deaton 2015).

Not only is the gap between high and low education large, it has also increased somewhat over the past two decades. For whites, the top-tercile to bottom-tercile gap in life expectancy at age 65 has gone from 3.6 to 4.2 years for men, and from 2.3 to 2.4 years for women. For Blacks, the parallel numbers are a rise from 2.8 to 3.1 years for men and 0.6 to 0.8 years for women.

A gap in life expectancy between higher- and lower-SES individuals translates to a difference in expected lifetime payouts from an annuity.[29] The analysis next addresses the money's worth of annuities by SES group.

Money's Worth by SES

An interesting characteristic of annuity pricing is that the information typically collected by the provider is limited to age, gender, and state of residence, even though, as shown above, other easily observable characteristics – such as education – are strongly correlated with

[28] 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 these gaps 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).

[29] Lower-SES individuals plausibly face higher de facto interest rates than higher SES individuals: they are less likely to have access to credit markets, and when they do have access to credit they are likely to face higher borrowing costs. A higher interest rate for lower-SES individuals would further reduce the value of an annuity stream relative to higher-SES individuals. The current analysis conservatively assumes the same interest rates for all consumers.

mortality expectations.[30] A consequence of this relatively uniform pricing is that, conditional on age and sex, observably different individuals can expect to receive dramatically different returns on the immediate annuities they purchase.

Figures 10a and 10b show the money's worth of immediate annuities in 2019 by education tercile for Blacks and whites by gender. A noticeable gap in the expected value of annuities is clear, with higher-SES groups in every year enjoying a larger expected value from immediate annuities than lower-SES groups.

Since 2001, the increase in the life-expectancy gap between the bottom and top terciles has led to a similarly modest, but noticeable, increase in the gap between the money's worth of these terciles (see Figures 11a and 11b). While the slope of these lines is not steep, it accumulates to large differences over time. Over the past 18 years, the gap in the expected value of a dollar of annuity premiums by education has grown by 36 percent for white men, 33 percent for white women, 22 percent for Black men, and 24 percent for Black women. By 2019, a single dollar of premiums yielded an expected value of 14 cents more for a white man in the top tercile of education than for one in the bottom tercile. This difference was 11 cents for Black men, 8 cents for white women, and 3 cents for Black women. This large difference by SES status may be a driver of poor take-up of annuities and is likely to lead to substantial adverse selection if annuity providers do not incorporate education or some other marker of SES into their pricing.

Racial differences in money's worth also exist, *even conditional on relative education*.[31] Figure 12 shows the gap in money's worth for nominal immediate annuities between white and Black men and women of the same education tercile. For example, the solid black line indicates that white men in the top tercile of their education distribution have a money's worth that is, on average, 7.8 cents more than Black men in the same relative position in their educational distribution. For women in the top tercile, the gap is 5.4 cents. For men in the bottom tercile,

[30] Underwritten, or substandard, annuities are a relatively new product, and their take-up has been limited. In 2004, only 4 percent of total immediate annuity contracts sold in the United States were substandard (Society of Actuaries 2006). Researchers in the past have remarked on both the limited nature of mortality-relevant information collected by annuity providers in the United States and on the puzzle posed by this limited underwriting (e.g., Meyricke and Sherris 2013 and Fong 2015 in the United States; and Finkelstein and Poterba 2004 in the United Kingdom).

[31] Recall that education terciles are calculated based on relative position in the education distribution *within* race-gender-cohort. Thus, these results do not imply that such differences exist conditional on *absolute* education levels.

the average gap is 5.2 cents, and for women in the bottom tercile it is 1.6 cents. These differences reflect the varying mortality rates of the different groups.[32]

In sum, the analysis finds large gaps in money's worth across education groups and race. The gaps by race have tended to be fairly stable over the past 20 years. However, educational gaps have grown at a pace that, while modest, accumulates to large differences over time.

As with the full population, when evaluating annuity products for different SES groups, money's worth does not tell the whole story, because it neglects the longevity insurance value of the products. The analysis next turns to estimating the utility value of immediate annuities for the different SES groups.

The Wealth Equivalence of Immediate Annuities by SES

Figure 13 shows the wealth equivalence of an immediate annuity for the bottom and top education groups of both genders and races considered in 2019. The most striking result is that annuities are preferred to non-annuitization for all groups, despite some having a low money's worth. Even the group that benefits least, high-education white women, would be willing to give up 14 percent of starting wealth to have the option of annuitization.

No particular pattern by gender or education is apparent in the estimates. All those analyzed would be willing to part with 14-19 percent of starting wealth in return for longevity insurance.

In terms of race, annuitization is more valuable for Blacks than for whites. For every gender-education tercile pair, the wealth equivalence of the annuity is worse for whites. This pattern persists despite the fact that whites tend to live longer, and thus reflects the greater *uncertainty* of longevity for minorities (Sasson 2016). Indeed, according to the mortality estimates by SES calculated here, the variance in lifespan is much larger for Blacks than for whites for every gender-relative education combination (Figure 14).[33] The demographic dimensions of who would benefit more from longevity insurance are in tension with the groups

[32] In terms of trends, the gaps in money's worth have remained quite stable over the past two decades. They have slightly increased for top-tercile men and slightly declined for bottom-tercile women. This pattern is also consistent with the relative changes in mortality for the different SES groups. Full results on life expectancy racial gaps are available upon request.

[33] To calculate the variance of longevity, 10,000 simulations of completed lifespans were run based on the estimated mortality probabilities by SES. The variance of completed lifespans was then calculated for each group.

for whom such insurance is most affordable and present an opportunity for public and private innovation.

Conclusion

Economic theory suggests that annuities are a good way for individuals and households to manage their finances in later life. Public policy in developed countries is also geared toward encouraging annuitization. Nevertheless, take-up of annuities is far less than predicted by theory. One reason might be that annuities are expensive, in the sense that the expected return on a dollar of premiums is less than a dollar. How much less depends on time, place, and the individual, particularly their expected future mortality probabilities.

A comprehensive analysis of the money's worth of immediate annuities in the United States has not been undertaken since 1995. Since then, declines in mortality and interest rates have raised the value of a fixed guaranteed stream of income, raising the possibility that the money's worth of annuities has grown – if insurers did not also adjust premiums. At the same time, new annuity products have become more widely available. Specifically, indexed annuities and deferred annuities have grown more common and seem poised for further growth as the regulatory and legal environment becomes more hospitable to them. The money's worth of such products has never been studied.

The analysis here examined the money's worth to a 65-year-old of immediate nominal annuities, annuities with a fixed escalation rate, and deferred annuities that begin paying out at age 85. The main finding is one of surprising stability, with the expected return on immediate annuities remaining similar to estimates from 25 years ago, at around 80 cents per dollar of premium. Similarly, the trends for the other products examined have been relatively flat for as far back as the data extend. Furthermore, the analysis also demonstrated that indexed annuities have slightly lower expected returns than nominal immediate annuities, while deferred annuities have *much* lower expected returns, around 50 cents per dollar of premium.

Of course, expected return is a limited measure of the value of an insurance product like an annuity. The analysis, therefore, also calculated the wealth that would make consumers indifferent between having no annuity and having each of the three lifetime income products. Here, too, the findings showed stability over time. More importantly, the analysis revealed that both immediate annuity products have similar insurance value. However, deferred annuities

have appreciably greater insurance value per dollar of premium than the immediate annuities, despite having a lower expected return.

Finally, the analysis recognized that different individuals may face different expected returns and insurance value based on characteristics such as race and education (gender less so, because annuity pricing accounts for gender). To explore these differences, the analysis estimated cohort survival rates starting at age 65 for gender-race-education tercile groups. These estimates showed large education gradients in mortality conditional on race, as well as differences by race conditional on education. The education gaps, in particular, have not narrowed over the past 20 years; if anything, they have grown wider.

The implications of mortality differences across these education groups for the evaluation of annuities were large, with the gap in the expected value of an immediate annuity growing by 22-36 percent since 2001. By 2019, these differences had accumulated to a 14-cent difference in the expected return per dollar of premium between top- and bottom-education tercile white men, 11 cents for Black men, 8 cents for white women, and 3 cents for Black women. Looking across race, conditional on education tercile, whites of both genders had noticeably higher expected returns on a dollar of immediate annuity premium, reflecting their lower mortality rates.

As with the full population results, expected returns paint an incomplete picture of the value of lifetime income products to different SES groups. The analysis, therefore, also explored how much insurance value various SES groups gained from immediate annuities in 2019. The results show that all analyzed groups would benefit from longevity insurance, the cost of such insurance notwithstanding. Moreover, Blacks would benefit slightly more than whites.

The analysis presented here leaves many unanswered questions for future work. On the theoretical front, the question of why annuity providers leave valuable information about annuitant survival probabilities on the table is perhaps the most perplexing. Also puzzling is the fact that money's worth has remained so stable over time despite the apparent increasing scope for adverse selection as unpriced demographic characteristics grow more predictive of mortality. Future research could also explore how sensitive the wealth equivalence estimates are to more complex modelling assumptions, particularly those that yield some value to liquidity, bequest motives, and realistically calibrated market risk. The optimal share of wealth to devote to a deferred annuity in these less stylized settings would also be a fruitful avenue of exploration.

Lifetime income products are a cornerstone of retirement planning. These products continue to raise theoretical questions that have remained unresolved for decades. The empirical results estimated in this paper can shed light on some of these questions, while raising new ones. The results also speak to the implications of wide and growing mortality gaps across SES. Researchers, policymakers, and annuity providers should be cognizant of these gaps in considering the landscape of lifetime income products in the United States.

References

Ameriks, John, Andrew Caplin, Steven Laufer, and Stijn Van Nieuwerburgh. 2011. "The Joy of Giving or Assisted Living? Using Strategic Surveys to Separate Public Care Aversion from Bequest Motives." *The Journal of Finance* 66(2): 519-561.

Aquilina, Matteo, Robert Baker, and Tommaso Majer. 2017. "The Money's Worth of Annuities in the UK between 2006 and 2014." *The Journal of the Economics of Ageing* 9: 208-218.

Auerbach, Alan J., Kerwin K. Charles, Courtney C. Coile, William Gale, Dana Goldman, Ronald Lee, Charles M. Lucas, Peter R. Orszag, Louise M. Sheiner, Bryan Tysinger, David N. Weil, Justin Wolfers, and Rebeca Wong. 2017. "How the Growing Gap in Life Expectancy May Affect Retirement Benefits and Reforms." *Geneva Papers on Risk and Insurance – Issues and Practice* 42: 475-499.

Bound, John, Arline Geronimus, Javier Rodriguez, and Timothy Waidmann. 2014. "Measuring Recent Apparent Declines in Longevity: The Role of Increasing Educational Attainment." *Health Affairs* 34(12): 2167-2173.

Brown, Jeffrey R. 2002. "Differential Mortality and the Value of Individual Account Retirement Annuities." In *The Distributional Aspects of Social Security and Social Security Reform*, edited by Martin Feldstein and Jeffrey B. Liebman, 401-446. Chicago, IL: University of Chicago Press.

Brown, Jason and Mark Warshawsky. 2013. "The Life Care Annuity: A New Empirical Examination of an Insurance Innovation that Addresses Problems in the Markets for Life Annuities and Long-Term Care Insurance." *Journal of Risk and Insurance* 80(3): 677-703.

Boyer, M. Martin, Sébastien Box-Couillard, and Pierre-Carl Michaud. 2020. "Demand for Annuities: Price Sensitivity, Risk Perceptions, and Knowledge." *Journal of Economic Behavior and Organization* 180: 883-902.

Bütler, Monika and Staubli Stefan. 2011. "Payouts in Switzerland: Explaining Developments in Annuitization." In *Securing Lifelong Retirement Income: Global Annuity Markets and Policy*, edited by Olivia S. Mitchell, John Piggott, and Noriyuki Takayama, 195-213. Oxford, UK: Oxford University Press.

Cannon, Edmund and Ian Tonks. 2016. "Cohort Mortality Risk or Adverse Selection in Annuity Markets?" *Journal of Public Economics* 141: 68-81.

Cannon, Edmund, Ralph Stevens, and Ian Tonks. 2015. "Price Efficiency in the Dutch Annuity Market." *Journal of Pension Economics and Finance* 14(1): 1-18.

Cannon, Edmund and Ian Tonks. 2009. "Money's Worth of Pension Annuities." Research Report No. 563. Leeds, UK: Department for Work and Pensions.

Case, Anne and Angus Deaton. 2015. "Rising Morbidity and Mortality in Midlife among White Non-Hispanic Americans in the 21st Century." *Proceedings of the National Academy of Sciences* 112(49): 15078-15083.

Chetty, Raj, Michael Stepner, Sarah Abraham, Shelby Lin, Benjamin Scuderi, Nicholas Turner, Augustin Bergeron, and David Cutler. 2016. "The Association between Income and Life Expectancy in the United States, 2001-2014." *Journal of the American Medical Association* 315(16): 1750-1766.

Cutler, David, Angus Deaton, and Adriana Lleras-Muney. 2006. "The Determinants of Mortality." *Journal of Economic Perspectives* 20(3): 97-120.

Dowd, Jennifer B. and Amar Hamoudi. 2014. "Is Life Expectancy Really Falling for Groups of Low Socio-Economic Status?" *International Journal of Epidemiology* 43(4): 983-988.

Finkelstein, Amy and James Poterba. 2002. "Selection Effects in the United Kingdom Individual Annuities Market." *The Economic Journal* 112(476): 28-50.

Finkelstein, Amy and James Poterba. 2004. "Adverse Selection in Insurance Markets: Policyholder Evidence from the U.K. Annuity Market." *Journal of Political Economy* 112(1): 183-208.

Fong, Joelle H. 2015. "Beyond Age and Sex: Enhancing Annuity Pricing." *The Geneva Risk and Insurance Review* 40: 133-170.

Fong, Joelle H. Y., Jean Lemaire, and Yiu K. Tse. 2011. "Improving Money's Worth Ratio Calculations: The Case of Singapore's Pension Annuities." SSRN Working Paper Series No. 1928323.

Galama, Titus J., Adriana Lleras-Muney, and Hans van Kippersluis. 2018. "The Effect of Education on Health and Mortality." Working Paper 24225. Cambridge, MA: National Bureau of Economic Research.

Gong, Guan and Anthony Webb. 2010. "Evaluating the Advanced Life Deferred Annuity – an Annuity People Might Actually Buy." *Insurance: Mathematics and Economics* 46: 210-221.

Horneff, Vanya, Raimond Maurer, and Olivia S. Mitchell. 2020. "Putting the Pension Back in 401(k) Retirement Plans: Optimal versus Default Longevity Income Annuities." *Journal of Banking and Finance* 114: 105783.

Kaschützke, Barbara and Raimond Maurer. 2011. "The Private Life Annuity Market in Germany: Products and Money's Worth Ratios." In *Securing Lifelong Retirement Income: Global Annuity Markets and Policy,* edited by Olivia S. Mitchell, John Piggott, and Noriyuki Takayama, 131-158. Oxford, UK: Oxford University Press.

Leive, Adam A., and Christopher J. Ruhm. "Education Gradients in Life Expectancy by Gender and Race." Working Paper 28419. Cambridge, MA: National Bureau of Economic Research.

Lleras-Muney, Adriana. 2005. "The Relationship Between Education and Adult Mortality in the United States." *The Review of Economic Studies* 72(1): 189-221.

Meara, Ellen R., Seth Richards, and David M. Cutler. 2008. "The Gap Gets Bigger: Changes in Mortality and Life Expectancy, by Education 1981-2000." *Health Affairs* 27(2): 350-360.

Meyricke, Ramona and Michael Sherris. 2013. "The Determinants of Mortality Heterogeneity and Implications for Pricing Annuities." *Insurance: Mathematic and Economics* 53(2): 379-387.

Milevsky, Moshe A. and Ling-Wu Shao. 2010. "Annuities and their Derivatives: The Recent Canadian Experience." PRC WP 2010-16. Philadelphia, PA: The Wharton School, University of Pennsylvania.

Mitchell, Olivia S., James M. Poterba, Mark J. Warshawsky, and Jeffrey R. Brown. 1999. "New Evidence on the Money's Worth of Individual Annuities." *American Economic Review* 89(5): 1299-1318.

Munnell, Alicia H., Gal Wettstein, and Wenliang Hou. 2021 (forthcoming). "How Best to Annuitize Defined Contribution Assets?" *Journal of Risk and Insurance*.

Ruiz, John M., Patrick Steffen, and Timothy B. Smith. 2013. "Hispanic Mortality Paradox: A Systematic Review and Meta-Analysis of the Longitudinal Literature." *American Journal of Public Health* 103(3): e52-e60.

Sasson, Isaac. 2016. "Trends in Life Expectancy and Lifespan Variation by Educational Attainment: United States 1990-2010." *Demography* 53(2): 269-293.

Society of Actuaries. 2006. "Substandard Annuities." Report. Schaumburg, IL. Available at: https://www.soa.org/globalassets/assets/files/research/007289-substandard-annuities-full-rpt-rev-8-21.pdf

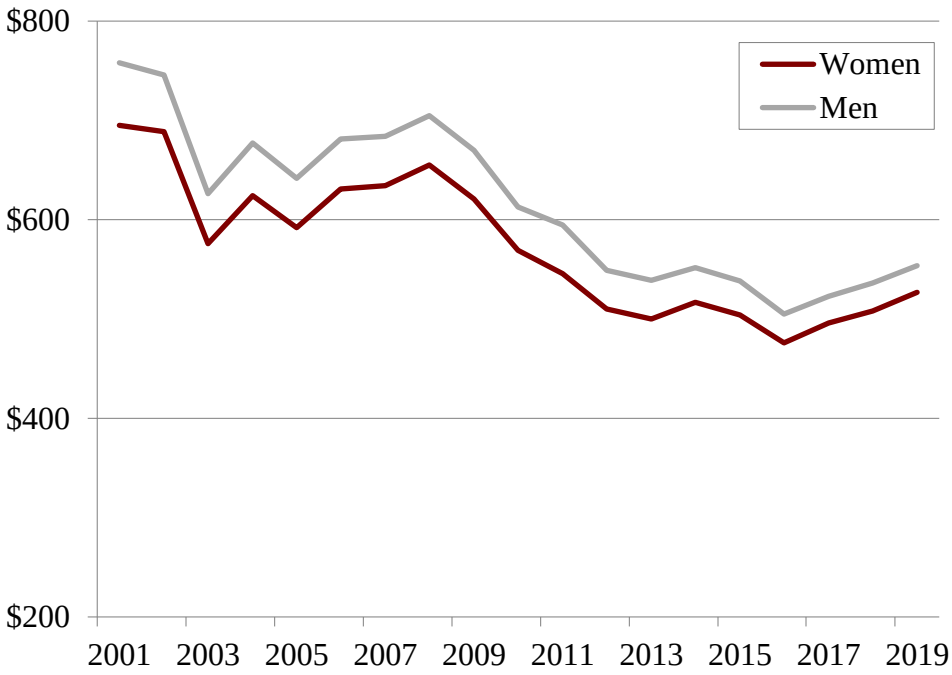
U.S. Social Security Administration. 2020. *The Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds*. Washington, DC: U.S. Government Printing Office.

Waldron, Hilary. 2007. "Trends in Mortality Differentials and Life Expectancy for Male Social Security-Covered Workers, by Socioeconomic Status." *Social Security Bulletin* 67(3): 1-28.

Yaari, Menahem E. 1965. "Uncertain Lifetime, Life Insurance, and the Theory of the Consumer." *Review of Economic Studies* 32(2): 137-150.

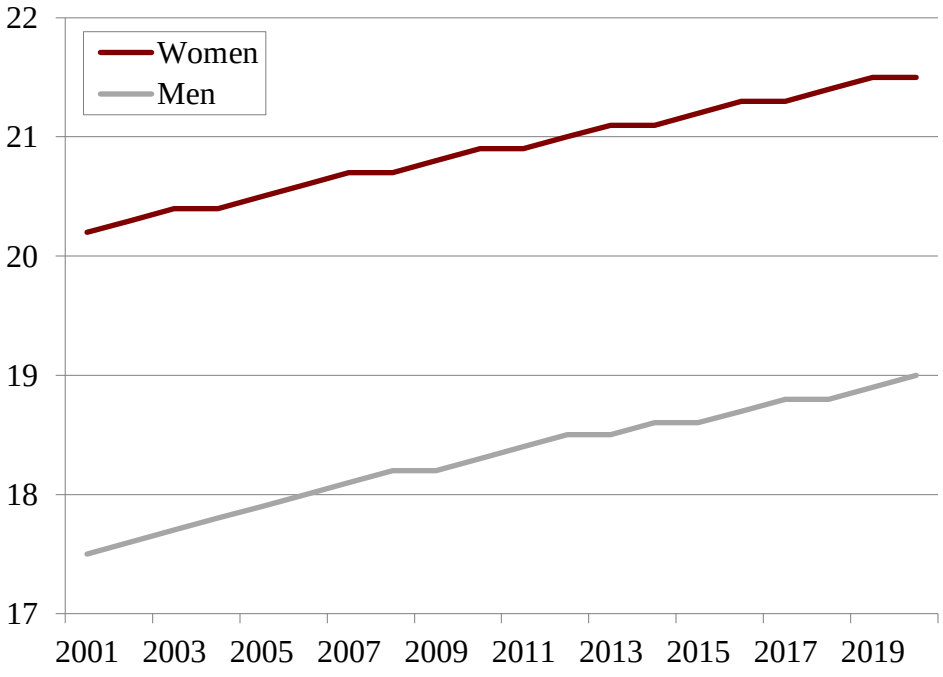
Zaiken, Judy, Joseph E. Montminy, Teodor Radu, Gary Baker. 2016. “Income Annuity Buyer Study: Creating Guaranteed Lifetime Income.” Atlanta, GA: LIMRA Secure Retirement Institute.

Figure 1. *Average Monthly Immediate Annuity Payment for $100,000 Premium at Age 65, by Gender, 2001-2019*



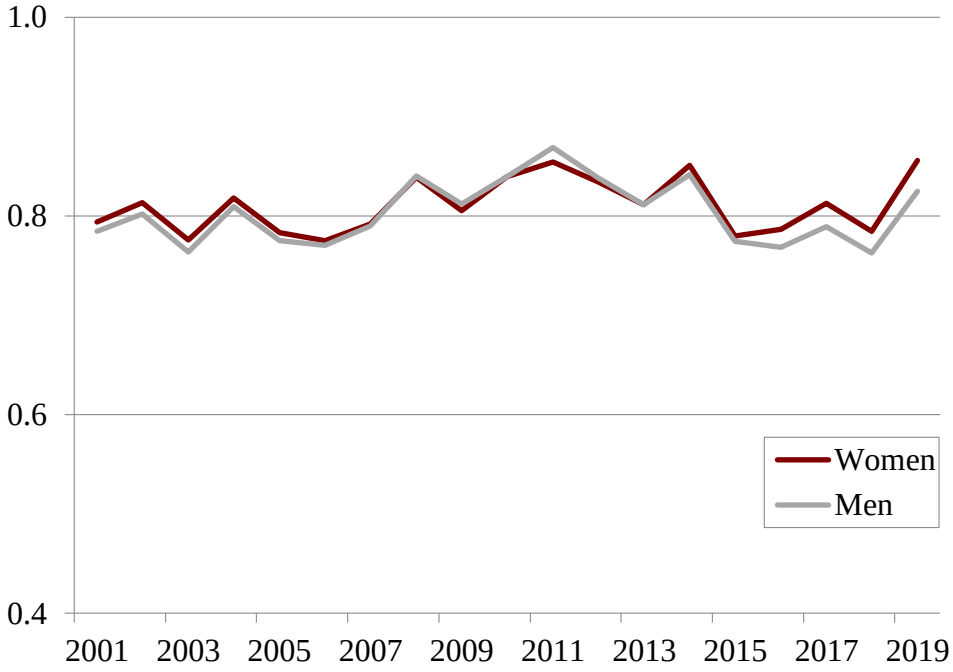
Source: Annuity Shopper archive files for the month of July each year, average of firms' quotes.

Figure 2. *Cohort Life Expectancy at Age 65, by Gender, 2001-2020*



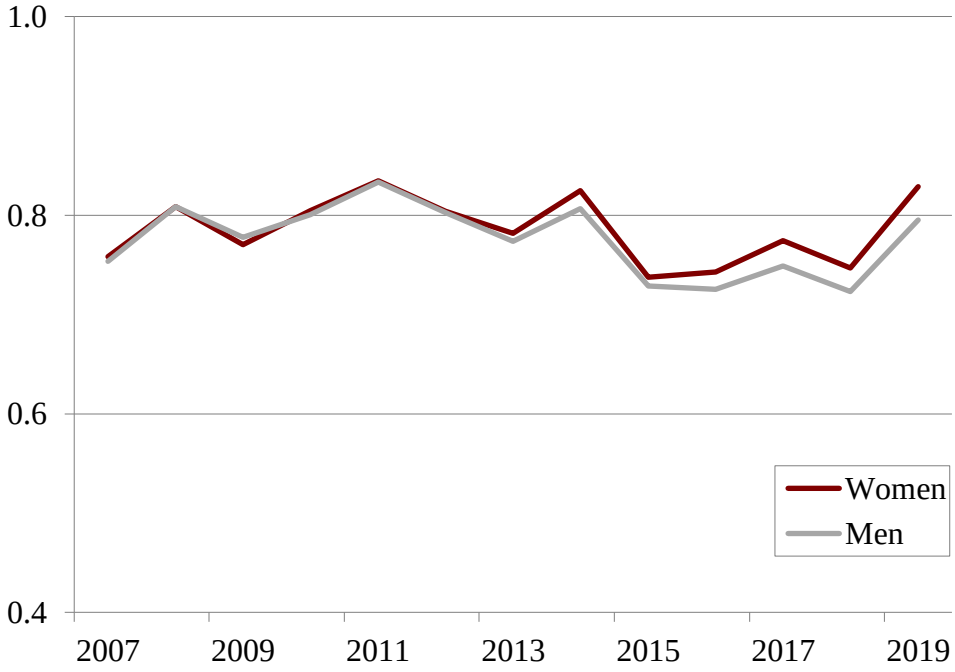
Source: U.S. Social Security Administration (2020).

Figure 3. *Money's Worth for Immediate Annuities at Age 65, by Gender, 2001-2019*



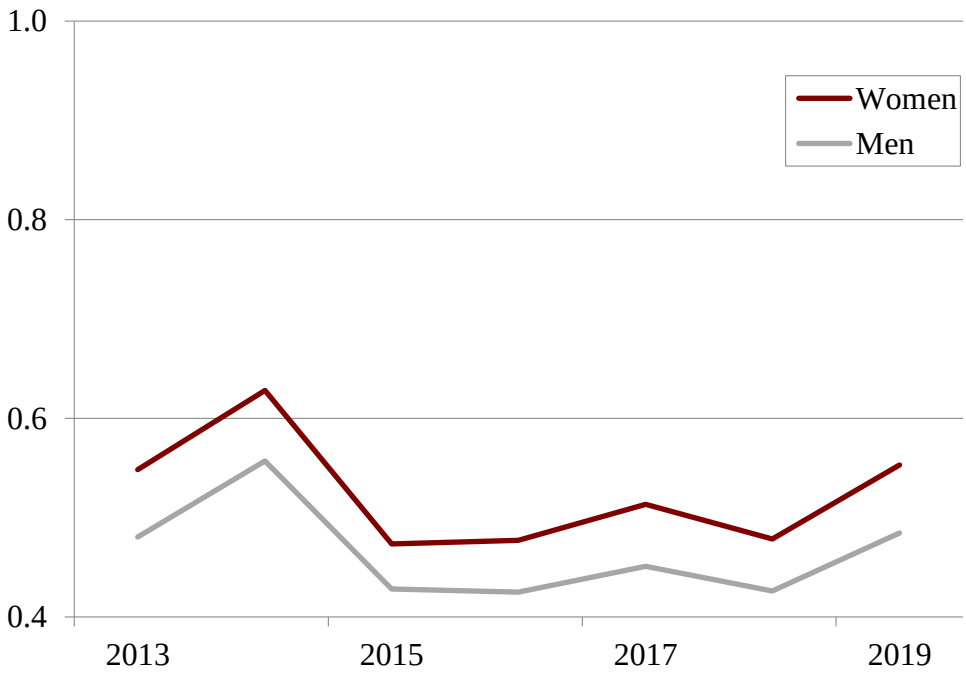
Source: Authors' calculations.

Figure 4. *Money's Worth for Immediate Annuities with a 3-Percent COLA at Age 65, by Gender, 2007-2019*



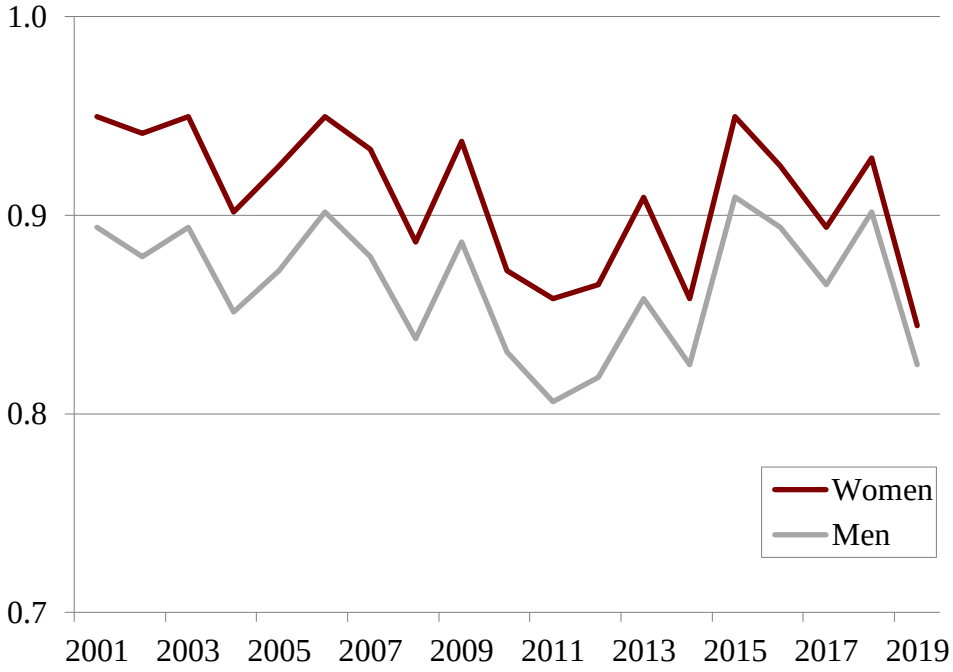
Source: Authors' calculations.

Figure 5. *Money's Worth at Age 65 for Annuities with Payment Deferred to Age 85, by Gender, 2013-2019*



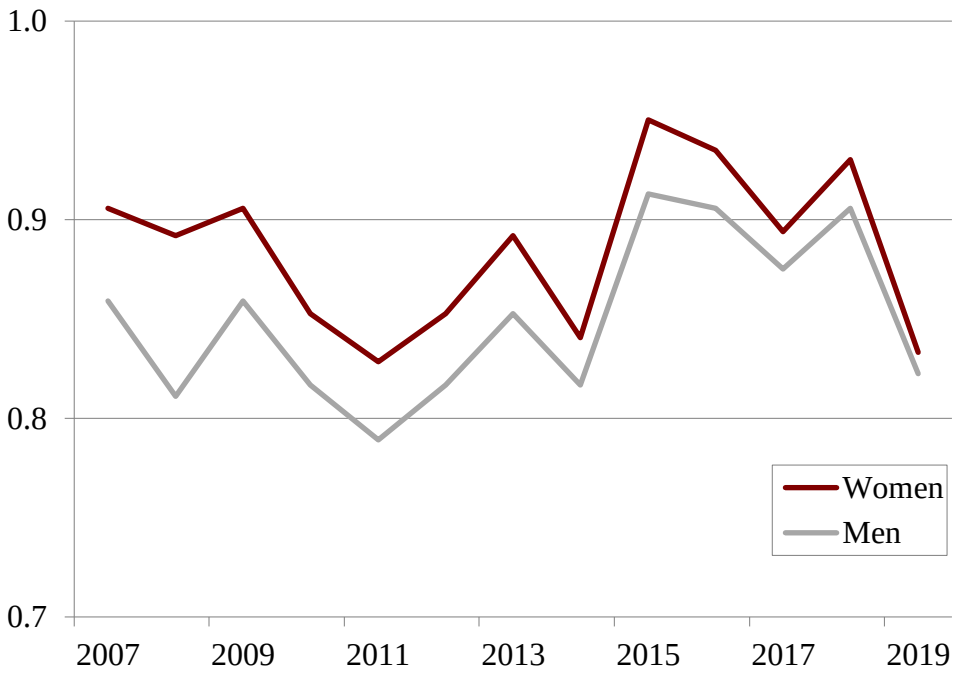
Source: Authors' calculations.

Figure 6. *Wealth Equivalence for Immediate Annuities at Age 65, by Gender, 2001-2019*



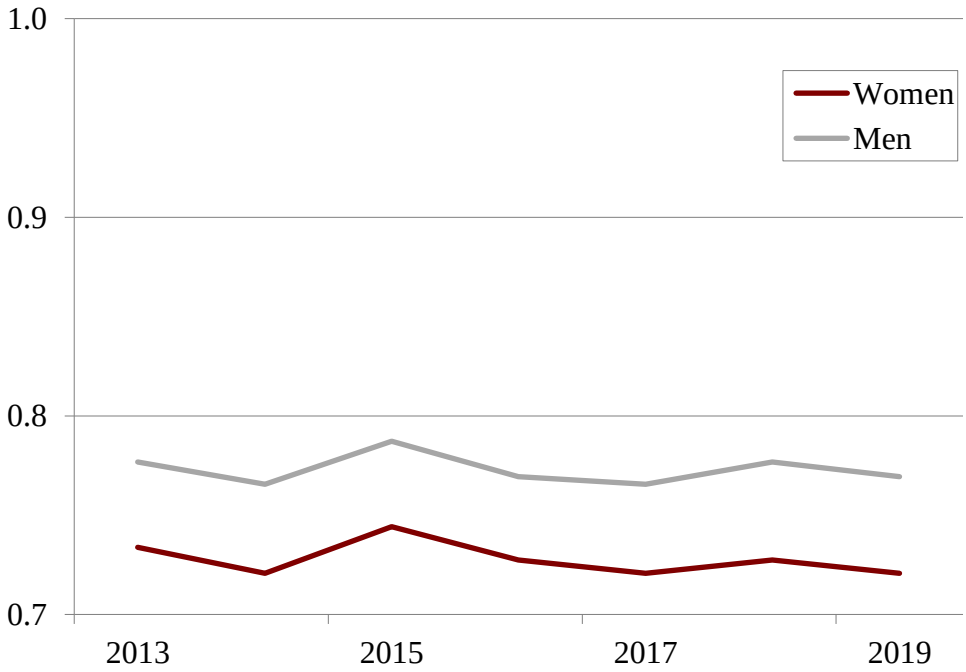
Source: Authors' calculations.

Figure 7. *Wealth Equivalence for Immediate Annuities with a 3-Percent COLA at Age 65, by Gender, 2007-2019*



Source: Authors' calculations.

Figure 8. *Wealth Equivalence at Age 65 for Annuities with Payment Deferred to Age 85, by Gender, 2013-2019*



Source: Authors' calculations.

Figure 9a. *Life Expectancy of Women at Age 65 in 2019, by SES Group*

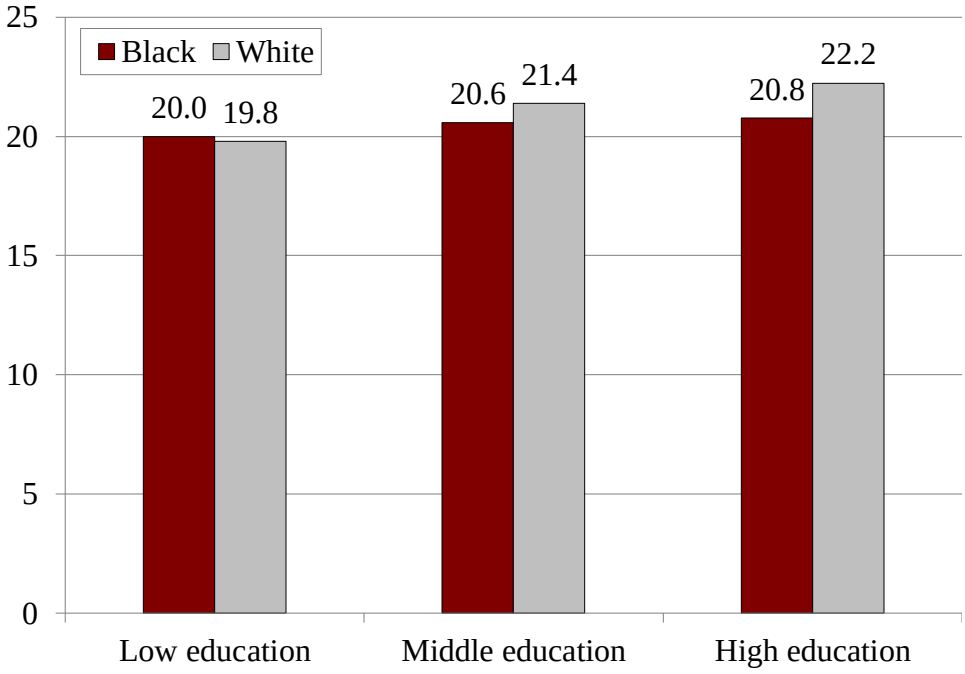
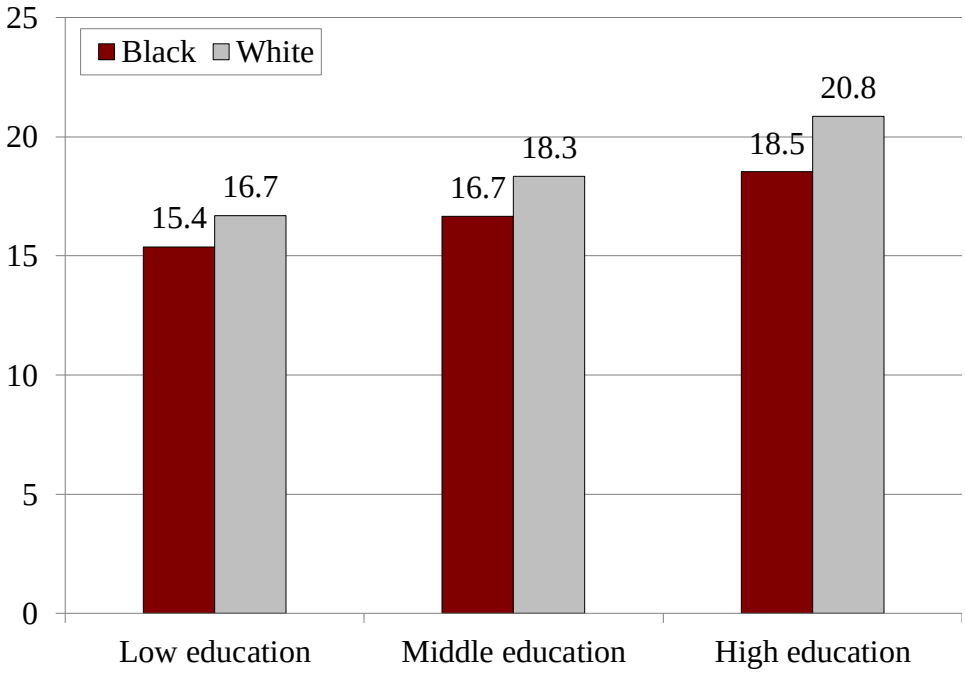


Figure 9b. *Life Expectancy of Men at Age 65 in 2019, by SES Group*



Source: Authors' calculations.

Figure 10a. *Money's Worth of a Nominal Immediate Annuity for Women at Age 65 in 2019, by SES Group*

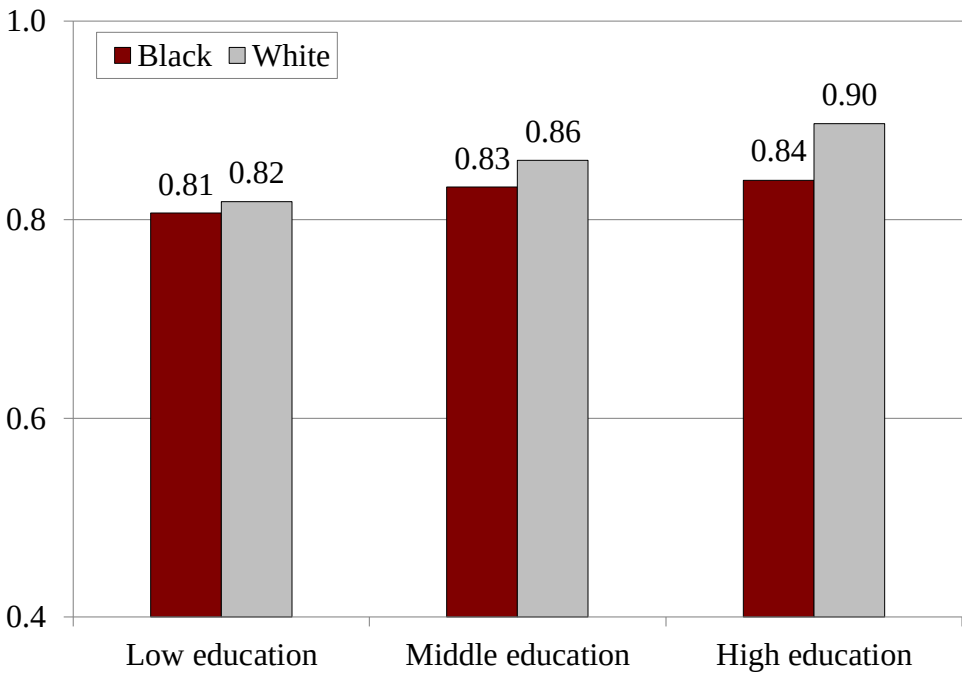
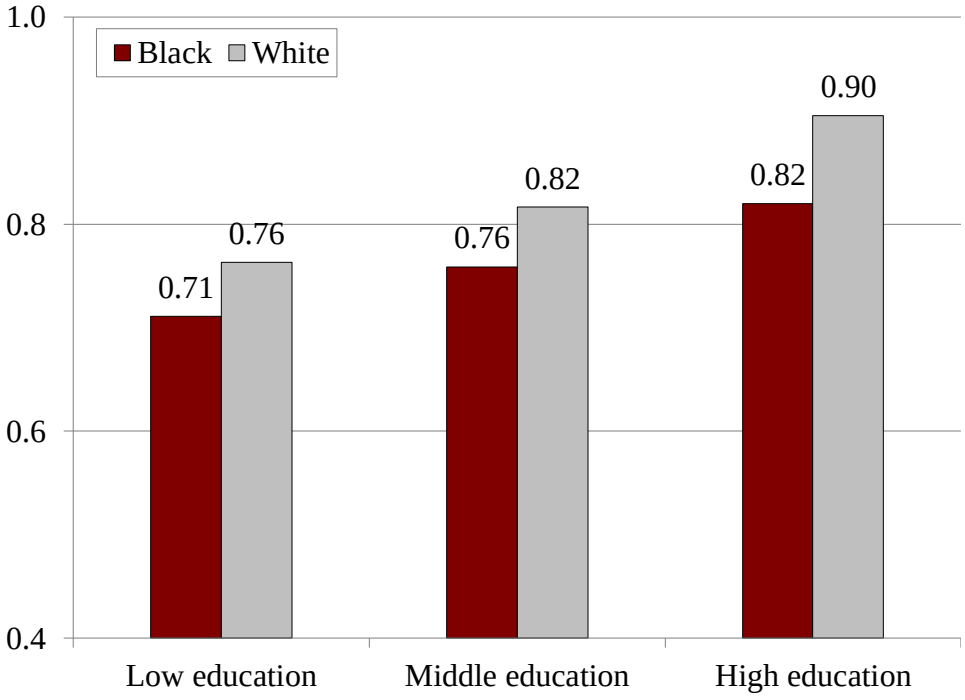


Figure 10b. *Money's Worth of a Nominal Immediate Annuity for Men at Age 65 in 2019, by SES Group*



Source: Authors' calculations.

Figure 11a. *Gap in Money's Worth between Top and Bottom Terciles for Blacks, by Gender, 2001-2019*

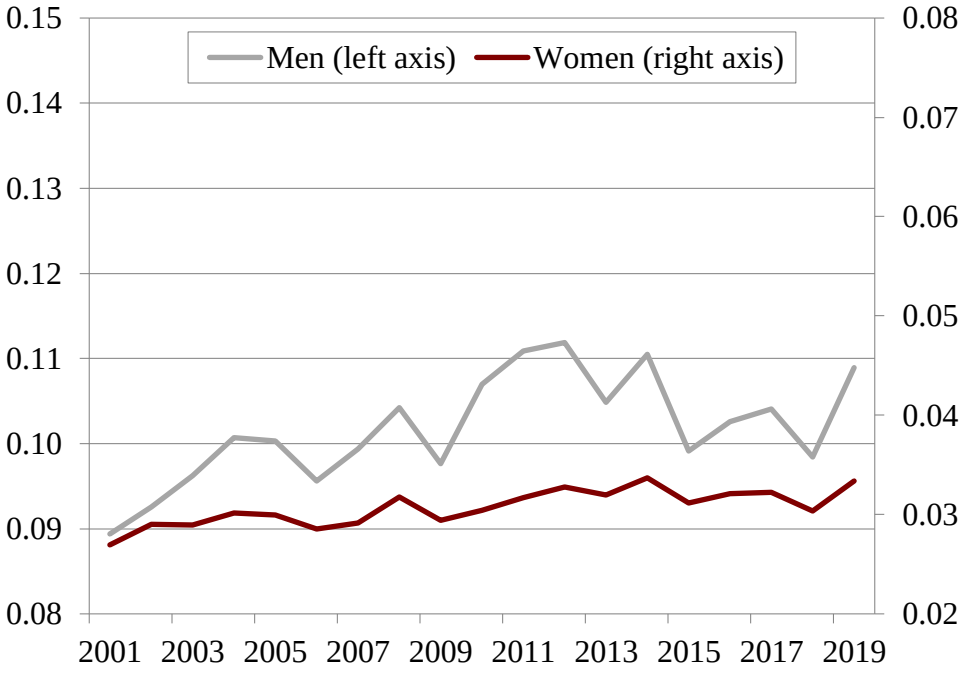
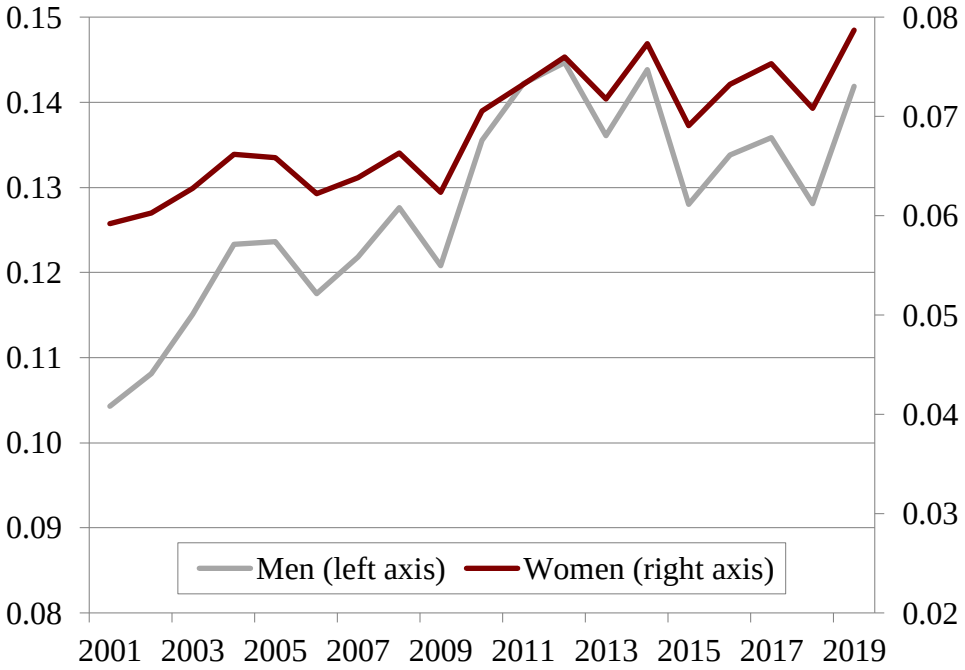
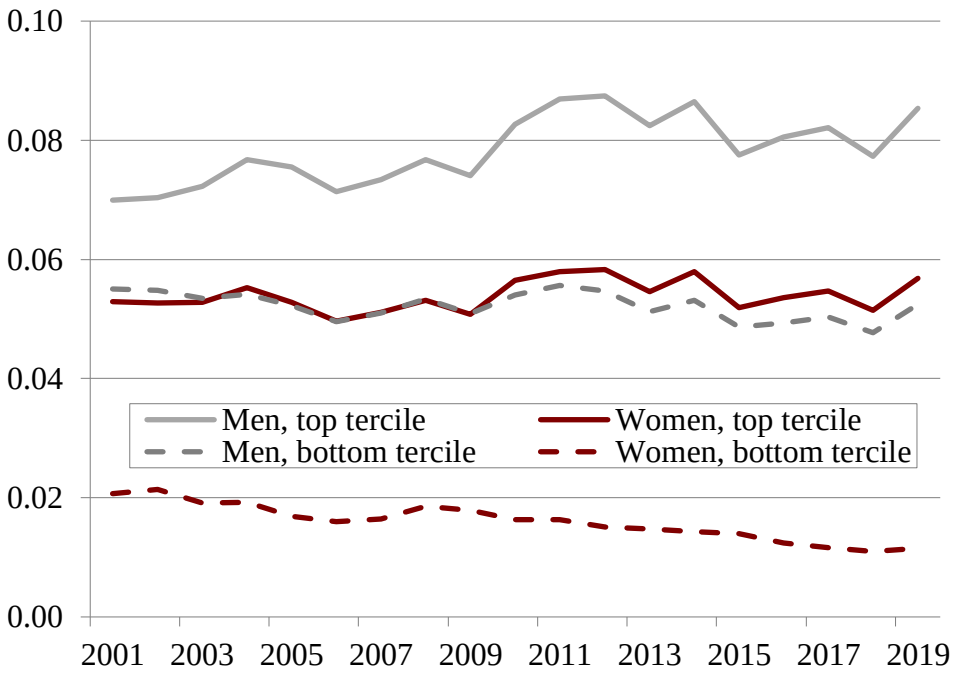


Figure 11b. *Gap in Money's Worth between Top and Bottom Terciles for Whites, by Gender, 2001-2019*



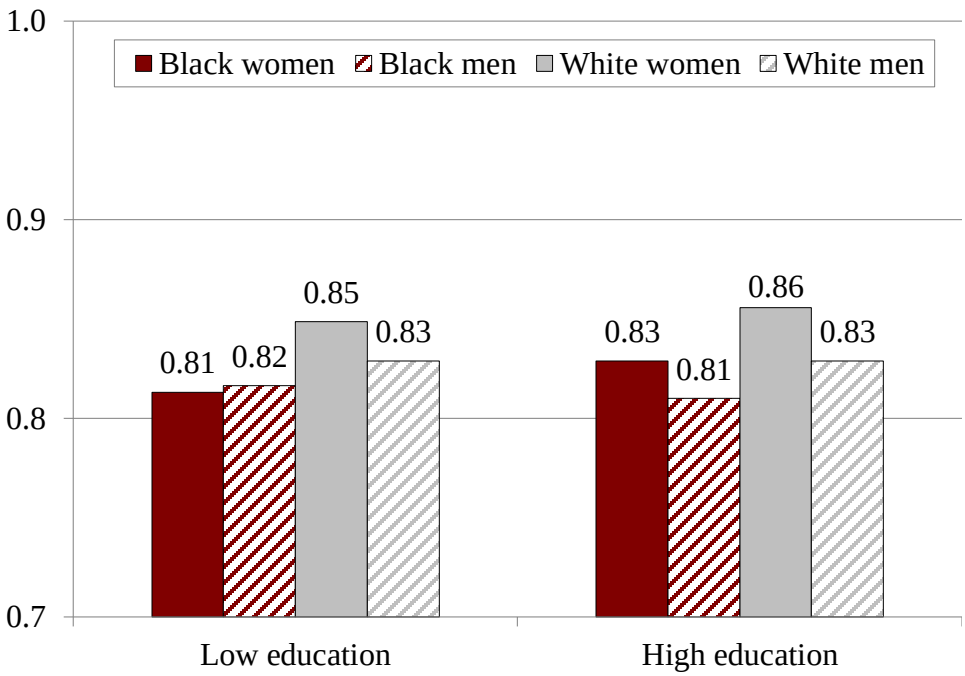
Source: Authors' calculations.

Figure 12. *Racial Gap in Money's Worth of Immediate Annuities Conditional on Relative Education, by Gender, 2001-2019*



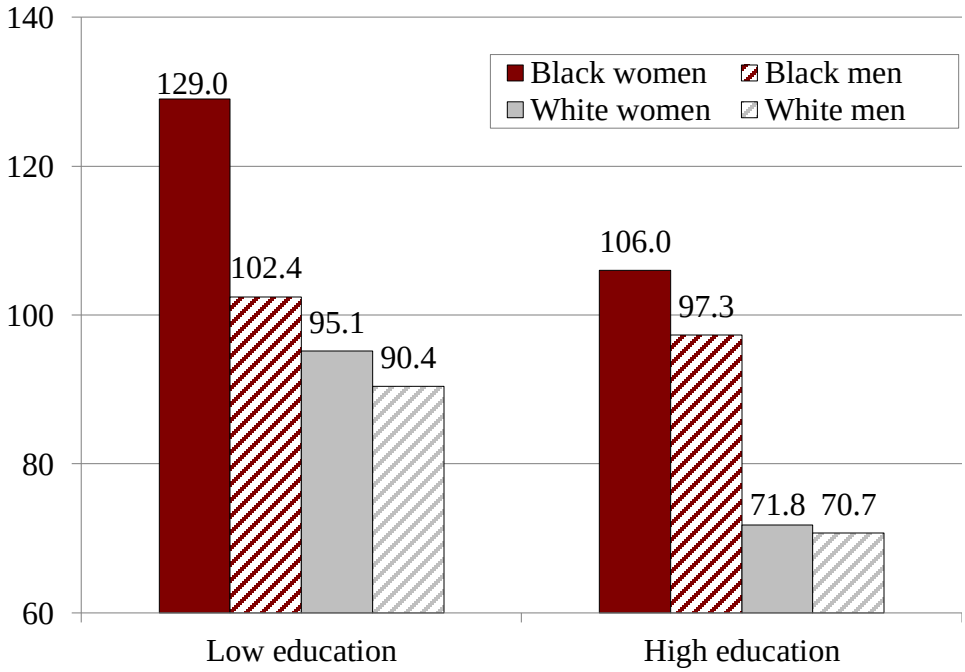
Source: Authors' calculations.

Figure 13. *Wealth Equivalent of Immediate Annuities for Top and Bottom Education Terciles, by Gender and Race, in 2019*



Source: Authors' calculations.

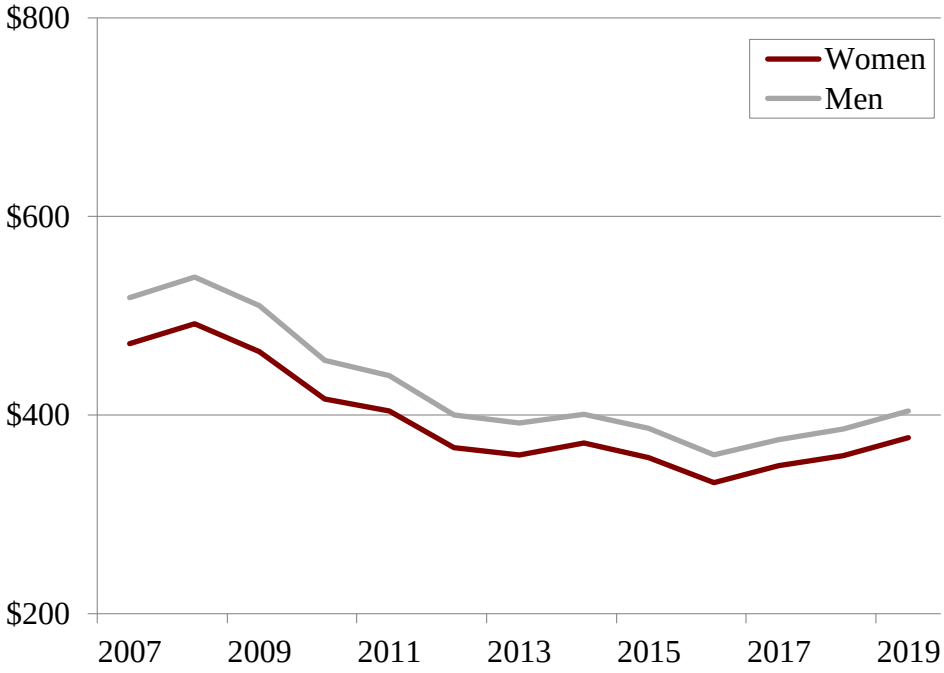
Figure 14. *Variance of Longevity by Gender, Race, and Education in 2019*



Source: Authors' calculations, based on 10,000 simulations.

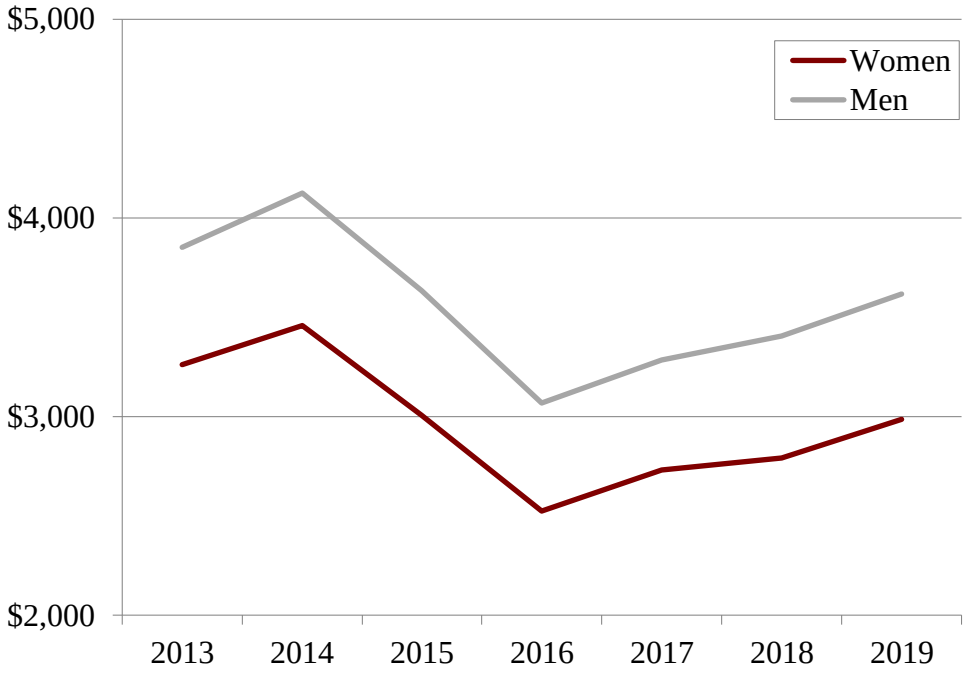
Appendix

Figure A1. *Market Quotes of Immediate Annuities with a 3 Percent COLA at Age 65, by Gender*



Source: Annuity Shopper archive files for the month of July each year, average of firms' quotes.

Figure A2. *Market Quotes of Deferred Annuities at Age 65, by Gender*



Source: Annuity Shopper archive files for the month of July each year, average of firms' quotes.

RECENT WORKING PAPERS FROM THE CENTER FOR RETIREMENT RESEARCH AT BOSTON COLLEGE

Will Women Catch Up to Their Fertility Expectations?
Anqi Chen and Nilufer Gok, February 2021

The Consequences of Current Benefit Adjustments for Early and Delayed Claiming
Andrew G. Biggs, Anqi Chen, and Alicia H. Munnell, January 2021

Intended Bequests and Housing Equity in Older Age
Gary V. Engelhardt and Michael D. Eriksen, January 2021

The Effect of Early Claiming Benefit Reduction on Retirement Rates
Damir Cosic and C. Eugene Steuerle, January 2021

Financial Security at Older Ages
Barbara A. Butrica and Stipica Mudrazija, December 2020

Do People Work Longer When They Live Longer?
Damir Cosic, Aaron R. Williams, and C. Eugene Steuerle, December 2020

Do State and Local Government Employees Save Outside of Their Defined Benefit Plans When They Need To?
Laura D. Quinby and Geoffrey T. Sanzenbacher, November 2020

How Much Taxes Will Retirees Owe on Their Retirement Income?
Anqi Chen and Alicia H. Munnell, November 2020

A Behavioral Economics Assessment of SSDI Earnings Reporting Documents
Denise Hoffman, Jonah Deutsch, and Britta Seifert, November 2020

How Accurate Are Retirees' Assessments of Their Retirement Risk?
Wenliang Hou, July 2020

Is Nontraditional Work at Older Ages Associated with Better Retirement Security?
Matthew S. Rutledge and Gal Wettstein, July 2020

New Insights on Self-Employment of Older Adults in the United States
Joelle Abramowitz, July 2020

What Jobs Do Employers Want Older Workers to Do?
Alicia H. Munnell, Gal Wettstein, and Abigail N. Walters, June 2020

All working papers are available on the Center for Retirement Research website (https://crr.bc.edu) and can be requested by e-mail (crr@bc.edu) or phone (617-552-1762).