What Replacement Rates Do Households Actually Experience in Retirement?

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The replacement rate is a basic measure of the performance of retirement income systems. It gauges the extent to which benefits replace earnings before retirement and thereby allow workers to maintain a reasonable approximation of their pre-retirement standard of living. In the U.S. retirement income system, Social Security provides a basic level of replacement, upon which individuals can build through additional saving. This additional saving comes mainly through employer-sponsored pension plans and the accumulation of home equity.

This paper estimates how much people actually receive in retirement relative to earnings before retirement when all sources of income, including income generated by homeownership, are combined. The calculation of a comprehensive replacement rate proceeds in three steps. The first section describes how Social Security derives its policy model replacement rates, evaluates the extent to which these hypothetical outcomes reflect reality, and then uses the Health and Retirement Study to produce individual earned replacement rates and compares these numbers to official Social Security numbers for new retirees. The second section moves from individual to household replacement rates and broadens the income sources to include employer-sponsored pensions and non-pension financial assets. The third section addresses the appropriate treatment of housing. The fourth section is the conclusion.

Several very practical conclusions emerge from this analysis. First, for the population as a whole, median average indexed lifetime earnings are somewhat lower than that of Social Security's "medium earner," suggesting a somewhat higher replacement rate than the policy model. On the other hand, most working women and men claim their Social Security benefits before the Normal Retirement Age and receive actuarially reduced benefits, suggesting a replacement rate somewhat lower. The fact that new retirees receive an actual median replacement rate of 42 percent of AIME — slightly higher than the level suggested by the policy model — is the net of these two offsetting factors. Second, the earnings records and replacement rates differ sharply by gender. Third, when individuals are combined into households, the median couple with a non-working spouse receives a high replacement rate – 58 percent, while couples where both spouses work average 41 percent. This outcome is to be expected in a system that provides a 50-percent spouse's benefit, so that wives' earnings frequently increase the denominator without raising the numerator of the

replacement rate. Finally, it is not correct to either ignore housing equity or to annuitize the entire value and add it to the numerator without any adjustment for imputed rent. Taking a comprehensive view of income, the results from the HRS suggest that about half of those who retire with private pension coverage have potential replacement rates (assuming all available assets are used to buy annuities) that meet the 65 percent to 75 percent threshold often cited as the amount required to maintain pre-retirement consumption. For those without pensions, the replacement rates fall below the adequacy threshold, and the shortfall can be substantial when pre-retirement earnings are defined in terms of earnings immediately prior to retirement.

Social Security Replacement Rates for Individual Workers

The Social Security *Trustees Report* contains four illustrative cases to present projected benefit amounts and replacement rates under current law. Three of these cases correspond to hypothetical workers with career average earnings equal to a percentage of the "average wage index" for the year prior to retirement – 45 percent for the "Scaled Low Earner;" 100 percent for the "Scaled Medium Earner;" and 160 percent for the "Scaled High Earner." A fourth worker represents someone who has earned the maximum taxable earnings throughout his career. Table 1 summarizes the replacement rates for the hypothetical individuals in 2004. The age-62 replacement rates are particularly relevant, because the majority of participants claim benefits before age 65.

The policy model used to construct hypothetical Social Security replacement rates is clearly a simplification of real-world patterns. It assumes that the "medium" worker enters the labor force at age 22, remains constantly employed until age 65, and has career average earnings equal to the national average wage in the year prior to retirement.[1] But most workers, especially married women, have significant breaks in employment, either in unemployment or time spent out of the work force. And most workers claim Social Security benefits well before the Normal Retirement Age.

A straightforward test of the accuracy of the policy model earnings and replacement rates is to compare these estimates with actual initial benefits received by real-world workers.

[1] With the "scaled" earnings profile, earnings will be lower early in the worker's career and towards then end and higher in the middle, but on average will result in an AIME equal the Average Wage Index in the year prior to retirement.

The policy model has the "medium earner" claiming benefits in 2003 receiving $13,814 if he retired at age 65, and roughly 80 percent of that amount, or $11,051, if he retired at age 62. Assuming that 60 percent of "medium earners" claim benefits at age 62 and 40 percent at age 65, the weighted average benefit for "medium earners" in 2003 projected by the policy model would be $12,156. For all workers who claimed benefits in 2003, the actual average benefit amounted to $11,276 – roughly $900 less than the hypothetical amount.[2] Thus, the simplest calculation suggests that the policy model benefit projections are somewhat high, which means – given the progressive structure of the Social Security benefit formula – that the policy-model replacement rate projections are somewhat low.

Confirming evidence that replacement rates for real-world workers are greater than those for the "medium earner" comes from a study by Social Security's Office of the Actuary (Clingman and Nichols 2004).[3] The SSA actuaries compare the primary insurance amount (PIA) for the policy-model workers with the PIAs for workers retiring in 2003, using a 1–percent sample of Social Security Administrative records. The PIA is the benefit a person would receive at the normal retirement age, neither reduced for early retirement nor increased for later retirement.[4]

The actuaries find that the policy model somewhat overestimates the PIA of real-world workers, implying that it underestimates actual Social Security replacement rates. For example, if the SSA policy model "medium earner" is taken to represent the median beneficiary, 50 percent of beneficiaries would have lower PIAs and 50 percent higher. Their calculations show, however, that 59 percent of workers have a lower PIA. This result is the

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[2] A more precise calculation yields a similar result. For hypothetical "medium scaled workers" retiring at ages 62 to 70 in 2003, the estimated annual scheduled benefit at normal retirement age is multiplied by the actuarial adjustment — from 0.77 for age 62 to 1.275 for age 70. Weighting this amount by the age distribution of initial Social Security benefit awards for all workers, the resulting benefit in 2003 would be $12,242.

[3] A number of other studies also conclude that income of actual workers falls below that of the average wage index. (See for example Au, Mitchell, and Phillips (2004) and Bosworth, Burtless and Steuerle (1999)).

[4] Calculating the PIA involves three steps. First, a worker's previous earnings are restated in terms of today's wages by indexing past earnings to wage growth. Second, earnings for the highest 35 years are then averaged and divided by 12 to calculate Average Indexed Monthly Earnings (AIME). Finally, the PIA is the sum of three separate percentages that are applied to portions of the AIME. The portions depend on the year in which a person reaches age 62. Specifically, for workers first becoming eligible for benefits in 2004, their PIA was the sum of:

- 90 percent of the worker's first $612 of AIME, plus
- 32 percent of AIME between $612 and $3,689, plus
- 15 percent of any AIME in excess of $3,689.

This PIA is continually recalculated so long as the individual remains employed; and is indexed to prices from age 62.

net of dramatically different patterns for men and women. Only 37 percent of men have a PIA below that for the hypothetical medium earner. In contrast, 83 percent of women fall below. This finding suggests that the median male worker has a lower Social Security replacement rate than the policy model "medium worker," and the median female worker a higher replacement rate.[5]

Another study – the *Performance and Accountability Report* also undertaken by the Social Security Administration – provides some evidence on why replacement rates for real-world workers might exceed those suggested by the hypothetical construct.[6] It reports the average number of years of zero earnings since age 22 for both men and women workers who have recently claimed benefits. Men average 6 years of zero earnings, and women 13 years. For men, years with zero earnings should have a minimal impact on their earnings history relative to the hypothetical worker. That is, new retirees have a potential for 40 years of earnings between age 22 and 62, from which SSA selects the highest 35 years for the benefit calculation. On average, male workers will have 34 years of nonzero earnings. Women, on the other hand, average 13 years of zero earnings. So even their 35 highest will include an average of eight years of zeros.

The *Performance and Accountability Report* also provides replacement rates for both men and women who have just claimed benefits. At first, the average replacement rate of 42 percent looks identical to that for the medium earner in the *Trustees Report*. But the *Performance and Accountability Report* calculates replacement rates relative to AIMEs, while the "medium earner" uses career-average earnings indexed to the year prior to retirement as the base. Shifting to AIME as the denominator, the hypothetical worker has a replacement rate of about 47 percent.[7] On the other hand, the "medium earner" retires at age

[5] In fact, the median male worker looks very much like the "medium earner." For an explanation of the discrepancy between the Clingman and Nichols results and actual Social Security outcomes, see footnote 8.
[6] The data come from the 1-percent Continuous Work History Sample supplemented with information from the Master Earnings File for persons retiring in 1999-2003.
[7] The AIME of the "medium earner" can be estimated from the published level of benefits ($13,814 in 2003), by applying the inverse of the Social Security Benefit Formula. First, the annual benefit is divided by 12 to obtain the PIA (13,814/12=1,151). Second, this PIA is adjusted to take out the cost-of-living adjustments from 2000 to 2003, which produces the 1,081 that results from applying the bend-points formula to the AIME. Third, the age 62 (year 2000) bend points are applied to calculate the AIME that generates 1,081, resulting in an AIME of 2,417 (531+ [1,081-(0.9 x 531)]/0.32=2,417). Last, this number is multiplied by 12 to obtain the AIME annual denominator (29,002). To estimate the AIME-based replacement rate, the benefit is divided by the new base resulting in 47 percent (13,814/29,002=0.476), which represents the age 65 AIME-based replacement rate for a hypothetical "medium earner" retiring in 2003 at age 65. To estimate the age 62 AIME-based replacement

65, while, as noted, most workers retire early and therefore receive actuarially reduced benefits. Given the actual retirement patterns of real-world workers, the weighted average replacement rate for the medium earner would be about 40 percent of AIME (0.40 x 47 percent + 0.60 x 36 percent), slightly below the reported 42 percent for actual retirees. The replacement rate for the new male retirees (37 percent of AIME) is virtually identical to that of the hypothetical worker retiring at age 62 (36 of AIME). This is not a surprising outcome given that the AWI has tracked the *median* wage for men very closely, that men tend to have few years of zero earnings, and that most men retire at age 62.[8]

HRS Replacement Rates for New Retired-Worker Beneficiaries

To test whether the Health and Retirement Study (HRS) provides a picture consistent with that reported by SSA, this section uses the HRS to replicate the tables provided in the SSA's *Performance and Accountability Report* described above. The HRS is a nationally-representative data set that began in 1992 with about 12,650 individuals from about 7,600 households.[9] This original survey interviewed people age 51-61 and their spouses (regardless of age), and the survey was re-administered in 1994, 1996, 1998, 2000, 2002, and 2004. The HRS contains detailed information on earnings before retirement and on Social Security and pension benefits as well as 401(k) balances and homeownership, and is thus ideal for this study.[10]

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rate, a similar procedure is followed, using an initial benefit equal to 80 percent of the age 65 benefit, dividing it by 12 —no COLA adjustments—, and using the 2003 bend points. This produces an AIME-based replacement rate of 36. See Social Security Administration 2005, http://www.ssa.gov/OACT/COLA/AWI.html, http://www.ssa.gov/OACT/TR/TR05/tr05.pdf, http://www.ssa.gov/finance/2004/Full_FY04_PAR.pdf.

[8] This finding appears to contradict the Clingman and Nichols (2004) conclusion that 37 percent of males have a lower PIA than that of the "medium earner" who retires at age 65 in 2003. The explanation for this apparent inconsistency is that the Clingman and Nichols study includes all workers retiring in 2003, regardless of their age of retirement. Even if the median male looks like the "medium earner" in each cohort, the PIA of the median retired worker will be higher than that of the "medium earner" when the 60 percent who retire at age 62 are put together with the 40 percent who retire at age 65. The reason is that – in a world of rising real wages – those retiring at age 62 will have enjoyed a higher level of earnings on average. With a wage-indexed benefit formula, these higher earnings will translate into higher PIAs, which will raise the median PIA for the combined group. As a result, less than 50 percent of male workers will fall below the hypothetical median. To be consistent, one should compare the PIAs of actual retirees with those from a hypothetical worker of the *same cohort* that retires in the *same year.*

[9] The HRS is conducted by the Institute for Social Research (ISR) at the University of Michigan and is made possible by funding from the National Institute on Aging. More information is available at the ISR website: http://hrsonline.isr.umich.edu/. Although using restricted data reduces the number of observations used in this study, the weighted mean values for the variables are very close to those reported by RAND.

[10] See Juster and Suzman (1995) for a detailed overview of the survey.

Calculating replacement rates for new retirees in the HRS involves looking in the first five waves of the HRS at individuals age 62 and over and calculating the number of years with zero earnings and benefits as a percent of AIME in the year when the worker first claims benefits. The specific calculations for the HRS are as follows:

- *Retirement age.* The retirement age comes from the self-reported year when the respondent first received Social Security Benefits (rassageb from RAND-HRS). For those respondents with missing values, retirement ages are obtained from the retirement year indicator from RAND-HRS (r*retyr). Individuals who retire before age 62 because of disability (radiget) are excluded from the final sample. Early retirees who can not be identified as disabled are randomly assigned a retirement age based on the pattern of retirement by gender.
- *AIME, PIA, and Social Security benefit.* Social Security earnings are taken from the restricted data set of the HRS Covered Earnings Records for the years 1951-1991. After 1991, earnings are calculated from self-reported data in the HRS and capped at the maximum taxable level. The earnings history is then used to construct the AIME. The PIA and Social Security benefit are estimated using the Social Security benefit formula.

Table 2 reports the average number of years with zero earnings from age 22 to the last year before collecting benefits. For women, the figures look very close between the two samples, with the average around 13 years. In the case of men, the HRS shows about half a year less of zero earnings than the SSA report. Overall, the picture is quite similar between the two samples.

Table 3 presents median earned replacement rates – replacement rates based on the individual's earnings record – of newly retired-worker beneficiaries for the SSA sample and the HRS. Again, the results are remarkably close. The median replacement rate for the total population in the two samples is about 42 percent.[11] This overall rate is the composite of a median replacement rate of 37 percent for men and about 52 percent for women.

Finally, Table 4 shows median replacement rates for the two samples by earnings quintile. The HRS results closely track those from the *Performance and Accountability*

[11] Again, this 42 percent should not be confused with the 42 percent reported in the *Trustees Report* for the worker with medium scaled earnings retiring at age 65, because 1) the "medium earner" replacement rate uses career-average earnings as the base instead of AIME, and 2) the majority of real-world men and women claim benefits well before the normal retirement age.

Report. The result is not too surprising, since the HRS calculations are based on SSA earnings data between 1951 and 1991. But after 1991, earnings are self reported, introducing the potential for some discrepancy between the two sources. That little exists is comforting.

Household Replacement Rates With Pensions and Other Assets

Having verified that the HRS produces earnings records and replacement rates for individuals very close to the official SSA numbers, this section moves the analysis forward in three steps. First, the HRS population is reassembled into households and Social Security replacement rates are estimated for the household unit. Since retirement income is limited to Social Security, the earnings base continues to be AIME. The next step is to add pensions and other assets to the numerator of the replacement rate calculations, and to expand the denominator to include earnings above the cap and the return on non-pension financial assets. The final step in this section is to experiment with denominators other than the AIME, specifically the five years of highest earnings in the ten years before retirement. The next section then addresses the appropriate treatment of housing in replacement rate calculations.

Household Social Security Replacement Rates

The earned replacement rates for individuals provided in SSA's *Performance and Accountability Report* offer a benchmark against which to assess the reasonableness of the household numbers. For example, SSA shows the median male earned replacement rate is 37 percent and the median female earned replacement rate is 52 percent. The average for single people, assuming that single people have similar earnings histories as married people, should be a weighted average of the two. Since women account for 70 percent of single workers covered by Social Security, a first approximation of the combined replacement rate for single workers should be 47 percent.

Couples consist of two types – those with one worker where the spouse has an AIME of zero and those where both spouses work and both have a positive AIME. Again assuming that single people have similar earnings histories as married people, for couples in which the wife has no earnings record of her own, one would expect a replacement rate of 150 percent of 37 percent or 55.5 percent. In couples where both spouses have an earnings record, two adjustments occur. First, the wife's earnings record goes into the denominator. Second, the

wife's benefit, which is the greater of 50 percent of her husband's benefit or the benefit based on her own earnings record, goes into the numerator. With the information that 1) the median earned replacement rate for men is 37 percent and for women 52 percent, and 2) according to the HRS the median ratio of wife's to husband's AIME is 42 percent, it is possible to approximate the replacement rate for the median two-earner couple.[12] That is, for a two-earner median couple the expected replacement rate is equal to:

$$\frac{BEN(male)+BEN(female)}{AIME(male)+AIME(female)}=\frac{BEN(male)+\max(0.5*BEN(male),BEN(female))}{AIME(male)+0.42*AIME(male)}$$

$$\frac{0.37*AIME(male)+\max(0.5*0.37AIME(male),0.52*0.42AIME(male))}{1.42*AIME(male)}=$$

$$\frac{0.37AIME(male)+\max(0.19AIME(male),0.22AIME(male))}{1.42AIME(male)}=\frac{0.37AIME(male)+0.22AIME(male)}{1.42AIME(male)}$$

$$\frac{0.59AIME(male)}{1.42AIME(male)}=41.5percent$$

The next step is to calculate actual replacement rates for households using the HRS. The derivation of the retirement age and Social Security AIME, PIA, and benefit are described above. This step involves aggregating individual information into a household format. In the case of single-person households, replacement rates are simply the ratio of benefits to AIME in the year the individual retires. For couples, replacement rates are estimated in the first year in which both members of the household are retired. In the case where both members of the couple are already retired, the procedure is to adjust the AIME and PIA for each spouse for inflation in order to report them for a common year and then divide the couple's combined benefits by the couple's combined AIME. In the case where only one spouse is retired, the working spouse – generally the woman – is randomly assigned a retirement age based on the female pattern of retirement. Since the replacement rate is calculated on the assumption that both spouses are retired, earnings are eliminated from the numerator of the replacement rate calculation. Eliminating earnings presents a more realistic picture of the income replacement the couple will enjoy over their retirement span.

Replacement rates for households as calculated from the HRS data and as predicted from SSA's *Performance and Accountability Report* are shown in Table 5. According to the HRS, couples receive Social Security benefits equal to 44 percent of their combined AIME.

[12] The following exercise assumes that the median man is married to the median woman. This is a strong assumption, but the equation is used only as a gauge for expected outcomes.

The replacement rate is sharply higher, however, for those couples where only one spouse works – 58 percent versus 41 percent for couples where both spouses have a positive AIME. This outcome is virtually inevitable in a system that provides a 50-percent spouse's benefit. As women go to work, they increase the denominator with their AIME but often fail to increase the numerator. Where the husband is the median worker, for example, the working wife does not add to the numerator until her earnings exceed 36 percent of her husband's. Since 43 percent of working wives earn less than 36 percent of their husband's earnings, working wives often reduce household Social Security replacement rates.

The median Social Security replacement rate for single individuals is 45 percent – very close to that for couples. The average, however, is the result of a replacement rate of 39 percent for single men and 49 percent for single women. This difference by gender simply reflects the fact that men on average earn more than their female counterparts. The replacement rate for single women (49 percent) is lower than that for all women (52 percent) published in SSA's *Performance and Accountability Report*. The discrepancy reflects the fact that single women, who must depend on themselves for support, earn more on average than married women. Indeed, the HRS shows that single women have an AIME equal to 1.2 times that of married women.

Table 6 presents replacement rates by quintiles of AIME for couples and for single individuals. For single-person households, replacement rates range from 72 percent to 32 percent, similar to the 72 to 30 range of individual earned replacement rates shown in Table 4. For couples, however, the range of actual replacement rates (63 percent to 33 percent) narrows considerably. The high earned replacement rates disappear once people are combined into couples because the primary recipients of the low AIMEs and high earned replacement rates are married women. When married women are paired with their husbands, who tend to have higher AIMEs and lower earned replacement rates, the range of replacement rates narrows.

The story so far is that Social Security benefits provide on average about 43 percent of household AIME to both couples and single individuals. The range of actual Social Security replacement rates is narrower, however, for couples than for individual workers.

Household Total Replacement Rates

Up to this point, the analysis has focused only on Social Security. This section expands retirement income to include benefits from defined benefit plans and the annuitized value of defined contribution assets and other financial assets.

Defined benefit wealth is based on the Peticolas-Steinmeier numbers posted on the HRS website; these numbers are derived from the restricted pension data provided by the employer.[13] *Defined contribution wealth* is based on self-reported estimates for all waves, where available. If not available, values are calculated from reported employee and employer contributions plus accruals.[14] The resulting numbers for both defined contribution and defined benefit plans are comparable to those reported by Gustman and Steinmeier (1998). *Financial wealth* comes from the RAND subset of the HRS and includes stocks, bonds, savings and checking accounts, certificates of deposit, and any other account, minus non-housing debt.

As before, household replacement rates are estimated at the first year in which both members of the household are retired. This is done by estimating the annuity value for defined benefit and defined contribution pensions for each member of the household starting at his or her retirement age and then projecting this value to the year in which the second member of the household retires. For financial wealth, which is a household rather than an individual asset, the value is annuitized starting at the first year in which both members of the household are retired. To make the numbers comparable among individuals, all figures are stated in 2002 dollars.

IRAs complicate the analysis because most of the assets in these accounts are rollovers from 401(k) plans and the earnings on those rollovers.[15] IRAs are handled in the subsequent analysis of replacement rates as follows. Pension coverage is defined excluding IRAs. That is, individuals must have participated in an employer-sponsored defined benefit or defined contribution plan to be classified as having pension coverage. In terms of the allocation of IRA assets, for those with pension coverage IRA balances are combined with

[13] For ages 55, 62 and 65, the values are taken right from the website. Values for other years are a weighted average of the reported data.

[14] A small fraction (less than two percent) of respondents in the HRS sample indicated having a pension plan with both defined benefit and defined contribution characteristics. Data on defined contribution assets in these "combined" plans were oftentimes not available, so they are grouped together with defined benefit plans.

[15] Increasingly, of course, IRA accumulations will also include rollovers from defined benefit and cash balance plans.

defined contribution assets. For those without pension coverage, IRA assets are included in total financial wealth.[16]

Table 7 shows the impact of pension coverage and financial assets on the replacement rates of couples and single individuals, first with a denominator of AIME and then with a denominator that includes earnings above the Social Security maximum taxable earnings cap and the return on financial assets, which provides a more relevant picture.[17] Median replacement rates including pensions and annuitized defined contribution and financial wealth in the numerator and a comprehensive measure of pre-retirement income in the denominator, are 55 percent for couples and 58 percent for single-person households without pensions and 74 percent for couples and 86 percent for single-person households with pensions.

Household Total Replacement Rates Based on Earnings Immediately Prior to Retirement

One challenge in constructing replacement rates is deciding precisely what earnings to replace. Up to now the analysis has been based on the concept of average indexed monthly earnings either excluding or including earnings above the cap. One could argue that households are more interested in replacing the earnings they enjoy immediately prior to retirement. The third section of Table 7 reports replacement rates where pre-retirement earnings are defined as the highest five out of the last ten years just before retirement. Earnings are indexed by prices to the year of retirement. The return on financial assets is also included in the denominator. Using this more immediate definition of pre-retirement earnings produces lower replacement rates. Since the outcome is sensitive to the definition of pre-retirement earnings, subsequent results will show both denominators.

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[16] Median defined contribution wealth for those with coverage is $34,244 (excluding IRA assets) and median defined benefit wealth is $132,505. These results are fully consistent with those from other studies.

[17] The restricted data SSAEAR3.DA contain the covered earnings records for individual workers between 1951 and 1991. Since earnings are top-coded at the maximum taxable earnings for each year, the calculation of actual career-average earnings for many individuals requires imputations. From the final sample of individuals used in this paper, about a third of those covered require imputations for at least one year of earnings. To impute earnings for those at the maximum taxable earnings, a random-effects, Tobit regression is applied to all of the available data, with earnings as the dependent variable. The explanatory variables include age, age square, a dummy for gender, and dummies each decade. For individuals below the cap, their actual earnings are used. For individuals with coded earnings at the cap, their earnings are imputed using the regression results to estimate the expected earnings for each individual based on the explanatory variables, conditional on the fact that their earnings were at or above the cap.

The Housing Issue

The replacement rates calculated up to this point have excluded any recognition of housing. Yet for most families, their house is their largest non-pension asset. The extent to which the house or some part thereof should be included in replacement rate calculations has been the source of considerable controversy. Some authors have thrown up their hands and presented numbers including zero, 50 percent, or 100 percent of home equity as contributing to earnings replacement.[18] The implication is that these are equally good options, and the choice rests with the reader. This section argues that theory and practicality suggest a more precise treatment of home equity. Specifically, the entire value of home equity – consisting of a) the present discounted value of imputed rent over the life of the household and b) the residual value less any outstanding mortgage – should be considered available for consumption in retirement. For consistency, however, the value of imputed rent enjoyed before retirement belongs in the denominator of the replacement rate calculation.

Imputed Rent Consumed Over the Life of the Household

The argument for including imputed rent as part of retirement income is that it will be used to support retirement consumption. Thus, the monthly value of this imputed rent should be incorporated in the numerator of the replacement rate. For consistency, it should also be included in the denominator since the household was receiving imputed rent as part of its income before retirement. This argument implies that "zero" cannot be the right amount of housing wealth available to support consumption in retirement.

Arguing that the imputed rent should be counted as part of pre-retirement income raises the question whether the return on other assets should also be included. Consistency would require that the return on financial assets, the increment in defined benefit wealth, and the employer contribution and return on 401(k) assets also appear in the denominator of replacement rate calculations. In practice, however, the increment to pension wealth probably does not enter household pre-retirement consumption decisions and therefore does

[18] The Congressional Budget Office (1993) includes housing wealth in the set of assets that can be used to finance retirement. Moore and Mitchell (2000) also include housing wealth with other wealth. On the other hand, Bernheim (1992) in considering whether the baby boom generation is preparing adequately for retirement excludes housing wealth. Those letting the reader decide include Engen, Gale and Uccello (1999) who offer zero, 50 percent, and 100 percent of housing equity as options and Gustman and Steinmeier (1999) who conduct their analyses using zero and 100 percent of home equity.

not belong in the measure of pre-retirement income.[19] Income from non-pension financial assets – small for most households – is readily accessible to the household and has been included in the denominator throughout.

Including imputed rent in the replacement rate calculation requires determining rents as a percent of home prices and the portion of imputed rent that will be received and consumed in retirement. Analogous to equity valuation, in which the future flow of dividends determines the current price of the stock, the current value of a house should equal the present discounted value of the future rents. For example, the value of a house with an annual rent of $10,000 to perpetuity should be priced at $333,333 when valued at a 3 percent real discount rate.

$$P_o = \sum_{1}^{\infty} \frac{d_1}{(1+r)^i} \approx \frac{d_1}{r} = \frac{10{,}000}{0.03} = 333{,}333$$

But house prices — and rents — are likely to appreciate over time. A simple extension of the basic dividend discount model suggests that a house with an annual rent of $10,000 and an annual appreciation of 1 percent should be priced at about $500,000 when valued at a 3 percent real discount rate.

$$P_o = \sum_{1}^{\infty} \frac{d_0(1+g)^i}{(1+r)^i} \approx \frac{d_0(1+g)}{r-g} = \frac{10{,}000(1+0.01)}{0.03-0.01} = \frac{10{,}100}{0.03-0.01} = 505{,}000$$

This equation also indicates that, at any point of time, rents should be about 2 percent of the value of the house.

$$\frac{d_i}{P_i} = \frac{d_0}{P_0} = \frac{d_0}{\frac{d_0(1+g)}{r-g}} = \frac{r-g}{1+g} = \frac{0.03-0.01}{1.01} = 1.98\%$$

But the results are very sensitive to the assumption about the discount rate and the rate of appreciation. Table 8 shows that increasing the discount rate significantly raises the rental rate, while increasing the appreciation rate lowers it.

The portion of housing equity that will be received as income (and consumed) in retirement can be estimated by splitting the present value of the house in two parts: the rents

[19] This may overstate the case, because households could react to the buildup in their 401(k) plans by saving less and increasing their consumption. For the HRS cohort, however, this effect is small since defined benefit plans dominate the pension landscape. It is much harder to make a persuasive case that households consider accretion in their defined benefit plan as part of annual income.

to be received from retirement (time 0) until death (time T) plus the remaining rents after the household dies:

$$P_o = \sum_{1}^{\infty} \frac{d_0(1+g)^i}{(1+r)^i} = \sum_{1}^{T} \frac{d_0(1+g)^i}{(1+r)^i} + \sum_{T+1}^{\infty} \frac{d_0(1+g)^i}{(1+r)^i}$$

At time T, the residual value can be expressed as

$$residual\,(T) = \sum_{1}^{\infty} \frac{d_T(1+g)^i}{(1+r)^i} \approx \frac{d_T(1+g)}{r-g}$$

And this can be discounted to time 0 using the discount rate,

$$residual\,(0) = \sum_{T+1}^{\infty} \frac{d_0(1+g)^i}{(1+r)^i} = \frac{\sum_{1}^{\infty} \frac{d_T(1+g)^i}{(1+r)^i}}{(1+r)^T} \approx \frac{\frac{d_T(1+g)}{r-g}}{(1+r)^T} = \frac{\frac{d_0(1+g)^T(1+g)}{r-g}}{(1+r)^T}$$

Then, the amount to be consumed by households during their lifetime as a proportion of the total value of the house equals:

$$\frac{\sum_{1}^{T} \frac{d_0(1+g)^i}{(1+r)^i}}{\sum_{1}^{\infty} \frac{d_0(1+g)^i}{(1+r)^i}} = 1 - \frac{\sum_{T+1}^{\infty} \frac{d_0(1+g)^i}{(1+r)^i}}{\sum_{1}^{\infty} \frac{d_0(1+g)^i}{(1+r)^i}} = 1 - \left(\frac{1+g}{1+r}\right)^T$$

The relationship means that for a 1 percent real house appreciation, a 3 percent real discount rate, and a joint life expectancy of a household of 25 years at retirement,[20] the portion of the house to be consumed as imputed rent is about 40 percent of the total value.

$$1 - \frac{(1+g)^T}{(1+r)^T} = 1 - \left(\frac{1+g}{1+r}\right)^T = 1 - \left(\frac{1+0.01}{1+0.03}\right)^{25} = 1 - 0.60 \approx 0.40$$

Again, the results are sensitive to both the discount rate and the rate of appreciation of house equity. The 3 percent real rate is close to a risk free rate; rates of 5 to 6 percent may more closely reflect the risk associated with housing.[21] Thus, the following analysis assumes that

[20] A household with a 65 year-old husband and 62 year-old wife has a joint-life expectancy of 24.5 years. The joint life expectancy is used for ease of exposition. A more careful calculation should include the annual survival probabilities combined with the discount rate. For the combinations of appreciation rate and discount rate presented in Table 9, both methodologies generate similar results.

[21] Estimates of imputed rent appear to be much higher than that implied by a 3 percent discount rate. One measure is simply the annual imputed space rent reported in the NIPA tables divided by the gross household real estate from the Federal Reserve's Flow of Funds. Since 1980, the percentage has ranged from 5.6 to 6.7 percent, averaging around 6.25. The estimate for imputed rent reported in the NIPA is measured using Census and CPI data on comparable rental units. In a recent paper, Crone, Nakamura, and Voith (2004) estimate that the capitalization rate on owner occupied housing averages 9.6 percent. The authors use a hedonic regression that treats the home like a bundle of goods (i.e. an air conditioner, a full bathroom, and a bedroom) to estimate the value of the home and the capitalization rate. This capitalization rate includes not only the imputed rent observable in the NIPA tables, but other factors like advantages in taxation, the physical limitations of converting rentals to owner-occupied (and visa-versa), the risk of increases in rent, expected appreciation, and

imputed rent consumed over the life of the household equals 70 percent, which is based on a 6 percent discount rate and a 1 percent appreciation rate (Table 9).

Residual Value of the House

In addition to the value of imputed rent, housing wealth can also be accessed through a reverse mortgage and the proceeds used to support consumption in retirement.[22] Whether the residual amount of housing wealth should be annuitized and included in monthly income when calculating replacement rates is more a policy issue. It is true that today's retirees tend to hold onto their home well into retirement. Most households (90 percent of couples and 62 percent of singles) enter retirement owning their own home (Venti and Wise 2001). In the absence of a precipitating event such as the death of a spouse or entry of a family member into a nursing home, most households continue to own their own home well into their eighties. Even when a shock occurs, selling the house is still a rare event; only 4 percent of households with a death and 11 percent of those with a nursing home entrant sell their house by the next wave of the HRS. In the absence of a shock, households that sell their house are likely to purchase another home and increase, rather than reduce, home equity. Thus, people do not appear interested in tapping their home equity for non-housing consumption.[23]

The fact that households do not currently tap home equity does not mean that policymakers should ignore the wherewithal that the elderly have to support themselves in retirement. Refusing to tap home equity may be a luxury that retirees and society can enjoy when the labor force is swelled with baby boomers and retirees are the relatively small number of depression-born babies. But as the baby boomers retire and the rate of growth of the labor force slows, the burden on workers of supporting increasing numbers of retirees will grow. It seems difficult in such an environment not to consider the residual value of

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appeal of ownership, all of which make home ownership more valuable than the observable rental price. Another study – Flavin and Yamashita (1998) – also attempts to construct a comprehensive estimate of the return to homeownership and reports a figure of 6.5 percent.

[22] Equating the residual value with the amount that can be accessed through a reverse mortgage assumes that the home owner and financial institution both discount the rental stream at the same rate of interest, that all home owners live in their homes until death, and that the prices in the reverse mortgage market are not affected by moral hazard, adverse selection, or administrative costs.

[23] The results from the HRS and AHEAD closely correspond to findings from a 2000 AARP survey that revealed that more than 80 percent of respondents age 45 and over and more than 90 percent of those 65 and over would like to stay in their own home for as long as possible. Even if they should need help caring for themselves, 82 percent would prefer not to move from their current homes.

housing equity as available for consumption. Therefore, on practical grounds, it may be desirable to include in the numerator of replacement rate calculations the annuitized residual value less any outstanding mortgage.

Replacement Rates Including Imputed Rent

Table 10 presents replacement rates as the definition of retirement income is expanded from Social Security alone to include pensions, financial assets, imputed rent, and finally the annuitized value of residual owner-occupied housing less mortgage debt. In the first case, pre-retirement income is defined in terms of AIME including earnings above the Social Security maximum, returns on financial assets, and imputed rent. In the second case, pre-retirement earnings is equal to the highest five of the last ten years prior to retirement indexed by prices to the year of retirement. The bottom line is that once imputed rent is added to the numerator and denominator, median replacement rates for couples and singles with pensions meet or exceed the 65-75 percent test of adequate replacement, depending on the definition of pre-retirement income. For those households without pensions, the median replacement rates fall below the adequacy threshold – the shortfall is modest when pre-retirement earnings are defined in terms of AIME and more substantial when defined as the best out of the last ten. Certainly households without pensions with replacement rates below the median – about 20 percent of the total – must be struggling.

Conclusion

This paper sheds light on five major issues. First, the median replacement rate for newly retired worker beneficiaries according to both SSA and HRS is about 42 percent of AIME. The outcome is the net of two offsetting effects. On the one hand, real-world workers in the middle of the wage distribution have AIMEs that are less than 100 percent of the *average wage index*. This occurs because real-world workers do not have continuous earnings; they experience unemployment and disability and, in the case of women, drop out of the labor force to care for children. Interrupted careers produce lower AIMEs and higher replacement rates than SSA's policy model. Thus, if the lower earnings were the only factor at play, the median replacement rate for new beneficiaries would exceed that of the "medium earner." The countervailing factor is that workers retire before the normal retirement age and

receive actuarially reduced benefits that lower replacement rates. In fact, based on actual retirement patterns, the replacement rate for the "medium earner" should be about 40 percent of AIME. So beneficiaries receive replacement rates slightly higher than the policy model would suggest because of lower earnings.

Second, men and women have very different earnings profiles. The median woman receives lower wages than her male counterpart, averages 13 years of zeros in her earnings history, and ends ups with an AIME well below that of the "medium earner." The median man, on the other hand, enjoys higher wages, has few years of zero earnings, and has an AIME (most likely coincidentally) virtually identical to that of the "medium earner." This earnings differential explains why the median replacement rate for a female worker is 52 percent and for a male worker 37 percent.

Third, the relationship between individual worker replacement rates and replacement rates received by households reveals two patterns. First, the median replacement rate for two-earner couples is significantly lower than that for the couple where the wife does not work (41 percent versus 58 percent). This outcome is virtually inevitable in a system that provides a 50-percent spouse's benefit. As women go to work, they increase the denominator with their AIME but often fail to increase the numerator. Second, the range of replacement rates is narrower for couples (62 percent to 32 percent) than for individual workers (72 percent to 30 percent). The high earned replacement rates for individuals disappear because they tend to belong to married women for whom the 50-percent spouse's benefit dominates the benefit based on their own earnings.

Fourth, the median Social Security replacement rate for those covered by an employer-sponsored pension is significantly lower for single-person households (40 percent versus 49 percent) and somewhat lower for couples (42 percent versus 48 percent) than for those households without pension coverage. The reason is that those with pension coverage have higher lifetime earnings. But adding payments from defined benefit plans and the annuitized value of defined contribution accumulations more than offsets the lower Social Security benefits, bringing the median replacement rate for those with pension coverage to 70 percent for couples and 76 percent for single individuals. Adding the annutized value of financial assets raises all replacement rates by another 10 percentage points.

Fifth, the monthly value of imputed rent that will be consumed over the life of the household should be incorporated in the numerator of the replacement rate since it will be used to support consumption in retirement. For consistency, imputed rent should also be included in the denominator since the household was receiving imputed rent as part of its income before retirement. Making this adjustment produces replacement rates for those with pensions of 79 percent for couples and 89 percent for single person households. Those without pensions have replacement rates, using this comprehensive measure of income both before and after retirement, of 62 percent for couples and 63 percent for singles. These replacement rates drop about 15 percentage points, however, when recent earnings (the highest five years of the last tern) are used as the benchmark.

The ultimate message from this analysis is that households retiring today are in pretty good shape. Regardless of how retirement income and pre-retirement income are defined, the majority of households with pensions appear to meet the threshold of adequacy. Those without pensions do not fare as well, and some must be really struggling. But overall the picture is good. But today is in some sense the "golden age" of retirement income. Today's retirees are claiming Social Security benefits before the rise in the retirement age to 66 and then 67, which is equal to an across-the-board cut in benefits. Today's retirees also do not face the huge deductions in their Social Security check to cover Medicare premiums for Parts B and D that tomorrow's retirees will. And today, the average retiree does not pay personal income tax on his Social Security benefits, whereas future retirees will increasingly see a portion of benefits subject to taxation. Finally, most of today's retirees are covered primarily by a defined benefit plan and do not face the uncertainty associated with the inadequate lump-sum payments from 401(k) plans. The comfortable circumstances of today's retirees make it very hard to call attention to the challenges that future retirees will face.

Table 1. *Replacement Rates for Hypothetical Workers, 2004*

Earner	Replacement Rate	
	Age 62	Age 65
Scaled Low Earner	45.2	56.5
Scaled Medium Earner	33.5	41.9
Scaled High Earner	28.2	35.2
Steady Maximum Earner	23.8	29.8

Source: 2004 Trustees Report, Table VI.F11

Table 2. *Average Number of Years with Zero Earnings[a] of New Retired-Worker Beneficiaries*

Year	Total		Men		Women	
	SSA[b]	HRS	SSA[b]	HRS	SSA[b]	HRS
Before 1999		9.5		5.8		13.6
1999	9.5	9.8	6.1	6.2	13.7	13.4
2000	9.2	9.4	6.2	5.7	13.8	13.8
2001	9.4	8.5	6.0	5.0	13.5	12.7
2002	9.1	8.7	5.9	5.5	12.9	12.7

Source: Authors' calculations from the HRS and Social Security Administration. 2004. *Performance and Accountability Report*, FY 2004, pp125.

a. Years of zero earnings shown are measured from age 22 to the last year before first collecting retired-worker benefits. This calculation does not subtract out the lowest 5 years as is done in the benefit calculation.

b. Based on the 1% Continuous Work History Sample supplemented with information from the Master Earnings File for persons retiring in 1999-2003.

Table 3. *Median Social Security Replacement Rates[a] of New Retired-Worker Beneficiaries*

Year	Total		Men		Women	
	SSA[b]	HRS	SSA[b]	HRS	SSA[b]	HRS
Before 1999		42.4		35.9		52.3
1999	42.8	44.1	37.0	37.6	52.0	50.6
2000	42.9	43.0	37.5	37.2	52.4	52.0
2001	42.6	42.0	36.7	36.6	51.8	52.1
2002	42.1	40.6	36.5	35.5	50.8	49.7

Source: Authors' calculations from the HRS and Social Security Administration. 2004. *Performance and Accountability Report*, FY 2004, pp125

a. The replacement rate is calculated as the ratio of the retired worker's benefit based on his or her own earnings to his or her average indexed monthly earnings (AIME). The AIME is the worker's highest 35 years of earnings, which have been adjusted for changes in the average wage index to the year of attainment of age

b. Based on the 1% Continuous Work History Sample supplemented with information from the Master Earnings File for persons retiring in 1999-2003.

Table 4. *Median Social Security Replacement Rates[a] of New Retired-Worker Beneficiaries, by AIME Quintile*

Year	Source	AIME Quintile				
		Lowest	Second	Third	Fourth	Highest
1999	SSA	72.5	51.6	41.5	35.9	31.2
	HRS	72.0	50.6	41.8	36.2	31.9
2000	SSA	71.6	52.2	41.5	36.8	31.5
	HRS	72.0	49.6	40.1	35.4	30.1
2001	SSA	70.9	50.8	40.5	35.0	30.2
	HRS	72.0	48.9	39.9	35.4	30.5

2002	SSA	70.1	50.8	40.5	35.0	30.2
	HRS	68.9	47.9	39.1	34.3	29.1

Source: Authors' calculations fromthe HRS and Social Security Administration. 2004. *Performance and Accountability Report*, FY 2004, pp128

a. The replacement rate is calculated as the ratio of the retired worker's benefit based on his or her own earnings to his or her average indexed monthly earnings (AIME). The AIME is the worker's highest 35 years of earnings, which have been adjusted for changes in the average wage index to the year of attainment of age 62.

b. Based on the 1% Continuous Work History Sample supplemented with information from the Master Earnings File for persons retiring in 1999-2003.

Table 5. *Median Social Security Replacement Rates for HRS Households*

Household type	Replacement rate		Number of HRS observations
	Predicted from SSA study	HRS	
Couples	44.6	44.1	2,581
Spouse AIME = 0	55.5	58.0	598
Spouse AIME>0	41.5	41.1	1,983
Single	47.3	45.2	1,336
Men	37.0	38.7	385
Women	52.0	48.7	941
All	45.5	44.4	3,917

Source: Authors' predictions based on results of SSA's *Performance and Accountability Report* (2004) and calculations from the HRS.

Table 6. *Median Social Security Replacement Rates for HRS Households, by AIME Quintiles*

AIME Quintile	Singles	Couples
Lowest	72.0	62.7
Second	51.0	48.6
Third	42.2	43.8
Fourth	36.9	39.1
Highest	32.3	33.4
All	42.2	43.8

Source: Authors' calculations from the HRS.

Table 7. *Median Replacement Rates for Couples and Single Individuals by Type of Coverage*

Replacement income source	Couples		Single individuals	
	Without Pensions	With Pensions	Without Pensions	With Pensions
Denominator = AIME				
Social Security	47.9	42.3	49.1	40.1
Social Security + pensions[a]	47.9	70.0	49.1	76.4
Social Security + pensions[a] + financial assets[b]	60.0	81.5	59.4	89.6
Denominator = AIME plus earnings above the cap + Earnings on Financial Assets				
Social Security	43.0	37.7	46.2	38.0
Social Security + pensions[a]	43.0	63.3	46.2	70.4
Social Security + pensions[a] + financial assets[b]	55.3	73.8	57.6	86.3
Denominator = CPI Indexed-Top 5 Household Pre-Retirement Earnings + Earnings on Financial Assets				
Social Security	34.4	29.5	32.8	27.8
Social Security + pensions[a]	34.4	51.5	32.8	55.7
Social Security + pensions[a] + financial assets[b]	45.4	60.1	44.4	66.9
Addendum: Percent of retiring population[c]	25	55	11	9

Source: Authors' calculations from the HRS.

a. For those with pension coverage, IRA assets are included in defined contribution wealth; for those without pension coverage IRA assets are classified as part of financial assets.

b. Financial assets are annuitized using a factor of 13.86 for households; 11.27 for single men; and 12.45 percent for single women.

c. In the case of couples, the 55 percent consists of 15 percent of retirees with a defined contribution plan only, 24 percent with a defined benefit plan only, and 16 percent with both. The 9 percent of retirees who are single and covered by a pension consists of 3 percent with a defined contribution plan only, 4.5 percent with a defined benefit plan only, and 1.5 percent with both.

Table 8. *Rent as a Percent of Total House Value*

Discount Rate	Appreciation Rate		
	0.5 percent	1.0 percent	1.5 percent
3 percent	2.49	1.98	1.48
5 percent	4.48	3.96	3.45
6 percent	5.47	4.95	4.43
7 percent	6.47	5.94	5.42
9 percent	8.46	7.92	7.39

Source: Authors' estimates

Table 9. *Present Discounted Value of Imputed Rent as a Percent of Total House Value*

Discount Rate	Appreciation Rate		
	0.5 percent	1.0 percent	1.5 percent
3 percent	45.3	38.3	30.3
5 percent	65.9	61.5	56.6
6 percent	73.0	69.5	65.6
7 percent	78.6	75.8	72.7
9 percent	86.4	84.7	82.7

Source: Authors' estimates

Table 10. *Median Replacement Rates Including Housing for Couples and Singles by Pension Coverage*

Replacement income source	Couples		Singles	
	Without Pensions	With Pensions	Without Pensions	With Pensions
Denominator = AIME plus earnings above the cap + Earnings on Financial Assets + Imputed Rent				
Social Security	38.7	34.0	39.8	32.2
Social Security + Pensions[b]	38.7	57.8	39.8	62.8
Social Security +Pensions[b] + Financial Assets[c]	48.9	66.8	48.8	71.4
Social Security +Pensions[b] + Financial Assets[c]+ Imputed Rent	60.2	76.2	62.2	87.9
Social Security +Pensions[b]+ Financial Assets[c] + Imputed Rent + Residual Housing Wealth	62.3	78.5	63.3	89.3
Denominator = CPI Indexed-Top 5 Household Pre-Retirement Earnings + Earnings on Financial Assets + Imputed Rent				
Social Security	31.6	27.0	30.1	29.4
Social Security + Pensions[b]	31.6	47.6	30.1	49.9
Social Security +Pensions[b] + Financial Assets[c]	41.8	55.2	39.1	59.1
Social Security +Pensions[b] + Financial Assets[c]+ Imputed Rent	50.2	63.1	50.8	70.0
Social Security +Pensions[b]+ Financial Assets[c] + Imputed Rent + Residual Housing Wealth	52.1	64.9	52.8	72.1
Addendum: Percent of retiring population[c]	25	55	11	9

Source: Authors' calculations based on the HRS.

a. Assets are annuitized using a factor of 13.86 for households; 11.27 for single men; and 12.45 percent for single women.

b. For those with pension coverage, IRA assets are included in defined contribution wealth; for those without pension coverage IRA assets are classified as part of financial assets.

c. The real return on financial assets is assumed to be 2.6 percent.

References

AARP. 2000. "Fixing to Stay: A National Survey of Housing and Home Modification Issues."

Au, Andrew, Olivia S. Mitchell and John W. R. Phillips. 2004. "Modeling Lifetime Earnings Paths: Hypothetical versus Actual Workers." Working Paper 2004-3. Boettner Center for Pensions and Retirement Research.

Banks, J., Blundell, R. and S. Tanner, S. (1998) "Is There a Retirement-Savings Puzzle?" *American Economic Review* 88:4 769–88.

Bernheim, B. Douglas. 1992. Is the Baby Boom Generation Preparing Adequately for Retirement. Technical Report. Merrill Lynch. Princeton N.J.

Bernheim, D., Skinner, J. and S. Weinberg (2001) "What Accounts for the Variation in Retirement Wealth among US Households?" *American Economic Review* 91:4, 832–57

Boskin, Michael J. and John B. Shoven. 1984. "Concepts and Measurement of Earnings Replacement during Retirement." NBER Working Paper No.1360. Cambridge, MA. National Bureau of Economic Research.

Bosworth, Barry, Gary Burtless, and C. Eugene Steuerle. 1999. "Lifetime Earnings Patterns, the Distribution of Future Social Security Benefits, and the Impact of Pension Reform" CRR WP 1999-06. Chestnut Hill MA: Center for Retirement Research at Boston College.

Clingman, Michael and Orlo Nichols. 2004. "Scaled Factors for Hypothetical Earnings Examples under the 2004 Trustees Report Assumptions." Actuarial Note, 2004.3. Office of the Chief Actuary, Social Security Administration.

Congressional Budget Office. 1993. *Baby Boomers in Retirement: An Early Perspective.* September.

Crone, Theodore, Leonard Nakamura, and Richard Voith. 2004. "Hedonic Estimates of the Cost of Housing Services: Rental and Owner-Occupied," *International Conference on Index Number Theory and the Measurement of Prices and Productivity.* Vancouver, British Columbia.

Donkar, Eli N. 1981. "Average Wages for Indexing under the Social Security Act and the Automatic Determinations for 1979-81." Actuarial Note 103, Office of the Chief Actuary, Social Security Administration.

Engen, Eric, William Gale and Cori Uccello. 1999. "The Adequacy of Retirement Saving." *Brookings Papers on Economic Activity.* Number 2, pp. 65-165.

Flavin, Marjorie and Takashi Yamashita. "Owner Occupied Housing and the Composition of the Household Portfolio over the Life Cycle." NBER Working Paper No.6389. Cambridge, MA.: National Bureau of Economic Research.

Gustman, Alan and Thomas Steinmeier. 1999. "Effects of Pensions on Savings: Analysis with Data From the Health and Retirement Study." Carnegie-Rochester Conference Series on Public Policy. Vol. 50. June. P271-324.

Hurd, Michael and Susann Rohwedder .2003. "The Retirement Consumption Puzzle: Anticipated and Actual Declines in Spending at Retirement." NBER Working Paper No.9586. Cambridge, MA. National Bureau of Economic Research.

Hurst, Erik. 2003."Grasshoppers, Ants, and Pre-Retirement Wealth: A Test of Permanent Income." NBER Working Paper No.10098. Cambridge, MA.: National Bureau of Economic Research.

Juster, F. Thomas and Richard Suzman. 1995. "An Overview of the Health and Retirement Study." Journal of Human Resources, Vol. 30, Supplement, pp. S7-S56.

Moore, James F. and Olivia S. Mitchell. 1997. "Projected Retirement Wealth and Savings Adequacy in the Health and Retirement Study." NBER Working Paper No. 6240. Cambridge, MA.: National Bureau of Economic Research.

Scholz, John Karl, Ananth Seshadri, and Surachai Khitatrakun, "Are Americans Saving 'Optimally' for Retirement?" NBER Working Paper 10260. Cambridge, MA.: National Bureau of Economic Research.

Social Security Administration. 2004. *Performance and Accountability Report*, Fiscal Year 2004.

Steuerle, Eugene, Christopher Spiro, and Adam Carasso. 2000. "Do Analysts Use Atypical Workers to Evaluate Social Security?" *Straight Talk on Social Security and Retirement Policy*, No. 19 (March 15).

U.S. Bureau of the Census. 2005. Annual Statistical Supplement: 2004-2005. http://www.census.gov/prod/www/statistical-abstract-04.html

Venti, Steven F., and David A. Wise. 2001. "Aging and Housing Equity: Another Look." NBER Working Paper 8608. Cambridge, MA.: National Bureau of Economic Research.