

The Accurate Benefits Calculator

Methodology

General Projections

The CPI-W, Adjusted Wage Index (AWI), and nominal GDP are assumed to grow in line with the Congressional Budget Office (CBO) long-term economic projections for Social Security (<http://cbo.gov/showdoc.cfm?index=6064&sequence=0>)

The Treasury bond rate (T) for a given year is assumed to be the Average Real Annual Interest Rate (I) projected by CBO inflated by growth in the CPI-W over the previous year (C) by the formula $T = (1 + I) \times (1 + C)$.

The Contribution Base is computed as described by Social Security (<http://www.ssa.gov/OACT/COLA/cbbdet.html>)

The minimum incomes to qualify for a Quarter (of a year) of Coverage are computed as described by Social Security (<http://www.ssa.gov/OACT/COLA/QC.html>)

The percent payable benefit (P) in a given year is 100% in years earlier than 2053, and less thereafter according to the formula $P = 0.124 / (0.124 + C - I)$ where C is the CBO estimate for scheduled outlays as a share of taxable payroll, and I is the CBO estimate for revenues as a share of taxable payroll.

Life expectancy for an individual is assumed to be the cohort life expectancy at age 65, averaged for males and females and rounded to the nearest whole year. Gender specific cohort life expectancies used in this calculation are come from the 2004 Social Security Trustees' Report, Table V.A4. (<http://www.ssa.gov/OACT/TR/TR04/lr5A4-a.html>)

The annual Cost of Living Adjustment (COLA) is computed as described by Social Security. (<http://www.ssa.gov/OACT/COLA/colaseries.html>)

The minimum wage is assumed to be \$5.15 per hour through 2008, and indexed to the CPI-W thereafter.

The 2004 poverty threshold for a single worker is \$9,060 per year and \$11,418 per year for a couple. The poverty threshold is indexed to the CPI-W thereafter, rounding to the nearest dollar.

The bend points in the Primary Insurance Amount (PIA) formula are computed as described by Social Security. (<http://www.ssa.gov/OACT/COLA/piaformula.html>)

The three PIA factors in the formula are assumed to be 90%, 32%, and 15% under current law, and deflated by growth in the real wage starting in 2009 under price indexing as described by the Social Security Trustees' memo on Model 2 reform section II.a.1.

(http://www.ssa.gov/OACT/solvency/PresComm_20020131.html)

The bend points in the maximum family benefit formula are computed as described by Social Security. (<http://www.ssa.gov/OACT/COLA/familymax.html>)

Consistent with the CBO analysis of model 2 reform,

(<http://www.cbo.gov/showdoc.cfm?index=5666&sequence=0>)

the private account portfolio is assumed to be 50% equities, 30% corporate bonds, and 20% Treasury bonds. The real rate on Treasury bonds is assumed to be 3.3% (5.5726% nominal) and the real rate on corporate bonds is assumed to be 3.8% (6.0836% nominal).

Computing the return on equities

The nominal (stable) return on equities is computed as follows:

Capital gains may be determined by

$$\frac{P_Y}{P_{Y-1}} = \frac{P_Y/E_Y}{P_{Y-1}/E_{Y-1}} \frac{E_Y}{E_{Y-1}}$$

where P is the stock price, and E the earnings. Similarly, dividend payouts may be determined by

$$\frac{D_Y}{P_{Y-1}} = \frac{D_Y/E_Y}{P_{Y-1}/E_{Y-1}} \frac{E_Y}{E_{Y-1}}$$

Because the return to stocks (N) must come from capital gains and dividends,

$$\begin{aligned} 1 + N_Y &= \frac{P_Y + D_Y}{P_{Y-1}} = \frac{P_Y}{P_{Y-1}} + \frac{D_Y}{P_{Y-1}} = \frac{P_Y/E_Y}{P_{Y-1}/E_{Y-1}} \frac{E_Y}{E_{Y-1}} + \frac{D_Y/E_Y}{P_{Y-1}/E_{Y-1}} \frac{E_Y}{E_{Y-1}} \\ &= \left(\frac{P_Y/E_Y}{P_{Y-1}/E_{Y-1}} + \frac{D_Y/E_Y}{P_{Y-1}/E_{Y-1}} \right) \frac{E_Y}{E_{Y-1}} \end{aligned}$$

Assuming earnings grow in step with GDP,

$$1 + N_Y = \left(\frac{P_Y/E_Y}{P_{Y-1}/E_{Y-1}} + \frac{D_Y/E_Y}{P_{Y-1}/E_{Y-1}} \right) \frac{GDP_Y}{GDP_{Y-1}} = \left(\frac{P_Y/E_Y}{P_{Y-1}/E_{Y-1}} + \frac{D_Y/E_Y}{P_{Y-1}/E_{Y-1}} \right) (1 + G_Y)$$

where G is the year's growth in GDP. Assuming also a constant price-to-earnings ratio and a constant dividend payout (dividend to earnings ratio),

$$1 + \hat{N}_Y = \left(1 + \frac{D/E}{P/E} \right) (1 + G_Y)$$

We see that the nominal return on stocks must be tied directly to nominal growth in the economy.

If we relax the constraint on the price-to-earnings ratio we may see that

$$\begin{aligned} \frac{P_Y/E_Y}{P_{Y-1}/E_{Y-1}} + \frac{D/E}{P_{Y-1}/E_{Y-1}} &= \frac{1 + N_Y}{1 + G_Y} \\ \frac{P_Y/E_Y}{P_{Y-1}/E_{Y-1}} &= \frac{1 + N_Y}{1 + G_Y} - \frac{D/E}{P_{Y-1}/E_{Y-1}} \\ P_Y/E_Y &= \left(\frac{1 + N_Y}{1 + G_Y} - \frac{D/E}{P_{Y-1}/E_{Y-1}} \right) P_{Y-1}/E_{Y-1} = \frac{1 + N_Y}{1 + G_Y} P_{Y-1}/E_{Y-1} - D/E \end{aligned}$$

The stable return in this calculator assumes a price-to-earnings ratio of 21 and dividends of 60% of earnings, (or $0.6/21 = 2.857\%$ of prices.) The long-term nominal return under CBO growth assumptions is approximately 6.64%, or 4.35% after inflation.

The total portfolio in an account is assumed to be 50% equities, 30% private bonds, and 20% Treasury bonds. The return on Treasury bonds is as described above (3.3% real in the long run) and the return on private bonds nets a 50 basis-point real premium (or 3.8%.) This results in a nominal portfolio return of 6.26% and a real portfolio return of 3.97% before administrative fees.

The minimum allowable long-run stock return is 100 basis points lower than stable, or 5.64%. This results in a portfolio return of 5.76% (3.48% real) before fees. The maximum allowable long-run stock return is 250 basis points above stable, or 9.14%, or 6.79% real. The maximum return results in a portfolio return before fees of 7.51%, or 5.20% real. This is the annual return assumed by CBO in its non risk-adjusted analysis. (<http://www.cbo.gov/showdoc.cfm?index=5666&sequence=0>)

When an additional stock premium is assumed, the premium is applied to years beginning in 2005, but no earlier than the year in which the worker attains age 22.

Annual fees on accounts are deducted in the same manner that stock premiums are added. That is, the long-run nominal portfolio return is 5.96% (3.68% real.)

Computing the Nominal Earnings for a worker

The nominal earnings for a worker is computed as follows:

The user inputs dollar figure. Let Q be this figure divided by the (estimated) AWI for 2005. Earnings in individual years are determined as follows. From age 45 to retirement the will generally be 1.02 times Q times the AWI to the earnings year. (That is, an average earner will make 2% more than the AWI starting at age 45.) In each year prior to age 45, 1.02 times Q will be reduced by a constant amount necessary to result in an AIME equal to 1/12 the AWI at age 60 for a worker that does not take time off and retires at age 65. If, at age 22 this results in earnings less than four times the minimum for a Quarter of Coverage, then the annual reduction will be moderated to attain the minimum, and the final Q will be reduced sufficiently to result in the desired AIME. Mathematically, this is seen as follows:

$Q = \frac{D}{AWI_{2005}}$, where D is the input dollar figure and AWI_{2005} is the AWI in year 2005.
 Let $E = \frac{AWI_{61} + AWI_{62} + AWI_{63} + AWI_{64}}{AWI_{60}}$. The annual percentage point reduction at each age is computed as

$$R = \max\left(0, \min\left\{\left[1.02 \times (31 + E) - 35\right] \times Q / 120, \left(1.02 \times Q - 4 M_{22} / AWI_{22}\right) / 23\right\}\right)$$

where M_{22} is the minimum and AWI_{22} is the AWI for the year when the worker is age 22. The final earnings factor F is therefore $F = (120R + 35Q) / (31 + E)$. Finally, in a year of work at age A, the earnings are

$$N_A = \max\left[F - R \times \max(0, 45 - A) \times AWI_A, 4M_A\right].$$

The first three years of work are assumed to be at ages 22-25. A worker's fourth year of work may be delayed based on input control. Note that the minimum year's earnings a worker may accept is that of four times that needed to record a Quarter of Coverage. That is, every year of work is covered. This minimum yearly amount is roughly 10% of the AWI. Workers that take many years off of work may wind up earning much less than 10% of the AWI on the average, but no less than that in any given year of work.

This worker is considered to be the primary earner. A spouse may be included at 1/3 the wages of the primary earner.

Taxable earnings are calculated as the minimum of the nominal earnings and the computed Contribution Base for that year.

The AIME, current-law PIA, maximum family and current-law retirement benefit for each worker are calculated as described by Social Security:
<http://www.ssa.gov/OACT/ProgData/retirebenefit1.html>

The modified PIA is computed as current-law, but with price-index PIA factors as described above.

The modified retirement benefit is computed as current-law, but using the modified PIA. If the enhanced low-earner benefit is included, the modified PIA is multiplied by a factor as described in http://www.ssa.gov/OACT/solvency/PresComm_20020131.html Section II.a.2.

For a married worker (in both the current-law and modified-benefit cases,) the family benefit that may be paid is the greater of the sum of the worker's benefits and roughly 150% of the larger benefit (the latter capped at the corresponding family maximum for that worker.)

For workers retiring early, the exact factor for computing the 50% spousal benefit is computed as described by Social Security: <http://www.ssa.gov/retire2/retirechart.htm> "Age to Receive Full Social Security Benefits" The appropriate percentage is specified in the corresponding link for each "Year of Birth" in the table.

The payable benefit under current law is the computed benefit (family or individual) multiplied by the percentage payable benefit (described above) in the first year of retirement.

The private account

The maximum diversion (D) to a private account for each earner is generally computed as $D = [1000 + 100 \times (Y - 2009)] AWI_{Y-1} / AWI_{2008}$ where Y is the year, AWI_{Y-1} is the previous year's AWI, and AWI_{2008} is the AWI in 2008. To contribute in 2009, the worker must be born no later than 1965. To contribute in 2010, the worker must be born no later than 1978. Each worker may divert up to 4% of taxable earnings up to the maximum diversion.¹ For simplicity, spousal contributions are credited to the same accounts as the primary worker's accounts.

Diverted monies are double-counted in parallel accounts: the private account and the notional account. Until retirement, the private account accumulates interest at the nominal portfolio rate of return, less annual fees. The notional account accumulates interest at the rate of return for Treasury bonds.

At retirement, the notional account is annuitized at no cost so as to provide a constant real monthly benefit. This amount, rather than being credited to the worker, is deducted from the worker's defined benefits as a clawback up to the total amount of defined benefits. Spousal benefits are computed based on the defined benefits before clawback.

Also at retirement, the private account may be annuitized, assuming a specific fee as a percentage of the sum to be annuitized. The amount to be annuitized must be at least enough, in conjunction with defined benefits after clawback, to provide monthly benefits

¹ Note that after 2040 the cap exceeds 4% of the Contribution Base and all workers may divert 4% of their taxable earnings.

at a poverty level. If the account is insufficiently large to provide the benefit, then the entire sum must be annuitized. If the defined benefit after clawback is itself sufficient, then none of the sum must be annuitized. Any sum not annuitized may be passed on as an inheritance. The maximum total benefit to an account holder is the defined benefit after clawback, plus the fully annuitized private account. The minimum total benefit is the defined benefit after clawback, plus the worker's minimum annuitized sum.

Annuities, both notional and private, are calculated as the real annual amount needed to be withdrawn from an account accumulating interest at the rate of return for Treasury bonds, and at the beginning of each year in order to cover twelve monthly payments through the average expected lifetime after retirement (life expectancy at age 65, less working years after age 64)