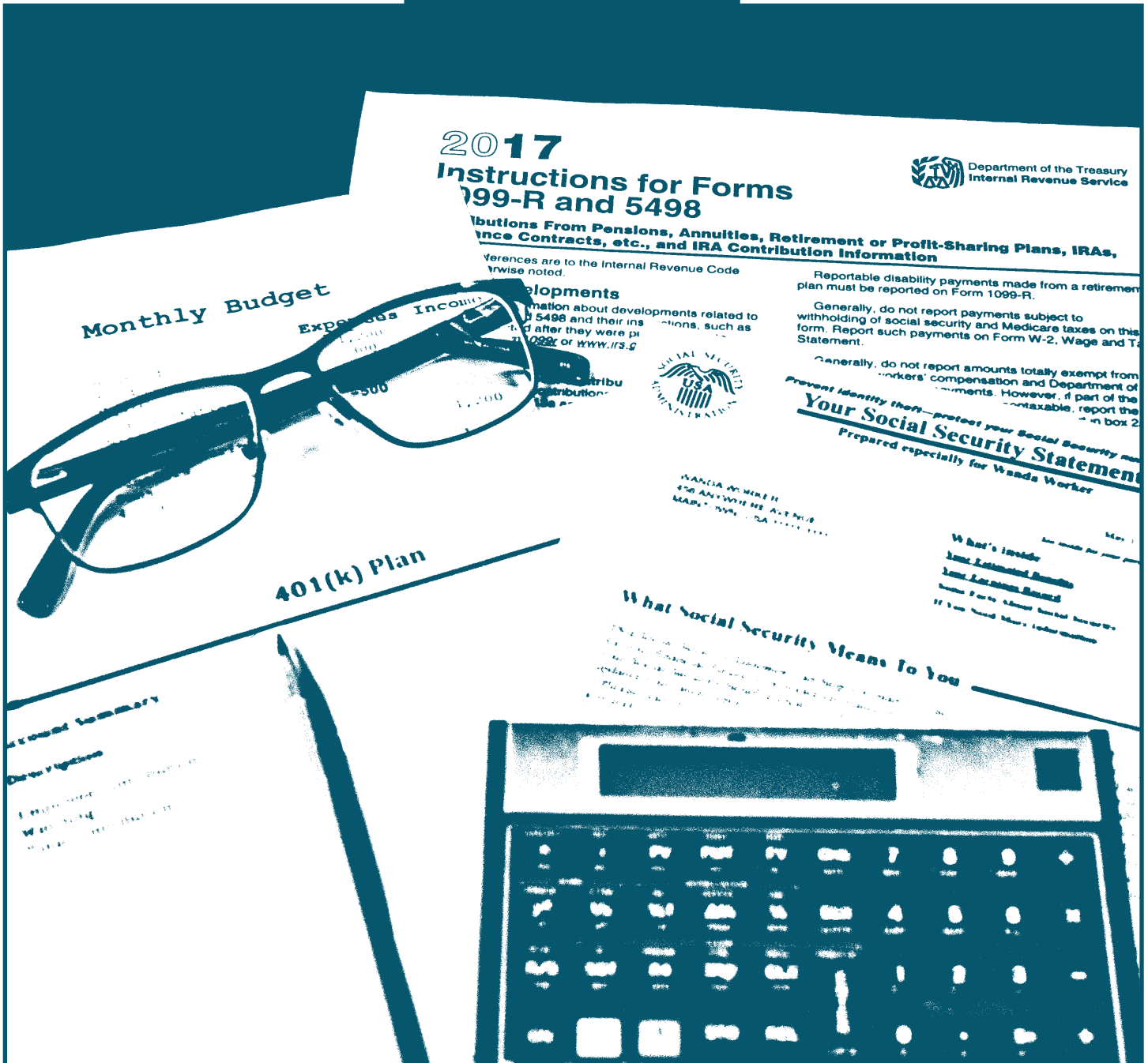


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Measuring the Adequacy of Retirement Income: A Primer





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Measuring the Adequacy of Retirement Income: A Primer

Summary and Introduction

Over the next 30 years, the share of the U.S. population age 65 and older will increase from about 15 percent to almost 22 percent, spurring growing interest in understanding whether people will have adequate income in retirement. As reflected in an extensive body of literature on the topic, researchers have developed diverse approaches for quantifying the adequacy of retirement income, focusing on different groups of retirees and employing different definitions of income and adequacy. For example, some researchers have computed the fraction of current retired workers whose income is below the poverty threshold and found it to be less than one-tenth of retirees. In contrast, others who have examined how income changes upon retirement project that a much larger fraction of current workers would experience a substantial decline in income as they retire. This report explains the various measures and approaches, providing a framework for further analysis of retirement income.

What Does Having an Adequate Retirement Income Mean?

Researchers have defined the adequacy of retirement income in two main ways: whether it satisfies basic needs and whether it allows retirees to maintain the standard of living they experienced before retirement. If the goal of the analysis is to determine how many retirees would be able to afford essential living expenses, then researchers would apply the first definition, which generally considers retirement income to be adequate if it exceeds a poverty threshold. Variations of that threshold are often used to determine eligibility for government programs targeted to low-income groups, such as the Supplemental Nutrition Assistance Program (SNAP) and parts of Medicaid.

In contrast, if the goal of the analysis is to examine whether retirees' income would allow them to enjoy the same standard of living they experienced during their working years, then the second definition would apply. Economists and financial advisers generally use

that second definition because large drops in consumption in retirement are typically considered undesirable. (However, maintaining a preretirement living standard does not necessarily mean that people would be able to avoid significant material hardship in retirement. For example, low-income workers who maintain their living standard in retirement could still have income that is below a poverty threshold.)

What Measures of Adequacy Have Researchers Used?

Gauges of retirement income can focus on a single year of retirement, typically the first year, or they can evaluate the adequacy of income over many years of retirement.

Single-Year Analysis. For simplicity, some studies analyze retirement income in a single year of retirement, providing a snapshot of retirement adequacy at a given point in time. Measures that evaluate retirement income for a single year can be based on either of the two definitions of adequacy.

Adequacy measures that are based on the basic needs definition include the official federal poverty thresholds (commonly referred to as the poverty thresholds) and the supplemental poverty measure (SPM) thresholds, both compiled by the Census Bureau, and elderly-specific thresholds, which particularly reflect the living expenses of retirees. (The various thresholds are described in greater detail in the section titled "Measures of Adequacy Used in Single-Year Analyses.") For all three types of thresholds, researchers calculate retirement income for the population of interest in a selected year, and if that income is at least as high as the chosen basic needs threshold, then it is considered to be adequate.

The most widely used measure of the adequacy of retirement income—a threshold based on the standard-of-living definition—is known as the target replacement rate. That rate is broadly defined as the amount of income in retirement, expressed as a percentage of income before retirement, that enables retirees to maintain the standard of living they enjoyed while

working. Although a common rule of thumb is that replacing at least 70 percent of gross preretirement income would avoid a marked decline in retirees' standard of living, that specific goal is not appropriate for all people. To better capture the diversity of people's circumstances, researchers have developed a range of target rates that vary with individual characteristics, such as marital status, lifetime income, and homeownership.

Multiyear Analysis. Although many researchers analyze retirement income in a single year, financial security is dynamic and may change as retirees' spending patterns evolve. For a more comprehensive measure of the adequacy of retirement income, basic needs and replacement rate thresholds can be applied to resources over multiple years, ultimately encompassing the full duration of the retirement period. Unlike single-year analyses, studies that look at multiple years can show whether or not retirees are able to maintain their standard of living as their needs change over time.

Multiyear analyses fall into two broad groups: limited multiyear analysis and a comprehensive simulation-based approach. Limited multiyear analysis applies basic needs thresholds or target replacement rates to resources in several different years of retirement, examining how the adequacy of retirement income changes between discrete points in time. The simulation-based approach, however, evaluates the adequacy in every year of retirement until the end of life, fully capturing changes in retirement income over time. That approach generally requires complex projections and more detailed data. One advantage of the simulation-based approach is its ability to incorporate increases in health care expenses that typically occur over the course of retirement as well as potentially large long-term care costs.

What Do the Measures Reveal About the Adequacy of Retirement Income?

Current measures of the adequacy of retirement income provide diverse answers about the state of retirement income security in the United States. That diversity stems from a number of sources. One source is which definition of adequacy is used (meeting basic needs or maintaining the preretirement standard of living). Other sources include which cohorts are analyzed and precisely how income and wealth are counted.

What proportion of retirees will have an adequate income? The answer varies depending on the threshold

for "adequate." In general, researchers conclude that fewer than one-tenth of retirees will have income below the lowest basic needs threshold—the poverty threshold—while a much larger fraction of people are projected to have income that will fall short of maintaining their preretirement standard of living. For example, in [one study](#), the authors projected that only about 6 percent of workers in their 40s and 50s would have future retirement income below the poverty threshold.¹ In contrast, [recent analysis](#) using the National Retirement Risk Index (NRRI), a measure developed by the Center for Retirement Research at Boston College, indicated that about half of working-age U.S. households were "at risk" of not being able to maintain their living standard in retirement.²

Even when the thresholds are based on the same broad definition of adequate income, researchers have made different analytical choices when constructing the adequacy measures, resulting in different findings. For example, in contrast with basic needs studies that rely on the poverty threshold, a [recent analysis](#) using the Elder Economic Security Standard Index, or the Elder Index—which is a basic needs threshold based on the larger expenses that are common among households with elderly members—found that about a quarter of two-person households whose members were age 65 or over and more than half of the elderly people in single-person households would have inadequate income.³

Similarly, according to a [recent literature review](#) by the Government Accountability Office (GAO), studies that evaluated the extent to which workers were able to maintain their preretirement living standards reached a

1. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, "This Is Not Your Parents' Retirement: Comparing Retirement Income Across Generations," *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).
2. See Alicia H. Munnell, Wenliang Hou, and Anthony Webb, "National Retirement Risk Index (NRRI) Update Shows Half of Working-Age Americans Still Falling Short," *Journal of Retirement*, vol. 3, no. 2 (Fall 2015), pp. 34–42, <http://tinyurl.com/ybokerrk> (PDF, 914 KB).
3. See Jan E. Mutchler, Yang Li, and Ping Xu, *Living Below the Line: Economic Insecurity and Older Americans Insecurity in the States 2016*, Paper 13 (Center for Social and Demographic Research on Aging, 2016), <http://tinyurl.com/h9dcj5g>.

broad range of conclusions.⁴ Overall, across the studies, the share of current workers who were at risk of having inadequate income ranged from about one-third to two-thirds.

Using more than one measure at a time can provide additional insights. For example, analyses pegged to the poverty threshold indicate how many people are experiencing significant material hardship; however, they do not reveal how those people's standard of living changed upon retirement. Similarly, analyses based on replacement rates generally show the fraction of retirees who are judged unable to maintain their preretirement standard of living, but they might not convey whether retirees are experiencing poverty or are near poverty. Comparing the results of such analyses sheds additional light, enabling better understanding of the financial security of retirees.

Although a number of factors cause conclusions about the adequacy of retirement income to diverge, recent research delves further into the role of data quality, examining differences between publicly available survey data and restricted-use administrative data. (Administrative data are collected for administrative purposes by governmental agencies, such as the Internal Revenue Service or the Social Security Administration.) The vast majority of studies on the adequacy of retirement income use self-reported data because that information is widely available. However, income is known to be underreported in surveys, particularly income from employer-sponsored pensions and other retirement accounts. Ongoing research is seeking to improve current understanding of the extent and nature of underreporting and to clarify how underreporting could affect conclusions about retirement adequacy.

Factors Considered When Measuring Retirement Income Adequacy

Researchers make choices about a number of factors when analyzing the adequacy of retirement income, including the following:

- What *data* to use for the analysis,
- The *population of interest*,

- The *unit of analysis*,
- Whether the analysis should cover a *single year* or *multiple years*,
- How to *define income*,
- How to *define adequacy*, and
- How to *quantify uncertainty* about the results.

Data

The data used for constructing measures of retirement adequacy could affect the studies' conclusions. Although the most commonly used data sets are publicly available surveys, such as the Health and Retirement Study (HRS), the Survey of Income and Program Participation, the Survey of Consumer Finances, and the Current Population Survey (CPS), researchers have long noted that self-reported data often contain systematic misreporting errors.⁵ More recently, researchers have shown that retirement resources in particular are prone to underreporting, which can overstate estimates of retirees with inadequate retirement income.⁶

Using data sources that link survey and administrative records for the same people, researchers have found that the share of people with certain types of retirement income is higher than found in survey data. For example, an analysis using the March supplement of the CPS showed that only 6 percent of married couples and nonmarried persons age 65 or older in the lowest income quintile and 27 percent in the second quintile received income from private pensions, annuities, or public

4. See Government Accountability Office, *Retirement Security: Most Households Approaching Retirement Have Low Savings*, GAO-15-419 (May 12, 2015), www.gao.gov/products/GAO-15-419.

5. For example, see Roger A. Herriot and Emmett F. Spiers, "Measuring the Impact on Income Statistics of Reporting Differences Between the Current Population Survey and Administrative Sources," *Proceedings of the Social Statistics Section* (American Statistical Association, 1975), pp. 147–158.

6. See for example, Billie Jean Miller and Sylvester J. Schieber, "Contribution of Pension and Retirement Savings to Retirement Income Security: More Than Meets the Eye," *Journal of Retirement*, vol. 1, no. 3 (Winter 2014), pp. 14–29, <http://tinyurl.com/ya9ypv4v>. Nevertheless, some studies have estimated that underreporting affects mainly higher-income individuals because lower-income workers have little wealth in retirement accounts. See Alicia H. Munnell and Anqi Chen, "Do Census Data Understate Retirement Income?" Issue in Brief No. 14-19 (Center for Retirement Research at Boston College, December 2014), <http://tinyurl.com/pchqun>.

pensions other than Social Security in 2014.⁷ In contrast, using a sample of tax filers who were still working in their late 50s, researchers at the Investment Company Institute and the Internal Revenue Service (IRS) found that 41 percent of people in the lowest income quintile and 70 percent of people in the second quintile received retirement income three years after claiming Social Security benefits, including income from defined benefit and defined contribution plans, annuities, and individual retirement accounts (IRAs).⁸ Furthermore, researchers at the Census Bureau, using newly linked survey and administrative data, found that underreporting of retirement income in public surveys has been growing over time.⁹ Although existing studies on administrative records have limitations (for instance, income data from the IRS is available only for households who file tax returns), they suggest that using self-reported survey data when analyzing the adequacy of retirement income could understate retirement resources.¹⁰ For example, an

analysis using data from the 2012 CPS Annual Social and Economic Supplement showed that the median household income for householders age 65 or older was \$33,800, whereas analysis using those survey data linked to administrative data found that the median household income was 30 percent higher: \$44,400.¹¹

Population of Interest

Researchers analyzing the adequacy of retirement income have studied a variety of populations—that is, groups with different demographic and socioeconomic characteristics. Some studies have focused on older cohorts of people who are nearing the end of retirement, and others have examined retirement prospects for workers still in the labor force. Some have analyzed the adequacy of retirement income on the basis of education, race, or sex, and others have distinguished among retirees on the basis of the type of Social Security benefits they receive, ranging from retired-worker benefits to benefits for widows. Current retirees and workers approaching retirement are generally found to be more likely to maintain their standard of living in retirement than is projected for future retirees.¹² (A number of factors

7. See Social Security Administration, Office of Retirement and Disability Policy, “Income of the Population 55 or Older, 2014,” SSA Publication No. 13-11871 (April 2016), www.ssa.gov/policy/docs/statcomps/income_pop55/2014/incpop14.pdf (2 MB).

8. See Peter J. Brady and others, “Using Panel Tax Data to Examine the Transition to Retirement” (paper presented at 2016 National Tax Association Annual Conference, Baltimore, Md., November 12, 2016; current draft updated on February 21, 2017), <http://tinyurl.com/yahe6xwx>.

9. See C. Adam Bee and Joshua Mitchell, *Do Older Americans Have More Income Than We Think?* Working Paper No. 2017-39 (Census Bureau, Social, Economic & Housing Statistics Division, July 2017), <https://go.usa.gov/xRG87>; and C. Adam Bee and Joshua Mitchell, *The Hidden Resources of Women Working Longer: Evidence From Linked Survey-Administrative Data*, Working Paper No. 22970 (National Bureau of Economic Research, December 2016), www.nber.org/papers/w22970.

10. In part because of growing concerns about retirement income accuracy, the Census Bureau redesigned the Current Population Survey questionnaire in 2014. The redesigned survey asks separate questions about whether respondents have pensions, retirement accounts, and what income they receive from each source. According to researchers at the Census, the redesign resulted in about a 420 percent increase in the number of people that received income from IRAs, Keogh, and 401(k) accounts and a 230 percent increase in aggregate income from those accounts. Researchers at the Employee Benefit Research Institute found the redesign increased the percentage of elderly individuals who had any pension income from 31.7 percent to 36.6 percent. See Jessica L. Semega and Edward Welniak Jr., “The Effects of the Changes to the Current Population Survey Annual Social and Economic Supplement on Estimates of Income” (draft for the 2015 Allied Social Science Association Research

Conference, Boston, Mass., January 2015), <https://go.usa.gov/xRG93>; Craig Copeland, “The Effect of the Current Population Survey Redesign on Retirement-Plan Participation Estimates,” *EBRI Notes*, vol. 36, no. 12 (Employee Benefit Research Institute, December 2015), <http://tinyurl.com/y7b25mn9>.

11. See C. Adam Bee and Joshua Mitchell, *Do Older Americans Have More Income Than We Think?* Working Paper No. 2017-39 (Census Bureau, Social, Economic & Housing Statistics Division, July 2017), <https://go.usa.gov/xRG87>.

12. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, “This Is Not Your Parents’ Retirement: Comparing Retirement Income Across Generations,” *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB). The authors found that, adjusted for changes in wages, projected median total income replacement rates among people in War Baby cohorts (people born between 1936 and 1945) were 14 percentage points higher than replacement rates among people in Generation X cohorts (people born between 1966 to 1975). Similarly, the authors of another study found that workers born between 1931 and 1941 were significantly less likely to be at risk for being unable to maintain their standard of living compared with workers born later (between 1943 and 1953). According to the authors, that decline in adequacy was driven by fewer one-earner couples among the later cohorts, scheduled increases in the full retirement age for the Social Security benefits, lower real interest rates that reduce income from annuities, and a switch from defined benefit to defined contribution plans. See Alicia H. Munnell, Anthony Webb, and Francesca Golub-Sass, *Is There Really a Retirement Savings Crisis? An NRRRI Analysis*, Issue in Brief

account for that phenomenon, including differences in returns on investments, earnings patterns for women, and saving preferences.) However, relative to current retirees, future retirees are more likely to have retirement income that meets their basic needs because wages typically grow faster than prices.¹³

Unit of Analysis

In studies of retirement income, a typical unit of analysis is an individual worker. Such a focus often means that only that worker's retirement income is counted, whether or not the person is married.

Because spouses tend to share resources and the majority of retired workers are married, some researchers consider sources of household income when analyzing retirement income adequacy. In a typical household-level analysis, the retirement income of both spouses is combined. (A household is typically defined as a person or a couple, including or excluding children.) Measuring adequacy at the household rather than the individual level can result in different conclusions. For example, for a married person who is the sole earner in his or her household, the Social Security replacement rate—the amount of Social Security benefit expressed as a percentage of preretirement earnings—would be substantially higher if the unit of analysis was a household rather than an individual worker because of the availability of spousal benefits.¹⁴

Span of Analysis

Many studies focus on a single year in retirement (typically the first), allowing for easier modeling and taking advantage of more widely available data. Evaluating retirement income in one year provides a useful snapshot but cannot capture dynamic forces that shape the

evolution of the adequacy of retirement income over time.¹⁵ The growing volume of multiyear analyses shows that changes over the course of people's retirement can be substantial. One study found that median household replacement rates, relative to preretirement earnings, can drop up to 20 percentage points over the first 10 years of retirement as any additional household earnings disappear, highlighting that single-year replacement rates could be significantly different from replacement rates produced by a multiyear analysis.¹⁶

Definition of Income

Another fundamental step in measuring the adequacy of retirement income is deciding which income categories should be included and how that income should be adjusted. Researchers have specified or defined retirement income in various ways, ranging from Social Security benefits only to broader measures of income that include Social Security, defined benefit and defined contribution plans, IRAs, personal savings, the value of a house owned or the resulting imputed rent, and any additional earnings or transfers.¹⁷ On the one hand, defining income narrowly as Social Security benefits alone can be informative for evaluating the generosity of the Social Security system. On the other hand, defining income more broadly can provide a more comprehensive understanding of retirement security.

No. 7-11 (Center for Retirement Research at Boston College, August 2007), <http://tinyurl.com/yd4bynrw>.

13. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, "This Is Not Your Parents' Retirement: Comparing Retirement Income Across Generations," *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).

14. See Alicia H. Munnell and Mauricio Soto, *What Replacement Rates Do Households Actually Experience in Retirement?* Working Paper 2005-10 (Center for Retirement Research at Boston College, 2005), <http://tinyurl.com/yac9qjap> (PDF, 171 KB); and April Yanyuan Wu and others, *How Do the Changing Labor Supply Behavior and Marriage Patterns of Women Affect Social Security Replacement Rates?* Working Paper 2013-16 (Center for Retirement Research at Boston College, 2013), <http://tinyurl.com/lyboawwnb> (PDF, 597 KB).

15. In some studies, the distinction between single- and multiyear analysis is blurred. For example, the NRRI studies conducted by the Center for the Retirement Research at Boston College project replacement rates at age 65. However, retirement income at age 65 is calculated on the basis of the assumption that the household purchases an inflation-indexed annuity using all of its financial assets as well as proceeds from a reverse mortgage. In that scenario, the retirement income at age 65 would equal the inflation-adjusted retirement income in every year of retirement as long as the household composition remains the same. See Alicia H. Munnell, Anthony Webb, and Wenliang Hou, "How Much Should People Save?" Issue in Brief 14-11 (Center for Retirement Research at Boston College, July 2014), <http://tinyurl.com/yd475k6o>.

16. See Patrick J. Purcell, "Income Replacement Ratios in the Health and Retirement Study," *Social Security Bulletin*, vol. 72, no. 3 (2012), pp. 37–58, <https://go.usa.gov/xRGNC>.

17. Imputed rent is the amount of rent that people would pay for living in their home if they did not own it. Transfers are the amounts paid to the eligible low-income recipients from government programs, such as Supplemental Security Income and SNAP.

Researchers also differ in how they measure preretirement income, which is needed to evaluate whether workers are able to maintain their preretirement living standard in retirement. Additional considerations include whether the income should be before-tax or after-tax, whether it should be the amount from a particular year or the average over some set span or an entire career, and how it should be adjusted for inflation. Each of those considerations can have a significant effect on the results. For example, using preretirement income equal to the last five years of substantial earnings before age 62 can yield mean replacement rates for retired workers that are up to 20 percentage points lower on average than those that result when preretirement income is based on average annual price-adjusted lifetime earnings. (Substantial earnings are annual earnings that are at least half of the worker's average indexed earnings.)¹⁸

Definition of Adequacy

To gauge the adequacy of retirement income, researchers typically rely on two main definitions—whether retirement income meets the basic needs for living and whether it allows retirees to maintain their preretirement standard of living.

Defining adequacy as satisfying basic needs aims to capture how many retirees are experiencing significant material hardship. Such lower bounds may equate to staying above the poverty threshold or being able to afford a necessary set of goods and services. Those approaches yield, respectively, the official federal poverty threshold and elderly needs indexes. Policymakers often use variations of the poverty threshold to establish eligibility for government programs for low-income groups, such as SNAP, the Children's Health Insurance Program, and parts of Medicaid.

Defining adequacy as maintaining a preretirement standard of living is based on the premise that retirement income is sufficient if it enables retirees to enjoy the same quality of life they experienced during their working years.¹⁹ Economists and financial advisers generally point

to that threshold—the target replacement rate—because achieving that target is supposed to enable workers to maintain their standard of living in retirement.

However, the threshold is not clear-cut. Researchers who define adequacy as maintaining a preretirement standard of living implicitly equate that standard of living with preretirement consumption. Because data on that consumption are not readily available, researchers approximate it by relying on an imperfect proxy: preretirement income. Most researchers agree that people need less than 100 percent of their preretirement income to maintain 100 percent of their preretirement consumption. (For example, work-related expenses disappear, reducing income needs in retirement.) Typically, researchers conclude that entering retirement with at least 70 percent of preretirement income allows people to maintain their preretirement consumption; however, that specific target has been criticized in the literature because target replacement rates can vary greatly depending on individual circumstances.²⁰

well-being by borrowing when young, saving during their working years, and drawing down saved assets in retirement. In the simplest version of the model, well-being depends solely on the consumption of goods and services, and maximum lifetime well-being is achieved when people are just as happy to spend an additional dollar during their working years as they are to spend it in retirement. However, maximizing lifetime well-being does not necessarily mean maintaining spending at a constant level. For an introduction to the life-cycle model, see Zvi Bodie, Jonathan Treussard, and Paul S. Willen, *The Theory of Life-Cycle Saving and Investing*, Public Policy Discussion Paper No. 07-3 (Federal Reserve Bank of Boston, 2007), <http://tinyurl.com/y8fvo319>. For a literature review, see Orazio P. Attanasio and Guglielmo Weber, "Consumption and Saving: Models of Intertemporal Allocation and Their Implications for Public Policy," *Journal of Economic Literature*, vol. 48, no.3 (September 2010), pp. 693–751, <http://tinyurl.com/y82blbxq> (PDF, 1.12 MB); and Martin Browning and Thomas F. Crossley, "The Life-Cycle Model of Consumption and Saving," *Journal of Economic Perspectives*, vol. 15, no.3 (2001), pp. 3–22, www.aeaweb.org/articles?id=10.1257/jep.15.3.3.

18. See Congressional Budget Office, *CBO's 2016 Long-Term Projections for Social Security: Additional Information* (December 2016), www.cbo.gov/publication/52298. Additional replacement rates are included in the supplemental data accompanying that report.

19. This definition has roots in the economic framework that guides the study of consumption choices over a lifetime, called the life-cycle model. Within the model, people maximize their

20. For example, see Vickie Bajtelsmit, Anna Rappaport, and LeAndra Foster, "Measures of Retirement Benefit Adequacy: Which, Why, for Whom, and How Much?" (Society of Actuaries, Pension Section and Pension Section Research Committee, January 2013), <http://tinyurl.com/yc5p3hb6>; and John Karl Scholz and Ananth Seshadri, *What Replacement Rates Should Households Use?* Working Paper 2009-214 (Michigan Retirement Research Center, 2009b), <http://tinyurl.com/yd562ctc> (PDF, 380 KB).

Using a threshold based on one of the two main definitions of adequacy, as well as choosing a particular configuration of the threshold within each group, can produce widely different conclusions. For example, using a basic needs threshold, the authors of one study projected that 5.7 percent of U.S. adults born between 1966 and 1975—Generation X—would be in poverty at age 67.²¹ However, using a replacement rate threshold, they found that more than seven times as many adults, a total of 43 percent of people in Generation X cohorts, were projected to have median replacement rates below 75 percent of wage-adjusted preretirement income. (Wage-adjusted earnings account for changes in the average wage index and reflect the increase in average living standards over time.) In addition, switching from wage- to price-adjusted earnings for the replacement rate construction further changed the conclusion: Only 25 percent of people in Generation X cohorts would have median replacement rates below 75 percent of preretirement income if price adjustment was applied instead.²² (Price-adjusted earnings account for inflation and reflect the purchasing power of earnings over time.)

In addition to being gauged in terms of meeting basic needs or maintaining a preretirement standard of living, adequacy can be defined in other ways. For example, in multiyear analyses, researchers may employ a measure of adequacy that distills the path of retirement income and spending to a single number—assets remaining at death. If the retiree does not run out of money in retirement and reaches the end of life with positive assets, that definition would classify that person as having adequate retirement income. In addition, the adequacy of retirement income can be defined on the basis of people's preferences about the type of retirement they envision—for example, whether they seek a retirement filled with luxurious travel and costly hobbies or a more modest retirement centered on low-cost activities at home. However, that preference-based definition cannot be readily used by policy analysts seeking to evaluate the adequacy of retirement income on a national scale: Detailed data on people's preferences are not available, and projecting such preferences for future cohorts would be difficult. (See the appendix for more information on the definition of

adequacy that incorporates individual preferences about the desired quality of retirement.)

Uncertainty

Once the adequacy threshold is determined, the remaining consideration is the uncertainty surrounding the measure's conclusions. When analyzing retirement adequacy for future retirees, researchers generally base their analysis on a number of parameters, and the values of those parameters could substantially affect the results.

The underlying factors that contribute to the uncertainty surrounding the adequacy measures are returns on investments, longevity, and health and long-term care costs. For example, when projecting retirement income for future retirees, researchers could base their analyses on the average rates of return or they could also consider rates of return at the lower end or the higher end of the possible outcomes. Similarly, instead of using average life expectancy or health care costs, they could vary the projections about how long workers would live and what their health expenses would be, thus quantifying the effects of the unexpectedly small or large costs. That approach would yield a range of uncertainty, or confidence interval.

Multiyear simulation studies are well suited for producing such confidence intervals, and many researchers have developed models that can describe the likelihood that a given retirement income would allow for adequate consumption until the end of life.²³ Overall, researchers find that the fraction of people who are projected to have a 95 percent chance of having adequate retirement income is much lower than the fraction of people who are projected to achieve adequacy on average.²⁴

Measures of Adequacy Used in Single-Year Analyses

In single-year analysis, researchers constructing measures of income adequacy make choices about data, the population of interest, and the unit of analysis. What distinguishes those measures from one another is the

21. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, "This Is Not Your Parents' Retirement: Comparing Retirement Income Across Generations," *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).

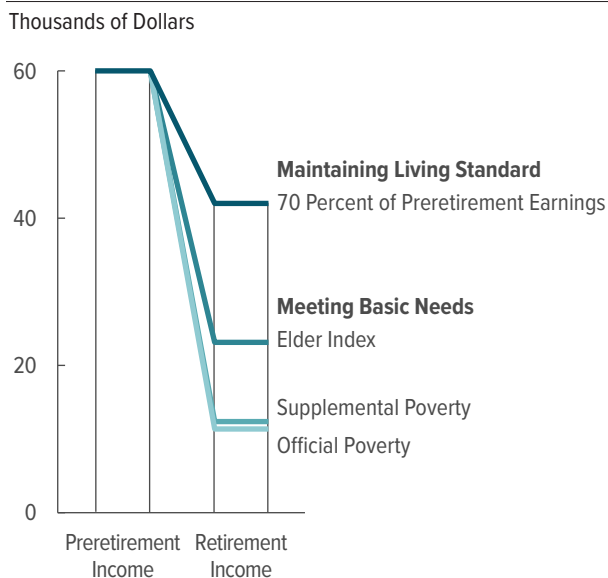
22. *Ibid.*

23. Although it is possible to construct confidence intervals for single-year measures, most studies that use such measures do not present confidence intervals for their results.

24. For example, see Vickie Bajtelsmit, Anna Rappaport, and LeAndra Foster, "Measures of Retirement Benefit Adequacy: Which, Why, for Whom, and How Much?" (Society of Actuaries, Pension Section and Pension Section Research Committee, January 2013), <http://tinyurl.com/jc5p3hb6>.

Figure 1.

First-Year Retirement Income Thresholds for a Single Worker With \$60,000 in Annual Preretirement Earnings, 2015



Source: Congressional Budget Office, using data from the Census Bureau and the Gerontology Institute at the University of Massachusetts, Boston.

The official federal poverty threshold generally provides the lowest bound for the adequacy of retirement income. It is set at the cost of a minimum food diet in 1963 multiplied by three to account for other necessary expenses and adjusted for the change in prices. The supplemental poverty measure (SPM) threshold represents the amount spent on basic goods, including food, clothing, shelter, and utilities, and a small additional amount for other basic needs. The Elder Index reflects the necessary living costs faced by households that include one or two older adults age 65 or older living independently.

When evaluating the adequacy of retirement income, a common rule of thumb is that replacing at least 70 percent of preretirement earnings would avoid a marked decline in retirees' standard of living; however, that specific goal is not appropriate for all people because target replacement rates can vary greatly depending on individual circumstances.

Values for the supplemental poverty measure threshold and the Elder Index reflect the dollar thresholds for a single person age 65 or older who does not own a home. The official poverty threshold does not vary geographically, whereas the SPM thresholds and the Elder Index do. The threshold values for the SPM and the Elder Index shown in the figure correspond to national averages. In addition, the Elder Index reflects the assumption that the worker is in good health.

way in which retirement income is defined and how much income is considered adequate, as specified by an adequacy threshold.

The adequacy thresholds can be ranked by the amount of income required, from income that would meet basic needs to income that would maintain preretirement living standards. (See Figure 1 for an example of how the thresholds relate to one another for a hypothetical worker with \$60,000 in annual gross preretirement earnings in 2015.)

Meeting Basic Needs

Basic needs measures of adequacy are designed to capture how well retirees will be able to cover the most essential living expenses. Researchers have used measures based on different basic needs thresholds, including the poverty threshold, the SPM threshold, and elderly-specific basic needs indexes.

Official Federal Poverty Measure. Of the three most commonly used basic needs measures, the poverty threshold generally provides the lowest bound for the adequacy of retirement income. The Census Bureau, which produces the poverty measure, defines income as the before-tax sum of various money income sources, including Social Security benefits, pension or other retirement income, Supplemental Security Income, interest, dividends, as well as wages and salaries, if any.²⁵ (The definition excludes capital gains, tax credits, or other noncash benefits such as those from SNAP, public housing, and Medicaid.) To calculate that measure, total money income is compared with a threshold that is set at the cost of a minimum food diet multiplied by three to account for other necessary expenses, originally calculated in 1963 and adjusted for changes in prices.²⁶ The threshold is further refined by family size and composition and by the age of the head of household. In 2015, the poverty threshold for a single person age 65 or older was \$11,367; for a two-person household in which the head of household was age 65 or older, the poverty threshold was \$14,326. The Census Bureau's estimates for that year show that about 8.8 percent of people age 65 or older were in poverty.

25. See Census Bureau, "How the Census Bureau Measures Poverty" (accessed February 22, 2017), <https://go.usa.gov/xRGnv>.

26. See Gordon M. Fisher, "The Development of the Orshansky Poverty Thresholds and Their Subsequent History as the Official U.S. Poverty Measure," Census Bureau, Poverty—Experimental Measures (May 1992, partially revised September 1997), <https://go.usa.gov/xRGne>.

The poverty threshold has been the benchmark for a number of researchers' evaluations of the adequacy of retirement income. For example, Butrica, Smith, and Iams (2012) estimated that 7 percent of people born between 1926 and 1955 were in poverty at age 67, and only about 5.7 percent of people born between 1966 and 1975 were projected to be in poverty at the same age.²⁷

An advantage of using the poverty threshold is its relative simplicity and modest data requirements. For analysts, calculating whether retirement resources are on track to meet or exceed the poverty threshold is relatively straightforward. A simplified version of this threshold, known as the poverty guideline, also has standing among policymakers, as evidenced by the required use of poverty guidelines in identifying low-income individuals for purposes of administering federal programs, such as SNAP and parts of Medicaid.²⁸

Although an analysis using the poverty threshold could inform policymakers about how many people have retirement income above a minimum dollar value, such analysis would not reveal whether people would be able to avoid a sudden change in consumption upon retirement. For workers who were well above the poverty threshold during their working years, dropping to just above the poverty threshold could mean a dramatic reduction in living standards. Additionally, the poverty threshold does not vary geographically, and large regional variations in the cost of living diminish the measure's usefulness. Finally, the official poverty threshold has not substantially changed since its development and might not accurately represent current basic living needs. The threshold is also lower for the elderly than for other adults and thus may not adequately reflect the needs of the elderly with regard to certain expenses, such as high out-of-pocket health care costs.²⁹

27. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, "This Is Not Your Parents' Retirement: Comparing Retirement Income Across Generations," *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).

28. For a comparison of poverty thresholds and poverty guidelines, see Institute for Research on Poverty, University of Wisconsin-Madison, "What Are Poverty Thresholds and Poverty Guidelines?" (accessed April 17, 2017), www.irp.wisc.edu/faqs/faq1.htm.

29. The lower poverty threshold for the elderly households is a result of the lower estimated cost of the food plan for the elderly compared to younger households based on the Agriculture Department's 1955 Household Food Consumption Survey.

Supplemental Poverty Measure. The Census Bureau also produces a supplemental poverty measure. For the SPM, the Census Bureau uses a broader definition of income than that used for the official federal poverty measure, including not only cash income but also in-kind benefits (for example, SNAP benefits, housing subsidies, and home energy assistance), while excluding tax payments, work-related expenses, and out-of-pocket medical costs.³⁰ Unlike the official poverty measure, the SPM accounts for regional variations in the cost of living. Income is considered adequate if it exceeds the SPM threshold, which is calculated using average spending on food, clothing, shelter, and utilities by a family between the 30th percentile and the 36th percentile of such spending. Separate SPM thresholds are calculated for homeowners with a mortgage, homeowners without a mortgage, and renters. In 2015, for a single householder, the average SPM thresholds were about \$12,224 for homeowners with a mortgage, \$10,000 for homeowners without a mortgage, and \$12,375 for renters. For a household with two adults, the thresholds were about \$17,238, \$14,057, and \$17,697, respectively.³¹ Using the SPM, researchers at the Census Bureau estimated that 13.7 percent of people age 65 or older had income below the threshold in 2015.³²

See Gordon M. Fisher, "The Development of the Orshansky Poverty Thresholds and Their Subsequent History as the Official U.S. Poverty Measure," Census Bureau, Poverty—Experimental Measures (May 1992, partially revised September 1997), <https://go.usa.gov/xRGne>. For an overview of how out-of-pocket expenses vary by age, see Philippe Gwet, Jerrod Anderson, and Steven R. Machlin, "Out-of-Pocket Health Care Expenses in the U.S. Civilian Noninstitutionalized Population by Age and Insurance Coverage, 2014," Statistical Brief No. 495 (Department of Health and Human Services, Agency for Healthcare Research and Quality, October 2016), https://meps.ahrq.gov/data_files/publications/st495/stat495.shtml. For a more in-depth look into out-of-pocket expenses of the elderly, see Juliette Cubanski and others, "How Much Is Enough? Out-of-Pocket Spending Among Medicare Beneficiaries: A Chartbook" (Kaiser Family Foundation, July 2014), <http://tinyurl.com/y8s5vays>.

30. See Census Bureau, "Supplemental Poverty Measure" (accessed February 22, 2017), <https://go.usa.gov/xRGQx>.

31. CBO's calculations using the 2015 Supplemental Poverty Measure Public Use Research Files. See Census Bureau, "2015 Supplemental Poverty Measure (SPM) Research File" (accessed February 24, 2017), <https://go.usa.gov/xRsFV>.

32. See Trudi Renwick and Liana Fox, "The Supplemental Poverty Measure: 2015" (Census Bureau, Current Population Report, September 2016), <https://go.usa.gov/xRQBq>.

A number of researchers have used the SPM thresholds to evaluate retirees' income, often computing additional variations of the thresholds. For example, Gould and Cooper (2013) have compared the income of people age 65 or older with portions of and multiples of the SPM thresholds, from 50 percent to 400 percent of the original threshold.³³ Using data from 2009 to 2011, they found that about 15.5 percent of the elderly population had income below the SPM thresholds and that 48 percent had income below 200 percent of the SPM thresholds. Compared with 200 percent of the official poverty threshold, nearly 6 million more seniors in the United States would have income below 200 percent of the SPM thresholds.

Although the SPM employs a more comprehensive definition of income and a generally higher adequacy threshold than the official poverty threshold, the SPM shares the main disadvantages of the official poverty measure as an indicator of the adequacy of retirement income. In particular, meeting the SPM threshold is not likely to ensure a smooth level of consumption from working years to retirement, and the measure is not specifically tailored to the elderly population's consumption patterns. In addition, the SPM has more rigorous data requirements because the value of in-kind benefits is needed to apply this measure. Finally, the treatment of medical expenses in the SPM is controversial as some researchers point out that the SPM can substantially overestimate poverty among the elderly population because of the way the measure accounts for out-of-pocket medical spending.³⁴

33. See Elise Gould and David Cooper, *Financial Security of Elderly Americans at Risk: Proposed Changes to Social Security and Medicare Could Make a Majority of Seniors 'Economically Vulnerable'*, EPI Briefing Paper No. 362 (Economic Policy Institute, June 2013), <http://tinyurl.com/k98t8f7>.

34. Studies have shown that the SPM's treatment of medical out-of-pocket expenses (MOOP) is the largest factor in the difference between estimates based on the SPM and the official poverty threshold for the population age 65 or older. See Benjamin Bridges and Robert V. Guesmaria, "The Supplemental Poverty Measure (SPM) and the Aged: How and Why the SPM and Official Poverty Estimates Differ," *Social Security Bulletin*, vol. 73, no 4 (2013), p. 49–69, www.ssa.gov/policy/docs/ssb/v73n4/v73n4p49.html. Some researchers find that the SPM's treatment of MOOP results in an upward bias in the estimates of the elderly poverty rates. See Sanders Korenman and Dahlia Remler, "Rethinking Elderly Poverty: Time for a Health Inclusive Poverty Measure?" Working Paper 18900 (National Bureau of Economic Research, March 2013), www.nber.org/papers/w18900.

Elderly-Specific Measures. To account for common expenses faced by households with adults age 65 or older, some researchers have created alternative basic needs measures. The most common measure, called the Elder Economic Security Standard Index (Elder Index), has been developed by the Gerontology Institute at the University of Massachusetts Boston with Wider Opportunities for Women and is managed in partnership with the National Council on Aging.³⁵ Researchers there first define retirement income as Social Security benefits, payments of pensions, and income from retirement savings and other sources, adjusted for taxes. That income is then compared with the Elder Index, which is based on the typical costs of housing, health care, transportation, food, and other essential expenses incurred by households that include one or two adults age 65 or older who are living independently. Further, the Elder Index accounts for geographic variations in the cost of living as well as people's health (whether it is excellent, good, or poor). Like the SPM thresholds, the Elder Index is calculated separately for homeowners with a mortgage, homeowners without a mortgage, and renters. Unlike the SPM, however, the Elder Index generally uses median or average spending on the included categories rather than the 30th to 36th percentile of such spending, resulting in the Elder Index thresholds being roughly twice as large as the corresponding SPM thresholds.³⁶ According to researchers at the Gerontology Institute, what makes the Elder Index reflective of basic, rather than average, budgets is that it does not include vacations, large purchases, or expenses for entertainment or dining out. In 2016, about 26 percent of older adults living in households with one or two adults age 65 or older and 53 percent of older adults living alone had annual income below the Elder Index.³⁷ Moreover, for

35. For more information, see Jan E. Mutchler, Yang Li, and Ping Xu, *Living Below the Line: Economic Insecurity and Older Americans Insecurity in the States 2016*, Paper 13 (Center for Social and Demographic Research on Aging, 2016), <http://tinyurl.com/h9dcj5g>; and Gerontology Institute, *The National Elder Economic Security Standard Index*, Paper 75 (University of Massachusetts, Boston, 2012), http://scholarworks.umb.edu/gerontologyinstitute_pubs/75/.

36. For example, housing expenses for homeowners are median owner costs from the American Community Survey. See Institute for Women's Policy Research, "Definitions of Elder Index Expenses" (accessed May 26, 2017), www.basiceconomicsecurity.org/EI/definition.aspx.

37. For more information, see Jan E. Mutchler, Yang Li, and Ping Xu, *Living Below the Line: Economic Insecurity and Older*

Figure 2.

Basic Needs Measures for People Age 65 or Older Who Do Not Own a Home, 2015



Source: Congressional Budget Office, using data from the 2015 Supplemental Poverty Measure Public Research File and the Gerontology Institute at the University of Massachusetts, Boston.

The official federal poverty threshold generally provides the lowest bound for the adequacy of retirement income. It is set at the cost of a minimum food diet in 1963 multiplied by three to account for other necessary expenses and adjusted for the change in prices. The supplemental poverty measure (SPM) threshold represents the amount spent on basic goods, including food, clothing, shelter, utilities, and a small additional amount for other basic needs. The Elder Index reflects the necessary living costs faced by households that include one or two older adults age 65 or older living independently.

The official poverty threshold does not vary geographically, whereas the SPM thresholds and the Elder Index do. The threshold values for the SPM and the Elder Index shown in the figure correspond to national averages. The Elder Index reflects the assumption that people are in good health. The Elder Index was obtained from a report published by Jan E. Mutchler, Yang Li, and Ping Xu and converted to 2015 dollars using the consumer price index. See Jan E. Mutchler, Yang Li, and Ping Xu, *Living Below the Line: Economic Insecurity and Older Americans Insecurity in the States 2016*, Paper 13 (Center for Social and Demographic Research on Aging Publications, 2016), <http://tinyurl.com/h9dcj5g>. Percentages of renters with income below each threshold are calculations based on the 2015 Supplemental Poverty Measure Public Research File created by the Census Bureau using 2016 CPS Annual Social and Economic Supplement data. That file is available from <https://go.usa.gov/xRsYM>.

some groups, the percentage of older adults with income below the Elder Index is even higher. (See Figure 2 for an example using single adults age 65 or older who do

not own a home and households consisting of two adults age 65 or older who do not own a home. In addition to the Elder Index measures, Figure 2 also shows the official

Americans Insecurity in the States 2016, Paper 13 (Center for Social and Demographic Research on Aging Publications, 2016), <http://tinyurl.com/h9dcj5g>.

poverty measures and the supplemental poverty measures for those groups.)³⁸

The main advantage of the elderly-specific basic needs thresholds is that they allow researchers to tailor the adequacy measure to the elderly while still providing a relatively simple way to evaluate retirement security. However, a disadvantage of the elderly-specific thresholds is that they are more data-intensive than the poverty thresholds and require a detailed understanding of retirees' consumption needs. Furthermore, as with other adequacy measures, meeting elderly-specific thresholds would not guarantee that workers would be able to maintain their living standard in retirement.

Replacement Rates

The most widely used tool for evaluating the adequacy of retirement income is the replacement rate. To use that measure in single-year analysis, researchers first choose their data set, specify the population of interest and the unit of analysis, then calculate both retirement and preretirement income, and finally determine whether the ratio of the two types of income meets the target replacement rate. (As noted, the target replacement rate is broadly defined as the amount of income in retirement—expressed as a percentage of earnings before retirement—that allows retirees to maintain their standard of living. In contrast, the replacement rate is the amount of income in retirement—expressed as a percentage of earnings before retirement—that retirees have or are projected to have.)

For an analysis to provide a meaningful measure of the adequacy of retirement income, the target replacement rates and the actual rates calculated for the studied population need to be based on consistent definitions and assumptions. However, a majority of studies show either target replacement rates or actual replacement rates but not both. Because different researchers often study different populations and use different definitions of income, comparing target replacement rates from one study with observed rates from another could be problematic. Among studies that include both target and observed rates are the National Retirement Risk Index studies conducted at the Center for the Retirement Research

at Boston College.³⁹ The NRRI projects the share of working-age households who are at risk of experiencing a decline in their standard of living after retiring.⁴⁰ Construction of the NRRI explicitly involves developing and comparing both target and actual replacement rates using the same definitions.

Even though discussions of replacement rates are common in financial planning literature, there is no standardized way to calculate them. Researchers continue to deliberate over three main considerations: whether the unit of analysis should be individual workers or their households; how to define both preretirement and retirement income; and exactly how much income is considered adequate. Replacement rate calculations that incorporate those key considerations in different ways produce divergent conclusions about the state of retirement security.

Unit of Analysis. An important consideration for replacement rates is whether they focus on an individual worker or whether they take into account that worker's household. The Social Security Administration's (SSA's) Office of the Chief Actuary (OACT) computes replacement rates for individual workers, and some researchers have followed that approach when studying the link between individual earnings and retirement income.⁴¹ The advantage of that approach is its simplicity; the calculations are less data-intensive because they do not require linked information about partners or

38. The basic needs measures for homeowners with and without a mortgage are included in the supplemental data that accompany this report. Those data are available on CBO's website (www.cbo.gov/publication/53191).

39. In addition, Pang and Warshawsky (2014) as well as Scholz, Seshadri, and Khitatrakun (2006) developed optimal wealth targets and compared them to the observed savings patterns in their studied populations. See, for example, Gaobo Pang and Mark Warshawsky, "Retirement Savings Adequacy of U.S. Workers," *Benefits Quarterly*, vol. 30, no. 1 (2014), pp. 29–38, www.ifebp.org/inforequest/ifebp/0165172.pdf (1.45 MB); and John Karl Scholz, Ananth Seshadri, and Surachai Khitatrakun, "Are Americans Saving 'Optimally' for Retirement?" *Journal of Political Economy*, vol. 114, no. 4 (University of Chicago Press, 2006), pp. 607–643, www.journals.uchicago.edu/doi/abs/10.1086/506335.

40. See Alicia H. Munnell, Wenliang Hou, and Anthony Webb, "National Retirement Risk Index (NRRI) Update Shows Half of Working-Age Americans Still Falling Short," *Journal of Retirement*, vol. 3, no. 2 (2015), pp. 34–42, <http://tinyurl.com/ybokerrk> (PDF, 914 KB).

41. See Social Security Administration, Office of the Chief Actuary, "Replacement Rates for Hypothetical Retired Workers," Actuarial Note No. 2016.9 (June 2016), www.ssa.gov/oact/NOTES/ran9/an2016-9.pdf (647 KB).

spouses. However, partners' or spouses' preretirement earnings and retirement income can have a large effect on replacement rates and overall conclusions about retirees' financial security.

Researchers account for a worker's household in two main ways. Some researchers make the household the unit of analysis, considering that household's retirement and preretirement income sources and computing one adequacy measure for each household unit. For example, Munnell and Soto (2005) computed a replacement rate for each couple or single-person household.⁴² Alternatively, researchers can account for a household's sources of retirement and preretirement income, and then assign one adequacy measure to each member of the household. For instance, Butrica, Smith, and Iams (2012) used household earnings when computing replacement rates, but they reported results for each individual worker in their sample.⁴³ The advantage of that approach is that it facilitates comparisons between individual-level and household-level analyses.

Household-level analysis requires researchers to make additional choices. To calculate preretirement income, for example, researchers can compute household income on a per capita basis, as if household members share family income equally, or use an adjustment to reflect economies of scale. The first approach is known as the shared-earnings approach, and it accounts for changes in the size and composition of households during preretirement years.⁴⁴ The drawback of that approach, however, is that it does not account for generally lower per capita living expenses in households with two or more members relative to single-person households. Because household members might share expenses for housing, utilities and other items, two partners or spouses would generally need less than twice the income that each individual would need if living separately. The shared-earnings approach assumes no economies of scale within households, thus underestimating the well-being of large

households relative to smaller ones. To account for savings that result from shared resources in households, researchers have developed a number of equivalence scales, which convert household income into per capita income with adjustments for economies of scale.⁴⁵

In household-level analysis, replacement rates can be broken down by household type: single-person households and two-person households, which further consist of one-earner and two-earner households. Researchers have found that, on average, replacement rates that include only Social Security benefits as the measure of retirement income are roughly comparable between single-person and two-person households. For example, Munnell and Soto (2005) found that the median Social Security replacement rate was 44.1 percent for married couples and 45.2 percent for single-person households.⁴⁶ However, among married couples, they found that the replacement rate was substantially higher for one-earner couples (58.0 percent) compared with two-earner couples (41.1 percent). The higher rate among one-earner couples occurs because the spouse who does not work is typically entitled to the Social Security spousal benefit that is paid at a rate equal to 50 percent of the worker's amount. However, if the spouse who does not work enters the labor force but earns sufficiently little, the additional earnings would raise the preretirement income of what is now a two-earner household without increasing the total household Social Security benefit. That scenario would hold as long as the spouse's earnings result in an individual benefit that is less than 50 percent of the primary earner's amount. Thus, distinguishing between the one- and two-earner households can have a substantial effect on replacement rates.⁴⁷

42. See Alicia H. Munnell and Mauricio Soto, *What Replacement Rates Do Households Actually Experience in Retirement?* Working Paper 2005-10 (Center for Retirement Research at Boston College, 2005), <http://tinyurl.com/yac9qjap> (PDF, 171 KB).

43. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, "This Is Not Your Parents' Retirement: Comparing Retirement Income Across Generations," *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).

44. Ibid.

45. For more information, see Organisation for Economic Co-operation and Development, "What Are Equivalence Scales?" (accessed February 28, 2017), <http://tinyurl.com/ycosbq55> (PDF, 388 KB).

46. See Alicia H. Munnell and Mauricio Soto, *What Replacement Rates Do Households Actually Experience in Retirement?* Working Paper 2005-10 (Center for Retirement Research at Boston College, 2005), <http://tinyurl.com/yac9qjap> (PDF, 171 KB).

47. Although the Social Security Administration's Office of the Chief Actuary does not publish replacement rates for one- and two-earner couples, they make such a distinction in their analysis of internal rates of return from the OASDI program, showing that one-earner couples have the highest rates of return. See Social Security Administration, Office of the Chief Actuary "Internal Real Rates of Return Under the OASDI Program for

Definition of Income. To construct replacement rates, researchers need to define both retirement income as well as preretirement income. (In calculations of replacement rates, retirement income serves as the numerator, and preretirement income serves as the denominator.)

Retirement Income. Researchers have defined retirement income, the numerator of replacement rates, either narrowly as Social Security benefits alone or more comprehensively as income from a number of sources, including pensions and private savings. Replacement rates that focus on Social Security benefits are referred to as Social Security replacement rates, and the rates that seek to capture a more comprehensive measure of income are correspondingly referred to as total income replacement rates.

To measure Social Security benefits, researchers first need to specify the age at which those benefits would be measured. Because monthly Social Security benefits are reduced when claimed before the full retirement age (FRA) and increased when claimed after the FRA, measuring benefits at different ages can produce substantially different replacement rates.⁴⁸ Some studies measure the average benefits at fixed ages, such as 67, irrespective of whether the workers claimed benefits or retired at that age.⁴⁹ Others estimate what the retirement resources would have been if the workers had retired at a fixed age. For example, when projecting Social Security replacement rates for future cohorts, CBO assumes that all workers claim benefits at age 65, whereas the SSA's OACT shows variations of replacement rates

for hypothetical individuals under the assumption that workers retire at age 62, 65, or the FRA.⁵⁰ One advantage of using a fixed age is the perspective it provides when evaluating retirement preparedness for a large group of people at the same point in their life. Another advantage of using a fixed age is that doing so allows researchers to more easily make comparisons across different cohorts by excluding the effect of changes in average benefit-claiming patterns. A disadvantage is that it does not account for variations in the timing of retirement and therefore potentially evaluates the adequacy of retirement income at ages when the workers are still employed and not considering retirement. Consequently, using a fixed age for measuring retirement income may not reflect actual retirement income.

When measuring total retirement resources, determining what age to select for measuring retirement income is also important because a worker may transition to retirement gradually by working less for some period of time before fully retiring. The literature has shown that many workers approach retirement by working fewer hours or switching to less demanding jobs.⁵¹ As a result, some researchers have measured retirement adequacy during years when workers are still employed, incorporating their final earnings into the measure of total retirement resources. For example, Butrica, Smith, and Iams (2012) included employment earnings in their calculation of income replacement rates and found that earned income accounted for nearly one-fifth of total resources at age 67.⁵² Similarly, Brady and others (2017) included earnings in their calculation of total income

Hypothetical Workers,” Actuarial Note No. 2008.5 (April 2009), www.ssa.gov/oact/NOTES/ran5/an2008-5.pdf (56 KB).

48. The FRA (also called the normal retirement age) is the age at which a person becomes entitled to claim full retirement benefits. That age is set according to the year in which a person was born. Under current law, the FRA is 65 for workers born before 1938. For workers born between 1938 and 1943, the FRA increases by two months for each successive birth year, until it reaches age 66 for people born in 1943. The FRA remains age 66 for workers born between 1943 and 1954, and then, starting with people born in 1955, it increases by two months for each successive birth year until it reaches age 67 for people born in or after 1960. For people turning 62 in 2015, the FRA is 66. It increases again for people turning 62 in 2017, and it will reach age 67 for those turning 62 in 2022.
49. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, “This Is Not Your Parents’ Retirement: Comparing Retirement Income Across Generations,” *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).

50. See Congressional Budget Office, *CBO’s 2016 Long-Term Projections for Social Security: Additional Information* (December 2016), www.cbo.gov/publication/52298; Social Security Administration, Office of the Chief Actuary, “Replacement Rates for Hypothetical Retired Workers,” Actuarial Note No. 2016.9 (June 2016), www.ssa.gov/oact/NOTES/ran9/an2016-9.pdf (674 KB).
51. See Kevin Cahill, Michael D. Giandrea, and Joseph F. Quinn, “Retirement Patterns From Career Employment,” *The Gerontologist*, vol. 46, no.4 (2006), pp. 514–523, <http://tinyurl.com/y7mpxfqg>; Richard W. Johnson, Janette Kawachi, and Eric K. Lewis, *Older Workers on the Move: Recareering in Later Life*, Research Report (Urban Institute, May 2009), <http://tinyurl.com/y838mlxh>; and Peter Rupert and Giulio Zanella, “Revisiting Wage, Earnings, and Hours Profiles,” *Journal of Monetary Economics*, vol.72 (May 2015), pp. 114–130, <http://tinyurl.com/y88e3o2k>.
52. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, “This Is Not Your Parents’ Retirement: Comparing Retirement

after finding that nearly half of adults continued to work three years after claiming Social Security benefits.⁵³ However, other researchers have argued that including earnings as a measure of retirement resources precludes a meaningful comparison of income during working years with income after all work ceases. When earnings are included in retirement income, some researchers have recommended calling the resulting measure something other than a replacement rate—for example, an income stability rate.⁵⁴

An additional consideration for researchers seeking to capture total retirement income is deciding how to incorporate accumulated financial wealth and the value of other assets. Researchers often take reported data on financial assets, including the value of retirement plans such as 401(k)s, and convert them into annual income flows, which can then be added to the total annual income in retirement. In addition, some researchers incorporate the value of housing wealth into the measure of retirement income. Because a majority of people over age 65 own a home and because that home is one of the largest components of a typical household's wealth, accounting for housing could have a substantial effect on findings about income adequacy in retirement.⁵⁵ Although housing wealth is more difficult to incorporate into a measure of annual retirement income than financial wealth, owning a home provides a number of financial benefits in retirement, including not having to pay rent or having the option to downsize or take out a home-equity loan or a reverse mortgage, which can then be used to increase spending in retirement.⁵⁶ Researchers

treat housing differently, with some including only the benefit to homeowners from not paying rent, some including a portion of home equity in the measure of retirement income, and others excluding all housing benefits from annual income measures.⁵⁷

Preretirement Income. In addition to defining income in retirement, researchers need to define preretirement income, which forms the denominator of the replacement rate. Researchers specify it in a variety of ways, leading to contrasting conclusions about retirement adequacy and ongoing debates over methodology. Some important considerations include the time span over which to measure earnings, whether to include years with no or very low earnings, whether to adjust past earnings for changes in prices or changes in wages, and whether to exclude earnings that are not subject to the Social Security payroll tax.

Researchers have used different time spans for defining preretirement income, ranging from a single preretirement year to the average of lifetime earnings. For

Income Across Generations,” *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).

53. See Peter J. Brady and others, “Using Panel Tax Data to Examine the Transition to Retirement” (paper presented at 2016 National Tax Association Annual Conference, Baltimore, Md., November 12, 2016; current draft updated on February 21, 2017), <http://tinyurl.com/yahe6xwx>.

54. See Bonnie-Jeanne MacDonald and Kevin D. Moore, “Moving Beyond the Limitations of Traditional Replacement Rates” (Society of Actuaries, September 2011), <http://tinyurl.com/y7btdejz>.

55. Alicia H. Munnell and Mauricio Soto, *What Replacement Rates Do Households Actually Experience in Retirement?* Working Paper 2005-10 (Center for Retirement Research at Boston College, 2005), <http://tinyurl.com/yac9qjap> (PDF, 171 KB).

56. Although homeowners have multiple options to tap into their home equity, Butrica and Mudrazija (2016) found that only about 17 percent of people age 65 or older have done so in 2012.

See Barbara A. Butrica and Stipica Mudrazija, *Home Equity Patterns Among Older American Households*, Urban Institute Research Report (Urban Institute, October 2016), <http://tinyurl.com/y7m3tcnf> (PDF, 527 KB). Focusing on the reverse mortgage option, which differs from a home equity loan in that it does not need to be repaid until the borrower dies or moves out of the home, Warshawsky (2017) estimated that only 12 percent to 14 percent of all retired households might be eligible for and find it beneficial to use reverse mortgages because of their high costs and homeowners' motivations about making bequests. See Mark J. Warshawsky, “Retire on the House: The Possible Use of Reverse Mortgages to Enhance Retirement Security,” Mercatus Working Paper (Mercatus Center, 2017), <http://tinyurl.com/ya65yryt> (PDF, 733 KB).

57. For examples of different treatments of housing wealth, see Alicia H. Munnell and Mauricio Soto, *What Replacement Rates Do Households Actually Experience in Retirement?* Working Paper 2005-10 (Center for Retirement Research at Boston College, 2005), <http://tinyurl.com/yac9qjap> (PDF, 171 KB); Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, “This Is Not Your Parents' Retirement: Comparing Retirement Income Across Generations,” *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB); and Jack VanDerhei and Craig Copeland, *The EBRI Retirement Readiness Rating: Retirement Income Preparation and Future Prospects*, EBRI Issue Brief No. 344 (Employee Benefit Research Institute, July 2010), <http://tinyurl.com/y8y3m8od>. For empirical findings on home equity patterns, see Barbara A. Butrica and Stipica Mudrazija, *Home Equity Patterns Among Older American Households*, Urban Institute Research Report (Urban Institute, October 2016), <http://tinyurl.com/y7m3tcnf> (PDF, 527 KB).

example, seeking to evaluate retirement income relative to peak earnings, LaRochelle-Cote, Myles, and Picot (2008) defined replacement rates relative to income at age 55, when earnings are typically their highest.⁵⁸ Focusing on such years produces lower replacement rates. Most researchers aim to capture late-career earnings and the corresponding living standard of the preretirement years, which leads them to study preretirement periods that are longer than a single year. Munnell and Soto (2005) examined the 10 years before retirement and used the five with the highest income as the preretirement period.⁵⁹ Similarly, Scholz and Seshadri (2009b) used earnings in the ninth through fifth years before retirement.⁶⁰ CBO uses a measure of late-career earnings, which are defined as price-indexed income from the last five years of substantial earnings prior to age 62.⁶¹ Replacement rates that are calculated using CBO's measure are considerably lower than those based on average price-indexed lifetime earnings.⁶² (See Box 1 for additional information about the ways in which different definitions of preretirement earnings would affect CBO's estimates of Social Security replacement rates.)

It is possible for replacement rates based on late-career earnings to approximate those that are based on lifetime earnings. For example, SSA's OCACT typically calculates preretirement earnings using the highest 35 years of earnings (including years with zero earnings if fewer than 35 years of positive earnings are available) but has found that measure yields results similar to rates calculated using the last six years of positive earnings (greater

than \$100) before retirement.⁶³ (In contrast, CBO finds that its measure of late-career earnings provides substantially lower replacement rates than its measure that uses lifetime earnings. That discrepancy in findings reflects the differences in thresholds for included earnings, with the OCACT including any earnings above \$100, whereas CBO includes only substantial earnings that are at least 50 percent of worker's average indexed earnings.) To explore the effects of alternative definitions, the OCACT also computed replacement rates that included late-career years with zero earnings. That alternative definition led to substantially higher replacement rates, which the OCACT viewed as inappropriate because the years leading up to claiming retired-worker benefits "too often include years with no earnings," suggesting that earnings are more intermittent in the late-career years.⁶⁴

Others have taken a different view about whether preretirement earnings should include years with no or very low earnings. Biggs (2017) argued that the occurrence of years with zero earnings is not much higher in the years immediately preceding the claiming of benefits than in earlier years. Therefore, according to Biggs, measures of preretirement earnings should include years with no or low earnings because those years affect workers' preretirement consumption.⁶⁵

Another area of active debate that is particularly relevant for Social Security replacement rates is whether past

58. See Sebastien LaRochelle-Cote, John Myles, and Garnett Picot, *Income Security and Stability During Retirement in Canada*, Analytical Studies Branch Research Paper No. 306 (Statistics Canada, March 2008), <http://tinyurl.com/y8kj7fxa>.

59. Alicia H. Munnell and Mauricio Soto, *What Replacement Rates Do Households Actually Experience in Retirement?* Working Paper 2005-10 (Center for Retirement Research at Boston College, 2005), <http://tinyurl.com/yac9qjap> (PDF, 171 KB).

60. See John Karl Scholz and Ananth Seshadri, *What Replacement Rates Should Households Use?* Working Paper 2009-214 (Michigan Retirement Research Center, 2009b), <http://tinyurl.com/yd562ctc> (PDF, 380 KB).

61. Substantial earnings are those that are at least 50 percent of the worker's average lifetime indexed earnings. For more information, see Congressional Budget Office, *CBO's 2016 Long-Term Projections for Social Security: Additional Information* (December 2016), www.cbo.gov/publication/52298.

62. Ibid.

63. SSA's OCACT omits the sixth year of the last six years of significant earnings because, on average, it reflects earnings for only half of the year. Other researchers follow the OCACT's preferred method of using the highest 35 years of earnings. See Barbara A. Butrica, Karen E. Smith, and Howard M. Iams, "This Is Not Your Parents' Retirement: Comparing Retirement Income Across Generations," *Social Security Bulletin*, vol. 72, no. 1 (2012), pp. 37–58, <https://go.usa.gov/xRvdY> (PDF, 405 KB).

64. See Social Security Administration, Office of the Chief Actuary, "Replacement Rates for Retirees: What Makes Sense for Planning and Evaluation?" Actuarial Note No. 155 (July 2014), www.ssa.gov/oact/NOTES/pdf_notes/note155.pdf (41 KB).

65. Biggs notes that years with zero earnings could occur throughout the working years as a result of unemployment or when a worker takes time off to care for children or obtain education. It is important to note that if years of zero earnings happen because of unemployment, workers may be eligible for unemployment insurance benefits as well as benefits provided through SNAP and other programs. See Andrew George Biggs, "The Life Cycle Model, Replacement Rates, and Retirement Income Adequacy," *Journal of Retirement*, vol. 4, no. 3 (Winter 2017), pp. 96–110, <http://tinyurl.com/y82rb8rs>.

Box 1.

Replacement Rates: Defining the Denominator

A replacement rate is a widely used tool for studying the adequacy of retirement income. That rate is the amount of income in retirement expressed as a percentage of preretirement income. Preretirement income, which forms the denominator of a replacement rate, can be defined in many different ways. Researchers continue to debate the time span that the earnings should cover, whether or not years with zero or very low earnings should be included, and whether past earnings should be adjusted for changes in wages or for changes in prices.

The following examples, using the Congressional Budget Office's long-term model, provide a simple illustration of how much replacement rates can change under different definitions of preretirement earnings. All examples show median values for initial Social Security replacement rates for retired workers born in the 1940s.¹

Average Lifetime Earnings Versus the Last Five Years of Substantial Earnings

Because average lifetime earnings generally reflect the living standards that workers have experienced over their lifetime, some researchers have used that value as the denominator in the calculation of replacement rates. However, others have claimed that workers are more interested in knowing what fraction of their late-career earnings they would be able to replace in retirement. Using the last five years of substantial earnings (that is, earnings that are at least 50 percent of the worker's average indexed earnings) produces considerably lower replacement rates than using average lifetime earnings, adjusted for growth in prices as measured by the personal consumption expenditures index:

	Median Replacement Rate (Percent)
Average Lifetime Earnings, Price-Indexed	54
Last Five Years of Substantial Earnings, Price-Indexed	39

1. Replacement rates are computed for all individuals who are eligible to claim retirement benefits at age 62 and who have not yet claimed any other benefit. To limit the focus to individuals with significant attachment to the labor force, workers with fewer than 20 years of earnings that are above 10 percent of the average wage index in each year are excluded.

The Last Five Years of Substantial Earnings Versus the Last Five Years With Zero or Positive Earnings

Instead of including only the years with substantial earnings in the calculation of the replacement rate denominator, one can include years with no or very low earnings. Including years with zero or any positive earnings, produces significantly higher replacement rates than using only years with substantial earnings:

	Median Replacement Rate (Percent)
Last Five Years of Substantial Earnings, Price-Indexed	39
Last Five Years With Zero or Positive Earnings, Price-Indexed	50

Price-Indexed Earnings Versus Wage-Indexed Lifetime Earnings

Preretirement earnings can be adjusted either for growth in prices or for growth in wages over time. Social Security's benefit formula uses the 35 years of highest earnings adjusted for growth in the average wage index, which captures the increase in average living standards over time. Price adjustment, by contrast, accounts only for the effects of inflation. Replacement rates using the wage-adjusted earnings are significantly lower than rates that use price-adjusted earnings:

	Median Replacement Rate (Percent)
Average Lifetime Earnings, Price-Indexed	54
Average Lifetime Earnings, Wage-Indexed	44

All workers are assumed to claim benefits at age 65, and all values are net of income taxes paid on benefits. Average lifetime earnings reflect the 35 years of highest earnings. For additional documentation, see Congressional Budget Office, *CBO's 2016 Long-Term Projections for Social Security: Additional Information* (December 2016), www.cbo.gov/publication/52298.

earnings should be adjusted for changes in prices or for changes in average wages. Adjusting earnings for changes in prices accounts for the effects of inflation, whereas adjusting for changes in wages not only incorporates the effects of inflation but also improvements in the average standard of living for U.S. workers over time. Wage adjustment mirrors SSA's formula for initial benefit calculation. The Chief Actuary at SSA, Stephen Goss, and other actuaries at SSA (2014) concluded that wage indexing "effectively equates earnings levels over time relative to the standard of living of workers of the day."⁶⁶ In contrast, Biggs, Pang, and Schieber (2015) argued that it is the worker's actual purchasing power, rather than the average purchasing power of all workers, that defines his or her standard of living, and, therefore, that price indexing is more appropriate in constructing replacement rates.⁶⁷ It is important to note that wage indexing typically produces substantially lower replacement rates than price indexing when longer time spans are considered. In 2016, CBO published the Social Security replacement rates using both wage-adjusted and price-adjusted measures of lifetime earnings, showing that replacement rates based on the wage adjustment tend to be 9 percentage points to 17 percentage points lower, on average.⁶⁸

Although studies of retirement income adequacy do not generally impose restrictions on preretirement income, some analyses of Social Security benefits use only earnings that are subject to the Social Security payroll tax. For example, the OCACT (2014) used earnings that are subject to the payroll tax in computing preretirement income.⁶⁹ (In 2017, the payroll tax applied to earnings up to \$127,200.) Limiting earnings to those subject to the payroll tax produces Social Security replacement rates reflecting the measure of earnings that Social Security

benefits were designed to replace. Others, including CBO, have incorporated all earnings, including those not subject to the payroll tax, in the measure of preretirement income.⁷⁰ Including all earnings fully captures the earned income available during the working years and better reflects the corresponding standard of living.

Definition of Adequacy: Target Replacement Rates.

Once retirement income and preretirement income have been specified and replacement rates have been calculated for the population of interest, the next step is choosing an adequacy threshold—the target replacement rate. (Because a target replacement rate implicitly relies on a comprehensive definition of income, such rates serve as the adequacy thresholds for total income replacement rates but not Social Security replacement rates. Even so, some researchers have evaluated Social Security replacement rates in the context of guaranteed income available to retirees in other countries.)⁷¹

Although researchers typically approximate consumption with income, they agree that people generally need less income in retirement to maintain full preretirement consumption.⁷² A common rule of thumb is that replacing at least 70 percent of preretirement earnings would allow workers to maintain their standard of living in retirement; however, that rule of thumb applies to few people because target replacement rates can vary greatly depending on individual circumstances. For example, GAO found that, while most recommendations for a target replacement rate lie between 70 percent and 85 percent of preretirement earnings, about a quarter of target rate

66. See Social Security Administration, Office of the Chief Actuary, "Replacement Rates for Retirees: What Makes Sense for Planning and Evaluation?" Actuarial Note No. 155 (July 2014), www.ssa.gov/oact/NOTES/pdf_notes/note155.pdf (41 KB).

67. See Andrew G. Biggs, Gaobo Pang, and Sylvester J. Schieber, *Measuring and Communicating Social Security Earnings Replacement Rates*, AEI Working Paper 2015-01 (American Enterprise Institute, January 2015), <http://tinyurl.com/y9ec6ff8>.

68. See Congressional Budget Office, *CBO's 2016 Long-Term Projections for Social Security: Additional Information* (December 2016), www.cbo.gov/publication/52298.

69. See Social Security Administration, Office of the Chief Actuary, "Replacement Rates for Retirees: What Makes Sense for Planning and Evaluation?" Actuarial Note No. 155 (July 2014), www.ssa.gov/oact/NOTES/pdf_notes/note155.pdf (41 KB).

70. See Congressional Budget Office, *CBO's 2016 Long-Term Projections for Social Security: Additional Information* (December 2016), www.cbo.gov/publication/52298.

71. For example, see Organisation for Economic Co-operation and Development, *Pensions at a Glance 2011: Retirement-Income Systems in OECD and G20 Countries* (OECD Publishing, March 2011), <http://tinyurl.com/bxwt3rn>. In that report, the OECD compared the generosity of gross pension replacement rates for member states and other countries with major economies. The report shows that the median Social Security replacement rate of 42 percent in the United States is substantially lower than the 61 percent average for OECD countries. However, the comparison does not accurately reflect the variation in income sources available to retirees in different countries.

72. A brief overview of the issues surrounding target replacement rates can be found in Mark J. Warshawsky, "The Retirement Crisis Controversy," *Tax Notes* (May 11, 2015), <http://tinyurl.com/y9k57plo> (PDF, 51 KB).

citations that the agency reviewed were below 70 percent and some exceeded 100 percent.⁷³

The substantial variation in target replacement rates has two main sources: differences in targets for workers with distinct characteristics and different analytical choices that researchers make when constructing adequacy thresholds. As an example of the former, researchers at the Center for Retirement Research at Boston College calculated higher targets for low-income workers because they typically consume a larger share of their preretirement income than higher-income workers.⁷⁴ As an example of the latter, researchers at the Center for Retirement Research calculated target replacement rates that were based on different assumptions: They used a target of 76 percent for a two-earner couple in their baseline specification for the NRRI and a target of 98 percent for a two-earner couple in an alternative specification that was based on different projections for health and long-term care expenses.⁷⁵

73. See Government Accountability Office, *Retirement Security: Better Information on Income Replacement Rates Needed to Help Workers Plan for Retirement*, GAO-16-242 (March 2016), www.gao.gov/products/GAO-16-242. Estimating target replacement rates for different retirement ages and assuming different goals, VanDerhei (2006) found that target rates can range from 43 percent (for a high-income male retiring at age 68 and targeting a 50 percent probability of retirement adequacy) to 476 percent (for a low-income male retiring at age 62 and targeting 90 percent probability of retirement adequacy). See Jack VanDerhei, “Measuring Retirement Income Adequacy: Calculating Realistic Income Replacement Rates,” EBRI Issue Brief No. 297 (Employee Benefit Research Institute, September 2006), <http://tinyurl.com/ycfwt2rq>.

74. See Alicia H. Munnell, Anthony Webb, and Luke Delorme, *A New National Retirement Risk Index*, Issue in Brief No. 48 (Center for Retirement Research at Boston College, June 2006), <http://tinyurl.com/y7pfgo7h> (PDF, 217 KB).

75. The original NRRI specification implicitly assumes that health care spending is a substitute for other forms of consumption. That substitution implies that as health care spending increases, spending on non-health care items goes down and the standard of living remains unchanged. An alternative specification assumes that health care expenses cannot be avoided and, at the same time, do not increase well-being, acting as a “tax” that people pay in retirement. Under that specification, as health care costs increase in retirement, people would need to increase their total spending proportionally to maintain their standard of living. See Alicia H. Munnell and others, *Long-Term Care Costs and the National Retirement Risk Index*, Issue in Brief No. 9-7 (Center for Retirement Research at Boston College, March 2009), <http://tinyurl.com/ycyp8rbr> (PDF, 419 KB).

Overall, studies have identified a number of considerations that could either decrease or increase target replacement rates. The effect of other factors, such as having children leave home, is less clear and subject to ongoing research. The upcoming discussion explores those considerations.

Factors That Can Lower Target Replacement Rates. Some of the factors that can decrease the amount of income needed in retirement include the following:

- Lower taxes owed on income,
- Less need (if any) for saving,
- Lower housing expenses (if a mortgage has been paid off), and
- The elimination of work-related expenses and increases in home production (for example, cooking at home rather than dining out).

Taxes are generally lower in retirement than during the working years for a number of reasons. For example, retirees have mostly nonwage income that is not subject to the Social Security payroll tax, and about half of all Social Security beneficiaries do not owe income tax on their benefits.⁷⁶ Using 2003–2005 data from the Consumer Expenditure Survey (CES), researchers at Aon Consulting (2008) estimated that total taxes fall between 9 percent and 18 percent of gross preretirement earnings as workers retire.⁷⁷ That difference in taxation substantially lowers the income needed to maintain a preretirement living standard in retirement.

Once workers retire, the reduced need to accumulate further retirement resources increases the share of the total income that can be spent on daily needs. During preretirement years, most households accumulate retirement savings, which come at a cost of reduced consumption during working years and consequently lower living standards. After retirement, the need to accumulate additional retirement savings disappears (or is significantly

76. See Congressional Budget Office, “The Taxation of Social Security Benefits,” *CBO Blog* (February 12, 2015), www.cbo.gov/publication/49948.

77. See Aon Consulting, *Replacement Ratio Study: A Measurement Tool for Retirement Planning* (2008), <http://tinyurl.com/kgantu8> (PDF, 1.08 MB).

reduced), and consequently, households need less income to maintain their preretirement standard of living.

Another factor that can affect replacement rates is whether housing expenses decline in retirement. According to the GAO's analysis of 2013 expenditure data from the CES, about half of households headed by someone age 65 through 69 owned a home without a mortgage, while the same was true for less than one-fifth of midcareer households (which consist of people ages 45 to 49).⁷⁸ Moreover, GAO found that young retiree households (consisting of people ages 65 to 69) spent about 17 percent less on housing expenditures than midcareer households, indicating a substantial decline in housing expenses at retirement that can lower target replacement rates.

The elimination of work-related expenses and increased opportunities for home production also tend to lower income needs in retirement relative to the amount during working years. However, researchers have estimated quite different magnitudes of the effects on replacement rates. On the one hand, some empirical studies have found significant decreases in spending on dining out and work-related costs such as those for commuting and clothing.⁷⁹ Other studies have found that although spending on food declines in retirement,

overall food intake remains constant, consistent with increased cooking at home.⁸⁰ On the other hand, some researchers have shown that the effect of eliminating work-related expenses is small. For example, according to Aon Consulting (2008), annual aggregate expenses for transportation, apparel and services, food, and household operations did not change significantly in retirement.⁸¹

Factors That Can Increase Target Replacement Rates.

Although a number of factors can reduce income needs in retirement, considerations that can raise them include the following:

- Higher health care costs, and
- Long-term care costs.

The growth in health care costs associated with aging can substantially raise the amount of income needed to maintain living standards in retirement.⁸² For example, in an analysis published in 2016, GAO found that health expenditures were about 40 percent higher for young retiree households than for midcareer households.⁸³ Furthermore, the agency showed that the share of total

78. See Government Accountability Office, *Retirement Security: Better Information on Income Replacement Rates Needed to Help Workers Plan for Retirement*, GAO-16-242 (March 1, 2016), www.gao.gov/products/GAO-16-242. Whereas most homeowners over the age of 65 have paid off their mortgage, the share of households that are headed by people age 65 or older who have housing debt has been increasing over time. For example, Butrica and Mudrazija (2016) estimated that the share of households age 65 or older with housing debt increased from 23.9 percent to 35 percent between 1998 and 2012, while their median debt amount grew from \$44,000 to \$82,000. See Barbara A. Butrica and Stipica Mudrazija, *Home Equity Patterns Among Older American Households*, Urban Institute Research Report (Urban Institute, October 2016), <http://tinyurl.com/y7m3tcnf> (PDF, 527 KB).

79. See James Banks, Richard Blundell, and Sarah Tanner, "Is There a Retirement-Savings Puzzle?" *American Economic Review*, vol. 88, no. 4 (September 1998), pp. 769–788, <http://tinyurl.com/ya37bpov>; Erik Hurst, *The Retirement of a Consumption Puzzle*, Working Paper 13789 (National Bureau of Economic Research, February 2008), www.nber.org/papers/w13789; and Hongbin Li, Xinzheng Shi, and Binzhen Wu, "The Retirement Consumption Puzzle in China," *American Economic Review: Papers & Proceedings*, vol. 105, no. 5 (May 2015), pp. 437–441, <http://tinyurl.com/y7r5dpke>.

80. See Mark Aguiar and Erik Hurst, "Consumption Versus Expenditure," *Journal of Political Economy*, vol. 113, no. 5 (October 2005), pp. 919–948, <http://tinyurl.com/y9ncyfh2> (PDF, 207 KB)

81. See Aon Consulting, *Replacement Ratio Study: A Measurement Tool for Retirement Planning* (2008), <http://tinyurl.com/kgantu8> (PDF, 1.08 MB).

82. Although Medicare covers a large share of health care expenses for people over the age of 65, it does not cover all costs. For example, Medicare beneficiaries are expected to pay monthly premiums, deductibles, copayments, and coinsurance. (To cover some of these expenses, beneficiaries may purchase Medicare Supplement, or Medigap, plans.) Most important, Medicare generally does not pay for long-term care services. Using 1996–2010 data from the Medicare Current Beneficiary Survey, De Nardi and others (2016) found that Medicare covered about 55 percent of total health care expenditures for Medicare beneficiaries, with out-of-pocket spending covering about 20 percent of total expenditures. See Mariacristina De Nardi and others, "Medical Spending of the U.S. Elderly," *Fiscal Studies*, vol. 37, no. 3–4 (September–December 2016), pp. 717–747, <http://tinyurl.com/y9wnq42f>. For more information on Medicare payment policy, see Medicare Payment Advisory Commission, "Chapter 1: Context for Medicare Payment Policy," *March 2017 Report to the Congress: Medicare Payment Policy* (March 2017), <https://go.usa.gov/xRH3b> (PDF, 3.3 MB).

83. See Government Accountability Office, *Retirement Security: Better Information on Income Replacement Rates Needed to Help Workers*

household spending on health care among older retiree households (ages 80 and over) was more than double the share that midcareer households spent on health.

In addition to health care costs, spending on long-term care could also raise income needs in retirement. Long-term care includes a variety of services designed to assist people with activities of daily living, including eating, bathing, and walking.⁸⁴ According to the 2016 Genworth Cost of Care Survey, the median monthly cost for a semiprivate room in a nursing home was \$6,844, amounting to over \$80,000 per year.⁸⁵ Although people who have low income and assets are generally eligible to receive assistance from Medicaid, which pays for nearly all nursing home care and much of community-based care for people who qualify, those who have higher income and assets need to pay for their care out of pocket or carry long-term care insurance.⁸⁶ Some actuaries have estimated that the premium for a long-term care policy, if purchased at age 65, is about \$4,500 per year, substantially raising income needs in retirement.⁸⁷

Additional Considerations for Target Replacement Rates.

Besides the above considerations, researchers continue to explore how spending on children and leisure activities affect target replacement rates.

People who raise children during their working years might need less income in retirement to maintain their living standards, although research has not yet reached

a consensus on the size of that effect.⁸⁸ Browning and Ejrnæs (2009) showed that the presence of children in a household causes consumption to increase when the adult members of that household are working and then to decrease later in life.⁸⁹ Given that a large amount of household resources is devoted to raising children, Scholz and Seshadri (2009b) argued that target replacement rates need to take into account the number of children that retirees have.⁹⁰ Assuming that children have left the household by the time their parents retire, the authors claim that people who have raised children would need substantially less income in retirement to maintain their preretirement standard of living than people who did not have children. However, in their correlational analysis, Scholz and Seshadri (2009a) did not find the expected effect of children on target replacement rates, concluding that the effect is masked by close association between the choice to have children and other factors that affect replacement rates.⁹¹

Furthermore, if an elderly couple with children continued to support their adult children in retirement (helping to pay for educational costs or expenses associated with grandchildren, for instance), then the difference in replacement rates due to the presence of children would be reduced. For instance, one study by Coe and

Plan for Retirement, GAO-16-242 (March 2016), www.gao.gov/products/GAO-16-242.

84. For an overview of long-term care services and trends, see Congressional Budget Office, *Rising Demand for Long-Term Services and Supports for Elderly People* (June 2013), www.cbo.gov/publication/44363.
85. See Genworth Cost of Care Survey, “Compare Long Term Care Costs Across the United States” (April 2016), <http://tinyurl.com/zbltq4e>.
86. Retirees who own their homes have the additional options of selling their homes or tapping into their home equity to pay for long-term care costs. See Thomas Davidoff, “Home Equity Commitment and Long-Term Care Insurance Demand,” *Journal of Public Economics*, vol. 94, no. 1-2 (February 2010), pp. 44–49, <http://tinyurl.com/y79lg6c8>.
87. For more details, see Christopher J. Giese and Allen J. Schmitz, *Premium Estimates for Policy Options to Finance Long-Term Services and Supports* (prepared by Milliman Inc. for the SCAN Foundation, AARP, and LeadingAge, November 2015), <http://tinyurl.com/yucj7szx> (PDF, 362 KB).

88. To account for the number of children in a household, some researchers use equivalence scales. The rationale behind the equivalence scales is that a two-person household would need less than double the income of two single people to achieve the same standard of living because of resource pooling and economies of scale within the household. A number of different equivalence scales have been developed in the literature. For example, Scholz and Seshadri (2009a) used an equivalence scale that implies that a household with two spouses and three children consumes 66 percent more than a two-spouse household without children. See John Karl Scholz and Ananth Seshadri, “Children and Household Wealth” (draft, July 2009a), <http://tinyurl.com/y7dc3ddz> (PDF, 202 KB).
89. See Martin Browning and Mette Ejrnæs, “Consumption and Children,” *The Review of Economics and Statistics*, vol. 91, no. 1 (2009), pp. 93–111, www.mitpressjournals.org/doi/pdf/10.1162/rest.91.1.93.
90. See John Karl Scholz and Ananth Seshadri, *What Replacement Rates Should Households Use?* Working Paper 2009-214 (Michigan Retirement Research Center, 2009b), <http://tinyurl.com/yd562ctc> (PDF, 380 KB).
91. For additional discussion of the relationship between children and wealth accumulation, see John Karl Scholz and Ananth Seshadri, “Children and Household Wealth” (draft, July 2009a), <http://tinyurl.com/y7dc3ddz> (PDF, 202 KB).

Webb (2010) found that total household consumption does not decline after children leave home, suggesting that parents may continue supporting grown children after they leave home or direct their spending elsewhere.⁹² Additional research is needed to pinpoint the effect of children on target replacement rates.

Besides expenses related to children, leisure activities could also have substantial effects on retirement income targets. As workers retire, their amount of leisure time jumps, and that additional time could guide their consumption choices.⁹³ On the one hand, particularly in the early years of retirement, retirees may choose to use their increased leisure for travel and expensive hobbies. On the other hand, retirees may use some of their leisure time to reduce spending, for example by shopping for discounts, preparing meals at home, and doing their own home maintenance. Recent findings by GAO (2016) indicate a

drop in entertainment expenditures in retirement, which is consistent with the latter explanation.⁹⁴

Advantages and Disadvantages. Overall, the replacement rate measure offers some important advantages as well as drawbacks. A clear advantage from the perspective of both workers and policy analysts is the simple premise that maintaining income through retirement ensures continuity of living standards. In addition, Social Security replacement rates, by including only Social Security benefits in the numerator, avoid the need for complex modeling of the other sources of income in retirement.

One of the disadvantages of both the Social Security and total income replacement rates is the lack of standardization and the resulting broad range of target replacement rates present in the literature. Those target replacement rates can vary depending on individual circumstances, such as the retiree's income, gender, and marital status, as well as on how much income researchers decide is adequate. The ultimate wide range of target replacement rates, all intended to capture the level of income needed to maintain preretirement living standards, complicates assessing the adequacy of retirement income—for workers and policy analysts alike.

Another disadvantage common to the majority of the replacement rate analyses is that they typically do not address how adequacy targets vary for different individuals within a particular socioeconomic group. Presented as a single point, a target replacement rate implicitly provides a metric that would be appropriate only for an average worker in that group, so it might be too high or too low for the majority of people. Researchers have pointed out that if workers desired a higher probability of maintaining their consumption in retirement, they would need to plan using higher target replacement rates.⁹⁵

92. See Norma B. Coe and Anthony Webb, *Children and Household Utility: Evidence From Kids Flying the Coop*, Working Paper 2010-16 (Center for Retirement Research at Boston College, November 2010), <http://tinyurl.com/ya73pxld>. Similarly, a recent study by Dushi and others (2016) found that households experiencing reduced expenses after children leave home do not increase their 401(k) contributions proportionally, suggesting that households might actually be increasing their consumption. See Irena Dushi and others, "Do Households Save More When the Kids Leave Home?" Issue in Brief No. 16-8 (Center for Retirement Research at Boston College, May 2016), <http://tinyurl.com/yc6nmpk3>. Assuming that households maintain consumption after children leave home, Munnell, Hou and Sanzenbacher (2017) estimated that each child increases the likelihood that households consisting of people ages 50 to 59 are at risk of not being able to maintain their living standards in retirement by about 2 percentage points. See Alicia H. Munnell, Wenliang Hou, and Geoffrey T. Sanzenbacher, "The Impact of Raising Children on Retirement Security," Issue in Brief No. 17-16 (Center for Retirement Research at Boston College, September 2017), <http://tinyurl.com/y7srhdns>.

93. For example, Bonsang and Klein (2012) developed a simple theoretical model for workers whose well-being depends not only on income but also on the amount of free time they have. In their model, workers would like to smooth their overall well-being over time as they transition into retirement. Because workers have significantly more leisure time after retirement, they may substitute leisure for consumption as they retire to maintain their well-being at nearly a constant level. The extent to which leisure can substitute for consumption would determine the overall effect on spending. See Eric Bonsang and Tobias J. Klein, "Retirement and Subjective Well-Being," *Journal of Economic Behavior and Organization*, vol. 83, no. 3 (August 2012), pp. 311–329, <http://tinyurl.com/yah92rpl>.

94. See Government Accountability Office, *Retirement Security: Better Information on Income Replacement Rates Needed to Help Workers Plan for Retirement*, GAO-16-242 (March 2016), www.gao.gov/products/GAO-16-242.

95. For example, see Vickie Bajtelsmit, Anna Rappaport, and LeAndra Foster, "Measures of Retirement Benefit Adequacy: Which, Why, for Whom, and How Much?" (Society of Actuaries, Pension Section and Pension Section Research Committee, January 2013), <http://tinyurl.com/yc5p3hb6>; and Jack VanDerhei, "Measuring Retirement Income Adequacy: Calculating Realistic Income Replacement Rates," EBRI Issue

As with most measures of retirement adequacy, replacement rates also require researchers to make assumptions about how to treat retirement savings in 401(k) and other accounts as well as how to incorporate the value of housing wealth, if any. The assumptions about those factors could have a substantial effect on the conclusions about adequacy.

A growing number of studies assert that single-year replacement rates inadequately measure the adequacy of retirement income. For example, Bajtelsmit, Rappaport, and Foster (2013) documented numerous conceptual and practical shortcomings of replacement rates, stressing that an oversimplified rule-of-thumb rate could be risky when used by workers in planning their own retirement.⁹⁶ Similarly, GAO (2016) concluded that generic replacement rates may lead workers to either overestimate or underestimate their retirement needs and that, therefore, more guidance on the use of those rates is needed.⁹⁷ MacDonald, Osberg, and Moore (2016) examined administrative data from Canada and found that a 70 percent target is optimal for very few people.⁹⁸ They focused on people who had achieved the 70 percent single-year replacement rate in the first year of retirement and examined the evolution of retirement income for those people over time, developing a multiyear measure of retirement adequacy. The authors showed that the distribution of that multiyear measure is exceptionally wide, implying that achieving a single rule-of-thumb target in the first year of retirement has little predictive power for the adequacy of living standards throughout retirement.

Brief No. 297 (Employee Benefit Research Institute, September 2006), <http://tinyurl.com/ycfwt2rq>.

96. See Vickie Bajtelsmit, Anna Rappaport, and LeAndra Foster, “Measures of Retirement Benefit Adequacy: Which, Why, for Whom, and How Much?” (Society of Actuaries, Pension Section and Pension Section Research Committee, January 2013), <http://tinyurl.com/yc5p3hb6>.
97. See Government Accountability Office, *Retirement Security: Better Information on Income Replacement Rates Needed to Help Workers Plan for Retirement*, GAO-16-242 (March 2016), www.gao.gov/products/GAO-16-242.
98. See Bonnie-Jeanne MacDonald, Lars Osberg, and Kevin D. Moore, “How Accurately Does 70% Final Employment Earnings Replacement Measure Retirement Income (In)Adequacy? Introducing the Living Standards Replacement Rate (LSRR),” *ASTIN Bulletin: The Journal of the IAA*, vol. 46, no. 3 (September 2016), pp.627–676, <http://tinyurl.com/y97fjneo>.

Measures of Adequacy Used in Multiyear Analyses

Although measures that focus on a single year of retirement provide snapshots of income adequacy, measures that evaluate retirement income over multiple years add an important longitudinal dimension. In its simplest form, multiyear analysis can apply the same basic needs and target replacement rate thresholds presented above to resources in several different years of retirement, showing how measures of adequacy change over time. Researchers typically adopt that limited approach when their studied population consists of cohorts of older retirees, for whom several years of retirement income data are already available. In contrast, when the population of interest consists of workers approaching retirement or newly retired workers, researchers typically use complex simulation models that project both retirement income and adequacy thresholds into the future. Those models have the capacity to evaluate the adequacy of retirement income in every single year of the retirement until the end of life. In addition, the simulation-based approach typically involves another adequacy threshold that distills the path of retirement income to a single number—assets remaining at the end of life.

Limited Multiyear Analysis: Evaluating Adequacy in Selected Years

Limited multiyear measures of the adequacy of retirement income are subject to the same considerations concerning the unit of analysis and definitions of income and adequacy that apply to the measures used in single-year analysis; but instead of offering only one snapshot of adequacy, basic multiyear analysis offers a series of them. Researchers can use each of the thresholds described above, from the poverty threshold to target replacement rates, in limited multiyear analysis. In a majority of studies, researchers measure adequacy in two different years of retirement, although some have measured it in up to five different years.

Using basic needs thresholds, Haveman and others (2007) measured retirement in two different years: shortly after receipt of the first Social Security benefit payment and 10 years later.⁹⁹ Specifically, the authors implemented household-level analysis and defined

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99. See Robert Haveman and others, “Assessing the Maintenance of Savings Sufficiency Over the First Decade of Retirement,” *International Tax and Public Finance*, vol. 14, no. 4 (August 2007), pp. 481–502, <http://tinyurl.com/ycudsh29>.

retirement income as annuitized wealth, including Social Security benefits, pension wealth, and financial and property holdings. The basic needs thresholds that the authors used were the SPM and 200 percent of the SPM. According to their analysis, the percentage of households with income below the SPM threshold went up from 4 percent to 6 percent over the 10-year period, and the percentage of households with income below 200 percent of SPM remained virtually unchanged at about 25 percent.

Using Social Security replacement rates, Steuerle and Spiro (2000) focused on two different ages, 65 and 85.¹⁰⁰ They examined a worker with average earnings and defined retirement income as the Social Security benefits that the worker would receive on the basis of his or her own earnings. Preretirement income was then defined as the average lifetime wage-indexed earnings. The authors highlighted changes in adequacy over the course of retirement by calculating average Social Security replacement rates at two different ages. They pointed out that because the Social Security benefits that a beneficiary receives grow with prices rather than with wages, the Social Security replacement rate declines relative to the average wages in the economy as retirement progresses, lowering the retiree's standard of living relative to the working population. (As noted earlier, price adjustment accounts only for the effects of inflation whereas wage adjustment incorporates the effects of inflation and reflects improvements in the average standard of living for U.S. workers over time.) The authors estimated that, over 20 years of retirement, Social Security replacement rates fell from 52 percent to 43 percent of wage-indexed average lifetime earnings.

Using total income replacement rates, Haveman and others (2007) assessed how well workers were able to maintain their preretirement living standards in retirement by estimating how those replacement rates changed over a 10-year period.¹⁰¹ The authors defined retirement

income as comprehensive annuitized wealth and preretirement income as the average of household earnings from age 50 to one year before a worker first received benefits, excluding any years with no earnings. The authors considered retirement income to be adequate if it replaced at least 70 percent of gross preretirement household earnings (making use of the common rule of thumb). The authors' findings highlighted the importance of longitudinal changes in the adequacy of retirement income by showing that, on the one hand, about a third of people who were not meeting the 70 percent threshold shortly after claiming Social Security benefits were meeting that threshold 10 years later; on the other hand, about a fifth of people who were initially meeting the 70 percent threshold experienced a drop in income to below the 70 percent threshold by the end of the 10-year period. The increase in retirement income was more likely to happen when the worker or his or her spouse continued to work after retiring, while the drop in retirement income was associated with changing marital status and with low education and poor health. The authors concluded that while, at the median, measures of retirement adequacy appeared stable over time, a large share of people experienced significant instability in their retirement income.

Some researchers take snapshots of income adequacy in more than two years. For example, Purcell (2012) measured it at five different points—every two years within the first decade of retirement.¹⁰² In that household-level analysis, the author defined retirement income as income from sources included in the Health and Retirement Study in a given year and defined preretirement income as the average of total individual income or total income shared by a couple over about six years before retirement.¹⁰³ According to the author's findings, median total

Annual Conference, Baltimore, Md., November 12, 2016; current draft updated on February 21, 2017), <http://tinyurl.com/yahe6xwx>.

100. See C. Eugene Steuerle and Christopher Spiro, *What Happens to Replacement Rates Over the Course of Retirement?* Brief No. 25 (Urban Institute, June 2000), <http://tinyurl.com/y96zex5r>.

101. See Robert Haveman and others, "Assessing the Maintenance of Savings Sufficiency Over the First Decade of Retirement," *International Tax and Public Finance*, vol. 14, no. 4 (August 2007), pp. 481–502, <http://tinyurl.com/ycudsh29>. For a more recent example of a limited multiyear analysis, see Peter J. Brady and others, "Using Panel Tax Data to Examine the Transition to Retirement" (paper presented at 2016 National Tax Association

102. See Patrick J. Purcell, "Income Replacement Ratios in the Health and Retirement Study," *Social Security Bulletin*, vol. 72, no. 3 (2012), pp. 37–58, <https://go.usa.gov/xRGNC>.

103. Income sources in the HRS include earnings, Social Security benefits, public and private pensions and annuities, lump-sum distributions from pensions, insurance or inheritances, income from annuities and regular withdrawals from retirement accounts, dividends, interest, rent, and cash income-support benefits, including SSI and SNAP, among others. The author used annual individual or shared couple income in the three survey waves before retirement. Because HRS data are biennial,

income replacement rates declined by 15 percentage points to 20 percentage points over the first 10 years of retirement as additional household earnings disappeared. (Those results contrast with the findings of Haveman and others (2007) for several possible reasons, including the use of different definitions of income, the choice of different cohorts of retirees, and differences between administrative and survey data.)

Limited multiyear analysis offers both advantages and disadvantages relative to other approaches. The main advantage over single-year measures is that it provides a better understanding of the evolution of financial well-being. The main drawback is that it requires the use of several additional years of data, which typically confines such analysis to older cohorts of retirees for whom such data are available. Furthermore, multiyear analysis that is based on just a few years can leave wide gaps in the understanding of changes in retirement security.

Comprehensive Model-Based Analysis

To expand the analysis from the financial security of older retired workers to that of the next generation of retirees, researchers have developed sophisticated models that project retirement income and adequacy thresholds into the future. The models' key innovation is projecting retirement resources for every year of retirement.

Multiyear models come in several different forms. Some are stylized—or simplified—models for representative workers that rely on a limited set of projections. Others are complex microsimulation models that construct entire life cycles for multiple cohorts and provide ranges of uncertainty surrounding their estimates. Finally, some multiyear analyses develop additional measures of retirement adequacy, such as retirees' having positive assets at the end of their life.

Representative-Worker Models. The stylized models typically produce lump-sum income targets for representative workers that correspond to those workers' meeting a certain adequacy threshold in every year of retirement. The models incorporate projections of longevity, inflation, and returns on investments. Analysts at Aon Consulting (2008) calculated that an average

male worker making about \$60,000 in gross earnings would need to accumulate about 5.2 times his final pay in retirement savings to generate an annual 32 percent replacement rate throughout retirement.¹⁰⁴ (Social Security benefits would provide the remaining income, raising the worker's total income replacement rate to 78 percent.) The main advantage of the models that produce lump-sum targets is that the resulting amounts provide simple savings goals for workers while recognizing that retirement is a multiyear period. However, as some researchers have pointed out, estimates of lump-sum targets are very sensitive to the underlying projections, such as interest rates, health-care costs, and age at retirement.¹⁰⁵ For example, a more recent study by Aon Hewitt (2012) showed that a lump-sum income target can vary by as much as 30 percent depending on whether a worker retires at age 62 or 67.¹⁰⁶

Microsimulation Models. Other multiyear models move beyond stylized cases and instead simulate retirement for entire cohorts of workers. CBO's long-term microsimulation model, known as CBOLT, focuses on Social Security benefits, projecting the benefits that workers would receive during their lifetime, including retired-worker benefits, spousal benefits, and survivor benefits.¹⁰⁷ The projections of benefits are based on detailed projections of workers' participation in the labor force and earnings trajectories, as well as marital transitions, longevity, and discount rates (the interest rates used to

three survey waves represented three of about six years. See Patrick J. Purcell, "Income Replacement Ratios in the Health and Retirement Study," *Social Security Bulletin*, vol. 72, no. 3 (2012), pp. 37–58, <https://go.usa.gov/xRGNC>.

104. See Aon Consulting, *Replacement Ratio Study: A Measurement Tool for Retirement Planning* (2008), <http://tinyurl.com/kgantu8> (PDF, 1.08 MB).

105. For an additional discussion of lump-sum targets, see Vickie Bajtelsmit, Anna Rappaport, and LeAndra Foster, "Measures of Retirement Benefit Adequacy: Which, Why, for Whom, and How Much?" (Society of Actuaries, Pension Section and Pension Section Research Committee, January 2013), <http://tinyurl.com/yc5p3hb6>.

106. See Aon Hewitt, *The Real Deal: 2012 Retirement Income Adequacy at Large Companies* (2012), <http://tinyurl.com/k6c873g>. While Aon Consulting estimated target retirement income for hypothetical workers, Aon Hewitt evaluated the retirement readiness of 2.2 million employees at 78 large U.S. firms, projecting savings targets of 9.4 times of pay for workers who retire at age 67 and 13.5 times pay for workers who retired at age 62.

107. For detailed information on CBO's long term model, see Congressional Budget Office, *CBO's Long-Term Model: An Overview* (June 2009), www.cbo.gov/publication/20807.

compute the present value of future income).¹⁰⁸ CBO publishes two multiyear measures of Social Security benefits on an annual basis.¹⁰⁹ The first measure is the ratio of lifetime Social Security benefits to lifetime earnings. The second measure is the ratio of lifetime Social Security benefits to lifetime taxes across cohorts of retirees and by quintiles of lifetime household earnings. Those two measures are meant to provide a more comprehensive perspective of the distribution of Social Security benefits than can be inferred from single-year analysis. The ratio of lifetime benefits to lifetime earnings resembles, but does not equal, a replacement rate because all benefits and all earnings are used in this calculation rather than benefits from a single year and average earnings. Because workers typically have many more years of earnings than benefits during their lifetimes, such a ratio would be considerably lower than the Social Security replacement rate. In 2016, for example, CBO projected that people who were born in the 1940s and who are in the lowest quintile of household earnings would receive lifetime Social Security benefits that, on a present-value basis, are 19 percent of lifetime earnings.¹¹⁰

Multiyear simulation models that include not only Social Security benefits but also other sources of retirement income assess the adequacy of retirement income throughout retirement. One of the crucial features that distinguishes these models is the change in retirees' needs over the course of retirement: Some studies hold constant the target income needed to achieve adequacy, whereas others model a gradual decline or an increase in that target income over the course of retirement.

For example, MacDonald and Moore (2011) used a dynamic microsimulation model called LifePaths, developed by Statistics Canada, to project the adequacy of retirement income for Canadian baby boomers who were beginning to enter retirement.¹¹¹ The LifePaths

model incorporates comprehensive projections of mortality, taxes and transfers, employment, and various income sources. The authors defined household income as government retirement benefits, any income from pensions, and withdrawals from various savings accounts, net of mortgage payments and personal income taxes. They specified a target replacement rate of 90 percent to 110 percent of preretirement consumption, defined as any income from earnings, investments, transfers, other money income and imputed rent, net of contributions to various pension plans and other savings, mortgage payments, personal income taxes, and federal payroll taxes. They also specified that retirees' needs remain constant over time, so the threshold of 90 percent to 110 percent of preretirement consumption would apply in every year of retirement. The authors' results indicated that the majority of Canadian retirees would be able to meet chosen target replacement rates in each year of retirement.

Focusing on U.S. workers, Hurd and Rohwedder (2011) developed an alternative microsimulation model in which retirement income needs do not stay constant but decline with age, reflecting patterns observed by the authors.¹¹² In their household-level analysis, the authors defined retirement income as the annuitized value of wealth that can be bequeathed and annuities, including Social Security benefits, defined benefit pensions, and purchased annuities. For each year of retirement, they compared income to a target level that was estimated from longitudinal data from older cohorts. Because Hurd and Rohwedder observed spending declining over the course of retirement among older cohorts of retirees, they reduced target income correspondingly. In their simulations of spending trajectories, they incorporated the risks of unexpected longevity, large out-of-pocket spending on health care and correlation in health care spending from year to year as well as income from expected work in retirement. On the basis of their simulations, the authors concluded that about 70 percent of the people in their sample who were ages 66 to 69 would have sufficient resources to sustain projected spending in retirement.

108. The present value is a single number that expresses the flow of income over time in terms of an equivalent sum received at a specific time. The present value depends on a rate of interest, known as the discount rate, that is used to translate future cash flows into current dollars.

109. See, for example, Congressional Budget Office, *CBO's 2016 Long-Term Projections for Social Security: Additional Information* (December 2016), www.cbo.gov/publication/52298.

110. Ibid., Exhibits 11 and 12, www.cbo.gov/publication/52298.

111. See Bonnie-Jeanne MacDonald and Kevin D. Moore, "Moving Beyond the Limitations of Traditional Replacement Rates"

(Society of Actuaries, September 2011), <http://tinyurl.com/y7btdejz>.

112. See Michael D. Hurd and Susann Rohwedder, *Economic Preparation for Retirement*, Working Paper 17203 (National Bureau of Economic Research, July 2011), www.nber.org/papers/w17203.

Other researchers allow for the possibility that income needs could increase with age. For example, VanDerhei and Copeland (2010), researchers at the Employee Benefit Research Institute (EBRI), applied a variable elderly-specific threshold for basic income in every year of retirement to calculate a measure called the Retirement Readiness Rating.¹¹³ In that measure, annual income is defined as the sum of Social Security benefits, defined benefit annuities, and annuitized income from defined contribution balances, IRA balances, and net housing equity. The authors then compared that income to the threshold, which was computed on the basis of resources needed to pay for basic retirement needs and uninsured health care costs. (Basic expenditures include average expenses for a household, by family size and income, in the following categories: food, housing, transportation, health care, apparel and services, entertaining, and reading and education.) The distinguishing feature of this approach is that the threshold can increase in conjunction with the probability that nursing home and home health expenses increase as retirement progresses. According to that analysis, 47 percent of people born between 1948 and 1954 had income below the Retirement Readiness Rating.

Models Using Adequacy Thresholds Based on Assets at the End of Life. In addition to the measures of the adequacy of retirement income discussed so far, an additional metric exists that condenses the stream of retirement consumption into a single number: positive resources at the end of life. For example, using their microsimulation model, Hurd and Rohwedder (2011) found that about 49 percent of single people and 77 percent of married people were likely to have positive wealth at the end of life and therefore concluded that those workers would be adequately prepared for retirement.¹¹⁴

Bajtelsmit, Rappaport, and Foster (2013), in one of their specifications, also defined adequacy as retirees' having positive wealth left at death; however, their microsimulation model relied on different projections of target

spending paths in retirement.¹¹⁵ The authors analyzed two alternatives: maintaining constant preretirement consumption (minus housing and health care spending) and experiencing a onetime 15 percent decline in spending at retirement. Additional considerations examined by the authors included the risks of variation in investments' performance and unexpectedly high inflation, variations in the timing of paying off a mortgage, the possibilities that people had purchased annuities and long-term care insurance, as well as the possibility of delayed retirement. The authors emphasized that very different conclusions about retirement adequacy could be reached by looking at average outcomes rather than the distribution of simulated outcomes: Although, on average, households might have sufficient resources to finance their consumption during retirement, they might run out of resources at least 5 percent of the time.

Similarly, researchers at EBRI have developed a sophisticated Retirement Security Projection Model that incorporates investment risks, longevity risks, and the risks of potentially catastrophic health care shocks, highlighting the importance of looking at the probabilities of different outcomes rather than averages.¹¹⁶ Among its capabilities, the model can calculate how much workers need to save in order to have resources left at the end of life 50 percent, 75 percent, and 95 percent of the time. The results indicate that some workers would need to increase their savings rate by a factor of four to raise the probability of their not running out of retirement resources from 50 percent to 95 percent.

Advantages and Disadvantages. All told, comprehensive multiyear analyses offer a number of advantages over single-year metrics. Given sufficient data, the simulations can properly account for the important risks faced by retirees and provide a comprehensive picture of people's preparedness for retirement. For example, instead of only showing whether or not retirement resources in the first year meet the threshold of 70 percent of preretirement

113. See Jack VanDerhei and Craig Copeland, *The EBRI Retirement Readiness Rating: Retirement Income Preparation and Future Prospects*, EBRI Issue Brief No. 344 (Employee Benefit Research Institute, July 2010), <http://tinyurl.com/y8y3m8od>.

114. See Michael D. Hurd and Susann Rohwedder, *Economic Preparation for Retirement*, Working Paper 17203 (National Bureau of Economic Research, July 2011), www.nber.org/papers/w17203.

115. See Vickie Bajtelsmit, Anna Rappaport, and LeAndra Foster, "Measures of Retirement Benefit Adequacy: Which, Why, for Whom, and How Much?" (Society of Actuaries, Pension Section and Pension Section Research Committee, January 2013), <http://tinyurl.com/yc5p3hb6>.

116. For example, see Jack VanDerhei, "How Much Needs to Be Saved for Retirement After Factoring in Post-Retirement Risks: Evidence From the EBRI Retirement Security Projection Model," *EBRI Notes*, vol. 36, no. 3 (Employee Benefit Research Institute, March 2015), pp. 2–16, <http://tinyurl.com/y8kg8u2r>.

income, simulations can provide a corresponding range of uncertainty, revealing what percentage of times the resources are adequate—given possible increases in health expenditures and above-average longevity—throughout the full retirement period. Another advantage of that approach is that it allows researchers to evaluate income adequacy using any retirement adequacy threshold, from basic needs measures to replacement rates, as well as using assets at the end of life.

However, simulations can have important drawbacks, including their methodological complexity and

data-intensiveness. Furthermore, the measure of assets at the end of life may show a positive number but not correspond to adequate income throughout the course of retirement. For example, owning a house at the time of death directly translates into positive assets, even though retirees' income could have been below their target values throughout retirement. Although ending retirement with positive assets might not provide an optimal gauge of the adequacy of retirement income, the rich capabilities of simulation models to evaluate adequacy using any threshold in every year of retirement make such analyses highly comprehensive and versatile.



Appendix: Preference-Based Measures of Income Adequacy in Retirement

An alternative definition of retirement adequacy is based on workers' having sufficient resources to finance their preferred level of spending in retirement. That preference-based definition of adequacy has yielded additional measures of adequacy: personalized cash-flow analysis and self-reported satisfaction measures.

Cash-Flow Analysis

Cash-flow analysis incorporates workers' preferences about the amount of expenses they are willing to incur in retirement and then projects those expenses forward to their retirement date. Because the task of estimating monthly expenses in retirement can be daunting, many financial firms have developed planning tools to help workers estimate their retirement needs. Some of those tools are monthly expense guides that walk people through various categories of spending, from housing to charitable contributions, eliciting how much workers intend to spend in each category in retirement.¹ Annual expenses, such as vacations and club memberships, can be included in that monthly budget on a prorated basis. The resulting retirement budget, adjusted for inflation, then becomes the adequacy threshold against which retirement income would be evaluated.

Like other retirement adequacy measures, cash-flow analysis has both advantages and disadvantages. The main advantage, from the worker's perspective, is its high degree of personalization. A report by the Society of Actuaries' Pension Section (Bajtelsmit, Rappaport, and Foster; 2013) highlighted the approach's ability to incorporate individual financial goals and unique financial responsibilities, such as supporting dependent

children, parents, or other family members.² However, the report also noted the many potential shortcomings of the approach that often make it infeasible to apply. From the perspective of policy analysts, cash-flow analysis is infeasible because of the lack of large-scale data on preferred retirement budgets. From the perspective of workers, cash-flow analysis is not as useful in projecting adequacy of retirement income for younger people as it is for people closer to retirement because younger workers might not yet have an understanding of what their retirement needs will be. Moreover, some expenses, such as unexpected home repairs and health care, are difficult to properly incorporate into projected annual spending.

Self-Reported Satisfaction Measures

Self-reported satisfaction measures show what fraction of individuals consider their own retirement to be adequate. The measures generally incorporate workers' retirement preferences and goals, which can be quite different from maintaining preretirement living standards. For example, Ameriks, Caplin, and Leahy (2007) found that many workers expect their consumption to decline substantially in retirement.³ In contrast, Binswanger and Schunk (2012) showed that a large fraction of U.S. workers anticipate increasing their consumption after retiring, which could partly reflect a desire for travel after leaving the labor force.⁴ Given diverse preferences, self-reported

1. For example, see Vanguard, "Retirement Expenses Worksheet" (accessed February 28, 2017), <http://tinyurl.com/q9yocyr>; Vanguard, "Retirement Income Worksheet" (accessed February 28, 2017), <http://tinyurl.com/mqd2m2d>; and Fidelity, "Getting Ready to Retire: Estimate Expenses" (accessed August 1, 2017), <http://tinyurl.com/y7tgn5xv>.

2. See Vickie Bajtelsmit, Anna Rappaport, and LeAndra Foster, "Measures of Retirement Benefit Adequacy: Which, Why, for Whom, and How Much?" (Society of Actuaries, Pension Section and Pension Section Research Committee, January 2013), <http://tinyurl.com/yc5p3hb6>.

3. The authors estimated that an average U.S. household anticipates a 20 percent drop in consumption at retirement. See John Ameriks, Andrew Caplin, and John Leahy, "Retirement Consumption: Insights From a Survey," *Review of Economics and Statistics*, vol. 89, no. 2 (May 2007), pp. 265–274, <http://tinyurl.com/yaxkvc9t>.

4. See Johannes Binswanger and Daniel Schunk, "What Is an Adequate Standard of Living During Retirement?" *Journal of Pension Economics and Finance*, vol. 11, no. 2 (April 2012), pp. 203–222, <http://tinyurl.com/y7tkq3bf>. The authors found that 25 percent to 41 percent of nonretired respondents to an

measures can reflect whether or not workers are meeting the adequacy targets that are most relevant to them.

The population of interest for the self-reported measures is typically current retirees, for whom such data can be gathered. The Health and Retirement Study (HRS), a nationally representative survey of older Americans, collects biennial data on how retirees rate their retirement experience as well as how they compare it to their preretirement years. Using the HRS, Banerjee (2016) found that, in 2012, 49 percent of retirees reported having a “very satisfying” retirement, 41 percent reported a “moderately satisfying” retirement, and 11 percent stated that they were “not at all” satisfied with their retirement.⁵ Overall, the self-reported measures in the HRS appear to align with the income-based measures such as replacement rates. For example, Munnell and Soto (2005) found that among retired couples who were “very satisfied” or “somewhat satisfied” with retirement, the median replacement rate was about 72 percent.⁶ In contrast, among the couples who reported having “not at all satisfying” retirement, the median replacement rate was 60 percent.

A distinguishing feature of self-reported retirement measures is that their focus is not on the workers’ evaluation of their income adequacy but rather on their overall well-being in retirement. Using HRS data, studies have found that although income positively affects satisfaction with retirement, other factors often play a bigger role. For example, Rohwedder (2006) showed that health has the largest effect on self-reported retirement satisfaction measures, with individuals in fair or poor health being eight times more likely to be “not at all” satisfied with retirement than people who reported being in excellent or very good health.⁷ Moreover, Rohwedder found that

being socially isolated had a similar effect on retirement satisfaction as did being in the lowest income quartile. In a different study, Bender (2012) found that the reason for retirement also has a large impact on satisfaction, with individuals who retired involuntarily being 30 percent less likely to have a “very satisfying” retirement.⁸

Self-reported measures have several advantages as well as drawbacks. Their broader focus allows them to capture not only the financial security of the retirees but also other factors that are important for well-being in retirement. Another advantage is that the measures can be tracked over multiple years in retirement through regular surveys. However, a critical shortcoming of the self-reported measures is the difficulty of comparing satisfaction levels across different individuals. Barrett and Kecmanovic (2013) pointed out that measures of well-being may depend on individual-specific traits as well as fleeting considerations, such as a respondent’s mood.⁹ Furthermore, researchers noted that the measures could be affected by adaptation, through which respondents become accustomed to their conditions and revert to “normal” levels of self-reported well-being after some time. Finally, self-reported measures of retirement satisfaction are problematic to project for future cohorts.

Internet survey chose an income replacement rate of 140 percent as their preferred spending outcome.

5. See Sudipto Banerjee, “Trends in Retirement Satisfaction in the United States: Fewer Having a Great Time,” *EBRI Notes*, vol. 37, no. 4 (Employee Benefit Research Institute, April 2016), pp. 1–12, <http://tinyurl.com/y6vs9wx5>.
6. See Alicia H. Munnell and Mauricio Soto, *What Replacement Rates Do Households Actually Experience in Retirement?* Working Paper 2005-10 (Center for Retirement Research at Boston College, 2005), <http://tinyurl.com/yac9qjap> (PDF, 171 KB).
7. See Susann Rohwedder, *Self-Assessed Retirement Outcomes: Determinants and Pathways*, Working Paper 2006-141 (University of Michigan Retirement Research Center, November 2006), <http://tinyurl.com/yawy2ksz>.

8. See Keith A. Bender, “An Analysis of Well-Being in Retirement: The Role of Pensions, Health, and ‘Voluntariness’ of Retirement,” *Journal of Socio-Economics*, vol. 41, no. 4 (August 2012), pp. 424–433, <http://tinyurl.com/y868ocsp>.
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About This Document

This Congressional Budget Office report was prepared at the request of the Chairman of the Senate Committee on the Budget. The report provides a framework for further analysis of the adequacy of retirement income, including income from particular sources such as Social Security benefits. In keeping with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

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Keith Hall
Director
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