

Vanguard research | Retirement Outlook

The Vanguard Retirement Outlook: A national perspective on retirement readiness



About the Vanguard Retirement Outlook

The global retirement landscape is changing. As populations age, government retirement benefits are under pressure. At the same time, the shift from defined benefit to defined contribution workplace retirement plans means that workers bear more responsibility for managing capital markets risk and turning accumulated savings into retirement income. And many workers have no access to a workplace plan. In the United States, the figure is about 50%.

The Vanguard Retirement Outlook surveys this changing landscape and assesses its implications for workers. We ground our analysis in the Vanguard Retirement Readiness Model, which uses Vanguard's capital markets forecasts and empirical data on household balance sheets, savings rates, and spending patterns to estimate retirement readiness for different demographic groups. This lens on the systemic and individual drivers of retirement readiness raises critical questions and yields actionable insights for policymakers, employers, and individuals. Our goal is simple: to give all workers the best chance for a secure retirement.

Takeaways

- The retirement readiness outlook is mixed. We evaluate retirement readiness for a nationally representative sample of American workers. We find that lower-income families spend a higher share of their pre-retirement income during retirement. As a result, despite Social Security's progressive benefit structure, lower-income workers face a greater retirement savings challenge: To meet their spending needs in retirement, lower-income workers must self-finance a larger proportion of their pre-retirement income than higher-income workers.
- We assess American workers' prospects of meeting this savings challenge with a novel metric, the sustainable replacement rate—the percentage of pre-retirement income that a worker can replace throughout retirement in 90% of market and mortality scenarios. Among late baby boomers, high-income workers are in good shape to meet their retirement spending needs. Low- and middle-income workers may struggle. Our retirement outlook for Generation X and millennials is modestly better.
- We highlight the potential to enhance retirement readiness by expanding access to the capital markets, reducing frictions that limit workers' ability to liquidate home equity, and accelerating adoption of smart defined contribution (DC) plan designs. We also discuss actions that workers can take to boost their retirement readiness.

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Are Americans ready for retirement? Higher-income workers likely participate in a well-designed workplace plan, which brightens their retirement outlook. In the past two decades, these workers have benefited from innovations such as automatic enrollment, automatic escalation of savings rates over time, and automatic investment in a mix of stocks and bonds consistent with a retirement goal.

In automatic enrollment plans, according to Clark and Young (2021), 91% of eligible workers save for retirement. In voluntary enrollment plans, the figure is 28%. Clark and Young (2021) also estimate that 7 in 10 participants in DC plans administered by Vanguard are saving at rates that would allow them to replace at least 65% of their pre-retirement income. Modest adjustments to target savings rates could boost that figure to 75%.

But only about 50% of private-sector employees participate in a workplace plan. For government employees, the figure is 82% (Bureau of Labor Statistics, 2021). And many plans have yet to adopt the design features that have enhanced workers' chances of retirement security. For lower-income workers who are less likely to have access to, or be participating in, a well-designed employer-sponsored retirement plan, the outlook is overcast. Even workers who participate in well-designed plans can experience setbacks if they change jobs and enroll in a plan with less-effective savings provisions or, worse, cash out their retirement savings.

These two realities of readiness are evident in a nationally representative sample of Americans that we examined for this study. High-income workers—those in the top 5% of the income distribution—can readily finance life after labor. The rest may struggle. We explore the drivers of these projected outcomes for cohorts from three generations: “late” baby boomers, who are now in their early to mid-60s; Generation X (ages 49–53); and millennials (ages 37–41).¹ Our analysis yields three insights:

1. Low-, middle-, and upper-middle-income workers, who have annual earnings in the 25th, 50th, and 70th percentiles of the national income distribution, may fail to accumulate enough to meet the spending levels typical of today's retirees. We estimate that late boomers at the bottom quartile of the income distribution will be able to sustain retirement spending equal to 64% of pre-retirement income. National survey data suggest that current retirees from this working cohort spend 96% of pre-retirement income, revealing a 32 percentage-point gap between typical retiree spending and the projected spending that they can sustain throughout retirement. Late boomers in the 70th income percentile face a 17 percentage-point shortfall in their projected retirement income.
2. Our outlook is sensitive to modeling assumptions. Some assumptions relate to exogenous risks—uncertain capital market returns or changes in Social Security benefits. Others are more like levers over which workers have some control—decisions about when to stop working or whether to sell their home. Workers on the cusp of retirement, for example, can pull two levers to boost retirement income. First, they can delay retirement. Second, if they are homeowners, they can tap home equity. If low-income late boomers could spend their home equity—an aggressive assumption—they could replace 76% of their pre-retirement income, a 12 percentage-point improvement.
3. Workers are also subject to forces beyond their control. In its 2022 report, for example, the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, which oversees Social Security, estimated that by 2034, the program would be able to pay just 77% of scheduled benefits. A cut in benefits would reduce retirement readiness for all workers, with the biggest impact on the lowest-paid. Prospective capital market returns are another risk, with the biggest impact on higher-income workers, who are more likely to invest in the market.

¹ This sample differs from the population used in Vanguard research on participant outcomes in Vanguard-administered retirement plans (Clark, 2023). The population in our sample has lower incomes and less access to workplace plans, diminishing their prospects for retirement security.

We model baseline, pessimistic, and optimistic capital market projections. In the optimistic scenario, high-income late boomers (members of the top-earning 5%) can replace 69% of their pre-retirement income. In the pessimistic scenario, the figure is 54%.

We elaborate on these insights with a review of the Vanguard Retirement Readiness Model (VRRM). We detail the model's assumptions and how changes in these assumptions affect the retirement outlook for different cohorts. We conclude with a review of key insights and implications for policymakers, employers, and individuals.

Retirement readiness: A puzzle with two pieces

We assess retirement readiness by comparing two pieces: first, the resources households need in retirement; and second, the resources they are projected to have by the time they retire. What households need, it turns out, has many interpretations, both prescriptive and descriptive.

The financial advice industry, whether through online calculators or financial advisors, will often ask workers what standard of living—expressed as the share of pre-retirement income—they want to maintain during retirement. Absent a stated target, the industry estimates the percentage. These estimates assume that workers hope to maintain their pre-retirement standards of living and use expected changes between pre- and postretirement expenses (taxes, commuting and health care costs, and changes in savings obligations) to produce a target replacement ratio (Lobel, Jaconetti, and Cuff, 2019). These prescriptive estimates are widely used in the financial services industry and range between 70% and 85% of pre-retirement income (U.S. Government Accountability Office, 2016).

Descriptive estimates of retirement income needs are based on what retirees spend, treating observable reality as a measure of adequacy.

Rather than focus on income replacement, for example, Hurd and Rohwedder (2015) compare pre- and postretirement consumption. This approach tends to produce a brighter outlook for retirement readiness both because pre-retirement income can overstate consumption needs and because consumption tends to decline as retirees age.

Our approach is a hybrid. Like Hurd and Rohwedder (2015), we derive actual spending needs from the Consumption and Activities Mail Survey (CAMS), an ongoing biennial supplement to the University of Michigan Health and Retirement Survey (HRS) that tracks changes in spending and activities throughout retirement. But like many financial-planning practitioners and other researchers (Munnell, Chen, and Siliciano, 2021), we compare spending needs with annual income (rather than consumption) in the years immediately preceding retirement.

This hybrid approach paints a realistic picture of what retirees might need while allowing them to compare it with pre-retirement income, a salient number that is less complex to calculate than pre-retirement consumption.

An important insight from our analysis is that the spending needs of retirees, expressed as a share of pre-retirement income, vary by income level. Low-income workers—those at the 25th percentile of the income distribution, who earn roughly \$22,000 in the year before retirement—spend 96% of their pre-retirement income. In contrast, workers at the 95th percentile of the income distribution, who earn roughly \$173,000 a year, spend only 43% of their pre-retirement income. Only workers in the middle range of the income distribution exhibit spending levels within range of the prescriptive targets—83% for median-income workers and 68% for workers at the 70th percentile of the income distribution. This range has important implications for how we assess retirement readiness.

The second puzzle piece in assessing retirement readiness is the resources families are projected to have by the time they retire. This is the central focus of this paper. We developed the VRRM to estimate retirement income. The model consists of three elements:

1. Profiles of pre-retirement income, savings, and net worth for different generational and income cohorts. We obtain detailed net-worth estimates from the Federal Reserve Board's 2019 Survey of Consumer Finances (SCF). We use the SCF, supplemental data from the HRS, research on demographic savings patterns (Mian, Straub, and Sufi, 2021), and data on DB pensions (Jacobs et al., 2020, and Sabelhaus and Volz, 2022) to create profiles of income, savings behavior, asset allocations, and Social Security benefits.
2. A wealth and market return simulation engine that incorporates return forecasts for each asset class from the Vanguard Capital Markets Model (Davis et al., 2014).
3. A distribution of mortality outcomes, which differ by generational and income cohorts.

Our VRRM model estimates the level of income that can be generated from Social Security benefits and the share of pre-retirement income that families must finance with assets from employer-sponsored retirement plans and nonworkplace savings. The model's key output is the sustainable replacement rate: the percentage

of pre-retirement income that can be sustained in 90% of our capital market and mortality scenarios. (See the **Appendix** for additional detail on the model's design.)

This approach has three advantages:

First, this retirement income measure incorporates an element of risk absent from most studies of retirement readiness: a distribution of forward-looking capital market returns. It also incorporates longevity risk, which varies considerably by income and increases with each generation.

Second, it allows us both to assess whether one can reach a sufficient income replacement rate in retirement and to quantify by how much typical workers within granular income and age cohorts fall short of or exceed that target. It also recognizes that spending in retirement may vary by income group and may involve, to some extent, a choice. In light of evidence that some groups may be spending less than they can afford to in retirement (Hahn, 2021), this approach highlights that gap, just as it identifies segments at risk of not having enough savings to meet typical spending needs.

Third, the measure highlights the outlook for individuals rather than cohorts. This focus on the individual provides more actionable insights than population-level estimates of readiness.

The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations as of December 31, 2021. Results from the model may vary with each use and over time. For more information, please see the Appendix.

We evaluate sustainable replacement rates for the typical worker in each income and age cohort in four scenarios that individuals may face: accessing home equity; working longer; investing in better- and worse-than-expected capital markets; and experiencing a reduction in Social Security benefits.

The VRRM incorporates design decisions that create a simplified model from individuals' varied work and retirement experiences. We highlight the three most important:

1. The model looks at outcomes for a hypothetical worker, and it ignores household structure and demographic characteristics such as gender and race or ethnicity that can influence retirement readiness (Hurd and Rohwedder, 2015). We intend to examine differences by demographic characteristics in subsequent releases.
2. The model relies on hypothetical employment histories, assuming no unemployment during a working lifetime that begins and ends at the same age across generations. These assumptions have less impact on our projections for the late boomers than for

Generation X and the millennials. The boomer projections rely more on empirical data than on multidecade assumptions about employment, savings behavior, and wealth. We stress-test our baseline results by incorporating hypothetical wage curves that allow for career changes and breaks from the labor force.

3. The model assumes fixed real spending throughout retirement. In reality, as Hurd and Rohwedder (2022) note, consumption falls as people age. In addition, families experience substantial expense volatility over time because of health events or long-term-care expenses (Farrell and Greig, 2017). Other retirement-readiness models have taken this volatility into account (VanDerhei, 2019), but it may not be fully captured in the HRS CAMS survey. Thus, our model estimates workers' ability to meet their spending needs in aggregate over the course of retirement and does not take into account the liquidity crunch or credit needs a family may experience in a particular year.

The problem statement: The percentage of pre-retirement income that people must self-finance

Social Security is an important source of income for families, especially lower-income families and those who do not have access to employer-sponsored retirement plans. We estimate that Social Security replaces 62% of income for families at the 25th percentile of the income distribution, compared with 18% of income for families at the 95th percentile. The gap between a family's spending needs in retirement and the income it will receive from Social Security represents the share of pre-retirement income that families need to finance through employer-sponsored retirement savings plans, individual savings, and other family assets.

How much do people need to finance? We compare the Social Security replacement rate with two benchmarks for retirement needs: the prescriptive target replacement ratios widely used in the financial services industry and the actual spending needs derived from HRS data. Notably, these spending-needs estimates exceed the target replacement ratios of 70% to 85%

widely used in the financial services industry for lower-income families. Conversely, for high-income families, estimated spending needs imply a more modest retirement savings target than the industry benchmark.

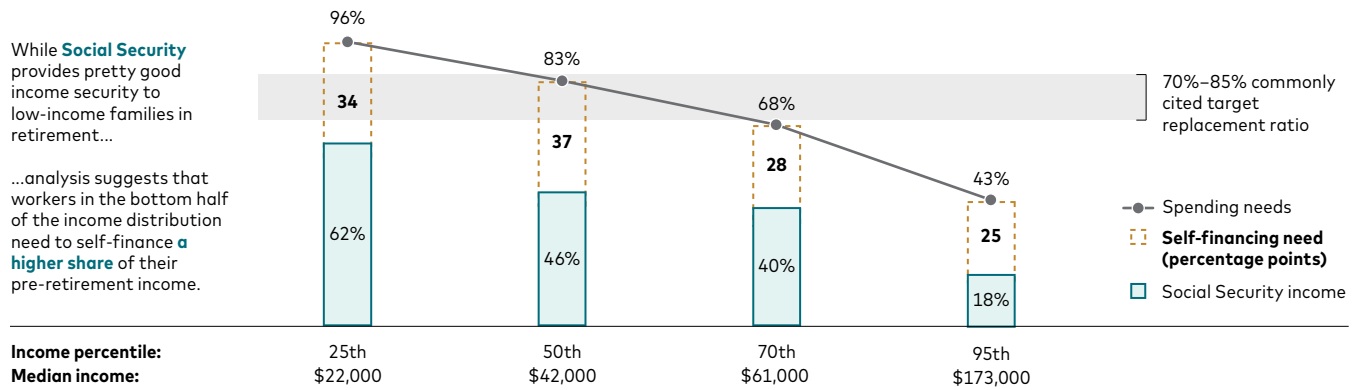
Figure 1 displays our income-replacement estimates for different income cohorts among the late boomers. Despite Social Security's progressive benefit structure, lower-income workers face a greater retirement savings challenge than higher-income families. In retirement, their spending drops the least, accounting for 96% of their pre-retirement income. In contrast, retirees at the 95th percentile of the income distribution spend less than half (43%) of their pre-retirement income.

Despite Social Security's progressive benefit structure, **lower-income workers face a greater retirement savings challenge:** To meet their spending needs in retirement, low-income workers must self-finance a larger proportion of their pre-retirement income than high-income workers.

FIGURE 1

Lower-income families need to finance a larger share of their pre-retirement income to meet their spending needs in retirement

Income replacement needs in retirement, by source of funds and family income level



While **Social Security** provides pretty good income security to low-income families in retirement...
 ...analysis suggests that workers in the bottom half of the income distribution need to self-finance a **higher share** of their pre-retirement income.

Notes: "Spending needs" measures the empirical consumption from the point of retirement as a percentage of pre-retirement income, using HRS and CAMS data. Social Security replacement rate calculations are based on Vanguard estimates for the late baby boomers.

Sources: Vanguard calculations, based on data from the Federal Reserve Board's SCF (2019), the HRS (2014), and the Social Security Administration (2019).

To meet their spending needs, low-income workers must finance a larger proportion of their pre-retirement income for their retirement years than high-income workers: 34% for workers in the 25th percentile of the income distribution compared with 25% for workers in the 95th percentile of the income distribution.

How much of this financing need are families able to meet? The sustainable replacement rate, detailed below, estimates the share of income in retirement that families can sustain above and beyond what Social Security provides.

Retirement readiness among late boomers

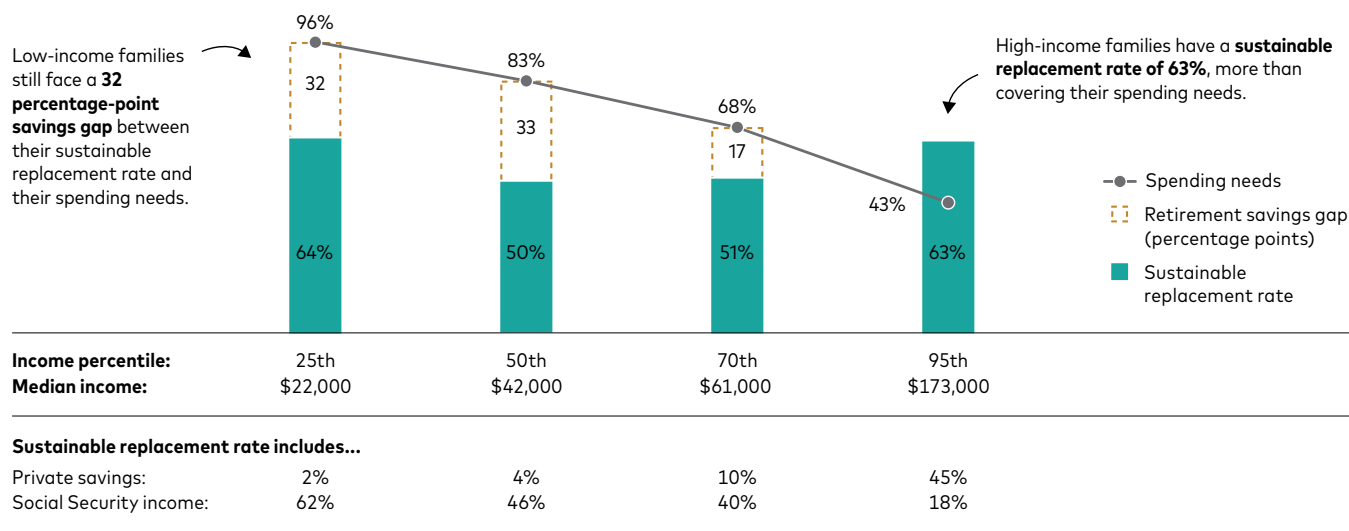
We begin by exploring retirement readiness results for the late boomers. Median-income workers in the baby boom generation are projected to be able to replace 50% of their pre-retirement income in 90% of market and

mortality scenarios (**Figure 2**). The sustainable replacement rate is similar for workers at the 70th percentile of the income distribution and higher for workers at the 25th and 95th percentiles of the income distribution.

FIGURE 2

High-income families have a sustainable replacement rate that more than meets their spending needs, while everyone else falls short

Sustainable replacement rate for the baby boom generation, by family income



Notes: The sustainable replacement rate is the highest level of consumption as a share of pre-retirement income that can be sustained in 90% of market return/mortality scenarios. "Spending needs" measures the empirical consumption from the point of retirement as a percentage of pre-retirement income, using HRS and CAMS data. Percentages may not total 100% because of rounding.

Sources: Vanguard calculations, based on data from the Federal Reserve Board's SCF (2019), the HRS (2014), and the Social Security Administration (2019).

For all but the highest-income cohort, projected income falls short of spending needs. Only baby boom workers at the 95th percentile of the income distribution can sustainably replace 63% of their pre-retirement income, or 20 percentage points more than their spending needs of 43%. They do so primarily through private savings (45%), which includes DB payouts, DC plans, and nonworkplace savings. Thus, unlike lower-income workers, the highest earners enjoy a self-financing surplus relative to their observed retirement spending levels.

Other workers are at risk. Given their income and savings patterns over their life cycle, the lowest-income workers generate 2% of sustainable spending from their savings, bringing their sustainable replacement rate to 64%. As shown in Figure 2, that leaves them 32 percentage points short of meeting their spending needs. The shortfall in the sustainable replacement rate relative to spending needs decreases with income. The sustainable replacement rate for the median worker is 50%, a 33 percentage-point shortfall in retirement savings. Those in the 70th percentile of the income distribution face a retirement savings gap of 17 percentage points.

Our baseline model reflects analytical choices in two areas with particularly high uncertainty: wage profiles over the life cycle and wealth from defined benefit retirement plans. As described below, however, our conclusions remain unchanged even when we make different analytical choices: Workers at and below the 70th percentile of the income distribution still have large retirement savings gaps, while workers at the 95th percentile of the income distribution still have retirement savings in excess of their spending needs.

Our baseline model relies on wage profiles that assume no breaks in employment during a working lifetime. When we incorporate hypothetical wage curves that allow for career changes and breaks from the labor force (but are more uncertain), we observe even lower sustainable replacement rates and larger retirement savings gaps for workers at the 25th and 70th percentiles of the income distribution. The sustainable replacement rate for workers at the 50th and 95th percentiles of the distribution increases slightly because their Social Security replacement rate increases.²

Another area of modeling uncertainty is how to estimate wealth and future retirement income from DB plans. In light of the decline in access to DB retirement plans, their inadequate funding and lack of inflation protection, and lower-income households' small share of retirement assets in DB plans (Sabelhaus and Volz, 2022), our baseline model conservatively assumes positive defined benefit wealth only for workers in the late baby boom generation at the 70th and 95th percentiles of the income distribution.³

When we use a more aggressive assumption—that families across the income spectrum and across generations retain DB wealth as estimated by Karamcheva and Perez-Zetune

(2023)—we find the sustainable replacement rate would be 3 percentage points higher for baby boomers at the 25th and 50th percentiles of the income distribution, a small dent in the 30 percentage-point retirement savings gap.⁴

Although the methodologies differ, our analysis reaches conclusions similar to those from high-profile retirement readiness studies such as The National Retirement Risk Index produced by Boston College (Munnell, Chen, and Siliciano, 2021) and the retirement readiness rating from the Employee Benefit Research Institute (EBRI) (VanDerhei, 2019). For most workers, a comfortable retirement is at risk.

The Boston College study evaluates readiness relative to target replacement ratios derived from the Aon study (Aon Consulting, 2008). EBRI projects readiness relative to the income necessary to cover average expenses and uninsured health care costs, including long-term care. We estimate readiness for the median worker in each income cohort, rather than the percentage of the total population.

These differences make comparisons among the studies complicated, but all three suggest a challenging outlook. The Boston College study estimates that 51% of workers will struggle to meet their pre-retirement standards of living (Munnell, Chen, and Siliciano, 2021). EBRI estimates that about 41% of households are at risk (VanDerhei, 2019). We find that the sustainable retirement spending rate will fall short of actual spending needs for the median earner in all but the highest-income cohort. Each study provides a different perspective, but all tell a similar story.

² With these alternate hypothetical wage curves, the sustainable replacement rate among baby boomers is 57% for workers at the 25th and 50th percentiles of the income distribution, 44% for the 70th percentile worker, and 66% for the 95th percentile worker.

³ Specifically, we estimate that DB wealth accounts for 6 percentage points of the sustainable replacement rate for boomers at the 70th percentile of the income distribution and 17 percentage points for boomers at the 95th percentile of the income distribution.

⁴ To estimate the DB wealth for each income and generational cohort, we apply the ratio of DB wealth to housing wealth as estimated by Karamcheva and Perez-Zetune (2023), since we directly observe housing wealth in the SCF.

Levers that increase or reduce retirement readiness

Our baseline analysis assumes that retirees depend solely on Social Security and financial assets such as DB pensions and DC savings and that they retire at age 65. If we assume that they can delay retirement or draw on home equity, readiness improves. We stress-test four VRRM assumptions to understand how changes can brighten or darken the retirement outlook:

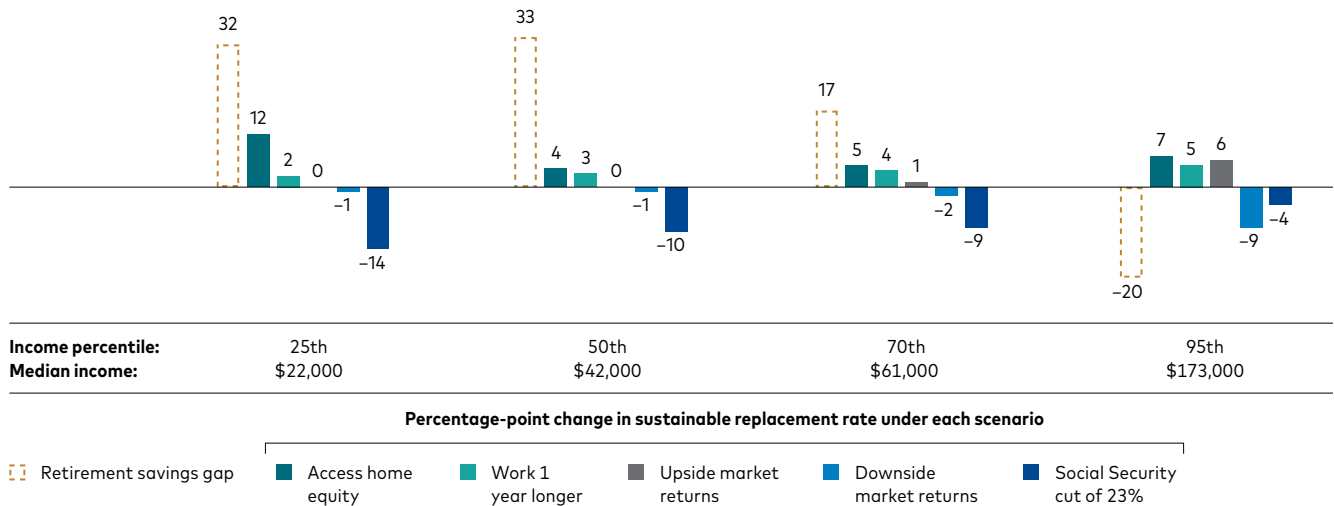
1. That retirees can access home equity.
2. That retirees can work longer.
3. That retirees invest in better- or worse-than-expected capital markets.

4. That retirees experience a reduction in Social Security benefits in 2034 based on the 2022 projections from the program’s Board of Trustees (Social Security and Medicare Boards of Trustees, 2022).

In **Figure 3**, the dashed bars chart the baseline retirement readiness gap for each income group—the difference between spending needs and the sustainable replacement rate. Because retirement income for workers in the 95th percentile of the income distribution is projected to exceed their spending needs by 20 percentage points, their retirement readiness gap is negative. The colored bars display the impact of each lever on the sustainable replacement rate; positive values represent an improvement in the sustainable replacement rate and negative values a deterioration. We review the levers and discuss considerations for each.

FIGURE 3
Accessing home equity and working longer are levers to improve retirement readiness for workers across the income distribution

Retirement savings gap and change in sustainable replacement rate for baby boomers, by scenario and family income



Notes: The sustainable replacement rate is the highest level of consumption as a share of pre-retirement income that can be sustained in 90% of market return-mortality scenarios. “Spending needs” measures the empirical consumption from the point of retirement as a percentage of pre-retirement income, using HRS and CAMS data. We assume that home equity is added to retirement savings in 2019 and invested in the asset allocation for nonhousing assets. (For more information about allocations, see **Figure 11** in the Appendix.) We model a potential 23% cut in scheduled Social Security benefits based on The 2022 OASDI Trustees Report, available at www.ssa.gov/oact/TRSUM/.

Sources: Vanguard calculations, based on data from the SCF, the HRS, and the Social Security Administration.

Home equity: A powerful if imperfect lever

Our sustainable replacement rates exclude home equity. When we assume that homeowners can liquidate and spend their home equity, the retirement readiness gap shrinks, even after accounting for ongoing postliquidation housing expenses. The impact is pronounced for late boomers in the 25th quartile: It erases 12 percentage points of the median worker's 32 percentage-point retirement readiness gap. Home equity also enhances the highest-income boomers' surplus, raising their sustainable replacement rate by 7 percentage points. Its impact on the other income cohorts is more modest, but powerful.

Prominent retirement readiness studies (Munnell, Chen, and Siliciano, 2021, and VanDerhei, 2019) treat home equity as a spendable asset. Our test of the home equity lever is similarly aggressive. We assume that workers liquidate their home equity by selling their home and then invest the proceeds in a portfolio of stocks and bonds. This approach models maximum home equity extraction and implies that workers become lifelong renters. But few execute this strategy (Venti and Wise, 2004).

Other strategies include:

- **Using a reverse mortgage.** A reverse mortgage, typically a home equity conversion mortgage, allows homeowners 62 and older to draw tax-free income from their home as long as they live there. Interest, principal payments, and fees accumulate each month, but don't need to be paid until the owner leaves the home. At that point, the home is typically sold to repay the outstanding debt. Fewer than 2% of homeowners 62 and older hold a reverse mortgage (Moulton and Haurin, 2019).
- **Downsizing or relocating to a lower-cost housing market.** Khang, McKinnon, and Rocha (2023) explore patterns in retirement-age migration that highlight the potential for homeowners who move to a lower-cost housing market to extract significant home equity. We explore this strategy in "Retire and relocate: A strategy to enhance retirement income" on page 14. Their analysis indicates that every year, 4% to 5% of retirement-age Americans who relocate extract home equity. Those figures suggest that, over a 10-year period, 25% of individuals 60 and older could use relocation to supplement retirement income with home equity extractions (Khang, McKinnon, and Rocha, 2023). Banks et al. (2010) find that retirement-age Americans who move tend to downsize, potentially increasing their home equity extraction.

Retire and relocate: A strategy to enhance retirement income

About 80% of Americans 60 and older own a home (Census Bureau, 2022). At the median, their home equity—the home’s value minus any mortgage—accounts for almost half their net worth. If retirees can tap this housing wealth, their retirement prospects improve. Khang, McKinnon, and Rocha (2023) use migration records from the American Community Survey, housing price data from the Federal Housing Finance Agency, and homeownership data from the U.S. Census to estimate that about 25% of Americans 60 and older could potentially relocate to a lower-cost housing market and extract equity from their homes.

In 2019, homeowners 60 and older in markets with home prices near the national median could have relocated and extracted, on average, \$99,000 in equity from their homes, a supplement to their average retirement savings of \$223,000. Americans who live in markets with home prices in the top 10th percentile of the national distribution could have extracted \$346,000, on average. And these estimates may be a lower bound. Retirees who move tend to downsize (Banks et al., 2010), potentially allowing them to turn more of their home equity into income-generating assets.

A simple example illustrates the estimation approach that Khang, McKinnon, and Rocha (2023) take. Consider a 65-year-old California resident with a primary residence in Santa Clara County who relocates to Merced, an adjacent

California county. In 2019, the average house price in Santa Clara was \$1,034,000. The average price in Merced was \$266,000. Assuming no mortgage on either property, the researchers estimate that this move would unlock \$768,000 in home equity.

Of course, the opportunity to unlock home equity through a move depends on location. **Figure 4** reports the average ratio of equity extraction to the destination house price for those who relocated in 2019.⁵ Most of the California movers relocated to regions with lower housing prices, including Arizona, Nevada, and lower-cost counties in California. These retirement-age homeowners, on average, extracted 77% of the equity in their previous home by relocating to a lower-cost location.⁶

Homeowners who lived in Midwestern and Southern states, such as South Dakota, Nebraska, Mississippi, and Alabama, experienced a different reality. On average, they needed to spend additional funds on housing when they relocated in retirement.

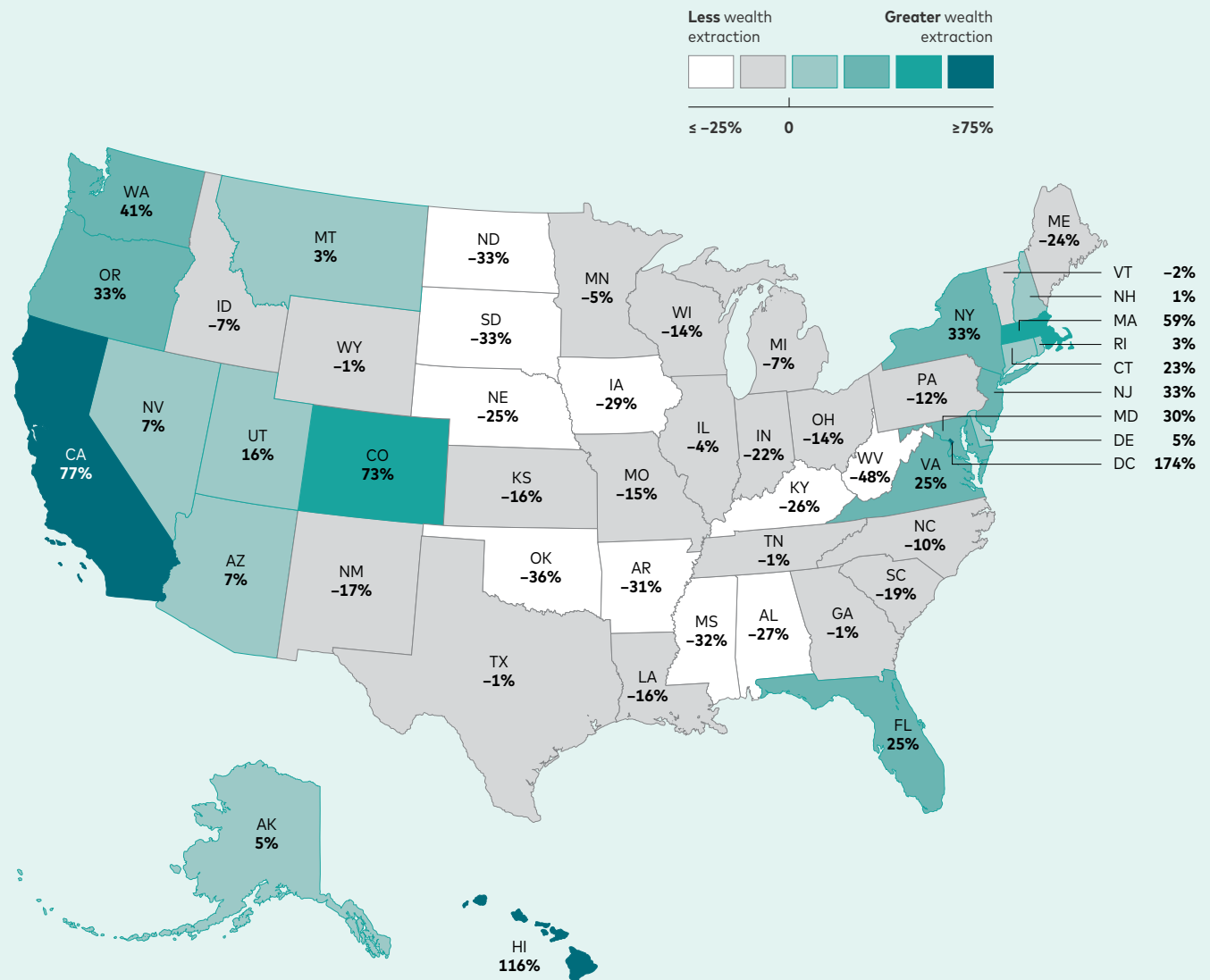
Our modeling suggests that spending home equity can enhance retirement readiness for all cohorts. Khang, McKinnon, and Rocha (2023) explore one strategy: retire and relocate. But success depends on the pre-retirement residence, the retirement destination, and dynamics in national housing prices. Relocating can carry high emotional and financial costs, and reverse mortgages can bring with them high transaction costs.

⁵ As mentioned above, nonlocal moves include both inter-county (but in-state) and interstate migrations.

⁶ The two highest equity extractions are observed among homeowners originating from Washington, D.C. (174%), and Hawaii (116%).

FIGURE 4

Average potential home equity extracted or injected by state of origin



Notes: A positive number means potential extraction, whereas a negative number means potential injection. These ratios are computed for individuals age 60 and over who moved to a different state or a different county in the same state in 2019. Migration flows serve as weights in computing average potential extraction or injection by state of origin.

Sources: Vanguard calculations, based on the 2019 American Community Survey and Federal Housing Finance Agency State and County House Price Indexes.

Delayed retirement: A boost to readiness

Our baseline analysis assumes that workers retire at age 65, consistent with the average retirement age in 2021 (Warshawsky, 2022). An additional year of work enhances retirement income for all cohorts, boosting their sustainable replacement rate by 2 to 5 percentage points. Delayed retirement increases the number of years when workers can rely on wage income and reduces the number of years when they depend on their portfolios.

It also increases their Social Security benefit. For example, for boomers born in 1959, the full retirement age—the age at which they are eligible to receive their full Social Security benefit—is 66 years and 10 months.⁷ If they delay claiming until age 70, their Social Security benefit would be 25% higher. Thus, while we model the impact of working a single additional year beyond age 65, the impact of multiple additional years is not linear, but, rather, increases to a greater extent when workers hit their full retirement age or 70. In addition, as Khang and Clarke (2020) show, the returns from delaying retirement by just one year could be even larger during a bear market.

Market risk: Important for upper-income retirees

Our VCMM and VRRM simulations use the full distribution of Vanguard's projected capital market returns in the decades ahead. We rerun these simulations for pessimistic (the bottom 25th percentile of the projected return distribution) and optimistic (the top 25th percentile) scenarios. **Figure 5** displays the median returns for stocks and bonds and median inflation rates for all three scenarios over 10-, 20-, and 30-year periods.

The return outlook has limited impact on workers in the bottom half of the income distribution because their asset allocations are heavily weighted toward cash (Figure 11). This suggests an opportunity to connect lower-income workers with the capital markets. Stocks and bonds are riskier than cash in the short term, but these

assets can also be expected, on average, to deliver higher returns (Goetzmann and Ibbotson, 2006). Connecting these savers with the capital markets could put them in a better position to meet their retirement needs.

FIGURE 5
Capital market projections inform the sustainable replacement rate in better- and worse-than-expected markets

		10-year median	20-year median	30-year median
Downside	Stock	0.90%	2.70%	4.50%
	Bond	2.30%	2.50%	3.00%
	Inflation	3.30%	2.80%	2.60%
Baseline	Stock	3.60%	4.20%	5.50%
	Bond	2.90%	3.20%	3.60%
	Inflation	2.40%	2.20%	2.10%
Upside	Stock	6.20%	5.80%	6.60%
	Bond	3.60%	3.90%	4.30%
	Inflation	1.60%	1.50%	1.60%

Source: Vanguard, using projections as of December 31, 2021.

Prospective returns have a bigger impact on upper-income workers. If late boomers achieve capital market returns from the top 25th percentile, or upside, of Vanguard's projected 30-year distribution, their sustainable replacement rate increases by 6 percentage points. If returns come from the bottom 25th percentile, or downside, the rate declines by 9 percentage points.

Notably, the highest-income earners can meet their consumption needs even in the pessimistic scenario. For workers in the 70th income percentile, the sustainable replacement rate improves by 1 percentage point (optimistic scenario) or declines by 2 percentage points (pessimistic scenario). The sustainable replacement rate is even less sensitive to market returns for workers in the 50th and 25th income percentiles.

⁷ For more details on how delaying retirement affects benefits, see www.ssa.gov/benefits/retirement/planner/1959-delay.html.

Social Security reductions: A bigger impact on the lower-paid

Our baseline VRRM simulations assume no changes in the Social Security program's current benefit structure. That assumption depends on legislative changes needed to address a projected shortfall in funding. In its 2022 report, Social Security's Board of Trustees estimated that by 2034, the program would be able to pay 77% of scheduled benefits (Social Security and Medicare Boards of Trustees, 2022).

We model the impact of a 23% benefit reduction on all income cohorts. Because Social Security replaces a larger share of lower-income workers' wages, benefit reductions would hit this group the hardest. For late boomers in the lower-income quartile, the cut would reduce the sustainable replacement rate by 14 percentage points. For the highest earners, the impact would be a 4 percentage-point decline.

The best- and worst-case scenarios for retirement income

An analysis of these four levers—home equity, delayed retirement, participation in capital markets, and Social Security cuts—suggests best- and worst-case readiness outlooks relative to our baseline model. Importantly, these scenarios are not mutually exclusive. In the best case, workers delay retirement a year or more, liquidate and spend their home equity, and enjoy better-than-expected capital market returns. And in this best case, their scheduled Social Security benefits remain unchanged.

For late boomers in the 25th income percentile, these levers increase their sustainable replacement rates from 64% to 78% of pre-retirement income—an improvement, but still 18 percentage points short of their estimated income needs. For the highest earners, these could raise their sustainable replacement rate to 81% of pre-retirement income. (These improvements are rough estimates. If retirees sell their home and invest the equity in a stock and bond portfolio, for example, their income will be subject to greater market risk. We ignore these interaction effects.)

In the worst case, workers retire at 65, choose not to spend home equity, live through worse-than-expected capital market returns, and experience a 23% cut in scheduled Social Security benefits. For low-income late boomers, the result would be a sustainable replacement rate of 50%, down from the 64% baseline. For the highest earners, the replacement rate would fall from 63% to 50%. These workers would still be on target to meet their spending needs.

A brighter outlook for younger generations

Our retirement outlook for Generation X and millennials is modestly better. These generations have faced more financial pressure than late boomers from the rising costs of higher education and health care and the growth in student debt. And those working in the private sector have less access to DB pensions than the late boomers. They are also projected to live longer.

But the younger generations have also benefited from improvements in DC plan design, particularly since the passage of the Pension Protection Act in 2006. This act facilitated the use of plan features such as automatic enrollment, automatic escalation, and investment in a Qualified Default Investment Alternative, typically a target-date retirement fund that gives participants access to multiasset portfolios (U.S. Department of Labor, 2006).

The combination of these enhancements has made it easier for retirement savers to join their workplace plans, increase their savings rates over time, and invest in diversified portfolios

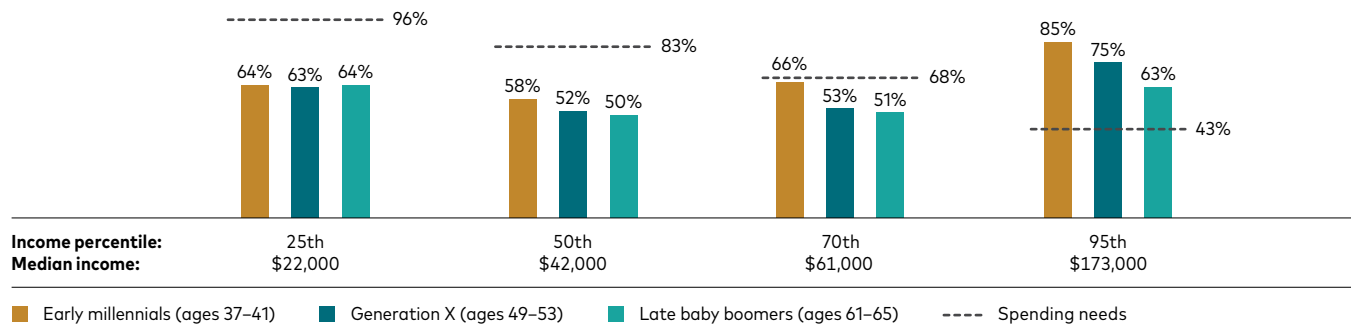
appropriate for long-term financial goals (Thaler and Benartzi, 2004). And the share of plans that default participants into a savings rate of 5% or more rose from 20% in 2012 to 45% in 2022 (Clark, 2023).

The interplay between financial challenges and changes in employer-sponsored retirement plans has resulted in different levels of net wealth for each generation at our starting point in 2019 and modest improvements to the retirement outlook for millennials and Generation X. We estimate that millennials at the 50th income percentile will be able to generate sustainable retirement income equal to 58% of their pre-retirement earnings, an 8 percentage-point increase over the sustainable replacement rate for median-income late boomers (at 50%), as displayed in **Figure 6**.⁸

The generational gains in retirement readiness are larger for higher-income workers. Early millennials at the 70th percentile of the income distribution are on track to reach a sustainable replacement rate of 66%, a 15 percentage-point increase over late baby boomers (51%) that will enable them to just about meet their spending needs in retirement (68%).

FIGURE 6
For most income cohorts, millennials and Generation X enjoy a brighter retirement outlook than boomers

Sustainable replacement rate by generation and income



Notes: The sustainable replacement rate is the highest level of consumption as a share of pre-retirement income that can be sustained in 90% of market return/mortality scenarios. "Spending needs" measures the empirical consumption from the point of retirement as a percentage of pre-retirement income using HRS and CAMS data.

Sources: Vanguard calculations, based on data from the Federal Reserve Board's SCF (2019), the HRS (2014), and the Social Security Administration (2019).

⁸ As described in the Appendix, the key differences in assumptions among generations are mortality rates, starting net wealth position in 2019, and DB retirement wealth. We do not model any change in wage profiles, retirement age, savings behavior, or asset allocation across generations. We find similar results when we apply more generous DB wealth assumptions, which extend across the income distribution and change across generations. For example, the sustainable replacement rate for the median-income worker increases from 53% for the baby boom generation to 60% for early millennials.

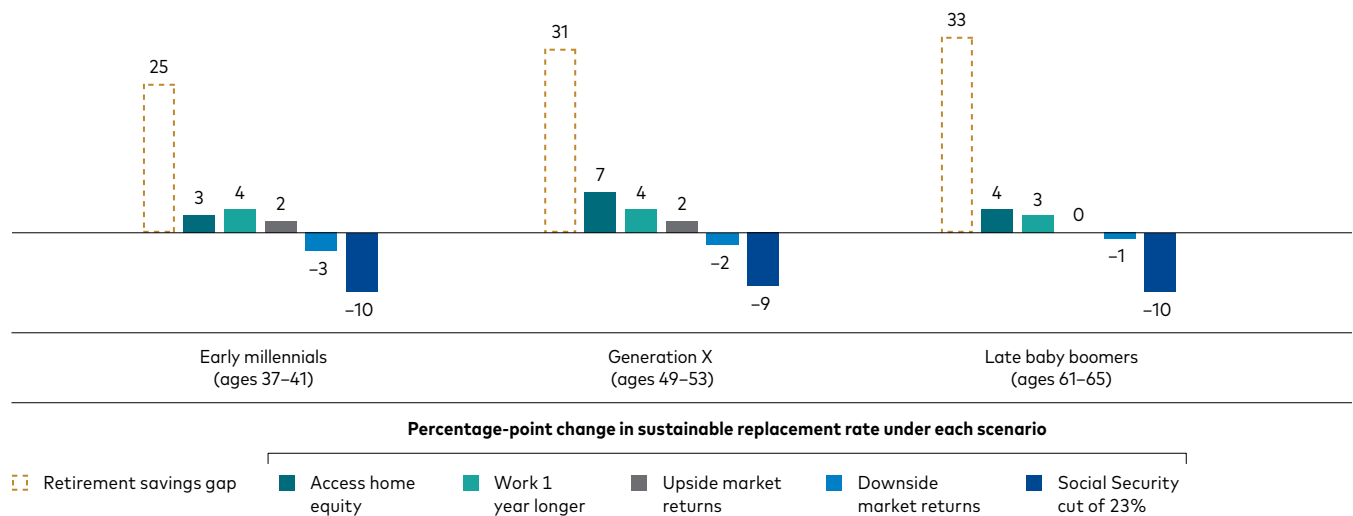
A notable exception to this improving outlook is workers at the 25th income percentile, whose retirement outlook remains unchanged across generations. In other words, the group facing the largest retirement savings gap—lower-income workers—is experiencing no improvement in retirement readiness.

In **Figure 7**, we show how changes in our model's baseline assumptions could affect retirement readiness for the median earner in each generation. The effects on younger generations are similar to those for the late boomers.

FIGURE 7

Like the boomers, millennials and Generation X are subject to exogenous risks and endogenous choices that can change their retirement readiness. The impacts are similar across generations.

Retirement savings gap and change in sustainable replacement rate among median income families, by scenario and generation



Notes: The sustainable replacement rate is the highest level of consumption as a share of pre-retirement income that can be sustained in 90% of market return/mortality scenarios. "Spending needs" measures the empirical consumption from the point of retirement as a percentage of pre-retirement income using HRS and CAMS data. We assume that home equity is added to retirement savings in 2019 and invested in the asset allocation for nonhousing assets. (For more information about allocations, see Figure 11 in the Appendix.) We model a potential 23% cut in scheduled Social Security benefits based on The 2022 OASDI Trustees Report, available at www.ssa.gov/oact/TRSUM/.

Sources: Vanguard calculations, based on data from the Federal Reserve Board's SCF (2019), the HRS (2014), and the Social Security Administration (2019).

Conclusion

We highlight improvements in retirement-plan design that have put some workers in a better position to meet their retirement goals. Their retirement outlook is improving. But in our modeling of a national sample of Americans, many of whom lack access to these plans, we see that for many, the outlook is challenging. We document estimated spending needs, the income that can be covered by Social Security, and the self-financing necessary to bridge the gap. For all but the highest earners, this self-financing falls short. We highlight changes to the retirement system and individual actions that can address this shortfall.

Our analysis yields three actionable insights:

1. Policymakers have an opportunity to connect low-income workers with the capital markets so they can reduce their projected retirement readiness gap. About half of workers participate in a workplace retirement plan. Access for lower-paid and part-time workers and for small-business employees is spotty. The conventional wisdom that Social Security will meet these workers' needs is wrong. They need not only to save but also to invest. We find that these workers may be overinvested in cash (Figure 11). Initiatives that can help this population participate in the capital markets, with their potential for higher long-term returns, could improve retirement readiness.

Federal and state policymakers have taken up the challenge. Under the federal Secure 2.0 Act of 2022, for example, new workplace plans will automatically enroll all workers. These plans will also raise participants' savings rates over time and default them into a diversified portfolio of stocks and bonds appropriate for long-term goals—all best practices in DC plan design. State governments have also acted to improve access to retirement savings vehicles through automatic-enrollment IRAs.

2. Employers can help workers save adequately for retirement by implementing well-designed workplace retirement plans. Clark (2023) documents increasing adoption of best practices in DC plan design: automatic enrollment, annual automatic escalation of savings rates, and default investment into a portfolio of stocks and bonds appropriate for retirement goals. Even so, employers have opportunities to accelerate this progress. At the end of 2022, for example, 42% of the employer-sponsored DC plans on Vanguard's recordkeeping system had yet to adopt automatic enrollment.

Plan sponsors can also amplify the impact of these design features by conducting re-enrollment campaigns that periodically default nonparticipants into the plan and "under-saver sweeps" that make sure participants are saving enough to maximize the employer match for their contributions. And they can implement automatic-portability provisions and other measures to ensure that when workers move from one job to another, their retirement funds remain invested. Finally, plan sponsors can evaluate the match schedules in their DC plans. Research (Choukhmane et al., 2022) suggests that current match schedules favor higher-paid workers.

3. Individuals can take steps to improve retirement readiness by delaying retirement and spending their home equity. Home equity extraction can be powerful, but high-cost frictions diminish retirees' ability to draw on this asset. This suggests an opportunity for policymakers and the financial services industry to develop more efficient means of turning housing wealth into retirement income.

As of 2023, our retirement outlook is overcast. The systemic changes and individual actions that we have highlighted can brighten it.

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Appendix

Vanguard Capital Markets Model

IMPORTANT: The projections and other information generated by the Vanguard Capital Markets Model regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. VCMM results will vary with each use and over time.

The VCMM projections are based on a statistical analysis of historical data. Future returns may behave differently from the historical patterns captured in the VCMM. More important, the VCMM may be underestimating extreme negative scenarios unobserved in the historical period on which the model estimation is based.

The VCMM is a proprietary financial simulation tool developed and maintained by Vanguard's Investment Strategy Group. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes include U.S. and international equity markets, several maturities of the U.S. Treasury and corporate

fixed income markets, international fixed income markets, U.S. money markets, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the Vanguard Capital Markets Model is that the returns of various asset classes reflect the compensation investors require for bearing different types of systematic risk (beta). At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over several time horizons. Forecasts are obtained by computing measures of central tendency in these simulations. Results produced by the tool will vary with each use and over time.

The Vanguard Retirement Readiness Model

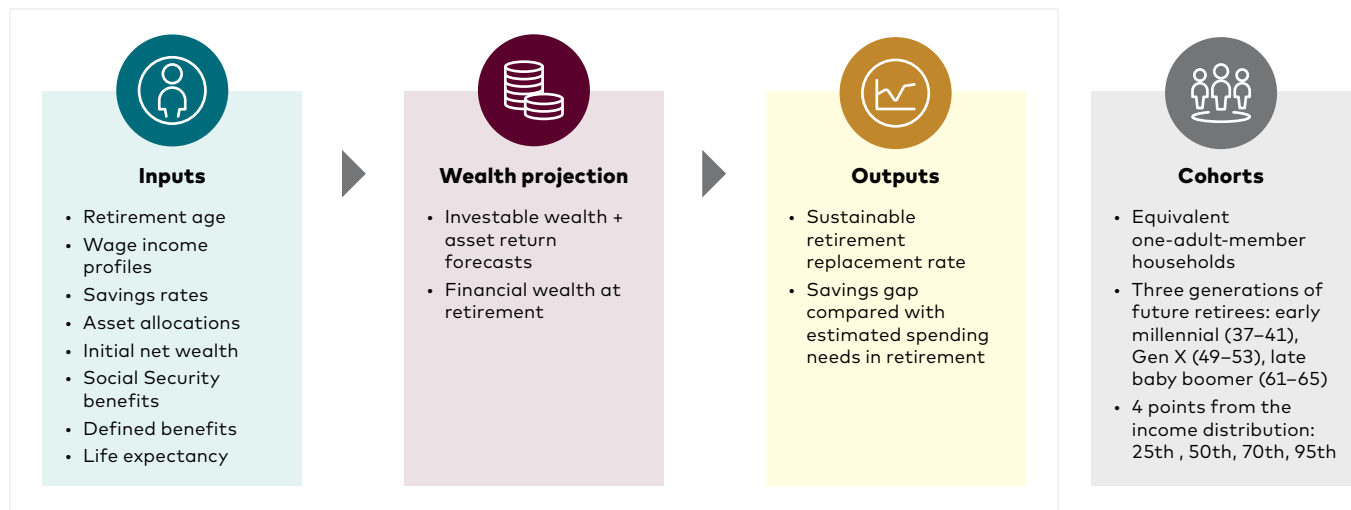
The Vanguard Retirement Readiness Model (VRRM) is a quantitative framework to assess retirement readiness. Retirement readiness depends on both individual circumstances—such as age, gender, marital status, labor market experience, retirement saving opportunities, retirement goals—and external factors, such as changes to the retirement system and financial market returns.

The Vanguard Retirement Outlook uses this model to investigate readiness for future retirees for 12 granular generational and income cohorts. We develop these cohorts and calibrate the VRRM using financial and demographic characteristics from the Federal Reserve Board's Survey of Consumer Finances (SCF), supplemented with data from the National

Income and Product Accounts (NIPA), the Federal Reserve's Financial Accounts (FA), and the Society of Actuaries (SoA).

The model combines assumptions about individual circumstances with simulated wealth projections based on Vanguard's asset-class return forecasts. The model's key output is the sustainable replacement rate, which captures the projected standard of living attainable for each generation and income cohort in a specified threshold of mortality and capital markets scenarios. We also compute a savings gap compared with retirement spending needs inferred from Health and Retirement Survey (HRS) data. **Figure 8** depicts the model's framework, inputs, and outputs, which we describe in more detail below.

FIGURE 8
Vanguard Retirement Readiness Model



Source: Vanguard.

Cohorts

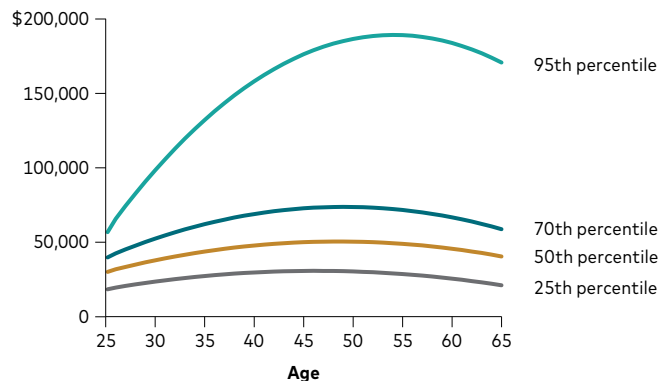
We assess retirement readiness for 12 generational and income cohorts using SCF waves from 1989 to 2019.⁹ The sample includes males and females from three generational cohorts based on their age in 2022: early millennials (ages 37–41); Gen X (ages 49–53); and late baby boomers (ages 61–65). For the three generational cohorts, we focus on individuals at four points in the income distribution: 25th percentile, 50th percentile, 70th percentile, and 95th percentile.

Key inputs

- **Retirement age.** Across all generational and income cohorts we assume a retirement age of 65, consistent with the average retirement age in 2021 (Warshawsky, 2022). In addition, recent analysis by Munnell (2022) documents that the average retirement age for men in 2021 was roughly on par with the age in the 1960s, and the average retirement age for women has not changed much over the last decade. As a sensitivity analysis, we evaluate retirement readiness if workers delay retirement by one year.

- **Wage income profiles.** We use cross-sectional pre-tax household wage and salary income reported in the 2019 wave of the SCF to construct income-cohort-specific lifetime wage trajectories of respondents between the ages of 25 and 65.¹⁰ If the respondent is married, we translate household-level wages into an individual-level wage estimate by applying a multiple of 0.5. **Figure 9** displays lifetime wage curves (in 2019 dollar terms) for each of the four income stratifications. We stress-test these wage curve assumptions with an alternative measure developed by Jacobs et al. (2020) that allows for the possibility of household-level breaks in earnings, which are not reflected in the SCF wage income profiles.

FIGURE 9
Income-cohort-specific lifetime wage income trajectories



Notes: The figure depicts the lifetime earnings trajectory for each of the four income cohorts: 25th percentile, 50th percentile, 70th percentile, and 95th percentile. Figures are in 2019 dollar terms.

Sources: Vanguard calculations, based on wage earnings from the 2019 wave of the SCF.

⁹ The birth year is determined using reported age in conjunction with survey year.

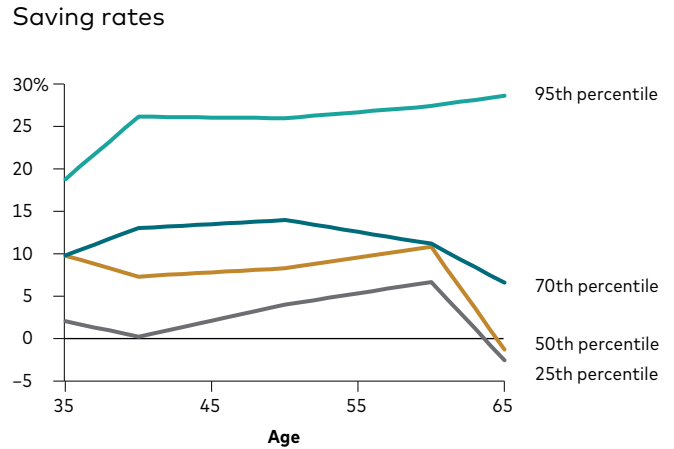
¹⁰ Because of data availability limitations, we adopt this wage curve for all age cohorts and make the implicit assumption that the wage curve is longitudinal.

- **Savings rates.** We estimate income-cohort-specific savings rates from ages 25 to 65 (the assumed working life) based on the “synthetic saving approach,” described by Mian, Straub, and Sufi (2021) and Kuhn, Schularick, and Steins (2020), which infers savings from data on changes in wealth. Specifically, the annual savings level, S , for a given group i , defined by income and age, is based on the law of motion for wealth evolution from time $t - 1$ to t .¹¹

$$S_{it} = W_{it} - W_{i,t-1} \cdot (1 + \pi_t) - H_{it},$$

where W_{it} is wealth of group i at time t , π_t is pure valuation gain on wealth, and H_{it} is net inheritances going to i at time t . The savings rate is then calculated as the ratio of the savings level to income. We use the 1989–2019 waves of SCF data on income, assets, liabilities, and inheritances, in conjunction with aggregate population-level wealth across asset classes from the FA and the NIPA to derive estimates of wealth and savings for each income and age cohort.¹² **Figure 10** presents savings rates from nonhousing wealth for ages 35 to 65 in each income cohort.¹³

FIGURE 10
Income-cohort-specific savings rates from ages 35 to 65



Notes: The figure depicts the savings rates for net wealth (excluding home equity) over the earnings years, from ages 35 to 65, for each of the four income cohorts: 25th percentile, 50th percentile, 70th percentile, and 95th percentile.

Sources: Vanguard calculations, based on data from the 1989 to 2019 waves of the SCF.

¹¹ The synthetic savings approach is used in lieu of explicit records of savings data.

¹² To calculate the valuation gains, asset shares (equity and fixed income) of broader SCF wealth categories such as DC wealth are decomposed using aggregate asset shares from the FA and the NIPA.

¹³ We compute an overall savings rate as well as savings rates for DC wealth and taxable wealth.

- Asset allocations.** The income-cohort-specific allocation to each nonhousing asset—equity, bonds, cash—from age 25 to 100 is a weighted average of DC wealth and taxable wealth held in the asset, where the weights are estimated saving rates for the respective wealth category. Our formulation:

$$AA_{aj} = \frac{S1_j \cdot W1_{j,a} + S2_j \cdot W2_{j,a}}{S1_j + S2_j},$$

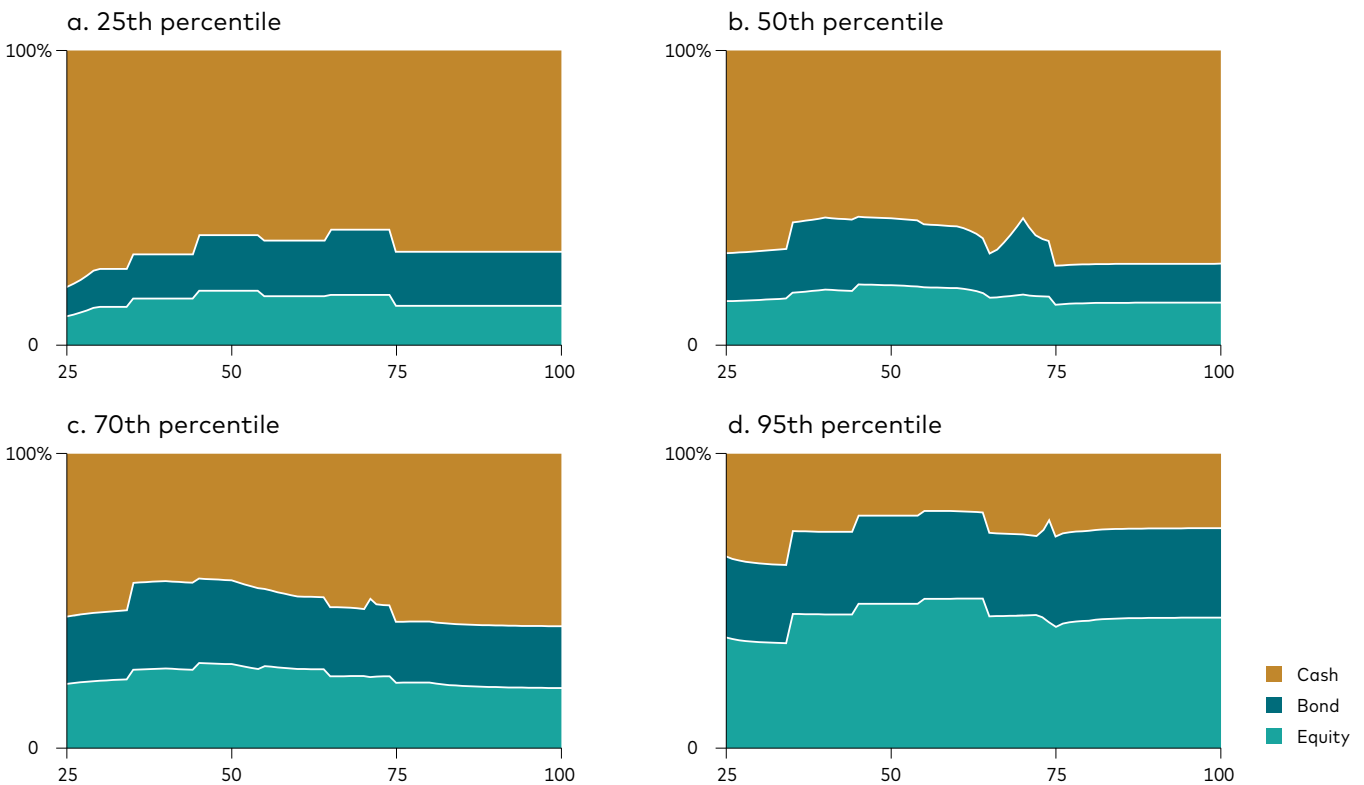
where $a \in \{\text{stocks, bonds, cash}\}$, $j \in \{25, 26, \dots, 99, 100\}$. $W1_{j,a}$ and $W2_{j,a}$ represent DC wealth and taxable wealth in the asset class a , and $S1_j$ and

$S2_j$ are saving rates estimated for DC wealth and taxable wealth at age j . We source data on asset allocations for each type of wealth from the 2007 to 2019 waves of the SCF and the FA.

Figure 11 displays asset allocation patterns over the life cycle for each income cohort. A notable difference across the income spectrum is the extent to which lower-income households are more heavily invested in cash, while higher-income households have more equity exposure.

FIGURE 11
Income-cohort-specific asset allocation from ages 25 to 100

Asset allocation over the life cycle by income percentile



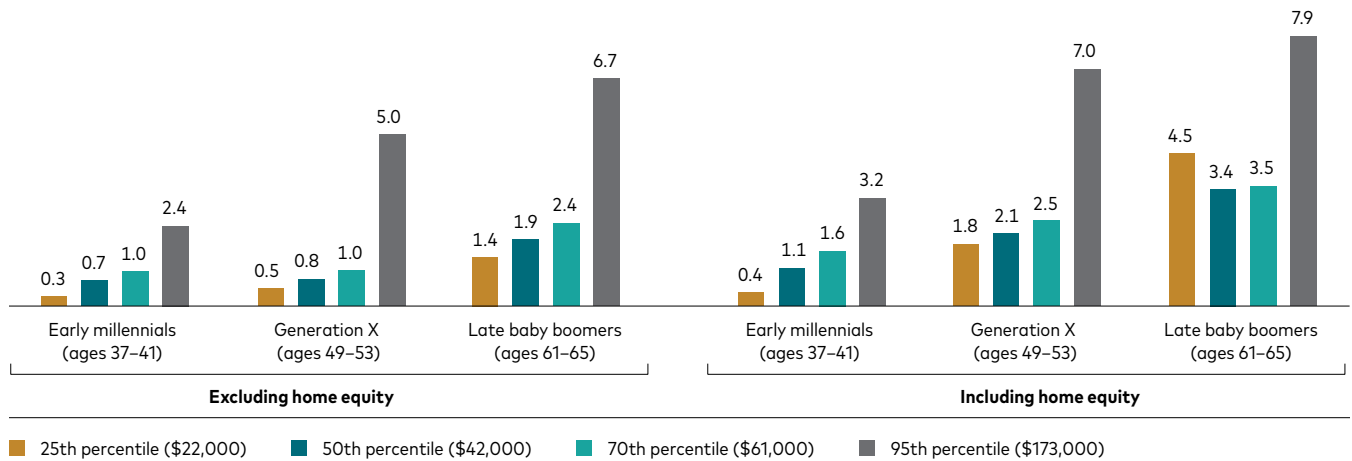
Notes: The figure depicts the lifetime asset allocation, from ages 25 to 100, for each of the four income cohorts: 25th percentile, 50th percentile, 70th percentile, and 95th percentile. Asset allocation at a given age decomposes the equity, bond, and cash share (in percentage terms) of the total portfolio.

Sources: Vanguard calculations, based on asset holding data from the 2007 to 2019 waves of the SCF and the FA.

- Initial net wealth.** Initial net wealth represents the value of financial assets less debts, excluding both housing assets and mortgage debt. We source income-generational-cohort-specific net worth as of 2019 from the SCF, which includes data on assets in defined contribution plans, individual retirement accounts, and taxable investments.¹⁴ Initial net wealth values in 2019 differ by generation and income cohort given the historical differences in savings behaviors, investment choices, and

incomes. That said, it is notable that millennial workers at the 70th percentile of the income distribution have the same net wealth-to-income ratio as Generation X workers at the 70th percentile of the income distribution, when excluding home equity as a source of retirement income (**Figure 12**). In simulations in which we assume that housing wealth can be liquidated, we estimate home equity amounts in 2019.

FIGURE 12
Initial net wealth-to-income ratio in 2019 by generation and income, excluding and including home equity



Notes: Initial net wealth excluding home equity is the value of financial assets less debts, excluding both housing assets and mortgage debt, observed in 2019. Home equity is housing assets less mortgage debt for primary residence. Income is the wage and salary income observed in 2019. A multiplier of 0.5 is applied to both net wealth and income measures to construct the net wealth-to-income ratio for two-person households.

Sources: Vanguard calculations, based on data from the 2019 wave of the SCF.

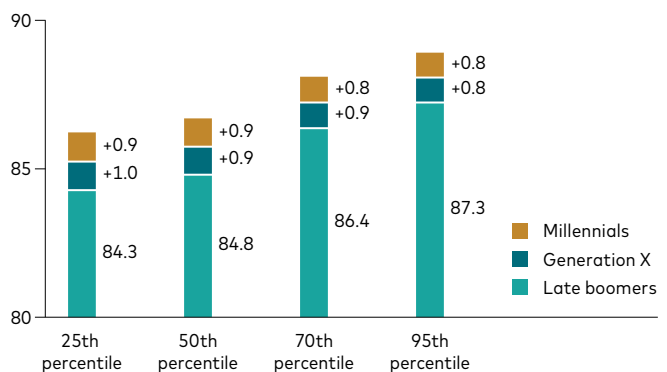
¹⁴ As with wage income, a multiple of 0.5 is applied to data for two-person households.

- **Social Security benefits.** We use a calculator developed by Vanguard to compute expected Social Security benefits for each income cohort based on the per-capita lifetime wage income profiles derived from the SCF 2019 wave. The calculator embeds the approach outlined in the Social Security Benefits Amount of the U.S. Government.¹⁵ The baseline approach assumes continuation of the current scheduled benefits, but sensitivity to hypothetical benefit cuts is also assessed.¹⁶
- **Defined benefits.** SCF data reliably capture information about currently received DB income streams or past-job DB entitlements; however, they do not reflect earned benefits for current employees. We follow the method adopted by Sabelhaus and Volz (2022) and Jacobs et al. (2022) to impute Social Security and DB wealth for SCF respondents with ongoing employment.¹⁷ The benefits that current employees are already entitled to are budgeted by plan sponsors and reflected in the national accounts. Aggregate administrative data in the FA are used to calculate the value of these obligations, which are then apportioned to SCF survey respondents based on current employment characteristics as well as additional national survey data from the HRS. Recognizing challenges in estimating future DB income, we conduct sensitivity testing using an alternate approach based on recent results in Karamcheva and Perez-Zetune (2023) on the DB share of assets by wealth quartile. We infer the impact of DB wealth on the sustainable replacement rate using their findings on the ratio of housing wealth to DB wealth across the income distribution together with our analysis of the impact of housing wealth liquidation on retirement readiness.

- **Life expectancy.** Life expectancies are calculated based on mortality tables and an improvement scale provided by the SoA. Given the documented relationship between income and life expectancy (Chetty et al., 2016), income-cohort-specific mortality rates are estimated as per **Figure 13**.

The same improvement scale from 2014 to 2021 is applied to adjust the base mortality tables by income cohort in 2014. Figure 12 depicts the resulting life expectancy estimates for each income-generation cohort.

FIGURE 13
Income-age-cohort-specific life expectancy



Notes: The life expectancies for different generations and income groups are calculated based on mortality tables and the improvement scale provided by the Society of Actuaries (SoA). We estimate life expectancy for each income cohort with the SoA table that most closely corresponds to the wage profiles in each cohort. For the 25th percentile, we use the SoA's base mortality table for bottom-quartile earners and annuitants. For the 50th percentile, we use the table for total employees and annuitants. For the 70th percentile, we use the SoA's base mortality table for white-collar employees and annuitants. And for the 95th percentile, we use the base mortality table for top-quartile earners and annuitants. We use the same improvement scale from 2014 to 2021 to adjust the base mortality tables by income group in 2014.

The figure depicts the life expectancy for each income cohort (25th percentile, 50th percentile, 70th percentile, and 95th percentile) across the three generations. The life expectancy of late baby boomers is shown in the base case, with differences for Generation X and early millennials also depicted.

Sources: Vanguard calculations, based on mortality tables and mortality improvement scales from the SoA.

¹⁵ More information about how Social Security benefit amounts are calculated is available at bit.ly/3pl9YeT.

¹⁶ We model a potential 23% cut in scheduled Social Security benefits based on the 2022 OASDI Trustees Report, available at www.ssa.gov/oact/TRSUM/.

¹⁷ Expected future DB income streams can be inferred from survey data on expectations for retirement age and future DB income, but the relevant measure of DB wealth for current employees is confined to the current legal obligations of plan sponsors, known as the "termination value."

Projection

The VRRM takes initial investable net wealth, lifetime wage income, and lifetime asset allocations and uses market scenario and asset-class return projections derived from the Vanguard Capital Markets Model (VCMM) to project wealth available for consumption through retirement. We incorporate our proprietary asset-class return projections derived from the VCMM as of the end of 2021. We project wealth in 10,000 capital market path simulations while applying survival probabilities implied from the life expectancy tables. Upside and downside market and return scenarios are in line with those defined in Khang and Pakula (2022).

Model outputs

- **Sustainable replacement rate.** The sustainable replacement rate reflects the highest level of consumption relative to pre-retirement income (at age 64) that can be sustained in 90% of capital market and mortality scenarios.

- **Savings gap.** To speak to retirement readiness, we compare the sustainable replacement rate with empirically based spending needs as a share of pre-retirement income. We source data on consumption spending needs in retirement from the 2006 to 2014 waves of the Health and Retirement Study (HRS) Consumption and Activities Mail Survey (CAMS) in line with the approach of Hurd and Rohwedder (2015).¹⁸ For a sub-sample of the survey of the cohort that retires between 62 and 65, average annual pre-tax consumption is tracked from retirement onward and expressed as a ratio to pre-tax pre-retirement income (average income from the two most recent waves of HRS data preceding retirement).¹⁹ For each respondent within CAMS, we calculate the average spending over the course of her retirement. Then, within each income segment, we take the median household spending level.²⁰

¹⁸ Consumption data are distinct from spending data in that they reflect the period over which utility is derived from a purchase, rather than the timing of the monetary outlay. For further details on the methodology used, see the RAND CAMS spending data file supporting documentation available at bit.ly/3BBVEqW.

¹⁹ Restricting the sample to those who retire at age 65 substantially reduces the number of observations.

²⁰ Income groups are segmented using pre-retirement wage income from the 2019 wave of the SCF. Segmentation based on HRS pre-retirement income did not materially change results.

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