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Excel spreadsheets for the calculations are available upon request. They will be made available on at least one author's homepage.

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What is the value of an individual's assets that can be used to satisfy retirement income needs? And, what is his or her current asset mix? When answering these questions, Fraser, Jennings, and King (2001) and Reichenstein (1998, 2000, and 2001) conclude individuals should estimate the present value of projected Social Security payments and include this value as a "bond" in their personal portfolios. Individuals' portfolios are usually substantially different when the value of Social Security is included than when it is excluded. When answering these questions, these authors conclude the profession has been miscalculating individuals' "true" portfolios by excluding Social Security. If individuals optimize their traditional portfolios, which exclude Social Security, then they have excessively conservative, sub-optimal true portfolios. But, before we can calculate the true portfolios, we must be able to estimate the present value of Social Security retirement benefits.

There are three objectives of this paper. First, we explain the current structure of Social Security retirement benefits. Professionals who advise individual investors should have knowledge of the benefits structure. With this knowledge, they can add value to clients by helping them decide when to begin receiving benefits. Second, we provide models to estimate the present value of expected Social Security retirement benefits.[1] These models rely on the similarities between inflation-linked Treasury bonds and Social Security. Third, we demonstrate that including the value of Social Security benefits can substantially change the calculation of the current asset mix.

[1] The Social Security program makes payments for other reasons besides retirement. For example, it makes payments to a family if a worker becomes disabled or dies prematurely. This paper is concerned with retirement needs and the value of Social Security retirement benefits. Although these other insurance benefits have value, estimations of their values are beyond the scope of this paper.

This paper's objectives are germane to the wealthy and their advisors. Maximizing Social Security's value requires and understanding of the benefits structure. Providing advice as to when a client should begin receiving payments is one area that an advisor can add value. For someone with $10 million in assets, Social Security's value can be more than 5% of the portfolio.

SOCIAL SECURITY RETIREMENT BENEFITS

Description of Entitlements

This section describes Social Security entitlements that apply to most individuals. As with many government programs, there are exceptions. Additional details are available on the Social Security Administration website at http://www.ssa.gov and in a TIAA-CREF pamphlet entitled "Making Sense of Social Security," which is available at http://www.tiaa-cref.org/wc_libser/mss/index.html.

Someone gains eligibility for Social Security benefits when he or she earns 40 work credits. A work credit is earned for each $830 (in 2001) of earnings subject to Social Security taxes, and up to four credits can be earned in each year. Almost all Americans earn at least 40 credits and are entitled to Social Security benefits. Benefit payments may begin as early as age 62 or as late as age 70. The later one starts, the higher the monthly benefit payment. Once benefits begin, payments are adjusted annually with consumer prices. This cost of living adjustment (COLA) ensures beneficiaries that payments will keep pace with inflation. Social Security may replace 60% of pre-retirement income for someone earning $15,000 a year, but only 25% of income for someone earning $74,000.

To repeat, Social Security benefit payments may begin as early as age 62 or as late as age 70. For someone born before 1938, the starting age for full benefits—henceforth, Full

Retirement Age (FRA)—is 65. (Terms used by the Social Security Administration are capitalized, while terms defined by this paper are not.) It is later for people born after 1937. Exhibit 1 summarizes the FRA by year of birth and the adjustments that occur if someone begins receiving benefits before or after FRA. The FRA is 65 years and two months for someone born in 1938, and it then increases by two months each year. It is 66 years for people born from 1943 through 1954. It increases by two months a year beginning in 1955, and it is 67 years for people born after 1959. The reduction from full benefits is 5/9% for the first 36 months (6 2/3% per year) before FRA and 5/12% for any additional months (5% per year) before FRA. Again, for someone born in 1938 the FRA is 65 years and two months. If benefits begin at age 62, the reduction is 36 (5/9%) + 2 (5/12%) or 20 5/6%, where 36 denotes the first 36 months of early retirement and 2 denotes the additional two months of early retirement; the benefits fraction at age 62 is 79 1/6%. Individuals who delay receiving Social Security benefits until after Full Retirement Age receive Delayed Retirement Credits (DRC). If born in 1935 or 1936, DRC is 6% per year (0.5% per month). The DRC is larger for people born after 1936, reaching 8% for those born after 1942.

Social Security benefits are based on a worker's earned income (subject to Social Security taxes). Consider Jane whose earnings record entitles her to a certain level of monthly benefits. In addition, others may be entitled to benefits based on her earnings record, including her husband, dependent children, parents (if over age 62 and her dependents), and possibly divorced husband. Jane's current husband may receive up to 50% of her benefit. Dependent unmarried children under age 18 (or 19 if a full-time high-school student) are eligible for up to 50% of the level of her benefit. However, there is a maximum family benefit *based on her earnings*, which varies from 150% to 188% of her monthly benefits.

If Jane is married, she has a dual entitlement. She is entitled to the larger of benefits based on her earnings record or spousal benefits based on her husband's record. We defer discussion of spousal benefit until later in the paper.

Calculation of Social Security Retirement Benefits

Suppose Anna Mathias was born January 3, 1936, and retires and begins receiving payments immediately after turning 62 in 1998. A detailed review of the calculation of Social Security benefits for someone born in 1936 is available at http://www.ssa.gov/pubs/10070-98.html. The first step records her actual earnings each year of her work career, but not more than that year's maximum income subject to Social Security taxes ($80,400 in 2001). For example, if she earned $6,000 in 1958, she should record $4,200 since Social Security taxes were applied to a maximum of $4,200 that year.

The second step adjusts her earnings history for wage inflation as measured by the average national wage level. For example, if she earned at least $4,200 in 1958, her inflation-indexed earnings would be $29,610 or $4,200 (7.05), where 7.05, the Index Factor, adjusts 1958 dollars for wage inflation. Past earnings are indexed for wage inflation through the year the person turns age 60, and actual earnings are considered thereafter. Thus, the Index Factor is 1.0 for 1996 and later years.

The next step calculates her Average Indexed Monthly Earnings, AIME. It is the average monthly earnings for the 35 calendar years with the highest indexed earnings. If she had 25 years of earnings, AIME includes ten years of zero earnings. In the early years, relatively little income was subject to Social Security taxes even after adjusting for wage inflation. Thus, the highest 35 years are generally the most recent years. AIME is the sum of

these 35 earnings divided by 420 (35 x 12 months). Suppose she retires in 1998 with an AIME of $4,157; her AIME98 is $4,157.

The next step converts AIME98 into a corresponding Primary Insurance Amount, PIA. For someone born in 1936, the Bend Points are $477 and $2,875, and they will not change. (The definitions of the Bend Points will soon become clear.) The Bend Points are adjusted each year with inflation, so they will be higher for someone born after 1936. Anna's PIA in 1998, PIA98, is $1,388. It is the sum of three amounts (rounded down to the whole dollar): 90% of the first $477 of AIME, 32% of the next $2,398, and 15% of the amount over $2,875 (up to the maximum subject to Social Security tax), where $477 and $2,398 come from the Bend Points. The multiples guarantee that retirees will receive 90% of the first few dollars of average monthly income, but much smaller portions of higher income. Even though Anna paid the same amount of taxes on her last dollar of Social Security income as someone with average income below $477, she only receives one-sixth the benefit; if we consider taxes and benefit reductions due to earnings limits (to be discussed later), she receives even less.

The final step is to adjust her PIA for the early retirement date. Her Full Retirement Age (FRA) is 65. Since she applies for payments at age 62 (and zero months), she receives 80% of PIA98 or $1,110.40 per month beginning in February 1998. Her reduction is 20% or 36 (5/9%). Her monthly payment is $1,110.40 in 1998, and payments will increase each year with inflation as measured by the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

Reductions and Taxation of Benefits

We need to estimate the present value of Social Security benefits—both before taxes and after taxes. Reichenstein (1998, 2000, and 2001) argues that we should first convert all

asset values to after-tax dollars and then calculate the asset allocation based on after-tax funds.[2] Some financial advisors may prefer to use the present value of before-tax benefits. This study provides estimates of the present value of both before-tax and after-tax benefits.

Monthly benefits may be reduced or eliminated due to three factors. The first two factors directly reduce or eliminate benefits, while the third—taxation—indirectly reduces benefits. The first factor is an Earnings Test. It applies to individuals who begin receiving payments before reaching Full Retirement Age. In years before reaching FRA, Social Security benefits are reduced by $1 for every $2 of *earned income* above $10,680 (in 2001). In the year someone reaches Full Retirement Age, benefits may be reduced by $1 for every $3 of earned income above $25,000 (in 2001). After reaching Full Retirement Age, individuals can receive full benefits with no limit on earnings.

Let's say Joe begins receiving Social Security benefits at age 62 in January 2001 and he is entitled to $600 a month ($7,200 for the year). During the year, he earns $20,000 ($9,320 over the $10,680 limit). Social Security would withhold $4,660 of his Social Security benefits, but he would still receive $2,540 in benefits. The $4,660 is $1 for every $2 over the limit. This is equivalent to a 65% "tax rate" on his benefits, $4,660/$7,200.

Now, suppose Joe was 64 at the beginning of the year, but reaches Full Retirement Age of 65 in July 2001. He earns $56,000 during the year, including $28,000 from January through June. The amount of benefits withheld would be $1,000 ($1 for every $3 earned through June above the $25,000 limit). For 2001, he would receive $6,200 in Social Security benefits. Beginning in July (when he reached Full Retirement Age), he would receive full

[2] His reasoning is that withdrawal of say $1,000 of *after-tax funds* from a money market fund held in a taxable account can buy $1,000 of goods and services, while withdrawal of $1,000 of *before-tax funds* from say a 401(k) will buy less because of taxes.

benefits no matter how much he earned. See page 6 of SSA Publication No. 05-10069 for a special rule that applies to someone who continues to earn money in the first year of retirement but retires before reaching full retirement age.

This Earnings Test is based on *earned income*, that is, wages, salary, and self-employed income. The following do not count as earned income: interest income, dividends, capital gains, withdrawals from a 401(k), 403(b), traditional IRA, Keogh and other deductible pensions, and withdrawals from non-qualified tax-deferred annuities.

Pensions from work not covered by Social Security are the second factor that may reduce or eliminate Social Security benefits. This has two aspects: a Windfall Elimination Provision that affects benefits based on the worker's earnings record and a Government Pension Offset that affects benefits based on a spouse's earnings record. The Windfall Elimination Provision applies to benefits based on the worker's earnings record when he or she also receives pension benefits from an employer that does not withhold Social Security taxes (*e.g.*, certain federal, state, or local government agencies).

Suppose Betty receives retirement benefits from the Texas State Teachers Retirement System, which is not part of the Social Security system. In addition, she paid Social Security taxes on "substantial" earnings for 20 years or less. In this case, when converting AIME to PIA, the 90% factor applied below the first Bend Point is reduced to 40%. If she paid Social Security taxes on "substantial" earnings for 21 to 30 (or more) years, the 90% factor varies by 5% a year from 45% to 90%. See SSA Publication No. 05-10045 for details including definitions of "substantial" earnings.

Assume Betty, the Texas teacher, receives $1,000 a month from the Texas State Teachers Retirement System and is eligible for $300 a month from Social Security based on

her earnings record. Bob, her husband, receives $1,200 a month from Social Security. Betty qualifies for the larger of a) $300 based on her record or b) spousal benefits based on Bob's record. In the absence of the teacher's pension, if she has reached FRA, she would be entitled to spousal benefits of $600 a month, half of Bob's benefit. The Government Pension Offset reduces the amount of the spouse's or widow(er)'s benefit by two-thirds of the amount of the government pension. For Betty, the offset is $667 (two-third's of $1,000), which eliminates her spousal benefits. Thus, she should collect $300 in Social Security benefits based on her record. (As an aside, her teacher's pension will not affect Bob's Social Security benefits when based on his record.) For further detail, see "A Pension from Work Not Covered by Social Security," SSA Pub no. 05-10045, and "Government Pension Offset," SSA Pub no. 05-10007.

Taxation of benefits is the third reduction of Social Security benefits. The Earnings Test, discussed above, applies only to individuals below Full Retirement Age. The Income Test, discussed here, applies to everyone who receives Social Security benefits regardless of age. The Income Test is based on Combined Income, which is the sum of Adjusted Gross Income plus nontaxable interest plus one-half of Social Security benefits.

A single person with Combined Income between $25,000 and $34,000 would have to pay taxes on up to 50% of Social Security benefits. If Combined Income exceeds $34,000, up to 85% of benefits may be taxable. For a couple filing jointly, the income thresholds are $32,000 and $44,000. Couples filing separately who lived together automatically pay taxes on 85% of benefits.

Consider a couple filing jointly with $45,000 of adjusted gross income, $2,000 of nontaxable municipal interest, and $18,000 of Social Security payments. Combined Income

is thus $56,000—the $45,000 plus $2,000 plus half of Social Security payments. The taxable portion of Social Security payments is the minimum of three totals. The first total is the sum of 50% of income between $32,000 and $44,000 plus 85% of income above $44,000. This is $16,200. The second total is 85% of Social Security benefits, which is $15,300. The third total is the sum of one half the Social Security benefits plus 85% of the amount above $44,000. This total is $19,200. This couple must pay taxes on 85% of Social Security benefits, the minimum of the three amounts. As this example shows, a couple need not be living in luxury before it has to pay taxes on 85% of benefits.[3]

To estimate the present value of after-tax Social Security benefits, we must consider the Earnings Test, pensions from work not covered by Social Security, and the Income Test. Practically, the Earnings Test is easy to handle since individuals affected by it will likely delay receiving benefits until reaching Full Retirement Age. The Windfall Elimination Provision and Government Pension Offset affect relatively few individuals who have pensions from work not covered by Social Security. To calculate after-tax benefits, the taxation of benefits must be reflected in the analysis. For someone in the 28% tax bracket during retirement, taxes effectively reduce Social Security benefits by up to 23.8%, 0.85(0.28).

ESTIMATING SOCIAL SECURITY'S BEFORE-TAX VALUE FOR SINGLES

To estimate the present value of Social Security benefits, we must estimate when benefits begin. Appendix 1 demonstrates that, for males and females with average life expectancy, the present value of benefits is at or near its maximum when benefits begin at age

[3] For a single beneficiary receiving $8,000 in benefits, combined income of only $33,295 is needed to reach 85% taxation; for married couples filing jointly receiving $19,000 in benefits, combined income of $46,442 is needed to reach 85% taxation. For a good example and useful table to calculate the taxable portion, see "Making Sense of Social Security" at the web site http://www.tiaa-cref.org/wc_libser/mss/index.html. Go to the chapter "How Tests and Taxes Affect Your Income," and finally click on "Do you owe tax on your Social Security benefits?" at the end of the chapter.

65. Also, it discusses factors to consider when deciding when to begin receiving benefits. We moved this analysis to an appendix because of its length and complexity. The next section illustrates our method of estimating the present value of before-tax benefits to single females, single males, widows, and widowers. We then discuss the adjustment for taxes. Finally, we discuss estimation issues.

Calculating Present Value of Before-tax Benefits for Singles

We begin by estimating the present value of *expected cash flows*, which is different from and theoretically better than the present value of *cash flows through life expectancy*. Later, we show that for singles the present value of cash flows through life expectancy is a slightly upward-biased estimate of the present value of expected cash flows. However, it is so much simpler to calculate the present value of cash flows through life expectancy. Later, we present a method of estimating the value of benefits that relies on the present value of cash flows through life expectancy with an adjustment for the bias.

We begin by estimating the theoretically preferred present value of expected cash flows. This estimated present value is the product:

(benefits fraction) (PIA at FRA) (12 months) (multiple) or Eq. 1

(initial monthly payment) (12 months) (multiple) or

(initial annual benefits) (multiple).

To illustrate the model, assume today is January 2004. Mary is single, was born in 1944, and turned 60 last month in December 2003. She recently received her annual *Your Social Security Statement* from the Social Security Administration. It says:

You have earned enough credits to qualify for benefits. At your current earnings rate, if you stop working …

At age 62, your payment would be about	$750 a month
If you continue working until …	
your full retirement age (66 years), your payment would be about	$1,000 a month
age 70, your payment would be about	$1,320 a month.

We assume she applies for benefits in the month she turns 65 and receives the first benefit one month later. Since she applies for benefits at age 65 and zero months, one year before reaching FRA, her benefits fraction is 0.933. PIA at FRA is $1,000, so her projected initial monthly payment is $933 a month to be received in January 2004. The "12 months" converts monthly payments to annual benefits to accommodate mortality tables. The initial annual benefits are $11,196. The multiple is the present value of Social Security payments assuming she receives an inflation-adjusted $1 each year she is alive beginning at age 65.

Exhibit 2 presents the calculation of the multiple. Recall that Mary is age 60. Based on updated mortality tables, there is a 0.966657 probability that she will be alive at age 65.[4] The expected cash flow is $0.966657 in 2004 dollars. There is a 0.957274 probability that she will be alive at 66 and receive a second $1 payment. The expected cash flow is $0.957274 (in 2004 dollars). There is a 0.946788 probability that she will be alive at age 67, and the expected cash flow is $0.946788 (in 2004 dollars). This procedure continues until age 120 when there is a 0.000009 probability that she will receive one last $1 payment (in 2004 dollars).

Since Social Security promises a constant real benefit, we discount the expected cash flows at today's (January 2004) long-term real yield on U.S. Treasury securities. As discussed in Fraser, Jennings, and King (2001) and Jennings and Reichenstein (2001), an

[4] See the Society of Actuaries web site at http://www.soa.org/research. We used Tables 4-5 and 4-6, the male (continued)

appropriate discount rate is today's yield on Treasury Inflation Protection Securities (TIPS) with maturity closest to her life expectancy. Like Social Security benefits, payments from TIPS are linked to consumer price inflation. Moreover, Social Security payments and TIPS are both obligations of the U.S. government. We use the mid-year convention. For example, benefits for someone age 65 are received at age 65.5. Discounting at a 3% real yield, we get the present value at age 60 at 12.32 times initial annual benefits. The multiple is 12.32 for a 60-year-old single female when the TIPS yield is 3%. The present value of Mary's expected before-tax benefits is the product of 0.933 ($1,000) (12) 12.32 or $137,935.

Benefit Reductions for Singles

Next, if necessary, we must adjust this before-tax present value for benefit reductions and taxes. We assume the Earnings Test does not apply.[5] Also, we assume there is no Government Pension Offset or Windfall Elimination Provision. If there is, the reduced benefits must be substituted for PIA at FRA. We recommend adjusting the estimated value of Social Security benefits for taxes, but some financial advisors may prefer to calculate the value before taxes. If 85% of Mary's benefits are taxable and she will be in the 28% tax bracket during retirement, the after-tax value of Social Security benefits is $105,106, or $137,935 (1 – 0.85(0.28)). When calculating her asset mix, we believe Mary should consider Social Security as a bond worth approximately $105,000 in her portfolio.

In short, we assume individuals begin receiving benefits when they reach age 65. The present value calculations rely on expected cash flows assuming annual benefits are paid at mid-year. We assume no benefits reduction due to an Earnings Test, Government Pension

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and female RP-2000 Rates for "Combined Healthy."

Offset, or Windfall Elimination Provision. The discount rate is the maturity-appropriate TIPS real yield. Then, if necessary, we recommend that benefits be reduced for taxes.

Exhibits 3 and 4 present the multiples, respectively, for single females and widows and for males and widowers for TIPS yields of 2.5%, 3%, 3.5%, and 4%. In addition, they present life expectancies. The multiples exhibit bond-pricing principles since valuing Social Security is essentially like valuing an inflation-linked bond. There is a negative relationship between multiples and interest rates. As rates rise, multiples fall and vice versa. The multiples exhibit the positive convexity of government bond prices. For example, consider a 60-year-old female. The multiple rises 0.96 if rates fall from 3% to 2.5%, but falls a smaller amount, 0.88, if rates rise from 3% to 3.5%. Naturally, multiples are highest at age 65 and fall through the retirement years. In this build-up in value before retirement and subsequent decline, the present value of Social Security benefits behaves much like other retirement portfolio assets. But they fall relatively slowly through retirement years. For example, at a 3.5% TIPS yield, a 65-year-old male has a multiple of 12.84 and a life expectancy of 17.6 years. Ten years later, after surviving more than half the 17.6 years, it is 8.77, about one-third lower. This relatively slow decline is due to two features. First, (assuming he survived the ten years) his life expectancy did not decrease from 17.6 years to 7.6 years, but only to 10.6 years. Second, the discounting process reduces the present value of expected cash flows. The more distant the cash flow, the larger the discount. As one ages, expected cash flows are much nearer. In the remainder of this section, we critique our estimation method.

Expected Cash Flows or Cash Flows through Life Expectancy

[5] If it does, she would likely delay benefits until FRA of 66. Appendix 1 estimates that, assuming she has average life expectancy, the present value of expected cash flows if she begins receiving payments at age 66 is 0.3% less than the present value if payments begin at age 65. Therefore, this model provides a good estimate even if the Earnings Test applies.

Consistent with traditional financial methods, we estimate the value of Social Security based on *expected cash flows.* An alternative approach is to estimate the value based on *cash flows through life expectancy*. For Mary, each year's expected cash flow is the probability she will be alive at the beginning of that year times $11,196. In contrast, cash flow through life expectancy assumes she is certain to receive payments until her expected date of death, and certain to receive nothing thereafter. To demonstrate that the present value of cash flows through life expectancy exceeds the present value of expected cash flows, our initial estimates of the former parallels the estimate of the latter. At age 60, Mary's life expectancy (assuming average life expectancy for a female) is 24.4 years. With a 3% TIPS yield, the present value of an $11,196 annual annuity due beginning in five years and continuing for 19.4 years is $142,586.[6] This is 3.4% larger than the present value of expected cash flows, $137,935.

Exhibit 5 presents the bias produced from estimating Social Security's value as the present value of the initial annual benefits through life expectancy (instead of expected cash flows). The bias is small. In fact, the 3.4% bias for a 60-year-old female is the largest bias for females or males age 80 or younger. Thus, singles—females, males, widows, and widowers—can approximate Social Security's value by discounting cash flows through life expectancy.

Moreover, there are advantages to discounting cash flows through life expectancy. It better accommodates the influence of family history on life expectancy. If Mary comes from a line of long-lived ancestors, she could estimate Social Security's value based on a longer but more appropriate expected life.

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[6] There are three parts to this calculation. To calculate the present value *of the annuity due* at age 65, insert into a financial calculator n=19.4, i =3%, PMT = $11,196, FV =$0 and compute the PV of $167,757. To move payments from the beginning of year to mid-year, divide by $(1.03)^{0.5}$ and get $165,296. To calculate the present value at age 60, insert FV = $165,296, n=5, i = 3%, PMT = $0 and compute the PV of this lump sum, which is

(continued)

Now that we have established that the bias is small when we estimate Social Security's value based on cash flows through life expectancy, we introduce a simpler method. We estimate the value as the present value of the initial monthly payment for the life expectancy and then adjust for the bias. The value of $933 a month annuity due for 232.8 months (19.4 years times 12) beginning in 60 months when discounted at 0.2466% a month ($(1.03)^{1/12} - 1 = 0.002466$) is $142,773.[7] Since the bias from Table 5 is 3.4%, the final estimated value is $142,773 (1 – 0.034), or $137,919. This estimate is trivially different than the $137,935 estimate of present value of expected cash flows.

Other Criticisms

We presented two estimation methods: one estimates the value of expected cash flows, while the other estimates the value of cash flows through life expectancy and then adjusts for the bias. There are at least three potential criticisms that apply to both methods. First, we assume benefits begin at age 65. Second, we assume the Earnings Test does not reduce benefits. Third, we estimate the value of projected benefits based in part on future earnings.

The Appendices suggest that the first assumption does not represent a serious problem. For singles and couples with average life expectancy, the present value of projected benefits is approximately the same whether benefits begin at age 62 or 63 or any age through 70. Individuals adversely affected by the Earnings Test will probably not begin receiving benefits until they attain Full Retirement Age. And, as we just said, the present value of cash flows

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$142,586. (For a lump sum, it doesn't matter if the calculator is set to annuity due or ordinary annuity.)

[7] There are two parts to this calculation. To calculate the present value *of the annuity due* at age 65, insert into a financial calculator n=232.8, i =0.2466%, PMT = $933, FV =$0 and compute the PV of $165,510. To calculate the present value at age 60, insert FV = $165,510, n=60 months, i = 0.2466, PMT = $0 and compute the PV of this lump sum, which is $142,773. A 3% rate compounded annually corresponds to a 0.2466% rate compounded monthly. If the discount (interest) rate is set at 0.25% per month, the present value is 0.56% less. This is well within estimation error. So, someone could estimate Social Security's value by setting the monthly rate at annual rate/12.

assuming payments begin at FRA is close to the present value if payments begin at age 65. The third criticism is more of a concern. The annual *Your Social Security Statement* projects benefits assuming earnings continue at the current real level until at least age 62. For someone age 50, this *Statement* may project benefits at FRA of $1,400, while actual benefits might be $1,250 if he or she drops out of the labor force today (at age 50). Even if he or she continues to work, conservatism suggests that Social Security's *current value* should not reflect the additional retirement benefits from *future* work. We suspect that this problem will not prove severe in practice. The calculation of Primary Insurance Amount consists of 90% of the first $531 of Average Indexed Monthly Earnings (for someone who turns 62 in 2000), 32% of the next $2,671, and 15% of the remaining AIME. And, AIME only considers each year's income up to that year's Social Security income limit. Due to this weighting scheme, for people age 50 or older, there is likely to be little difference between their PIA if they quit work today and their PIA if they continue to work. This criticism is more of a problem for individuals under age 50.

ESTIMATING SOCIAL SECURITY'S BEFORE-TAX VALUE FOR COUPLES

The couples' model estimates the present value of expected cash flows to a couple with average life expectancy. It thus follows the spirit of the singles' model. In this section, we first describe spousal and survivor's benefits. We then illustrate the couples' model for a same-age couple. We then present multiples for couples the same age and when one spouse is three years younger than the other.

Spousal and Survivor's Benefits

A spouse is entitled to the larger of 1) 100% of benefits based on his or her earnings record or 2) up to 50% of the spouse's benefits. Consider the couple, Jan, age 63, and Bob,

age 66. Both have Full Retirement Ages of 66. Based on her record, Jan has a Primary Insurance Amount at FRA of $800. Based on his record, Bob has a PIA at FRA of $1,000. Now consider Jan's choices. Based on her record, she could begin benefits today and receive $640 a month, 80% of $800. Her benefits fraction is 0.8, 1 – 36(5/9%).

Alternatively, Jan may receive spousal benefits based on Bob's record. The rules for spousal benefits are more complex. If she had reached FRA, she would be entitled to 50% of his PIA at FRA or $500. But spousal benefits are reduced by 25/36% for each month begun before FRA. Since she is 63, she could receive $375 a month, 75% of $500, where 75% is 1 – 36 (25/36%). Furthermore, Jan can only begin receiving spousal benefits before she reaches FRA if Bob has begun receiving benefits. Once Jan reaches FRA, she is entitled to 50% of Bob's PIA when he reached FRA (or 100% of her own if larger); spousal benefits do not reflect Delayed Retirement Credits. If Bob delays the beginning of benefits until age 67, one year after reaching FRA, his benefits would reflect the 8% Delayed Retirement Credits, but her spousal benefits would not reflect the delayed credits.

Survivor's benefits follow different rules. Should Bob die first, Jan's survivor's benefits are 100% of Bob's monthly benefits (or she may receive 100% of her PIA if larger). Unlike spousal benefits, survivor's benefits reflect Delayed Retirement Credits.

This allows for some interesting strategies. Return to the prior example but assume Bob and Jan are both 66. Normally, Jan and Bob would receive, respectively, $800 and $1,000 a month based on their own records. Suppose Bob has a short life expectancy due to cancer. Bob could receive $400 a month spousal benefits and Jan $800 a month. If he dies in two years, Jan receives survivor's benefits of $1,160 a month for life; the 16% increase over $1,000 reflects two year's of Delayed Retirement Credits. Bob foregoes $600 ($1,000 - $400)

a month for two years, but Jan receives an additional $160 a month in survivor's benefits for her life. If she has a long life expectancy, the tradeoff may make sense.

Return to the prior example but assume Bob and Jan are both retired at age 63. Based on their own records, Bob and Jan could currently receive $800 and $640, respectively. Jan is entitled to $640 a month based on her earnings record or (assuming Bob has begun receiving benefits) $300 a month based on his record, 75% of $400 where 75% if the benefits fraction and $400 is 50% of his $800 monthly payment at age 63. She could opt today for spousal benefits of $300 a month and, when she reaches Full Retirement Age, change to her full benefits based on her record. She foregoes $340 a month for three years ($640 – $300), but receives $800 instead of $640 a month thereafter. (The above numbers ignore COLA increases that would affect all values by the same percent.)

Alternatively, suppose Bob and Jan are both 63. Jan's PIA at FRA is $1,000 and Bob's is $500. Jan is employed and earns too much money to apply for benefits since the Earnings Test would eliminate benefits. Note that the Earnings Test applies individually, even if the couple files taxes jointly. Bob could begin receiving $400 a month today—80% of $500—based on his record. When Jan retires at age 66, he could switch to 50% of her monthly benefits; their combined benefits will be 1.5 times her higher level of benefits.

Calculating Present Value of Before-tax Benefits for a Couple

We estimate the present value of a couple's before-tax Social Security benefits as the product:

(benefits fraction at age 65)(PIA at FRA of higher earner) (12 months) (couple multiple) or

(initial monthly payment) (12 months) (couple multiple) or

(initial annual benefits) (couple multiple). Eq.2.

Appendix 2 concludes that the present value of a same-age couple's expected benefits is at or near its maximum when benefits begin at age 65, whether their Full Retirement Age is 65, 66, or 67. Therefore, our model assumes each partner begins receiving benefits when he or she reaches age 65.

To illustrate the model consider Mike and Fran. They are both currently 55 years old, and their Full Retirement Age is 66. They will begin receiving benefits at age 65, and their benefits fraction at age 65 is 0.933. They recently received their annual *Your Social Security Statements.* Mike's PIA at FRA is $1,200. Fran's is $1,400. The formula inserts the higher PIA of $1,400. The 12 months converts monthly payments into annual benefits. As we shall see, the couple multiple considers the lower PIA.

The couple multiple reflects the present value of the couple's benefits per $1 of initial benefits paid to the higher earner. We first calculate the ratio of lower-to-higher full-retirement PIAs, $1,200/$1,400, which is 0.857. The PIA ratio is the larger of this ratio or 0.5. In this example, it is 0.857. But if Mike's benefits based on his earnings were less than his spousal benefits based on her earnings, the PIA ratio would be 0.5. At age 55, Mike and Fran's current age, the expected dollar benefits (in age 55 dollars) to be received at mid-year at age 65 are:

$$(0.933)\ (\$1{,}400)[p(m)\ p(f)\ (1.857) + (1 - p(m))\ p(f)\ 1 + p(m)\ (1 - p(f))\ 1], \quad \text{Eq. 2}$$

where p(m) and p(f) denote the probabilities of, respectively, the male and female being alive at age 65. Thus, for example, (1 – p(m)) denotes the probability of Mike being dead at age 65. Equation 2 says the couple will receive (0.933) $1,400 (1.857) if both are alive, (0.933) $1,400 if one is alive, and nothing if neither is alive. Equation 2 already reflects the benefits

fraction, 0.933, and higher PIA, $1,400. The couple multiple calculates the present value of the bracketed amount discounted at today's maturity-appropriate TIPS yield.

Each year's expected cash flow is:

[p(m) p(f) 1.857 + (1 – p(m)) p(f) 1 + p(m) (1 - p(f)) 1] times initial annual benefits. At age 55, the probabilities of Mike and Fran being alive at age 65 are, respectively, 0.933821 and 0.949715. Inserting these amounts in the bracketed term produces 1.756714. At age 55, the expected cash flow at age 65 is 1.756714 times initial annual benefits. The expected cash flow at age 66 is 1.738433 times initial annual benefits. The 1.738433 is slightly lower than 1.756714 because the probabilities of Mike and Fran being alive at age 66 are slightly lower. Follow the same procedure until age 120, the end of the mortality tables. The couple multiple reflects the present value of these bracketed amounts discounted back to their current age 55 at the TIPS yield.

Exhibit 6 presents information to calculate the couple multiple for this 55-year-old same-age couple. For a 3% TIPS yield, it presents two numbers: 12.39 and 7.38. The couple multiple is 12.39 + 0.857(7.38) or 18.71. This couple multiple applies to all same-age couples regardless of their Full Retirement Age.

The before-tax value of Social Security is estimated at $293,268 or (0.933) ($1,400) (12) (18.71). If 85% of payments are taxable and they are in the 28% tax bracket, the after-tax value is estimated at about $223,000, or $293,268 (1 – (0.85)0.28). We argue that this couple should consider Social Security benefits a $223,000 bond in their portfolio. Some financial planners may want to include the before-tax value of Social Security in the family portfolio and consider it a bond. That is, they may prefer not to adjust for taxes. They would

consider Social Security a $293,000 bond in the family portfolio.[8] Clearly, Social Security is a valuable asset and one that the profession has traditionally ignored when calculating the value of an individual's or family's portfolio.

Recall that we could use the life expectancy of a single male or single female to approximate the value of Social Security retirement benefits. Unfortunately, in general, we cannot use life expectancies to approximate the value of Social Security to a couple. The exception occurs when both spouses receive the same Social Security benefits. In this case, the PIA ratio is 1.0, and the couple multiple is the sum of the comparable multiple for single women and multiple for single men.[9]

Exhibit 7 presents information to calculate the couple multiple when the wife is three years younger than the husband. For comparison with the earlier couple multiple, assume a TIPS yield of 3%, PIA ratio of 0.857, and the spouses ages are 55 and 52, respectively. The multiple is 18.14, or 13.03 + 0.857(5.96). This is 0.57 lower than the couple multiple when they are both age 55 because the wife does not begin receiving payments until she reaches age 65, which is three years later. After both partners begin receiving payments, the couples multiple is larger due to the wife's longer life expectancy.

INVESTMENTS IMPLICATIONS

We recommend that individuals and couples include the present value of Social Security payments when calculating the value of their retirement assets and their current asset

[8] Note that the "Social Security bond" has inflation-indexed bond features, including low volatility and low correlation with other assets. For a fuller discussion of the portfolio implications of these features, see Fraser, Jennings & King (2001).

[9] We estimated the value of Social Security based on cash flows through expected life assuming both are alive through the male's life expectancy and the female survives through the couple's life expectancy. The bias from this estimation—that is, difference between present value of expected cash flows and present value of cash flows through this life expectancy—is much larger than the bias for singles, has an erratic pattern, and depends on more variables. In short, (with the exception noted in the text) we cannot estimate Social Security's value to a

(continued)

mix. When answering the following questions, we believe the individual's or family's portfolio should include the value of Social Security: Can the family satisfy its income needs during its lifetime? What is its current asset mix (based on assets that can be used to satisfy retirement income needs)? When answering other questions, the family portfolio would ignore the value of Social Security. For example, if a widow died today, would she owe estate taxes and, if so, how much?

Nancy and Chris Dobbs are a 65-year-old financially secure couple. They have $1 million in stock funds held in 401(k) plans and $1 million in bonds held in taxable accounts. The market value and tax basis of the bonds are both $1 million. They have average life expectancy for their sex and age, and they will apply today to begin receiving Social Security payments. Chris will receive $1,483 per month, and Nancy will receive $1,335 per month. What is their current asset mix?

According to the traditional approach, they have $1 million in stocks in a $2 million total portfolio. The traditional approach ignores the value of Social Security and other retirement income streams such as military retirement and company pensions. It says their current asset mix contains 50% stocks.

If we include the present value of Social Security benefits in their portfolio, they have a different mix. The before-tax value of benefits is about $429,000. It is the product of (0.933) ($1,483) (12) (25.83), where 25.83 is the couple multiple assuming a 3.5% long-term TIPS yield. The couple multiple is 16.13 + 0.9(10.78), where 0.9 is the PIA ratio of $1,335/$1,483. If they include the $429,000 as a bond (and do not adjust for taxes), their current asset mix contains 41% stocks, $1,000,000/$2,429,000.

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couple by estimating cash flows through expected life.

We recommend that they adjust pre-tax funds to after-tax funds and then calculate the asset mix based on after-tax funds. This is an apples-to-apples comparison. For more on this topic, see Reichenstein (1998, 2000, 2001). If their expected tax rate during retirement is 28%, the $1 million of before-tax funds in the 401(k) converts to $720,000 after taxes, $1,000,000 (1 – 0.28). Similarly, Social Security benefits are worth about $327,000 after taxes, $429,000 (1 – (0.85) 0.28). Their current asset mix contains 35% stocks, in thousands $720/($720 + $1,000 + $327).

By ignoring the value of Social Security benefits, the Dobbs underestimate the value of assets intended to meet their retirement needs. In addition, they overestimate their current stock exposure by up to 15%. Clearly, including Social Security substantially changes the portfolio of this financially secure couple. Including Social Security would have a more dramatic affect on less secure individuals and couples.

FUTURE CHANGES IN SOCIAL SECURITY

In all likelihood, there will be future changes in the Social Security system. We suspect most changes will occur on the revenue side—increases in taxes—with relatively few changes in benefits. Furthermore, of the relatively few benefit changes, we suspect most of them will affect younger workers who have decades to adjust to the changes. As benefits change, we will need to adjust the models. Neither the expectation of future changes nor the many assumptions embedded in the models changes the fundamental reality that Social Security has value. Since current practice ignores the value of Social Security when calculating a family's asset mix, it implicitly assumes its value is zero. If the value of Social Security retirement benefits should be considered a bond in the family portfolio—and we

certainly believe it should—then the current models represent a substantial improvement over current practice.

SUMMARY

There are three objectives to this paper. First, we present the current structure of Social Security retirement benefits. Professionals who advise individual investors should understand the current system, including client options under this system. Professionals can explain to single clients the financial implications of beginning Social Security payments before or after reaching Full Retirement Age and help them select the best time to begin receiving payments. Due to the dual entitlement system, the decision as to when each member of a couple begins receiving benefits is much more complex. Professionals can add value to clients by helping them work through the interesting alternatives.

Second, we present models that estimate the present value of Social Security retirement benefits for singles, including widows and widowers, and married couples. In addition, we discuss estimation issues, critique the models, and present examples.

Finally, we show that a family's portfolio usually looks substantially different when it includes the present value of Social Security benefits as a "bond" in that portfolio. We believe professionals should capitalize Social Security (and military retirement, company pensions, and teacher retirement) benefits and include them in the family portfolio. If we are correct—and we believe we are—professionals who fail to consider the value of retirement income streams cannot be providing optimal advice to their clients.

APPENDIX 1.

When Should the "Average" Single Person Begin Receiving Benefits?

There are two objectives to this appendix. The first is to determine when a single female, single male, widow, or widower *with average life expectancy* should begin receiving benefits. The second is to discuss factors that should influence when a single should begin receiving benefits.

We estimate the present values at age 62 of expected before-tax benefits for males and females with average life expectancy and Full Retirement Ages of 65, 66, and 67. Each individual may begin receiving payments on any birthday from age 62 through 70. We show the present value is at or near its maximum when benefits begin at age 65. Consequently, in this study we estimate Social Security's value assuming benefits begin at age 65.

Exhibit 8 summarizes the present value calculations. The present-value formula is: (benefits fraction) (PIA at FRA) (12 months) (multiple). We assume the Primary Insurance Amount at Full Retirement Age is $1,000 a month.[10] We do so without loss of generality since the initial level does not affect the comparison of present values by age.

The top third summarizes the calculations for a single female or widow with Full Retirement Age of 65. If she begins receiving payments at age 62, her benefits fraction is 0.80. The PIA at FRA is $1,000. The 12 months converts monthly payments into annual benefits. Assuming a TIPS yield of 3.5%, the multiple is 15.22.[11] Therefore, the present

[10] The PIA is based on the average earnings in the 35 years with highest inflation-indexed earnings. The more years someone works, the larger could be the PIA since latter years' earnings likely exceed inflations-adjusted earnings in earlier years. We formed an otherwise identical table that allows PIA to grow by 1% a year until benefits begin. In that table, the present value of benefits is at or near its maximum when benefits begin at age 65.

[11] These multiples are not in Exhibits 3 and 4. The latter calculate present value at various ages assuming payments begin at age 65. Exhibit 8 calculates present values at age 62 assuming payments begin at ages 62 through 70.

value at age 62 is $146,112. The next row, FemRel65, shows present values relative to the age-65 present value. For example, when benefits begin at age 62, the present value is 1.7% lower than the value when benefits begin at age 65. When females begin benefits at age 65, the present value is within 0.2% of its maximum. The last row, MaleRel65, shows present values relative to the age-65 present value for men. When males begin benefits at age 65, the present value is within 0.9% of its maximum.

The second and third parts summarize analyses for singles with Full Retirement Ages of 66 and 67, respectively. The benefits fractions change with Full Retirement Age, but the multiples do not. For female and males with Full Retirement Ages of 66 and 67, the present values when benefits begin at age 65 are always within 1% of their maximums.

Consequently, the model in this study assumes singles begin receiving benefits at age 65. However, the model provides good value estimates to singles *with average life expectancy* even if they expect to begin benefits at other ages.

The second objective is to discuss factors that influence when a single should begin receiving benefits. The two most important factors are the Earnings Test and the individual's life expectancy. The model assumes the Earnings Test does not apply and the person has average life expectancy. In general, if the Earnings Test applies, benefits should not begin until FRA or later. In general, singles with shorter-than-usual life expectancies should begin payments sooner, and vice versa. Each individual must estimate his or her longevity prospects and incorporate this individual-specific information into the decision. An obese male smoker with a history of short-lived ancestors will tend to begin payments at an early age, probably age 62. A fit female non-smoker with a history of long-lived ancestors should consider deferring benefits, perhaps to age 70. There are no survivor's benefits for singles.

Consequently, a 62-year-old with terminal cancer should begin benefits as long as the Earnings Test would not eliminate benefits.

The relative present values in Exhibit 8, FemRel65 and MaleRel65, have implications for singles *with average life expectancy*. If the benefit fractions are actuarially "fair," someone with average life expectancy should be indifferent to when he or she begins receiving payments. Consider females with average life expectancy. For females with FRA of 65, the benefits fractions are too low at ages 68 through 70; that is, FemRel65 is substantially negative at these ages. For females with FRA of 66 and 67, the benefit factions are close to actuarially fair. The benefit fractions do not change with sex despite men's shorter life expectancy. Consequently, they provide a weak incentive for men with average life expectancy to begin payments earlier. For example, at FRA of 66 and 67 men with average life expectancy have a slightly larger present value when benefits begin at age 62 than 65.

In summary, the two most important factors that influence when a single person should begin receiving payments are whether the Earnings Test applies and whether they have a shorter- or longer-than-expected life expectancy. A third factor is the person's sex. There is a weak incentive for men to begin receiving payments earlier.

APPENDIX 2.

When Should the "Average" Couple Begin Receiving Benefits?

The purpose of this appendix is to determine when a couple *with average life expectancy* should begin receiving benefits. We estimate the present value of expected before-tax benefits for same-age couples with Full Retirement Ages of 65, 66, and 67. We assume the Primary Insurance Amount (PIA) of the couple's lower earner is 80% of the higher earner's PIA. We estimate present values at age 62 assuming benefits begin at age 62, at age 63, and so on through age 70. The analysis implies that the present value is at or near its maximum when benefits begin at age 65. This statement applies to couples with Full Retirement Ages of 65, 66, and 67. Consequently, in this study we estimate the before-tax value of a couple's Social Security retirement benefits assuming they begin benefits at age 65.

Exhibit 9 summarizes the present value calculations for 62-year-old couples with Full Retirement Ages of 65, 66, and 67 when the TIPS yield is 3.5%. As described in the text, the present-value formula is: (benefits fraction) (PIA at FRA of higher earner) (12 months) (couple multiple). We assume the Primary Insurance Amount at Full Retirement Age of the higher earner is $1,000 a month.[12] But the initial PIA level does not affect the comparison of present values by age.

The top third of Exhibit 9 summarizes the calculations for a couple with Full Retirement Ages of 65. If they begin receiving payments at age 62, their benefits fraction is 0.80. The PIA at FRA is $1,000 for the higher earner. The 12 months converts the monthly PIA into an annual amount. The couple multiple assumes the PIA of the lower earner is 80%

of the higher earner's PIA. The couple multiple is 26.88, meaning their joint benefits have a present value that is 26.88 times the higher earner's annual PIA.[13] The present value at age 62 of expected benefits is $258,048. The next row shows present values relative to the age-65 present value. For example, if benefits begin at age 62, the present value is 1.3% lower than the present value if benefits begin at age 65. The present value if benefits begin at age 65 is within 0.3% of the maximum.

The second and third parts summarize analyses for couples with Full Retirement Ages of 66 and 67, respectively. The benefits fractions change with Full Retirement Age, but the couple multiples do not. Present values for these couples reach a maximum when benefits begin at age 65.

Consequently, in this study we present multiples assuming couples begin payments when they reach age 65. However, even if benefits begin at other ages, the estimated values of Social Security are close to the value if benefits begin at age 65. Therefore, the model should provide good value estimates to couples with average life expectancies even if they expect to begin benefits at other ages.

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[12] The PIA is based on the average earnings in the 35 years with highest inflation-indexed earnings. The more years someone works, the larger could be the PIA since latter year's earnings likely exceed inflations-adjusted earnings in earlier years. We formed an otherwise identical table that allows PIA to grow by 1% a year until benefits begin. In that table, the present value of benefits is at or near its maximum when benefits begin at age 65.

[13] The multiples in Exhibit 9 are different from those in Exhibit 6. The latter calculates present values at various ages assuming benefits begin at age 65. The former presents present values at age 62 assuming benefits begin at age 62 through 70.

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EXHIBIT 1. Eligibility Age for Full Social Security Benefits is Increasing: Full Retirement Age

Year of Birth*	Year individual turns 62	Full Retirement Age (FRA) (years/ months)	Reduction for beginning payments before FRA (per month)	Benefits fraction at Age 62 (percent of benefits at FRA)	Delayed Retirement Credits (per year)	Benefits fraction at age 70 (percent of benefits at FRA)
1936 or before	1998 or before	65/0	5/9%	80%	6%	30%
1937	1999	65/0	5/9%	80%	6 ½%	32 ½%
1938	2000	65/2	5/9% for 36 +5/12%/mo.	79 1/6%	6 ½%	31 5/12%
1939	2001	65/4	5/9% for 36 +5/12%/mo.	78 1/3%	7%	32 2/3%
1940	2002	65/6	5/9% for 36 +5/12%/mo.	77 ½%	7%	31 ½%
1941	2003	65/8	5/9% for 36 +5/12%/mo.	76 2/3%	7 ½%	32 ½%
1942	2004	65/10	5/9% for 36 +5/12%/mo.	75 5/6%	7 ½%	31 ¼%
1943-54	2005-16	66/0	5/9% for 36 +5/12%/mo.	75%	8%	32%
1955	2017	66/2	5/9% for 36 +5/12%/mo.	74 1/6%	8%	30 2/3%
1956	2018	66/4	5/9% for 36 +5/12%/mo.	73 1/3%	8%	29 1/3%
1957	2019	66/6	5/9% for 36 +5/12%/mo.	72 ½%	8%	28%
1958	2020	66/8	5/9% for 36 +5/12%/mo.	71 2/3%	8%	26 2/3%
1959	2021	66/10	5/9% for 36 +5/12%/mo.	70 5/6%	8%	25 1/3%
1960 or later	2022 or later	67/0	5/9% for 36 +5/12%/mo.	70%	8%	24%

Social Security considers people born on January 1 to have been born in the prior year.

EXHIBIT 2. Calculation of Multiple for a 60-Year-Old Single Female Starting Benefits at Age 65

Age	Probability of Being Alive	Real Payment	Expected Real Payment	Present Value of Expected Real Payment
65	0.966657	$1	$0.966657	$0.966657/(1.03)$^{5.5}$
66	0.957274	$1	$0.957274	$0.957274/(1.03)$^{6.5}$
67	0.946788	$1	$0.946788	$0.946788/(1.03)$^{7.5}$
120	0.000009	$1	$0.000009	$0.000009/(1.03)$^{60.5}$
				Multiple = 12.32

The multiple is the present value of expected real payments, where $1 is the annual real or inflation-adjusted payment. The $1 is an annuity received at mid-year. For example, the $1 benefit for someone age 65 is received at age 65.5. The TIPS yield, discount interest rate, is 3%.

EXHIBIT 3. Multiples and Life Expectancy of Single Females and Widows

Age/TIPS Yld.	Multiples				Life Expectancy
	2.5%	3%	3.5%	4%	
30	6.06	4.86	3.90	3.14	53.0
35	6.87	5.64	4.64	3.83	48.1
40	7.80	6.56	5.53	4.67	43.2
45	8.86	7.64	6.60	5.71	38.4
50	10.09	8.91	7.89	7.00	33.6
55	11.53	10.44	9.47	8.60	28.9
60	13.28	12.32	11.44	10.65	24.4
65	15.55	14.77	14.06	13.40	20.1
70	13.16	12.60	12.08	11.59	16.2
75	10.85	10.46	10.09	9.75	12.7
80	8.66	8.40	8.16	7.93	9.7
85	6.68	6.52	6.37	6.22	7.1
90	5.10	5.00	4.91	4.82	5.2

EXHIBIT 4. Multiples and Life Expectancy of Single Males and Widowers

Age/TIPS Yld.	Multiples				Life Expectancy
	2.5%	3%	3.5%	4%	
30	5.34	4.30	3.47	2.81	50.0
35	6.06	5.00	4.14	3.43	45.1
40	6.89	5.82	4.93	4.19	40.3
45	7.84	6.79	5.90	5.13	35.5
50	8.95	7.94	7.06	6.29	30.8
55	10.26	9.33	8.50	7.76	26.2
60	11.89	11.08	10.34	9.67	21.7
65	14.06	13.43	12.84	12.30	17.6
70	11.65	11.21	10.79	10.41	13.9
75	9.33	9.04	8.77	8.51	10.6
80	7.21	7.03	6.86	6.70	7.8
85	5.41	5.30	5.20	5.10	5.5
90	4.02	3.96	3.91	3.85	3.9

EXHIBIT 5. Bias in Social Security Valuations Based on Cash Flows Through Expected Life

Age	Female	Male
30	2.1%	0.1%
35	2.3%	0.3%
40	2.5%	0.9%
45	2.9%	1.4%
50	3.0%	2.0%
55	3.2%	2.6%
60	3.4%	2.6%
65	2.6%	2.2%
70	2.2%	1.7%
75	1.2%	0.6%
80	0.4%	-1.0%
85	-1.7%	-4.2%
90	-3.7%	-7.1%

Bias denotes the percent by which present value of cash flows through expected life exceeds present value of expected cash flows. All estimates assume a 3% TIPS yield.

EXHIBIT 6. Multiples for Married Couples: Husband and Wife Same Age

	2.5%		3%		3.5%		4%	
Age	**1**	**F**	**1**	**F**	**1**	**F**	**1**	**F**
30	7.32	4.09	5.84	3.32	4.68	2.70	3.76	2.20
35	8.29	4.65	6.78	3.86	5.56	3.22	4.57	2.68
40	9.39	5.30	7.87	4.51	6.62	3.85	5.57	3.29
45	10.65	6.05	9.15	5.28	7.88	4.62	6.80	4.04
50	12.08	6.96	10.64	6.22	9.38	5.57	8.29	5.00
55	13.74	8.06	12.39	7.38	11.19	6.77	10.13	6.22
60	15.67	9.50	14.47	8.92	13.40	8.39	12.42	7.89
65	17.98	11.63	17.01	11.19	16.13	10.78	15.31	10.39
70	15.48	9.34	14.76	9.05	14.10	8.77	13.49	8.51
75	12.93	7.25	12.43	7.07	11.96	6.90	11.52	6.73
80	10.44	5.43	10.11	5.33	9.80	5.23	9.50	5.13
85	8.15	3.93	7.94	3.88	7.74	3.82	7.55	3.77
90	6.28	2.85	6.15	2.82	6.03	2.79	5.91	2.76

This Exhibit presents two factors used to compute the couple multiple. To calculate the couple multiple, we must first calculate the PIA ratio. It is the larger of 0.5 or the ratio of lower Primary Insurance Amount at Full Retirement Age to higher PIA at FRA. If the couple's PIAs at FRA are $1,200 and $1,400 then this ratio is 0.857. Assuming a 3% TIPS yield, the couple multiple for a 55-year-old couple is 12.39 + 0.857(7.38) or 18.71, where 12.39 and 7.38 are under columns labeled, respectively, 1 and F.

EXHIBIT 7. Multiples for Married Couples: Wife Three Years Younger than Husband

Husband's Age	2.5%		3%		3.5%		4%	
	1	F	1	F	1	F	1	F
30	7.74	3.36	6.16	2.69	4.92	2.16	3.94	1.74
35	8.76	3.81	7.15	3.13	5.84	2.58	4.79	2.13
40	9.92	4.34	8.29	3.66	6.95	3.08	5.84	2.60
45	11.25	4.96	9.63	4.28	8.27	3.70	7.11	3.20
50	12.76	5.69	11.19	5.03	9.84	4.45	8.68	3.94
55	14.49	6.58	13.03	5.96	11.73	5.40	10.59	4.90
60	16.50	7.72	15.19	7.16	14.02	6.65	12.96	6.18
65	18.87	9.34	17.80	8.88	16.82	8.45	15.93	8.05
70	16.41	9.84	15.60	9.52	14.86	9.21	14.17	8.93
75	12.96	7.30	12.46	7.12	11.99	6.94	11.54	6.78
80	11.37	5.80	10.98	5.68	10.61	5.57	10.26	5.46
85	9.00	4.24	8.75	4.18	8.51	4.11	8.28	4.05
90	6.95	3.06	6.79	3.03	6.64	3.00	6.50	2.96

This Exhibit presents two factors used to compute the couple multiple. To calculate the couple multiple, we must first calculate the PIA ratio. It is the larger of 0.5 or the ratio of lower Primary Insurance Amount at Full Retirement Age to higher PIA at FRA. If the couple's PIAs at FRA are $1,200 and $1,400 then this ratio is 0.857. (The model assumes the husband's PIA is larger, but the estimated value is similar if the wife's PIA is higher.) Assuming a 3% TIPS yield, the couple multiple when the husband is 55 and the wife is 52 is 13.03 + 0.857(5.96) or 18.14, where 13.03 and 5.96 are under columns labeled, respectively, 1 and F. The model assumes the both partners begin receiving payments at age 65.

EXHIBIT 8. Relative Present Values of Beginning Single Benefits at Age 65

FRA 65	62	63	64	65	66	67	68	69	70
Benefits Fraction	0.8	0.867	0.933	1	1.06	1.12	1.18	1.24	1.3
Primary Insurance Amount at FRA	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
12 Months	12	12	12	12	12	12	12	12	12
Female Multiple	15.22	14.24	13.30	12.39	11.53	10.70	9.90	9.15	8.43
Female Present Value	146,112	148,153	148,907	148,680	146,662	143,808	140,184	136,152	131,508
FemRel65	-0.017	-0.004	0.002	0	-0.014	-0.033	-0.057	-0.084	-0.115
MaleRel65	0.001	0.009	0.008	0	-0.021	-0.047	-0.078	-0.114	-0.152

FRA 66	62	63	64	65	66	67	68	69	70
Benefits Fraction	0.75	0.8	0.867	0.933	1	1.08	1.16	1.24	1.32
FemRel65	-0.013	-0.015	-0.003	0	-0.003	-0.001	-0.006	-0.019	-0.038
MaleRel65	0.006	-0.002	0.004	0	-0.010	-0.016	-0.029	-0.050	-0.077

FRA 67	62	63	64	65	66	67	68	69	70
Benefits Fraction	0.7	0.75	0.8	0.867	0.933	1	1.08	1.16	1.24
FemRel65	-0.008	-0.006	-0.010	0	0.001	-0.004	-0.004	-0.012	-0.027
MaleRel65	0.010	0.007	-0.003	0	-0.006	-0.019	-0.027	-0.044	-0.067

This Exhibit compares present values at age 62 of benefits when they begin at age 62, age 63, and so on through age 70. For singles, it demonstrates that the present value of benefits is at or near its maximum when benefits begin at age 65. Benefits Fraction reflects early retirement penalties and Delayed Retirement Credits. It assumes TIPS yield is 3.5% and an arbitrary Primary Insurance Amount of $1,000. FemRel65 and MaleRel65 denote percentage increase or decrease in present value relative to the present value at age 65. The three panels reflect singles with Full Retirement Ages of 65, 66 and 67. For brevity, details are suppressed for FRAs of 66 and 67 and for males at FRA of 65.

EXHIBIT 9. Relative Present Values of Beginning Single Benefits at Age 65

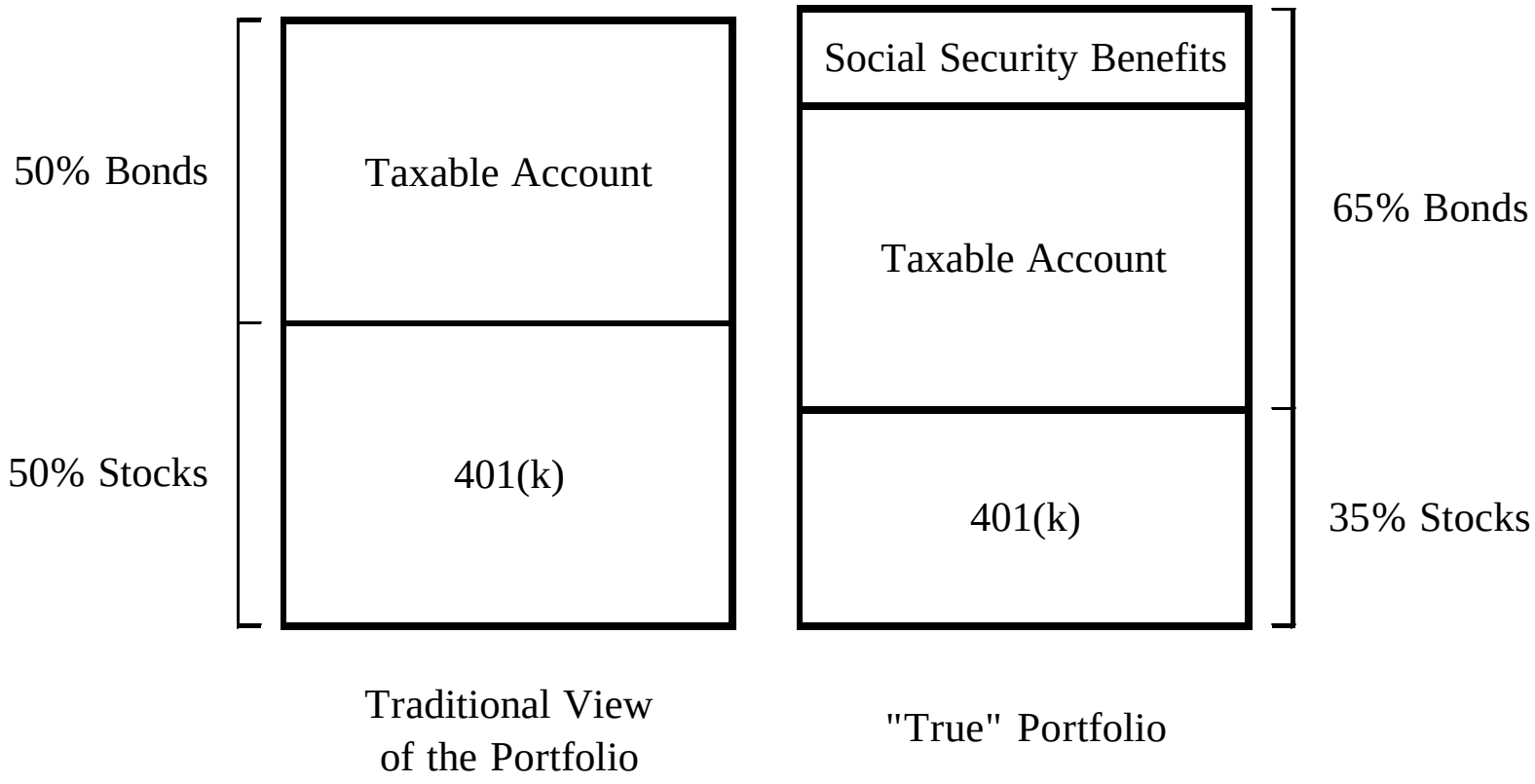
FRA 65	62	63	64	65	66	67	68	69	70
Benefits Fraction	0.8	0.867	0.933	1	1.06	1.12	1.18	1.24	1.3
PIA at FRA higher earner	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
12 months	12	12	12	12	12	12	12	12	12
Multiple	26.88	25.11	23.42	21.79	20.23	18.74	17.32	15.96	14.66
PV at 62	258,048	261,144	262,304	261,480	257,326	251,866	245,251	237,485	228,696
PVRel65	-0.013	-0.001	0.003	0	-0.016	-0.037	-0.062	-0.092	-0.125

FRA 66	62	63	64	65	66	67	68	69	70
Benefits Fraction	0.75	0.8167	0.8833	0.95	1	1.08	1.16	1.24	1.32
PVRel65	-0.026	-0.009	-0001	0	-0.023	-0.022	-0.029	-0.044	-0.065

FRA 67	62	63	64	65	66	67	68	69	70
Benefits Fraction	0.7	0.7667	0.8333	0.9	0.95	1	1.08	1.16	1.24
PVRel65	-0.041	-0.018	-0.005	0	-0.020	-0.044	-0.046	-0.056	-0.073

This Exhibit compares present values at age 62 of benefits when they begin at age 62, age 63, and so on through age 70. It assumes a PIA ratio of 0.8, TIPS yield of 3.5%, and the higher earner has a Primary Insurance Amount at Full Retirement Age of $1,000. For couples, it demonstrates that the present value of benefits is at or near its maximum when benefits begin at age 65. Benefits Fraction reflects early retirement penalties and Delayed Retirement Credits. FemRel65 and MaleRel65 denote percentage increase or decrease in present value relative to the present value at age 65. The three panels reflect couples with Full Retirement Ages of 65, 66 and 67. For brevity, details are suppressed for FRAs of 66 and 67.

Figure 1. Illustrative Implications of After-Tax Valuation and Retirement Benefits



Chris and Nancy, a hypothetical retiree couple described in the text