Low Returns and Optimal Retirement Savings

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Abstract

Lifetime financial outcomes relate closely to the sequence of investment returns earned over the lifecycle. Higher return assumptions allow individuals to save at a lower rate, withdraw at a higher rate, retire with a lower wealth accumulation, and enjoy a higher standard of living throughout their lifetimes. Often analysis of this topic is based on the investment performance found in historical market returns. However, at the present bond yields are historically lower and equity prices are quite high, suggesting that individuals will likely experience lower returns in the future. Increases in life expectancy, especially among higher-income workers who must also rely more heavily on their private savings to smooth spending, further increases the cost of funding retirement income today. The implications are higher savings rates, lower withdrawal rates, the need for a larger nest egg at retirement, and a lower lifetime standard of living. We demonstrate this using a basic life cycle framework, and provide a more complex analysis of optimal savings rates that incorporates Social Security, tax rates before and after retirement, actual retirement spending patterns, and differences in expected longevity by income. We find that lower-income workers will need to save about 50 percent more if low rates of return persist in the future, and higher-income workers will need to save nearly twice as much in a low return environment compared to the optimal savings using historical returns.

Keywords: retirement planning, saving for retirement, sustainable spending, lifecycle finance

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This chapter explores how lower expected returns affect optimal saving and spending during working years, retirement replacement rates, retirement lifestyles, and the cost of bequests. This is important because the prices of bonds and stocks are much higher than in the recent past, suggesting a greater likelihood that portfolio returns will fall below the assumptions commonly used to estimate retirement savings adequacy. Basing retirement planning recommendations on historical returns can provide a misleading picture about what individuals at present will need to do to smooth their lifestyles and fund successful retirements.

We estimate a simple life cycle model to illustrate how lower future asset returns will impact workers. Optimal lifetime spending is sensitive to expected rates of return. Workers will need to save significantly more to smooth spending and they will need to spend less before and after retirement. In a model that incorporates Social Security, taxes, expected longevity by earned lifetime income, and spending patterns in retirement we find that lower income workers will need to save about 50 percent more if future asset returns resemble today's low yield environment, and higher-income workers will need to save as much as 100 percent more to retire at age 65. A reasonable alternative to facing a lower level of lifetime spending is delaying retirement.

Investments Have Become More Expensive

Lower investment returns must be factored into how workers plan for retirement. Figure 1 compares the cost of buying $1,000 of income from a 10-year Treasury Bond, $1,000 of stock dividends, and $1,000 of total corporate earnings, during 20-year time periods beginning in 1955. The figure suggests that it is now more expensive to buy income from investments than in the past, and this era of high asset prices has persisted for a long period of time. There were a few periods during the twentieth century when bond yields fell to a rate similar to the near-zero yields of today, but these were generally caused by a flight to safety during each of the World Wars and the Great Depression. The current era is unique in that low bond yields and high stock valuations are occurring in tandem for an extended period of time. This suggests an increase in demand for all financial assets.

Figure 1 here

Life Cycle Implications

A reasonable goal for most households is to save and spend in a manner that roughly smooths spending (as a proxy for one's standard of living) over the lifetime, giving rise to retirement saving. Forward-looking workers will understand that their lifestyles cannot be maintained by Social Security alone, so they will set money aside during their working years to avoid spending reductions in retirement.

Among other factors, decisions about optimal lifetime saving and spending depend on future salary, retirement length, and the investment rate of return. Given a salary profile and length of life, higher investment returns will allow a household to save less while accumulating the same wealth at retirement. For example, if a household earns $50,000 at age 25, expects 3 percent annual salary growth, and seeks $1 million at age 65, this can be achieved with a 10 percent annual savings rate when investments return 5 percent. But if returns are only 2 percent, the required savings rate increases to 18 percent to reach this goal.

Lower returns will also reduce the income generated from $1 million from age 65. Figure 2 shows the amount of income a retiree can purchase using a bond ladder at real interest rates from 0 to 5 percent for a duration of 30 years (until age 95), 35 years (to age 100), and 40 years (to age 105). Sustainable income falls from $61,954 to only $38,364 as rates fall from 5 percent to 1 percent. Extending the ladder to age 100 or 105 not only reduces the income that can be withdrawn each year at 5 percent ($58,164 and $55,503), but also increases the income spread compared to a 1 percent expected return ($33,667 and $30,154). Longer retirements are particularly hard hit by lower asset returns.

Figure 2 here

Figure 3 shows how optimal spending levels are reduced with lower rates of return, and the varying impact of asset returns on the cost of funding a legacy goal. Because workers need fewer dollars today to fund a dollar of spending in the future, higher rates of return allow a saver to spend more before and after retirement. Although the difference between a 6 percent and a 4 percent real rate of return appears modest, this two percentage point drop in returns results in a 9.1 percent decrease in lifetime spending (from $46,938 to $42,653) with no bequest and an 11.6 percent decrease in lifetime spending (from $46,008 to $40,572) with a $500,000 bequest. If real lifetime rates fell to 2 percent, lifetime spending would drop by 22.2 percent ($36,538) compared to a 6 percent real rate of return and by 34 percent ($32,195) with a $500,000 bequest. Low lifetime real rates of return will have a significantly larger impact on the spending of households that hope to leave a bequest.

Figure 3 here

Income replacement rates at retirement also fall with lower expected returns, if the retiree seeks to smooth his lifetime standard of living (see Figure 4). Planners therefore should consider the need to adjust replacement rates downward if they anticipate a low return environment during the retirement planning process. While optimal replacement rates at a 6 percent real portfolio return are near the 70 percent replacement rate rule of thumb, a 2 percent real portfolio return will result in an optimal replacement rate of about 55 percent when there is no bequest motive. At a 0 percent real portfolio return, the optimal replacement rate is a bit above 40 percent. With a legacy goal of $500,000, the optimal replacement rate falls further to 31 percent.

Figure 4 here

Finally, a perhaps counterintuitive result of our life cycle simulations in a low-return environment is that households will need to accumulate more wealth by the time they retire in order to maintain even a lower standard of living in retirement – particularly if they hope to leave a legacy. At a 2 percent expected real rate of portfolio return, the household must save just over $1 million by retirement with a $500,000 legacy goal, while a household expecting a 6 percent real rate of return will need to save just over $750,000. The amount of savings required in a low return environment as shown in Figure 5 (the difference between income and spending) needs to be much higher to fund a larger nest egg in order to pay for a more expensive retirement. As noted, the amount that the household can spend each year in this more expensive retirement is also more modest.

Figure 5 here

What is a reasonable portfolio return assumption? From the investor's perspective, the choice should be net of inflation, investment expenses, asset management fees, and taxes. Real interest rates can be found using the yield curve for Treasury Inflation-protected Securities (TIPS). With a 1 percent rate and longer-term maturities, investment and asset management fees may result in negative real returns. Expected real equity returns may be in the range of perhaps 2-4 percent net of asset fees and inflation. It is reasonable to evaluate the planning consequences of a future 0 percent to 2 percent real future portfolio return.

Changes in Longevity

While the length of the retirement life cycle stage is unknown at the time of retirement, the cost of funding an income stream rises as expected longevity rises. A longer lifetime gives workers three choices. They can retire later; they can retire at the same age as yesterday's retiree and spend less; or they can retire at the same age and accept a greater risk of outliving assets while maintaining the same lifestyle. None of these choices results in a better retirement than the high return environment would.

Life expectancies for Americans who reach the age of 65 rose significantly during the twentieth century. In addition, higher-income earners are living longer than lower earners, as indicated in Figure 6. This relatively recent trend (Chetty et al. 2016) in which higher-earning Americans are seeing the largest improvements in longevity raises the cost of retirement for those who rely the most on savings to maintain their spending in retirement. Since Social Security provides a larger income replacement rate for lower-income workers, increases in longevity raise the cost of retirement for those who need to replace the largest portion of their retirement income with savings.

Figure 6 here

The simultaneous improvement in longevity coupled with the decline in real interest rates on bonds raise the cost of buying an annuitized income stream in retirement. Figure 7 reports the cost of buying $1 in lifetime income via an inflation-adjusted annuity using mortality-weighted net present value of cash flows. Using historical mortality tables from the Social Security Administration (2015), historical bond Treasury yields from the Federal Reserve (2017), and historical implied inflation estimates from Cleveland Federal Reserve Bank (2017), we calculate the cost of buying safe real income between 1982 and 2015. Observed annuity payouts offered by annuity companies differ slightly, but they are very similar to the prices of annuities using data from Immediateannuities.com (2017).

Figure 7 here

Our results show that rising longevity and falling real interest rates doubled the cost of buying safe income over the last 35 years. In other words, a retiree today who hopes to fund expenses through safe investments will need to save twice as much, all else equal, if he or she expects to retire at age 65.

It may be tempting for retirees to avoid annuitizing wealth at retirement when the cost of buying safe income is so high. In reality, annuitizing safe investments becomes even more important when interest rates are low. This is because building a bond ladder, an alternative to annuitization, is also more expensive when interest rates are low. But the difference between the cost of buying a bond ladder to fund spending, particularly spending at older ages, and buying income through an annuity widens as interest rates fall. In other words, the mortality credit that allows a retiree to spend a higher percentage of his or her income than he or she could receive from a bond ladder becomes relatively more important when interest rates are low.

Estimated Increases in Optimal Savings Rates

Many assumptions in this life cycle model are unrealistic. We have not included Social Security income, which provides an income cushion that softens the blow of low asset returns. We also omit differences in taxation before and after retirement, and we do not consider the natural decrease in spending that most retirees experience as their physical and cognitive abilities decline in old age.

To address these complexities, we have built a model to estimate the required savings rate needed to fund a spending amount after tax that smooths consumption immediately after retirement and then maintains a typical retiree's subsequent declining spending path (Blanchett and Idzorek 2015). It also incorporates the impact of progressive taxation at different levels of income before and after retirement, and it estimates the amount of Social Security income that a retiree at different levels of income can expect to receive. We assume that all savings are pre-tax (e.g., in a Traditional 401(k) or IRA). A more detailed description of assumptions is provided in the Appendix.

In line with the observed decline in real spending that occurs during retirement (Blanchett 2014), we assume that real spending needs fall each year in retirement. Earnings paths are based on empirically observed changes in pay by age and level of income. We also assume that the amount of annual savings rises with income over the life cycle. Since longevity is expected to improve for future workers, we assume younger workers will have to fund more years of spending in retirement if they retire at a given age. Since higher-income workers will also live longer, we assume that higher earners will need to fund more years of retirement spending.

American retirees rarely annuitize their savings to provide guaranteed income throughout retirement, and hence, a certain percentage of retirees will outlive their savings. This requires us to establish an acceptable probability of depleting savings during retirement in order to generate a lifetime spending path. Our simulations set this probability at 20 percent. A lower probability would result in higher estimated savings rates. Mortality rates for single households are based on gender-neutral mortality, while mortality rates for a married household assume one male and one female of the same age.

Asset returns are estimated using an autoregressive model (Blanchett et al. 2013), calibrated so that one return series approximates the historical averages; it includes three additional scenarios of low, medium, and high expected returns. The high scenario has returns similar to long-term averages but incorporates today’s low bond yields. We also include a 50 bp portfolio fee, so workers will need to save more than our estimates in order to pay higher fees on savings.

Worker’s portfolios are assumed to decrease the fraction in risky assets nearing retirement. The allocation is based on the Morningstar Moderate Lifetime Index glide path, which takes into account the present value of human capital as a bond-like asset to generate optimal asset allocations over the life cycle (Morningstar 2015).

We estimate savings rates for scenarios that include low, moderate, and historical asset returns. In the low and moderate simulations, bond yields begin at a 2 percent real rate of return. In the low return scenario, the mean real return starts at 2 percent and follows a random distribution that rises to 3.5 percent at the 75th percentile and 5.25 percent at the 95th percentile (or falls to 1 percent at the 5th percentile). In the moderate return scenario, the real return rises to 4 percent on average. Since rates of return on long-duration corporate securities are currently below the mean expectations in the low return scenario, our projected saving rates using these rates of returns may underestimate the saving needed if the low return environment persists.

Results

Table 1 provides results for workers at various age and income levels who intend to retire at age 65. Optimal saving rates using historical data for joint households who start saving at age 25 are between 4.3 percent for low earners ($25,000), up to 9 percent for high earners ($250,000), and between 6.8 percent and 8.8 percent for singles. Higher-income households must save more because Social Security replaces a smaller percentage of income and because of progressive taxation.

Table 1 here

Assuming moderate returns increases the optimal saving rate by 63 percent, to 7.0 percent for couples with $25,000 of household income, and by 82 percent, to a 16.4 percent savings rate for couples earning $250,000. For most higher-income workers, a persistent low return environment results in workers optimally contributing up to the limit of their employer-sponsored retirement contributions even if they begin saving at young ages. Workers relying on historical returns to estimate optimal savings would believe that they needed to save much less than is needed to preserve their lifestyle after retirement.

The increase in saving needed to fund retirement is even more dramatic if households begin saving for retirement at ages 35 or 40. Now optimal saving rates rise to 24.1 percent, in the low return simulation, versus 14.3 percent using historical returns for a single worker who begins saving at age 35. If the household waits until age 40, the optimal savings rate rises to 27.5 percent. Even in a moderate return scenario, optimal savings rates are 24.8 percent for a single household and 22.8 percent for a couple. Both single and joint households who use historical asset returns to project optimal savings rates would save near the employee contribution limit for those with incomes of $100,000. At lower interest rates, this amount of savings is not nearly enough to sustain a lifestyle for those retiring at age 65.

Fortunately, most retirees are able to defer retirement to a later age. This allows them to save less during their working years, resulting in an improved lifestyle both before and after retirement. Despite deferring retirement for a few years, increases in longevity will not necessarily result in fewer years spent in retirement. For this reason, a reasonable alternative is to delay retirement since doing so increases the number of years of savings (and asset growth), reduces expected longevity, and increases Social Security income. Table 2 shows how optimal savings can be reduced (or lifestyle today can be improved) by delaying retirement for a household that begins to save at age 35.

Table 2 here

A couple earning $250,000 could reduce its saving rate from 26 to 18.7 percent if it deferred retirement from age 60 to 70. The benefits of deferring retirement are even greater in a low return environment. A couple using historical rates would need to save only 16.4 percent of income to retire at age 60, versus 12.2 percent if it retired at age 70. Workers who are shown realistic projections of lower expected returns may be more likely to choose a later retirement date, while those who project their retirement savings using historical returns may falsely believe that modest savings rates will allow them to retire at age 65.

Conclusion

In recent decades, prices for stocks and bonds have risen well above their historical averages. Higher asset prices imply lower expected future asset returns, so workers who rely on historical asset returns to project optimal retirement savings are at risk of unexpected shortfalls.[1] Improvements in longevity have also increased the cost of retiring at a given age. Workers, employers, and policymakers who rely on historical asset returns to make saving recommendations may fail to recognize how sensitive optimal savings rates are to persistent low investment returns. Our simple life cycle framework suggests that saving rates would need to rise by roughly two-thirds for most Americans given persistent low returns. Also, higher-income workers are most at risk of under-saving if they use historical asset return projections.

Appendix

Methodology and Data Details

We build on the model of Blanchett and Idzorek (2015) in our analysis.

Retirement income goal. Our model assumes that the individual seeks to maintain his or her level of after-tax (i.e., take-home) pay during retirement, compared to his or her after-tax income immediately before retirement. Retirement is assumed to commence at age 65.[2]

Change in annual retirement income need. Many retirement income models assume that retiree consumption (i.e., the annual retirement income need) increases annually with inflation throughout retirement (i.e., constant real spending), yet Blanchett et al. (2014), among others, suggests that actual retiree spending need not increase by inflation throughout retirement. Our model assumes that retirees tend to decrease spending in retirement in real terms, although the relationship varies by the total level of household spending. In particular, we assume that the annual retirement spending need changes (ΔAS) during retirement for a given age (Age) and for a given target spending level ($SpendTar$) as follows where the maximum annual real change is +1 percent and the minimum annual real change is -1 percent:

$$\Delta AS = 0.00008(Age^2) - (0.0125 * Age) - 0.0066 \ln(SpendTar) + 54.6\% \quad \text{[A1]}$$

Figure A1 shows how the real retirement income need changes for three target spending levels: \$25,000, \$50,000, and \$100,000 from ages 65 to 100.

Figure A1 here

Income growth model. To trace workers' earnings over the life cycle, we have estimated regressions using data from the IPUMS-CPS (2015). To be included in the analysis, individuals had to be coded as employed, working at least 20 hours a week in all jobs, and have annual total wage compensation of at least \$5,000.[3]

It is assumed that an individual in a given earnings percentile (e.g., the 15th percentile) remains in that percentile for his or her entire working career (see Figure A2).

Figure A2 here

Savings growth model. A common assumption in retirement planning models is that deferral rates remain constant as the individual ages. Nevertheless, this does not track actual investor behavior. Our research suggests that a more realistic accrual path has saving rates increase by approximately 25 percent over 10 years. For example, a 35-year-old saving 10 percent of pay would be assumed to be saving 12.27 percent at age 45, but only 1.56 percent by age 55.

Retirement period. The base mortality table used for this analysis is the Social Security Administration 2013 Periodic Life Table (Social Security Administration 2015). Mortality rates in the future are assumed to decline based on the G2 projection scale in the Society of Actuaries 2012 Individual Annuity Mortality Table (Society of Actuaries 2012). We further adjust mortality rates by a constant factor so that life expectancies are allowed to vary by income level.

Returns model. Three types of series were created for this analysis: bonds, stocks, and inflation. For bond returns, we first select an initial bond yield (i.e., seed value) for the simulation. This is the bond yield at the beginning of the retirement simulation based approximately on 10-year US bonds. For simulation purposes, the historical yield seed is assumed to be 5 percent.

Yields for subsequent years are based on equation (1.1), where $\varepsilon_{\mathrm{Yld}}$ is an independent white noise that follows a normal distribution with a mean of 0 and a standard deviation of 1.25 percent:

$$Yld_t = \alpha + \beta_1 Yld_{t-1} + \beta_2 {Yld_{t-1}}^2 + \varepsilon_Y \qquad [1.1]$$

The resulting annual bond yield ($\mathrm{Yld_t}$) is assumed to be bounded between 1.0 and 10.0 percent:[4]

After the bond yield for a given year is determined, the bond return (r_{bond}) is estimated using equation (1.2), where $\varepsilon_{\mathrm{bond}}$ is assumed to have a mean of 0.0 percent and standard deviation of 1.5 percent:

$$r_{bond} = Yld_{t-1} + -8.0(Yld_t - Yld_{t-1}) + \varepsilon_{bond} \qquad [1.2]$$

The 1.5 percent standard deviation for the error term (ε_b) is not the assumed standard deviation for the asset class (bonds, in this case); rather it is the standard deviation for the errors around the regression estimates. The actual standard deviation of bond returns of 10.0 percent is higher because other factors (such as the yield and the change in yield) affect the actual variability of returns.

The stock return model is based on the yield for a given year plus the assumed equity risk premium (ERP). Therefore, we assume the following levels of ERP for the analysis:

	Historical	Low	Mid	High
ERP	5.5%	3.5%	4.5%	5.5%

Stock returns each year are based on equation (1.3), where ε_{stock} is assumed to have a mean of 5 percent and standard deviation of 20 percent, where Yld_t is the average yield for all years in that scenario:

$$r_{stocks,t} = \overleftarrow{Yld_t} + \varepsilon_{stocks} \qquad [1.3]$$

The inflation model is based on the loose historical relation between bond yields and inflation and is depicted in equation (1.4), where ε_i is an independent white noise term that follows a standard normal distribution with a mean of zero and a standard deviation of 0.5 percent:

$$r_i = 0.6\% + + 0.5Yld_{t-1} + \varepsilon_i \qquad [1.4]$$

Additional structure. Social Security retirement benefits are estimated based on the highest assumed average 35 years of earnings for each simulated participant. Social Security retirement benefits are estimated using the 2015 bend points (bps) and assumed to commence at age 65 on retirement.

The required level of retirement savings is determined using a solver routine, which determines the amount of savings or balance required to achieve an 80 percent probability of success during retirement.[5]

For simplicity, our model assumes that all savings are Roth contributions. For some scenarios, the individual is unlikely to have accounts sufficient to fund the Roth (e.g., if he or she needs to save $50,000). Portfolio allocations follow the Morningstar Moderate Lifetime Index glide path. The portfolio fee is 50 bps.

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Endnotes

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[1] For a model which endogenizes retirement, work, and saving in a low return environment, see Horneff et al. (2018).

[2] Alternative replacement levels are explored by Aon Consulting (2008) and Blanchett (2013), among others.

[3] The income definition is per individual (not household) and it only includes wage income (i.e., it excludes non-wage income such as pension benefits).

[4] The coefficients vary by model type, as below:

	Historical	Low	Mid	High
α	0.25%	0.30%	0.30%	0.40%
β_1	0.95	0.55	0.65	0.50
β_2	0.00	0.50	0.50	0.65

[5] While 80 percent may seem like a relatively aggressive estimate (e.g., some researchers use probability-of-success metrics that exceed 95%), it is important to look at the combined impact of the assumptions, and not to focus on a single assumption in isolation. For example, two of the most important assumptions when estimating the cost of retirement are the assumed length of retirement and the target safety level (i.e., the target probability of success). Since the length of retirement period is relatively conservative (i.e., much longer than true life expectancy) the target success level need not be as conservative (e.g., it is possible to target an 80% chance of success versus a 95% chance of success). It is also important not to be too conservative with respect to assumptions (e.g., assuming a 99% probability of success), given the potential impact on consumption during

retirement. After all, dying at an advanced age with a major portion of savings untouched is another form of retirement 'failure' (except, of course, in the case of a planned bequest).

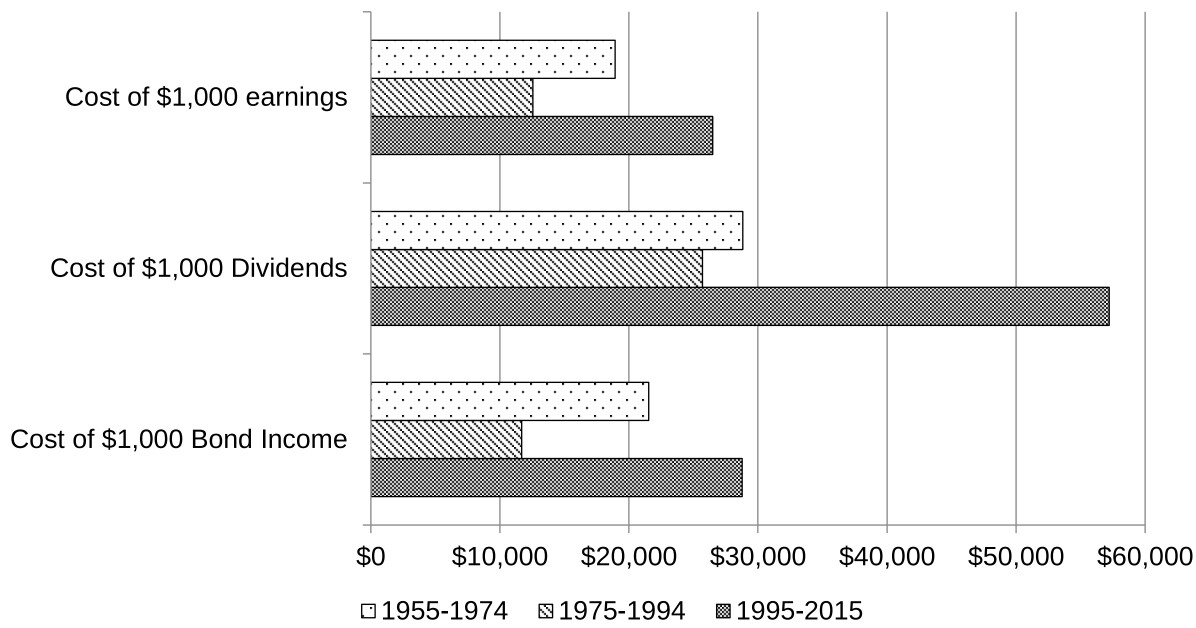

Figure 1. Average cost of purchasing $1,000 in 10-year Treasury income, dividends, and corporate earnings.

Source: Federal Reserve of St. Louis (2017).

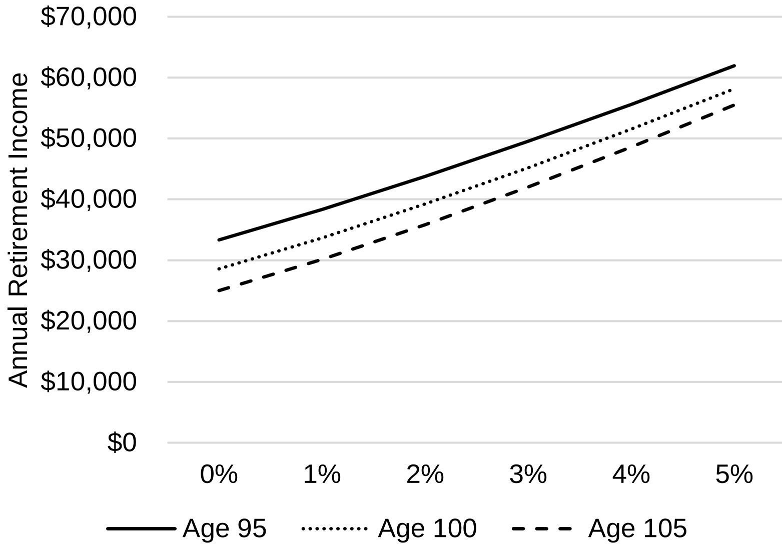

Figure 2. Cost of funding retirement income to various ages with a $1 million bond ladder.

Source: Authors' calculations.

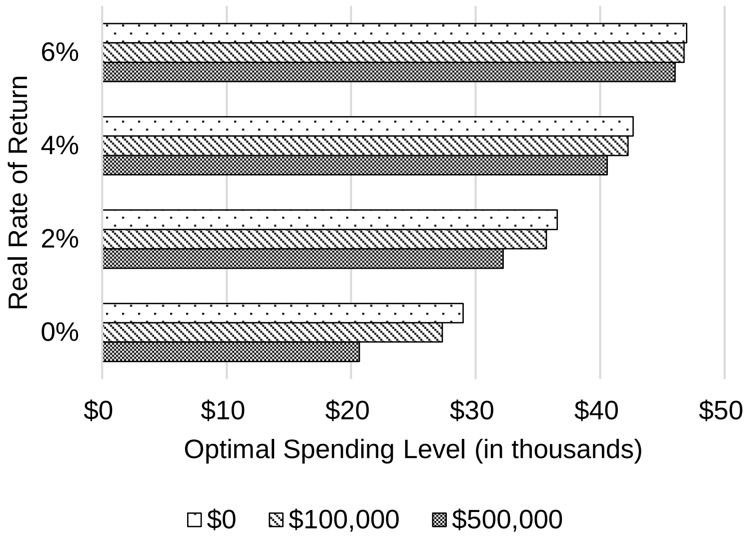

Figure 3. Optimal spending by expected real portfolio return and legacy goal.

Note: Calculations assume a thirty-year career followed by a thirty-year retirement, a starting salary of $50,000, and real salary growth of one percent. Rates of return are defined in real terms, and retirement spending adjusts for inflation. The legacy goal reflects the value of investment assets targeted to remain at the end of retirement.

Source: Authors' calculations.

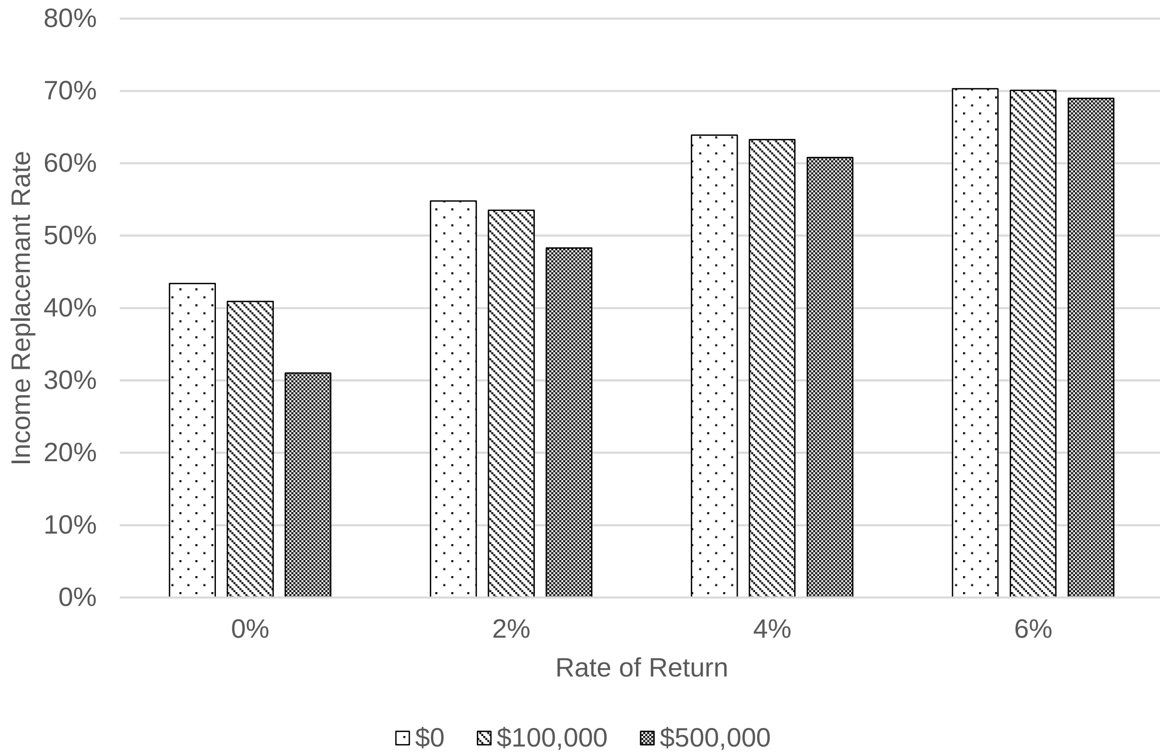

Figure 4. Income replacement rates and legacy goal.

Note: Calculations assume a thirty-year career followed by a thirty-year retirement, a starting salary of $50,000, and real salary growth of one percent. Rates of return are defined in real terms, and retirement spending adjusts for inflation. The legacy goal reflects the value of investment assets targeted to remain at the end of retirement.

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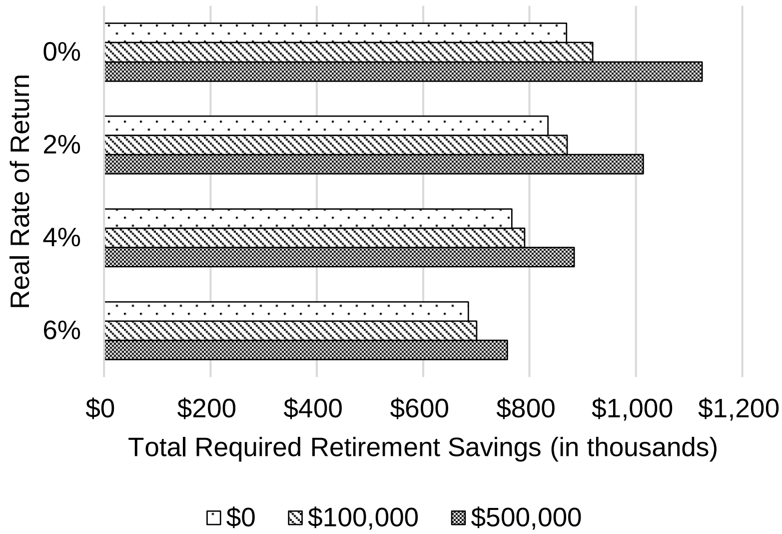

Figure 5. Total savings required to fund lifetime spending goal at retirement by legacy goal.

Note: Calculations assume a thirty-year career followed by a thirty-year retirement, a starting salary of $50,000, and real salary growth of one percent. Rates of return are defined in real terms, and retirement spending adjusts for inflation. The legacy goal reflects the value of investment assets targeted to remain at the end of retirement.

Source: Authors' calculations.

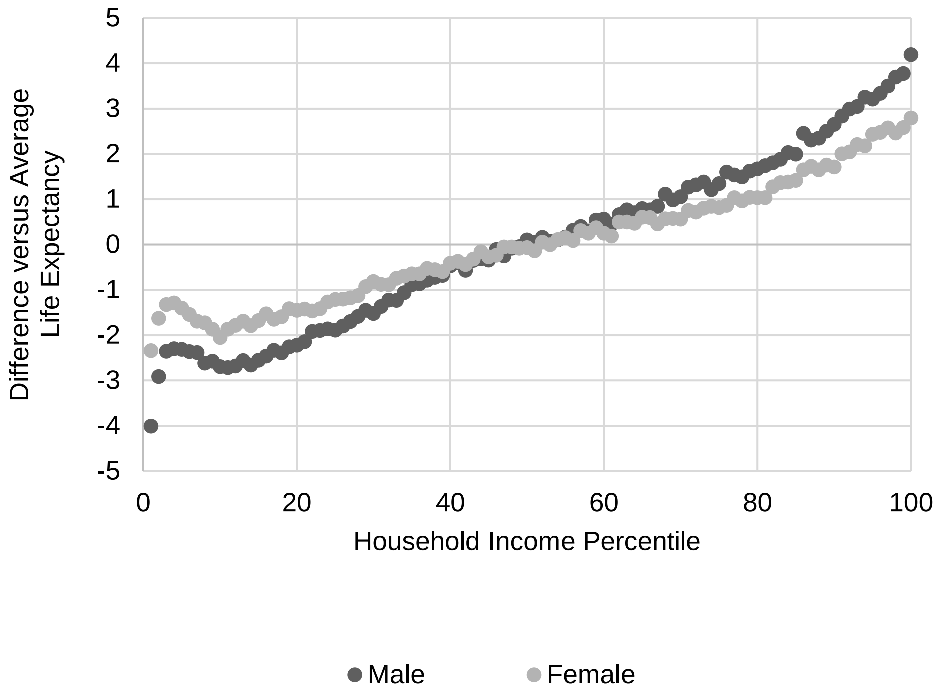

Figure 6. Differences in life expectancies by household income for a 65-year old man and woman.

Source: Human Longevity Project (2017)

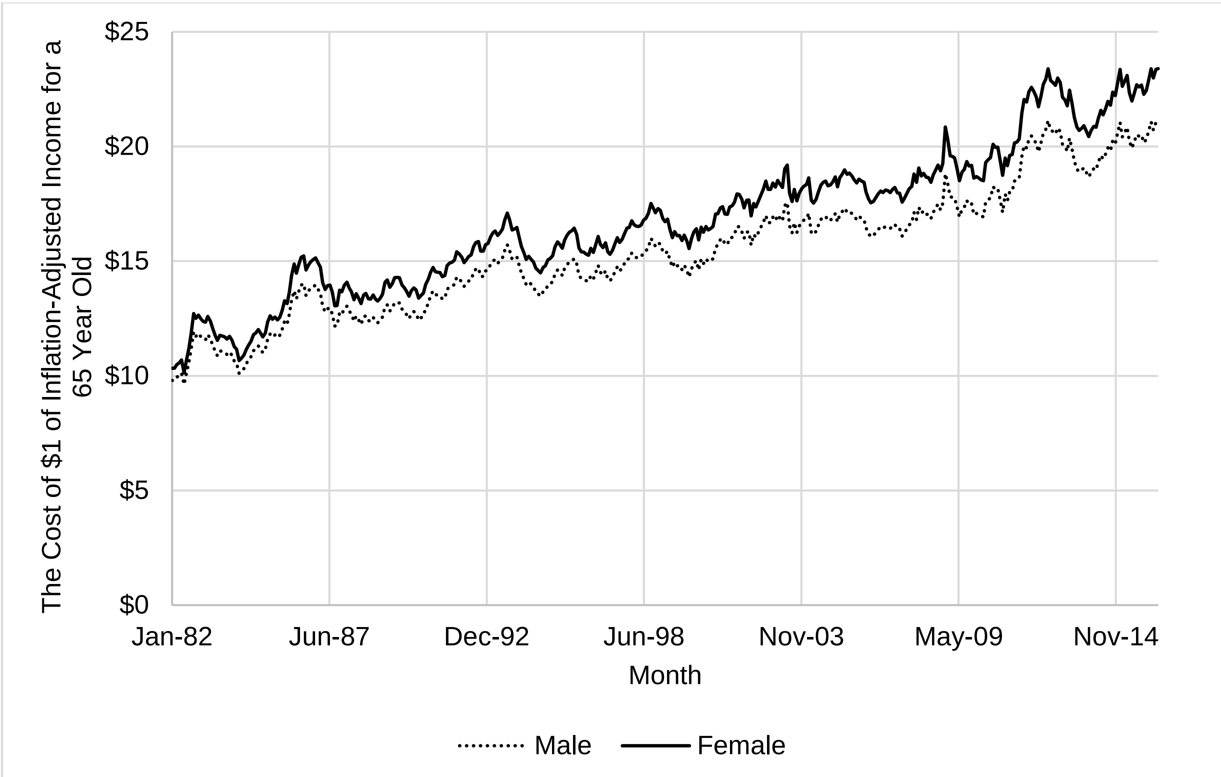

Figure 7. The cost of buying $1 in real annuity income at age 65 overtime.

Source: Blanchett et al. (2017).

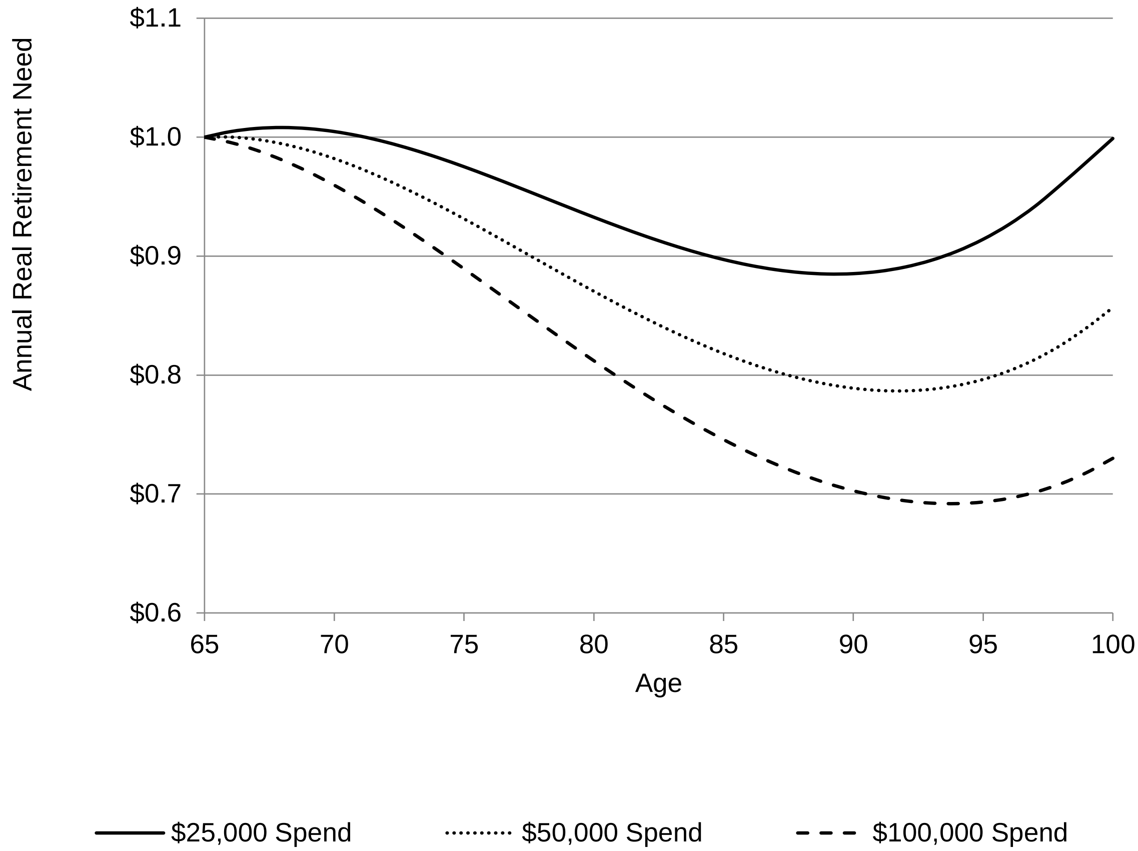

Figure A1. The Spending Smile: Lifetime real income target for various spending levels.

Source: Blanchett (2014).

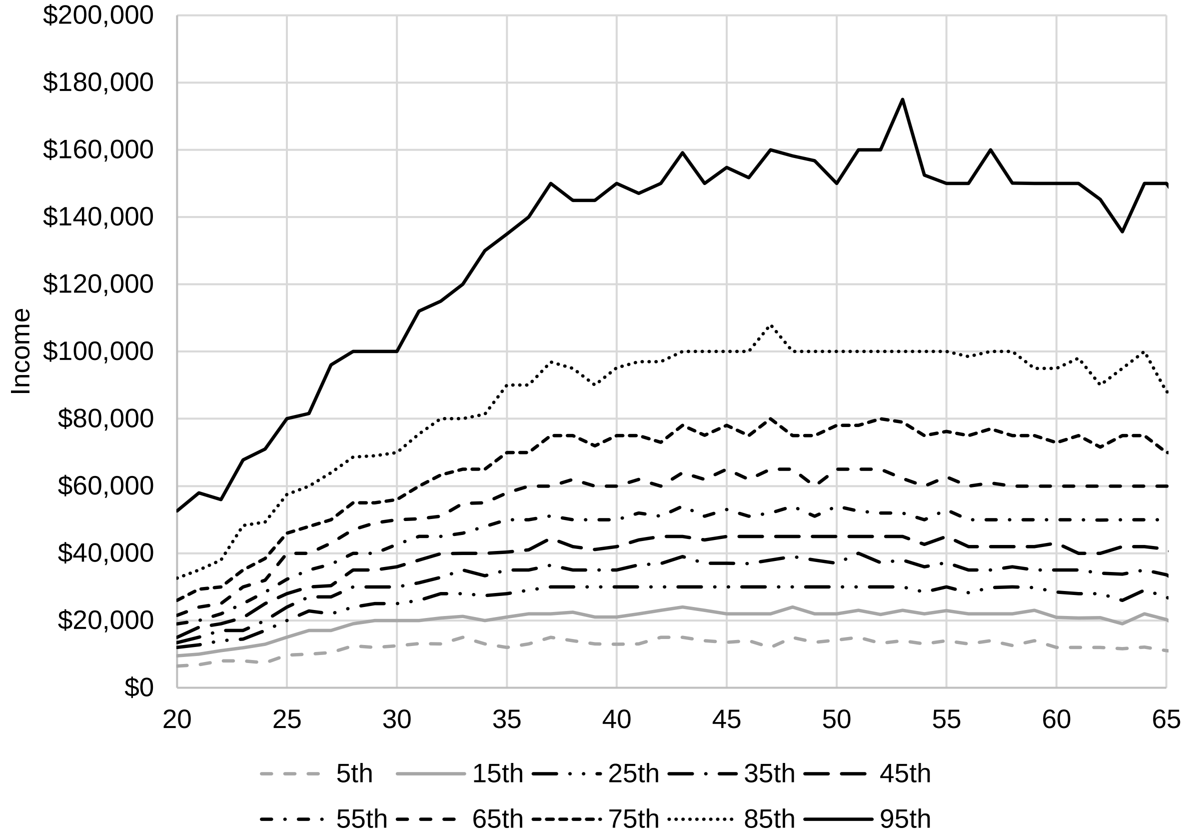

Figure A2. Earnings curves at various income percentiles.

Source: Bureau of Labor Statistics (2015).

Table 1. Target total pre-tax savings rates for various households just starting to save for retirement

25 Years Old

	Single Household				Joint Household		
	Returns				Returns		
Household Income ($0,000s)	Historical	Low	Mid	Household Income ($0,000s)	Historical	Low	Mid
$25	6.8	11.3	9.0	$25	4.3	7.0	5.7
$50	8.1	14.2	11.2	$50	6.4	10.9	8.6
$100	8.2	14.9	11.4	$100	6.9	12.5	9.7
$150	8.8	15.9	12.1	$150	8.0	14.2	11.2
$200	9.0	16.4	12.7	$200	8.7	15.6	12.0
$250	9.3	16.8	13.0	$250	9.0	16.4	12.7

30 Years Old

	Single Household				Joint Household		
	Returns				Returns		
Household Income ($0,000s)	Historical	Low	Mid	Household Income ($0,000s)	Historical	Low	Mid
$25	7.4	12.2	9.9	$25	4.2	6.6	5.5
$50	9.9	17.0	13.5	$50	7.2	12.1	9.6
$100	10.1	17.6	14.0	$100	8.5	14.3	11.5
$150	11.0	18.7	14.6	$150	9.6	16.9	13.2
$200	11.4	19.2	15.4	$200	10.6	18.1	14.2
$250	11.7	19.5	15.7	$250	11.3	18.8	15.0

35 Years Old

	Single Household				Joint Household		
	Returns				Returns		
Household Income ($0,000s)	Historical	Low	Mid	Household Income ($0,000s)	Historical	Low	Mid
$25	8.9	13.6	11.3	$25	4.2	6.3	5.0
$50	12.1	18.1	15.8	$50	8.6	13.1	11.1
$100	12.5	20.4	17.1	$100	10.0	16.8	13.4
$150	13.2	22.2	17.8	$150	11.8	19.0	15.4
$200	13.9	23.7	18.4	$200	12.8	21.1	17.4
$250	14.3	24.1	18.8	$250	13.7	23.5	18.3

40 Years Old

	Single Household				Joint Household		
	Returns				Returns		
Household Income ($0,000s)	Historical	Low	Mid	Household Income ($0,000s)	Historical	Low	Mid
$25	10.4	14.8	12.8	$25	4.3	6.3	4.9
$50	13.9	19.4	17.5	$50	9.4	12.4	11.2
$100	16.5	25.6	20.4	$100	12.6	19.0	16.5
$150	17.6	26.4	22.8	$150	14.5	23.8	18.6

$200	18.1	27.3	24.3	$200	16.4	25.5	20.1
$250	18.5	27.5	24.8	$250	17.6	26.4	22.8

Source: Blanchett et al. (2017).

Table 2. Impact of retirement ages on target total pre-tax savings rates for a 35-year-old (%)

Retire at Age 60

Household Income ($0,000s)	Single Household: Low	Single: Mid	Single: Historical	Household Income ($0,000s)	Joint Household: Low	Joint: Mid	Joint: Historical
$25	21.7	17.8	14.1	$25	18.3	14.9	12.0
$50	24.6	19.1	16.9	$50	21.4	18.2	15.0
$100	25.9	20.7	16.3	$100	24.8	19.2	15.0
$150	25.8	20.1	16.2	$150	25.6	19.6	15.5
$200	25.9	20.5	16.3	$200	25.9	19.9	16.1
$250	25.9	20.7	16.4	$250	26.0	20.5	16.4

Retire at Age 65

Household Income ($0,000s)	Single Household: Low	Single: Mid	Single: Historical	Household Income ($0,000s)	Joint Household: Low	Joint: Mid	Joint: Historical
$25	13.6	11.3	9.1	$25	6.3	5.0	4.3
$50	18.1	15.8	12.3	$50	13.1	11.1	8.9
$100	20.4	17.1	13.2	$100	16.8	13.4	10.7
$150	22.2	17.8	13.8	$150	19.0	15.4	12.1
$200	23.7	18.4	14.3	$200	21.1	17.4	13.4
$250	24.1	18.8	14.8	$250	23.5	18.3	14.2

Retire at Age 70

Household Income ($0,000s)	Single Household: Low	Single: Mid	Single: Historical	Household Income ($0,000s)	Joint Household: Low	Joint: Mid	Joint: Historical
$25	6.2	4.8	4.2	$25	0.0	0.0	0.0
$50	12.7	10.6	8.7	$50	3.8	2.8	2.0
$100	15.9	12.8	10.3	$100	9.1	7.4	6.3
$150	18.3	14.7	11.7	$150	13.8	11.3	9.1
$200	19.8	16.6	12.8	$200	17.2	13.8	11.1
$250	21.4	17.6	13.6	$250	18.7	15.4	12.2

Source: Blanchett et al. (2017).