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# The Life Cycle Model, Replacement Rates, and Retirement Income Adequacy

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# THE LIFE CYCLE MODEL, REPLACEMENT RATES, AND RETIREMENT INCOME ADEQUACY

By ANDREW G. BIGGS\*

## Abstract

The key insight of the life cycle model in economics is that a household's consumption at any given time is determined not so much by its current income as by the total income available to the household over its lifetime. A replacement rate can be a useful tool in approximating the life cycle model's predictions for how households wish to prepare for retirement. The Social Security Administration's Office of the Chief Actuary (SSA OACT) publishes two different calculations of retirement income replacement rates, each of which find that Social Security benefits replace about 40 percent of a typical retiree's pre-retirement earnings. Some interpret these figures as indicating that Social Security benefits are insufficiently generous and that U.S. households' total retirement saving is inadequate.

But SSA OACT's two methods for calculating replacement rates each violate the life cycle model in a meaningful way. SSA OACT's career-average earnings replacement rates, in which lifetime earnings are first indexed upward by the rate of economy wide wage growth, exaggerates by roughly one-fifth the real value of earnings available to a household for consumption over its lifetime. This overstatement lowers household's measured ability to replace their pre-retirement earnings. SSA OACT's final-earnings replacement rates effectively compare Social Security retirement benefits pre-retirement earnings only in the years in which the individual worked, ignoring the life cycle model's prediction that household consumption is a function of long-term average earnings including years in which a household member was not employed. A variation of that method, calculated by the Congressional Budget Office based upon recommendations from the Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods, take the SSA OACT approach further by comparing Social Security benefits to an average of above-average earnings years in the period immediately preceding retirement. A replacement rate calculation more consistent with the life cycle model would compare retirement income to an average of real earnings calculated over a significant number of years. Such an approach would find substantially higher replacement rates for the typical retiree. It is important both for Social Security policy and the analysis of overall retirement saving adequacy that replacement rate calculations build on the insights of the life cycle model that guides most economic analysis of retirement saving.

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## 1. Introduction

Retirement saving is a pressing issue for U.S. households and policymakers as the population ages and the Baby Boom generation retires. At the same time that population aging has put pressure on Social Security's finances, many Americans are concerned that Social Security benefits are inadequate. A number of leading public figures, as well as the Democratic Party's 2016 electoral platform, favor expanding Social Security benefits.<sup>1</sup> Likewise, several studies find that Americans are saving inadequately for retirement.<sup>2</sup> Without informative measures of retirement income adequacy, however, it is difficult for households to know how to adjust their saving or for policymakers to know how to address Social Security or other government programs related to retirement income.

The life cycle model (or life cycle hypothesis) is the basic framework through which economists think about planning and saving for retirement. The life cycle model originated with Modigliani and Brumberg (1954) but has been developed and employed extensively since that time. In simple terms, the life cycle model address how households make decisions with regard to saving and spending. Prior to its development, the most common assumption was that households consumed some declining percentage of their annual incomes and saved the remainder. (Keynes 1936.) By contrast, the life cycle model predicts that households plan their consumption over a longer time frame in an effort to produce a standard of living that tends not to vary greatly from one year to the next. More specifically, the life cycle model holds that individuals will borrow and save so that the discounted marginal utility of their consumption – that is, the satisfaction derived from the final dollar of spending in a period – is equal from one year to the next. Were individuals not to act in such a way, they could increase their lifetime utility by shifting spending from one period in life to another. As a simplified case, if an

individual's rate of time preference is equal to the interest rate available in the market, that individual's expected level of consumption will be identical from one year to the next.

The Royal Swedish Academy of Sciences' (1985) announcement awarding the Nobel Prize in Economics to Franco Modigliani described the life cycle model as "a new paradigm in studies of consumption and saving, and is today the basis of most dynamic models used for such studies," saying that "it has proved an ideal tool for analyses of the effects of different pension systems." Over time, the life cycle model has been expanded to account for issues such as precautionary saving, uncertainty regarding future events, the costs of raising children, and the desire to leave an inheritance. The life cycle model's influence has been significant in both micro and macroeconomics, with applications to economy-wide correlations between saving, demographics and rates of economic growth, labor supply, the growth of human capital through education and on-the-job training, the effects of government fiscal policies and other areas.

Many factors complicate the picture, including the entry and exit of children from the household, the inability to borrow at certain periods of life, the need for precautionary savings and uncertainty about future earnings and investment returns. But smoothing consumption from one year to the next is the basic story, both in the textbook life cycle model and in how its broad principles are applied in practical retirement planning. And while the real world is inevitably messier than a textbook economic model, a significant body of research finds that controlling for changes in family size and other factors generates relatively stable individual-level consumption over the life cycle. (For instance, see Attanasio and Browning, 1995; Attanasio et al., 1999; Blundell, Browning and Meghir, 1994.)

In a 2016 survey of replacement rates methodology, the U.S. Government Accountability Office (2016) provides a concise account of the life cycle model and how it plays into retirement planning.

Economists broadly agree that a conceptual benchmark measure for adequate retirement saving is an amount that will, along with other sources of retirement income, allow a household to maintain its pre-retirement standard of living into retirement. A key concept underlying such a measure is the lifecycle model of savings, which suggests that individuals will adjust their saving and spending to ensure a consistent level of consumption over their lifetime.

This broad outlook is by far the most common framework through which retirement income adequacy is viewed and analyzed.

While the insights afforded by the life model are intuitive and understandable, actually solving a life cycle model to maximize lifetime utility through saving and spending decisions is considerably more complex, such that a typical saver or policymaker could not be expected to do so. Thus, it is not surprising that shorthand measures such as replacement rates are more commonly used in retirement planning and retirement policy. (Winter et al., 2012)

The most prominent shorthand by which to judge retirement income adequacy is the replacement rate, which represents retirement income as a percentage of some measure of pre-retirement earnings. Because costs of living decline in retirement, households can maintain their pre-retirement standard of living without matching their pre-retirement level of income. A target replacement rate based upon pre-retirement earnings creates a simplified retirement income goal that households can seek to attain. It is common for financial planners to recommend that retirees

be able to generate an income equal to roughly 70 percent of their pre-retirement earnings, though both higher and lower target replacement rates have been proposed. (Springstead and Biggs, 2008.)

Replacement rates are also regularly used in the policy world, both to judge the adequacy of Social Security retirement benefits and to assess how well all sources of retirement income will allow working-age households to maintain their standards of living once they retirement. Social Security replacement rates calculated and published by the Social Security Administration's office of the Chief Actuary (SSA OACT) are the most prominent figures used in Social Security policy discussions and have influenced the broader discussion of retirement policy in the United States.<sup>3</sup> Similar replacement rate methodologies are utilized by the Center for Retirement Research at Boston College in calculating the National Retirement Risk Index, which assesses the adequacy of overall retirement saving, including both Social Security and private retirement saving plans.<sup>4</sup> More recently, the Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods (2015) suggested adjustments to SSA OACT's replacement rate methodology. This adjusted approach was utilized by the Congressional Budget Office (2015) in calculating Social Security replacement rates for a December 2015 report.

SSA OACT has in recent years calculated replacement rates using two methods. In the first, Social Security benefits are compared to the average of the highest 35 years of career earnings, where nominal earnings are first indexed to the growth of national average wages. For simplicity I will refer to these figures as career-average replacement rates. The second method compares Social Security benefits to the final five years of substantial earnings prior to retirement, where substantial is defined as annual earnings in excess of \$100. I will refer to these figures as final-earnings replacement rates. Both career-average and final-earnings replacement

rates may be helpful to households planning their own retirement saving or to lawmakers considering how to construct policies regarding Social Security or private retirement plans.

However, SSA OACT's replacement rate methodologies depart from key insights of the life cycle model, as do the enhancements proposed by the 2015 Technical Panel and the Congressional Budget Office. First, in calculating career-average earnings replacement rates, SSA OACT's assumes that households wish for their consumption to rise over time in line with the average earnings of other workers in the economy. In the life cycle model, by contrast, individuals are concerned with allocating their own resources over time, and the model makes no reference to "keeping up with the Joneses." This assumption, which is embedded in the replacement rate calculation via the indexing of pre-retirement earnings to economy-wide average wage growth, overstates the earnings available to an individual over his lifetime and inappropriately raises the bar for what counts as an adequate retirement income. Second, in calculating final earnings replacement rates, SSA OACT compares Social Security benefits to an individual's earnings only in the years in which he works, as do the Technical Panel and CBO revisions of the SSA OACT's approach. Years of zero earnings are common throughout workers' careers. In the life cycle model, consumption is driven by average earnings over time, including zero-earnings years. Comparing retirement incomes only to the pre-retirement earnings in years in which retirees had worked, rather than their average earnings over time, understates the degree to which retirement incomes allow for the maintenance of pre-retirement levels of consumption.

These assumptions have significant effects on SSA OACT's findings that both career-average and final-earnings replacement rates are around 40 percent for a typical worker. Using assumptions more consistent with the life cycle approach – such as that individuals desire steady



rather than rising consumption and that individuals base their consumption on their average earnings across time, including years in which they do not work – would produce significantly higher measured replacement rates and a more optimistic assessment of the adequacy of Social Security benefits and Americans’ broader retirement saving adequacy.

## 2. Replacement Rates Based on Career-Average Earnings

For many years, SSA OACT has published replacement rates that compare Social Security retirement benefits to the average of the retiree’s highest 35 years of earnings, where those earnings are first indexed to the growth of national average wages. These replacement rates have been featured in the annual Social Security Trustees Report, in standalone publications, and in SSA OACT analyses of prospective Social Security reform plans. In its most recent calculations, SSA OACT finds that a hypothetical “medium earner” retiring at the Full Retirement Age of 66 in the year 2015 would receive a Social Security benefit equal to 41.1 percent of his career-average earnings, adjusted for national wage growth.<sup>5</sup> Due to Social Security’s progressive benefit formula, individuals with lower lifetime earnings receive higher replacement rates while those with higher lifetime earnings receive lower replacement rates. While measured replacement rates for a hypothetical medium earner vary by small amounts from year to year, these figures are the source of the Social Security Administration’s (2014) statement that “Under current law, if you have average earnings, your Social Security retirement benefits will replace only about 40 percent” of your pre-retirement earnings.

Replacement rates based upon career-average earnings are consistent with the life cycle model’s view that a household’s standard of living is a function of its average earnings over the long term, not its earnings in any particular year. Thus, calculating replacement rates relative to

career-average earnings is a reasonable approach to generating a shorthand measure of retirement income adequacy.

However, there is embedded in SSA OACT's calculations of career-average replacement rates an assumption that is at odds with the life cycle model's predictions of how households wish to plan their retirement saving. Before SSA OACT averages the highest 35 years of an individual's career earnings, it first "indexes" those earnings to the growth of national average wages through the year prior to their retirement, with national wages measured using the Social Security Administration's Average Wage Index (AWI). For example, for an individual who retires at the Full Retirement Age of 66, nominal earnings in a given year are multiplied by the ratio of the AWI at age 65 to the AWI in the year in which earnings took place. Since average wages tend to grow about one percent faster per year than prices, the effect of wage-indexing is to overstate the real purchasing power available to a retiree during his pre-retirement years. By itself, this is contrary to the life cycle model's assumption that a household's consumption is a function of the real income available to it over its full lifetime.

SSA OACT's argument for wage-indexing earnings before calculating career-average replacement rates is that individuals think of their retirement prospects in relative rather than absolute terms. As Goss et al. (2014, p. 3) state, wage-indexing past earnings "effectively equates earnings levels over time relative to the standard of living of workers of the day. As the standard of living rises over time, using wage indexed career-average earnings brings the average up to date to the standard of living at the end of career."<sup>6</sup> The Center for Retirement Research's National Retirement Risk Index also employs wage-indexed earnings in setting target replacement rates to measure the adequacy of total retirement incomes. Munnell (2014a), one of the NRRI's authors, states: "When constructing the NRRI targets, my colleagues and I made a

conscious decision to assume that households had a preference for a standard of living that increased during their working lives at the rate of economy-wide wage growth. This assumption reflected our belief that households care not only about their absolute standard of living, but also about their relative standard of living.” In other words, rather than smoothing their own consumption from year to year, retirees wish to “Keep up with the Joneses,” where the Joneses’ incomes aren’t merely those of other retirees but of working-age households. This assumption merits attention: as shown above, it effectively dictates the results of the career-average replacement rates calculation.

To illustrate, imagine a low-wage employee who earns \$16,000 in real terms each year of a full working career and who retires at the full retirement age of 66 in 2016. While a simplified example, steady real wages over time are an unfortunate reality for many individuals given stagnant wage growth for less-skilled workers. (Bosworth, Burtless and Steurle, 2000.)<sup>7</sup> More importantly, however, the assumption of steady inflation-adjusted annual earnings provides clarity regarding the pre-retirement standard of living this worker could potentially maintain. For a low-wage earner the typical 70 percent target replacement rate probably isn’t sufficient, so let us assume he aims for a 90 percent replacement rate. If so, he would seek to achieve a retirement income of \$14,400 -- that is, 90 percent of his average real earnings of \$16,000.

How close does Social Security alone come to achieving that goal? The answer depends upon how you ask the question. If you simply look at the benefit the low earner receives upon retirement, which happens to be \$11,137, then Social Security by itself brings him to a 70 percent total retirement income replacement rate. This worker could reach a 90 percent replacement rate by saving about 2.25 percent of his annual earnings, invested at the yield earned by the Social Security trust funds during his career.

But according to the replacement rate methodology used by SSA OACT, that \$16,000 per year earner would receive a Social Security replacement rate of just 56 percent of his lifetime earnings. This lower replacement rate arises not from a difference in benefits, but in the career-average earnings used in the replacement rate calculation. Using the SSA OACT methodology, a worker earning a constant, inflation-adjusted \$16,000 wage throughout his career would be judged to have had career-average earnings of \$20,011, 25 percent higher than his actual real earnings. The increase in the denominator of the replacement rate calculation reduces the measured replacement rate from 70 percent to 56 percent. To achieve a 90 percent replacement rate the \$16,000 per year worker would need to save roughly 3.8 percent of his annual earnings. A replacement rate of 90 percent of wage-indexed career average earnings would produce a retirement income of \$18,010, which is 13 percent higher than the real earnings the individual had in any year of his working career. If we net out the worker's 7.65 percent Social Security and Medicare payroll taxes and the 3.8 percent of earnings he saved to attain a 90 percent wage-indexed replacement rate, his retirement income would be 27 percent higher than his pre-retirement net earnings. The difference in potential consumption is even higher if we assume that living costs decline in retirement.<sup>8</sup> There is nothing in the life cycle model to suggest that individuals desire a standard of living in retirement that substantially exceeds their pre-retirement standard of living; the point of the life cycle model is that households generally desire their standard of living to be steady over time.

The logic illustrated here for a low earner applies to Social Security participants of higher earnings levels as well. For SSA's hypothetical medium scaled earner, which is often used to illustrate typical benefits and replacement rates, wage-indexed career-average earnings are about 19 percent higher than those same earnings indexed for inflation using the CPI-W, the inflation

measure common used by the Social Security Administration, and 27 percent higher than when adjusted using Personal Consumption Expenditure price index, which is used by the Congressional Budget Office. The Congressional Budget Office (2015) calculated replacement rates for Social Security participants using both inflation-indexed career average earnings and wage-indexed earnings. For participants born in the 1970s, the mean replacement rate relative to the highest 35 years of wage-indexed career earnings was 47 percent, versus 61 percent when benefits are compared to the inflation-adjusted average of the career earnings.<sup>9</sup> This amounts to a 30 percent increase in the measured value of Social Security benefits as a tool to maintain pre-retirement standards of living.

Embedding a relative income assumption in a replacement rate calculation is at odds with the life cycle model which, as Ando and Modigliani (1963) note, “starts from the utility function of the individual consumer: his utility is assumed to be a function of *his own* aggregate consumption in current and future periods.” [Emphasis added.] From the perspective of retirement planning, the GAO (2016, p. 6) states, “Economists broadly agree that a conceptual benchmark measure for adequate retirement saving is an amount that will, along with other sources of retirement income, allow a household *to maintain its pre-retirement standard of living into retirement.*” Again, the reference is to the household’s *own* standard of living. There is no reference, either in descriptive terms or in the underlying mathematics of the life cycle model, to the economy-wide standard of living or to the individual’s placement in the distribution of income or wealth. In the life cycle model, an individual with a given allocation of lifetime resources would consume in more or less the same pattern were he stranded on a desert island or living with others in a society in which his resources made him relatively rich or relatively poor.

Likewise, to this author's knowledge, no financial planning books or software packages utilize either wage-indexed earnings or the broader idea of pegging one's standard of living to that of other households. While peer effects and neighbor-comparisons are studied in certain financial contexts, there is very little research in this area regarding retirement and practically nothing to suggest the relative income approach be given precedence over the life cycle model's more conventional consumption-smoothing assumption. Indeed, the only known context in which this relative-income approach to retirement saving is advocated for is in defense of replacement rates calculated relative to wage-indexed career-average earnings. Outside the context of retirement income replacement rates, this Keeping-Up-With-The-Joneses theory of retirement planning – which, if true, would constitute a significant finding in economic thought – is almost entirely undiscussed.

While the inconsistency between wage-indexed replacement rates and the life cycle model has not yet been fully grappled with, it also has not gone entirely unnoted. Purcell (2012) notes that “Social Security bases retired-worker benefits on the worker's earnings through age 60 indexed to national average wages. For purposes other than calculating Social Security benefits, however, past earnings [for the calculation of replacement rates] are more commonly indexed to prices.” MacDonald and Moore (2011) note that “using a wage index also incorporates a comparison to the consumption of currently working generations. For most purposes, replacement rates are used to evaluate whether retirees' own consumption falls after retirement, rather than to make intergenerational comparisons, and for this reason, some form of price indexation is appropriate.” In a December 2014 publication the Congressional Budget Office (2014) states that “Indexing earnings to prices better captures the real amount of resources available to a worker over his or her lifetime, whereas indexing earnings to wages may overstate

those amounts.” In a report that came out the same month, the Organization for Economic Cooperation and Development (2014) noted that “The use of average wage indexing equates earnings levels over the career relative to the standard of living of workers at the time of retirement.”<sup>10</sup> More recently, the Government Accountability Office noted in its 2016 report on replacement rates that “Indexing earnings to wage growth also incorporates a comparison to the consumption of current workers.”<sup>11</sup>

In fact, the reference to current workers’ wages is almost literally true: the wage-indexed average of career earnings for SSA’s hypothetical medium scaled earner is almost precisely equal to the Average Wage Index in the year the medium scaled earner retires.<sup>12</sup> Thus, the wage-indexed career average replacement rate calculated by SSA OACT – that is, the approximately 40 percent figure that influences discussions of Social Security and retirement policy – actually compares the Social Security benefits of a new retiree in a given year to the earnings of the average worker in that year, a comparison that is uninformative for most households planning for retirement. Moreover, as Mitchell and Phillips (2006) note, while the ratio of pension benefits to average wages “is commonly used in Europe, where retirement adequacy is often judged according to whether retirees maintain a given relative position vis-à-vis current working cohorts... [h]istorically in the United States, policy makers have tended to prefer a replacement rate measure tied to workers’ own past earnings.”

Were replacement rates to be calculated using an approach that is more theoretically consistent with the life cycle approach – such as comparing Social Security benefits to the inflation-adjusted average of career-long pre-retirement earning – measured replacement rates and the perception of Social Security’s generosity would increase. For instance, Biggs (2016) finds that for the median retiree household born in 1940, Social Security benefits are equal 65

percent of inflation-adjusted average earnings from ages 21 through retirement.<sup>13</sup> The Congressional Budget Office (2014) found similarly high replacement rates calculated relative to real average earnings.

Likewise, total retirement income replacement rates calculated relative to career-average earnings adjusted for inflation would show a more benign situation with regarding to Americans' retirement income adequacy. Butrica, Smith and Iams (2012), using a detailed Social Security Administration microsimulation model referred to as MINT (Modeling Income in the Near Term), found that the median retiree born from 1926 through 1935 had a total retirement income at age 67 equal to 109 percent of his highest 35 years of pre-retirement earnings, adjusted for inflation. Subsequent birth groups – from 1936-1945, 1946-1955, 1956-1965 and 1966-1975 – are projected by the model to have replacement rates at age 67 of 119, 116, 113 and 110 percent, respectively. The distribution of replacement rates within birth cohorts also remains very similar over time, despite changing sources of retirement income. Assuming these projections are reasonable – and SSA's MINT model is the longest-running, best-resourced and most-thoroughly documented effort in the field – there is little reason to fear that future retirees will face greater resource shortfalls than do current retirees.

### 3. Replacement Rates Based Upon Final Earnings

More recently, SSA OACT has generated estimates of final-earnings replacement rates, which compare Social Security benefits to earnings in the years preceding retirement. (Goss et al. 2014). The 2015 Technical Panel on Assumptions and Methods, appointed by the Social Security Advisory Board, refined SSA OACT's final-earnings approach in its September 2015 report. In December 2015, the Congressional Budget Office calculated replacement rates based its interpretation of the Technical Panel recommendations.



SSA OACT's methods for calculating final earnings replacement rates produce figures that are seen as consistent with replacement rates calculated relative to wage-indexed career-average earnings, with both finding a typical replacement rate of about 40 percent. These results are taken as confirmation that Social Security indeed produces an approximately 40 percent replacement rate for the typical earner, regardless of whether benefits are compared to career-average or final earnings. However, as with SSA OACT's career-earnings methodology, SSA OACT's final-earnings replacement rate methodology is inconsistent with the life cycle hypothesis in a way that overstates households' pre-retirement earnings and reduces the measured replacement rates they receive from Social Security in retirement. Thus, one flawed replacement rate methodology is used to buttress another.

SSA OACT calculates final-earnings replacement rates by comparing initial Social Security benefits to the final five years of earnings prior to benefit claiming. SSA OACT defines an earnings year as any year with annual earnings in excess of \$100. Using Social Security Administration administrative data, SSA OACT concludes that the median replacement rate paid to new beneficiaries in 2011 was 39.3 percent, based upon the actual average claiming age of 63.75 years. At age 65 the median replacement rate would be 43.2 percent. While SSA OACT's report does not note it, the median replacement rate assuming benefit claiming at the Full Retirement Age of 66 would be approximately 46.1 percent. While this figure is higher than the 41 percent career-average replacement rate the medium scaled earner is calculated to receive, the medium earner actually has average indexed lifetime earnings that are in the 56<sup>th</sup> percentile of the distribution. Given that Social Security replacement rates, however measured, decline as lifetime earnings rise, it is fair to conclude that SSA OACT's final-earnings and career-average earnings methodologies generate broadly similar replacement rates for a typical earner.<sup>14</sup>

The problem with SSA OACT's final earnings replacement rates is straightforward: the life cycle model holds that households smooth consumption over time, meaning that a household's standard of living in a given year will relate more closely to its average income over time than to its earnings in that particular year. SSA OACT's final-earnings replacement rates exclude years of zero earnings, thereby exaggerating households' average earnings and understating Social Security replacement rates.

The administrative data that SSA OACT use to calculate final-earnings replacement is unavailable to the public. However, the conceptual issues can easily be illustrated using SSA's hypothetical "scaled earners," whose age-earnings profiles are derived from the same administrative data that SSA OACT uses in its replacement rate study. The scaled earners, with designations of very low, low, medium, high and maximum earners, are used to illustrate benefit levels, replacement rates, internal rates of return and other policy issues related to Social Security.<sup>15</sup> When SSA OACT describes an approximately 40 percent replacement rate based upon career-average earnings, this figure is generally calculated using the medium scaled earner.

In constructing the scaled earnings patterns, SSA OACT begins with data on new retirees from the agency's Continuous Work History Sample.<sup>16</sup> Looking back over these individuals' earnings histories, SSA OACT calculates both the percentage of individuals who are employed at a given age and the average earnings of individuals who do work, with earnings calculated as a percentage of the Average Wage Index. The product of the two equals a "raw scaling factor" which represents the average earnings of all individuals of a given age as a percentage of the AWI in that year. For illustration, Table 1 shows raw scaling factors for ages 55 through 64. For instance, at age 55, 81 percent of SSA OACT's sample of Social Security participants have earnings; of those individuals, earnings average 108 percent of the Average Wage Index. Thus,

the probability-adjusted earnings level at age 55 is 87 percent of the AWI. By applying these ages-specific scaling factors to the AWI in a given year, SSA OACT can create stylized career-long earnings patterns. Further adjustments are made to the raw scaling factors to create SSA OACT’s low, medium and high scaled earners, but the process described heretofore is sufficient for the purposes of this discussion.<sup>17</sup>

From these earnings patterns SSA OACT calculates Average Indexed Monthly Earnings (AIME) and the Primary Insurance Amount (PIA). The PIA represents the basic benefit paid to a worker who retires at the Full Retirement Age.<sup>18</sup> As described above, career-average earnings replacement rates are calculated by comparing the PIA to the average of the worker’s highest 35 years of earnings, where all earnings are first wage-indexed to the year prior to benefit claiming.<sup>19</sup>

As shown in Table 1, the annual earnings used by SSA OACT to calculate this 40 percent

<b>Table 1. Examples of SSA OACT Raw Scaling Factors.</b>			
<b>Age</b>	<b>Percent of Individual s with Earnings</b>	<b>Average Earnings as Percent of AWI</b>	<b>Scaling Factor (Probability Times Earnings)</b>
55	81%	108%	87%
56	80%	106%	85%
57	78%	105%	82%
58	77%	103%	79%
59	75%	101%	76%
60	74%	98%	72%
61	71%	95%	67%
62	77%	110%	85%
63	77%	114%	87%
64	75%	114%	86%
Source: Clingman and Burkhalter (2015).			

career-average earning replacement are *already adjusted* for the probability that an individual will work in a given year. This means that SSA OACT’s calculation of career-average earnings replacement rates effectively includes years of zero earnings. In calculating final earnings replacement rates, however, SSA OACT argues that Social Security benefits should be compared only to years in which the individual had positive

earnings. Goss, et al (2014) state that including zero earnings years in a final earnings

replacement rate “is inappropriate ... because the last 5 calendar years prior to benefit entitlement too often include years with no earnings.” (p. 4) Likewise, Munnell (2014a) states, “It makes no sense to include ‘zero years’ in the denominator of the replacement rate calculation.”

But why not? SSA OACT’s calculations of career-average replacement rates – whether using stylized earners as in Clingman, Burkhalter, and Chaplain (2016) or the administrative data used in Goss et al (2014) – do include zero years. This seems reasonable if we assume that households smooth their consumption from year to year, including years of zero earnings. Yet this leaves SSA OACT with two results that while seemingly compatible and confirmatory – both career-average earnings and final earnings replacement rates are about 40 percent – are in fact calculated in inconsistent ways. For instance, a medium scaled earner aged 64 in 2014 has earnings of \$33,336, but that figure is based on the assumption that only 75 percent of 64-year olds work. Restricting to those who do work, however, average earnings are about \$44,448. In calculating replacement rates for the medium scaled earner, SSA OACT’s calculation of career-average earnings would include the probability-adjusted earnings of \$33,336 while SSA OACT’s final earnings replacement rate calculation would be based upon the contingent-upon-work earnings of \$44,448. In other words, SSA OACT’s career-average and final earnings methodologies would produce roughly the same replacement rates for the same worker by relying upon different earnings.

The question is whether the inconsistency in SSA OACT’s calculations of lifetime and final earnings replacement rates is justifiable. Goss et al (2014) correctly point out many workers shift to part-time work or exit the workforce entirely in the years prior to claiming Social Security benefits. The declining probability of employment between the peak earnings years of

the early 50s and the near-retirement years of the early 60s is mostly attributable to the increase in the percentage of individuals who describe themselves as “retired.” In the Current Population Survey for the years 2010-2014, 9 percent of men and 12 percent of women aged 57 to 61 reported being out of the workforce due to retirement. Among that group, 96 percent report not wanting a regular job, indicating that most of those retirements were voluntary. In general this might be seen as a sign of adequate retirement incomes, which raises interesting implications given that the frequency of zero-earnings years in the period immediately preceding retirement is used to justify methodological changes that, in sum, make Americans appear less prepared for retirement.

More directly to the point is the degree to which zero earnings are more common in the years immediately preceding Social Security benefit claiming than in other parts of the working career. That is, do zero years occur “too often,” as stated in Goss et al. (2014)? To illustrate, consider the five years from ages 58 to 62 that precede the typical Social Security claiming age of 63. The administrative data SSA OACT use in constructing the scaled earnings patterns indicate that from ages 58 to 62, 75 percent of individuals are employed in a given year and 25 percent are not. However, in the prior five years – from ages 53 to 57 – only 80 percent of individuals work, a difference in the relative probability of employment of less than 7 percent. From ages 48 to 52, which are the peak earnings years for most households, only 83 percent of individuals are working. There is never an age at which more than 85 percent of individuals work in a given year. Simply put, individuals have years of zero earnings throughout their careers, due to spells of unemployment, time off for education, raising children or early retirement.

While there is no single age at which more than 85 percent of Social Security participants are employed, SSA OACT calculates final-earnings replacement rates under the implicit assumption of 100 percent employment. That is, by excluding years of zero earnings from the denominator of the replacement rate calculation the SSA OACT final earnings replacement rate effectively compares Social Security benefits to the average of years in which the beneficiary had worked, not to the overall average. We can estimate the effects of including zero earnings years in replacement rate calculations using SSA's stylized scaled medium earner. A medium scaled earner retiring at age 66 in 2016 would receive an annual benefit of about \$19,436.<sup>20</sup> His final five years of earnings, adjusted for the CPI-W and contingent upon working, average \$46,425, producing a SSA OACT-style final earnings replacement rate of 42 percent, similar to the 41 percent replacement rate the medium earner receives relative to wage-indexed career-average earnings. By contrast, a final earnings replacement rate calculated relative to probability-adjusted earnings – that is, the same annual earnings used by SSA OACT in calculating career-average earnings replacement rates – produces a replacement rate of 56 percent. Even comparing Social Security benefits at the Full Retirement Age of 66 to real average earnings in the 10 years from ages 56 to 65 produces a replacement rate of 50 percent for the scaled medium earner, a 25 percent relative improvement on the 40 percent replacement rate that is commonly assumed.

In short, SSA OACT's career-average earnings and final earnings replacement rate methodologies produce consistent results, but only by using inconsistent methods. Career-average earnings replacement rates are calculated against average earnings including zero earnings years while the final earnings replacement rates are calculated only against earnings in the years an individual worked, despite only modest differences in the probability of employment between the years immediately preceding Social Security benefit claiming and other periods of

adult life. If we believe that households smooth consumption over years of low or zero earnings through early and mid-career, there seems little reason to assume they cannot or do not do so later in life. Thus, what matters for final earnings replacement rates is merely that the averaging period be sufficiently long to adequately capture the underlying standard of living enjoyed by the worker in question.

#### 4. The Technical Panel/CBO Approach to Calculating Replacement Rates

Following the publication of Goss et al. (2014), the Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods built its recommendations upon the SSA OACT approach in its September 2015 report. The Congressional Budget Office (2015) then interpreted the Technical Panel recommendations to calculate final earnings replacement rates in a report published in December 2015. I will refer to the resulting approach as the "CBO methodology" as it works within the specific parameters outlined in the December 2015 report, but note that the methodology is the CBO's interpretation of the Technical Panel's recommendations which themselves derived from SSA OACT's final earnings methodology.

The Technical Panel's September 2015 report suggested a number of alterations to SSA OACT's final earnings replacement rate methodology.<sup>21</sup> First, SSA OACT counted a year as having earnings only if the individual earned more than \$100 in that year. The Technical Panel, by contrast, "thinks it would be more informative to use an individual-specific cutoff, such as a percentage of AIME or some other measure of long-career earnings." Second, while SSA OACT calculated replacement rates for all individuals who qualified for benefits under their own earnings record, the Technical Panel recommended a focus on long-career workers for whom replacement rates would be more meaningful. Third, the Technical Panel recommended that

replacement rates be illustrated inclusive of auxiliary benefits, such as those paid to a spouse, widow or child.

The Congressional Budget Office (2015) adopted several of the Technical Panel's recommendations in calculating final earnings replacement rates. First, the CBO focused on individuals with at least 20 years of earnings equal to at least 10 percent of the Average Wage Index, to isolate individuals who were more likely to have subsisted upon their own earnings during their preretirement years. Replacement rates calculated for individuals who did not subsist on their own earnings during their working years are unlikely to be meaningful.

Second, in calculating replacement rates the CBO limited itself to "substantial earnings," which it defined as earnings in a year that were in excess of 50 percent of the individual's Average Indexed Earnings. Average Indexed Earnings are the average of the highest 35 years of earnings indexed for the growth of the Average Wage Index. For simplicity I will refer to the denominator of CBO's replacement rates measure as "Final Substantial Earnings" (FSE). For the reasons discussed above, Average Indexed Earnings – that is, the highest 35 years of wage-indexed annual earnings – are generally equal to about 120 percent of inflation-adjusted average earnings. Years of earnings that exceed 50 percent of Average Indexed Earnings are thus earnings that exceed roughly 55 percent of inflation-adjusted career-average earnings. Calculating replacement rates relative to the final five years of earnings that fit these criteria, then, is in effect to compare Social Security benefits to an average of above-average earnings.

Using the Social Security Administration's Benefits and Earnings Public-Use File, released in 2005, it is possible to make at least basic comparisons of Final Substantial Earnings to other ways of measuring annual earnings.<sup>22</sup> I begin with individuals born in 1935. As does the CBO, I restrict the sample to individuals with at least 20 years of earnings at 10 percent or more



of the Average Wage Index and who receive a retired worker Social Security benefit. Thus, disabled workers, spouse-only beneficiaries and other non-retired workers are not included in this calculation. For this group, Final Substantial Earnings are equal to \$28,207. This figure is 28 percent higher than real average annual earnings from ages 51 through 60, inclusive of zero-earnings years. If we believe that average earnings over a longer period, such as the ten years from ages 51 through 60, are more representative of a household's standard of living than are five years of above-average earnings, then it is likely that the CBO's Final Substantial Earnings methodology overstates households' likely levels of consumption. Replacement rates calculated using such assumption thus would likely understate Social Security benefits' role in helping households maintain their pre-retirement standard of living.

In addition, the CBO's methodology did not incorporate the Technical Panel's recommendation that replacement rates be calculated inclusive of auxiliary spouse or widow benefits. While auxiliary benefits are not a major factor for the long-career workers examined by the CBO, they are more important in the broader household context. Auxiliary benefits are briefly discussed in the following section.

It is difficult to interpret the CBO's Final Substantial Earnings in the context of a life cycle approach. For instance, one might believe that household consumption at a given time is based not on average earnings over a full career but on some more limited time range. If so, instead of comparing Social Security benefits to career-average earnings, replacement rates might be calculated relative to an average of late-in-life earnings . Even then, however, looking at average earnings, including zero-earnings years, over a five- or ten-year time span might capture that intuition. What is not clear is from a conceptual standpoint is why Social Security benefits should be compared to the average of above-average earnings in the years preceding

retirement. The key insight of the life cycle model is that earnings in any particular year – high, low or zero – are less important to the household’s standard of living than are average earnings over longer periods. If replacement rates are to approximate the predictions of the life cycle model, the denominator of the replacement rate calculation should likely incorporate average earnings over a larger number of years.

## 5. Approximating Replacement Rates Calculated at the Household Level

In the retirement context, the household is generally a more informative unit of calculation than the individual. Spouses tend to share both income and household costs and thus the individual replacement rates received by the spouses is likely to be less revealing regarding their retirement income security than is the household’s replacement rate. Neither SSA OACT nor the CBO calculate Social Security replacement rates at the household level.

To analyze this issue more closely I again rely upon the Social Security Administration’s Public Use Earnings and Benefits file, which contains data on annual earnings and benefits for a sample of Social Security participants. For this exercise I analyze a subsample of that file containing data for on 1,702 individuals born in the year 1935. The sample is limited to individuals who receive benefits as retired workers, the spouse of a retired worker, or the non-disabled widow of an eligible worker. Thus, Disability Insurance beneficiaries are not included in this analysis.

The SSA Public Use files do not link spouses together. Thus, it is not possible from these data to calculate replacement rates for distinct households or to analyze the distribution of household benefits.<sup>23</sup> However, it is possible to approximate the average Social Security replacement rate paid to the average retiree households by measuring total benefits paid to retirees as a percentage of those retirees’ total pre-retirement earnings. Given that most policy

attention is paid to average replacement rates, not to replacement rates at different points in the earning distribution, such an exercise can provide useful information.

The Public Use file measures benefits as of 2004, at which time the 1935 cohort is aged 69. I inflation-adjust those dollar figures to age 65 and also adjust benefits for a constant claiming age of 65, which was the Full Retirement Age for the 1935 birth cohort. The average annual total benefit for this group is \$10,813 in year 2000 dollars. This figure is about 5 percent higher than benefits based only upon the retiree's own earnings, which average \$10,340. I then calculate average annual earnings from ages 51 through 60, again inflation-indexed to age 65. These annual earnings average \$12,526. Thus, the average Social Security benefit paid to a non-disabled member of the 1935 birth cohort was equal to 86 percent of average earnings from age 51 through 60. These figures incorporate a wider variety of Social Security participants and benefit types than do either the SSA OACT or CBO replacement rate analyses.

Again, because the SSA Public Use data do not create distinct households it is impossible to calculate how households of different earnings levels are treated by Social Security. Nevertheless, when all Social Security benefits and all beneficiaries are included and compared to average late-career earnings, Social Security replacement rates are substantially higher than the 40 percent figure that is commonly presupposed.

## 6. Conclusions

The life cycle model is by far the dominant theory by which economists analyze retirement saving behavior. The life cycle model predicts that individuals will maximize the welfare they derive from lifetime consumption by consuming roughly equal amounts in each period, rather than following a pattern of feast-and-famine. This implies that a household's standard of living in any given year will be a function of its average income over time, not the

income it receives solely in that year. Conventional retirement planning, which often thinks in terms of retiree's ability to replace their pre-retirement level of earnings, captures that intuition. Replacement rates also are used in policy analysis as a shorthand measure of a household's ability to maintain its standard of living as it shifts from work into retirement. While replacement rates are necessarily a simplification of the life cycle approach, they should be designed to capture the broad implications of the life cycle concept while not giving up the simplicity that makes replacement rates a desirable retirement planning tool.

The Social Security Administration's Office of the Chief Actuary publishes two replacement rate measures, which have great influence in framing discussions of Social Security and retirement policy. From these figures, which state that a typical worker receives a Social Security benefit equal to about 40 percent of his pre-retirement earnings, many have come to conclude that Social Security benefits are inadequate. Others, applying similar methodologies to total retirement incomes, concludes that Americans not saving sufficiently to produce adequately retirement incomes.

But these two methods each violate key assumptions of the life cycle model in ways that generate meaningful differences in the results they produce. SSA OACT's measure of career-average replacement rates, which compares Social Security benefits to the wage-indexed average of the highest 35 years of career earnings, overstates the real lifetime earnings available to households by about one-fifth and premises that households target rising consumption that "Keeps Up With the Joneses" rather than seeking to smooth consumption evenly over time.

Likewise, SSA OACT's final-earnings replacement rate calculation assumes that households wish to replace some percentage of earnings only in the years they work, rather than

the life cycle model's assumption that household consumption is based upon average earnings over time, including years in which a household member was not employed.

If a replacement rate measure is to be broadly consistent with the life cycle model, it seems that it should compare retirement incomes to an average of real annual pre-retirement earnings measured over some extended period of time. Households are not assumed to wish to “Keep up with the Joneses,” nor are they assumed to target retirement incomes that match their peak pre-retirement earnings rather than their pre-retirement average. For instance, Biggs (2016) calculates replacement rates relative to the inflation adjusted average of all earnings from age 21 through retirement. The Congressional Budget Office (2014), Biggs and Springstead (2008) and Butrica, Smith and Iams (2012) calculate replacement rates relative to the highest 35 years of inflation adjusted pre-retirement earnings, although they use different price indices for adjusting pre-retirement earnings. MacDonald et al. (2014) compare Canadian retirement incomes to the average of the final 30 years of earnings preceding retirement, where the highest and lowest five years of earnings are excluded from the calculation. All of these approaches are more consistent with the broad intuitions of the life cycle approach and all would produce measured Social Security replacement rates substantially higher than the 40 percent figures calculated by SSA OACT and absorbed into the analytic culture of U.S. retirement policy. These more life cycle-friendly replacement rate methodologies also would tend to show that Americans' overall retirement saving is more adequate than is commonly supposed. Given the importance of retirement programs both to the federal budget and to households' own finances, it is important to improve measurements of Social Security benefit adequacy.

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<sup>1</sup> See Garcia (2016).

<sup>2</sup> For instance, see Munnell et al. (2012) and Rhee (2013).

<sup>3</sup> SSA OACT’s career-average replacement rate figures can be found in Clingman, Burkhalter and Chaplain (2016).

<sup>4</sup> For background see Munnell, Webb and Golub-Sass (2012).

<sup>5</sup> Clingman, Burkhalter and Chris Chaplain (2016).

<sup>6</sup> Goss et al (2014).

<sup>7</sup> Bosworth, Burtless and Steurle (2000) find that 21 percent of workers have earnings that are declining over the course of their career while 40 percent have earnings patterns that they describe as “level.” Level or declining age-earnings profiles are more common among workers with less education. Applying wage-indexing to earnings that are level or declining can produce a figure for “average pre-retirement earnings” that substantially exceeds either the true inflation adjusted average of earnings or earnings occurring in the years leading up to retirement.

<sup>8</sup> For instance, retirees spend substantially less on food than pre-retirees, while consuming similar quantities and quality of food. The explanation is that retirees spend more time shopping and preparing food at home and, in particular, consume less food from fast-food restaurants. See Aguiar and Hurst (2004).

<sup>9</sup> Congressional Budget Office (2015).

<sup>10</sup> Organisation for Economic Co-operation and Development (2014).

<sup>11</sup> Government Accountability Office (2016) p. 27.

<sup>12</sup> The reason for this is that the scaled medium earner was designed to have the same wage-indexed average earnings and the same benefits as a previous styled medium earner who was assumed to earn the Average Wage Index each year of his career. For this steady earner, wage-indexed career average wages will thus be equal to the Average Wage Index. See Pang, Schieber and Biggs (2015).

<sup>13</sup> The difference between the 65 percent figure found in Biggs (2016) and the approximately 40 percent wage-indexed replacement rate commonly cited is not attributable purely to differences in how pre-retirement earnings are measured. In addition, Biggs (2016) includes Social Security auxiliary benefits, supplement benefits for widows and lower-earning spouses.

<sup>14</sup> That statement is not necessarily so for Social Security participants at above or below-median earnings, where final-earnings and career-average earnings replacement rates may differ.

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<sup>15</sup> The most recent update to the scaled earners is available through Clingman and Burkhalter (2015).

<sup>16</sup> SSA OACT limits its analysis to individuals who are fully insured, meaning that they have at least 40 quarters of covered earnings and are thus likely to receive benefits at retirement. Unless noted, references to individual data and characteristics will cite the fully-insured individuals analyzed by SSA OACT, not the overall population of Social Security participants.

<sup>17</sup> In creating the stylized medium scaled earner, the raw scaling factors are adjusted upward by about 20 percent to produce lifetime earnings and benefits equivalent to an individual who earned the Average Wage Index every year of his career. This step increases average annual earnings and, due to the progressivity of the Social Security benefit formula, reduces replacement rates relative to those a true average worker. This issue is discussed in greater detail in Pang, Schieber and Biggs (2015).

<sup>18</sup> The PIA does not include any auxiliary spousal or widow's benefits that might be paid.

<sup>19</sup> Career-average earnings are related to, but not identical to, the AIME. In the AIME, earnings are wage-indexed to age 60, with earnings occurring after 60 included in the average in nominal terms.

<sup>20</sup> Figures are derived from Social Security Trustees (2015).

<sup>21</sup> Discussion of replacement rates begins on page 80 of the Technical Panel's report.

<sup>22</sup> Data are derived from Social Security Administration (2005).

<sup>23</sup> Such household-level calculations are contained, however, in Biggs and Springstead (2008).