ACTUARIAL NOTE

Number 144
June 2001

SOCIAL SECURITY ADMINISTRATION
Office of the Chief Actuary

INTERNAL REAL RATES OF RETURN UNDER THE OASDI PROGRAM FOR HYPOTHETICAL WORKERS

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Introduction

This note presents analysis of internal real rates of return for hypothetical workers with various earnings patterns and levels under the Old-Age, Survivors and Disability Insurance (OASDI) program. The internal real rate of return (hereinafter referred to as the internal rate of return) is the real interest rate (effective real annual yield) for which the present value of expected payroll taxes is equal to the present value of expected benefits. Therefore, internal rates of return represent an attempt to answer the question: If the contributions of a group of workers with selected characteristics were invested to fund the future benefits of the workers and their dependents, at what real annual yield would the contributions need to be invested[1]? Because contributions are not expected to be sufficient to fully finance scheduled benefits after 2037, analysis is included for the OASDI program both as in present law, and with assumed future increases in contribution rates that would fully finance the benefits of present law.

Because the Social Security program has operated on a largely pay-as-you-go (PAYGO) basis, the level of contributions of each generation of workers is not directly related to the benefits they will receive. Under a PAYGO plan, benefits are not based on the accumulation of individual contributions, as in a defined contribution plan, nor are annual contributions determined based on scheduled future benefits of current workers and beneficiaries, as in an advance-funded defined benefit plan. Rather, the combined amount of contributions from workers needed to fund the system at any time has been largely determined by the combined amount of benefits paid at that time. The internal rates of return depend on the contribution tax rates and Social Security benefit levels set by Congress. They do not in any significant way reflect the rate of interest on assets invested in the OASI and DI Trust Funds.

Internal rate of return does not reflect the full value of insurance in reducing the risk for extreme outcomes, like death or disability at very young ages or survival to very old ages. In addition, calculations of the internal rate of return from Social Security benefits are not fully adequate for making comparisons with private-sector plans, since many features of Social Security benefits are not typically available in private-sector plans. Examples include guaranteed cost-of-living adjustments based on the Consumer Price Index, and benefits for life in the event of disability. However internal rates of return are of value for exploring the relative value of benefits provided across generations and types of workers.

Hypothetical workers are presented in this note with two types of earnings patterns. These are designated as *steady* and *scaled.* A worker with a steady pattern has earnings that are a constant percentage of the average wage[2] for each year of work. A worker with a scaled earnings pattern has earnings that vary with age as a percentage of the average wage. Steady workers are assumed to enter covered employment at age 22 and remain employed until disability, death, or retirement at age 65. Scaled workers are assumed to enter the labor force at age 21, and reflect varying rates of employment until disability, death, or retirement at age 65.

The results for steady workers are consistent with similar calculations done previously by our office, and presented for example in the report of the 1994-96 Advisory Council on Social Security. The steady worker calculations presented in this note have been updated to reflect the latest actual average wage index amounts, and current assumptions about future average wage increases. Alternative approaches to the question of non-steady earnings histories have been addressed briefly by other authors, and it is recognized that a much broader set of earnings patterns might be desirable to fully explore the distributions of benefits payable and internal rates of return under the OASDI program. However, for the sake of practicality, the number of cases considered in this note is limited.

Internal rates of return are presented in tables 2, 3, 4, and 5 for hypothetical workers who differ by year of birth, earnings level, marital status, and earnings pattern (steady and scaled).

Methodology and Assumptions

Computation of internal rates of return requires a complete simulation of the experience of each hypothetical group of workers for all years after first entering the labor force (assumed at age 21 or 22 for this study). The possibility of dying or becoming disabled in each year after entering the

[1] Because the OASDI trust funds receive transfers from the General Fund of the Treasury equal to a portion of taxes on benefits, internal rates of return that ignore these transfers may arguably overstate the return on contributions. Due to the difficulty of determining the level of income tax on benefits, this relatively small factor is not addressed in this note.

[2] "Average wage" refers to the Social Security average wage index for the entire economy. The Social Security average wage index is based on the average amount of total wages for each year after 1950, including wages in both covered and noncovered employment and wages in excess of the OASDI contribution and benefit base. A table of the historical average wage index is available at http://www.ssa.gov/OACT/COLA/AWI.html. The 2001 Trustees Report projections of future average wage amounts are available at http://www.ssa.gov/OACT/TR/TR01/lr6E7-2.html.

labor force must be taken into account. Actual experience is used for historical years. Projections of future experience are based on the intermediate assumptions of the 2001 Trustees Report. While it is recognized that mortality and disability both tend to be higher for lower paid workers, this fact is not reflected in the cases presented in this note. Further analysis will be necessary to properly address this issue. We have chosen hypothetical cases with 11 different years of birth from 1920 through 2004 to demonstrate the variation in internal rates of return across generations. Our analysis includes the payment of all OASDI benefits for death, disability, and retirement, reflecting historical and projected probabilities of death, disability, and recovery from disability. Retirement is assumed to be at age 65 for non-disabled workers.

As mentioned above, two types of hypothetical earnings patterns are presented, steady and scaled. The steady earnings pattern assumes that the worker is a steady full-time employee with no interruptions in employment. The steady worker begins working in covered employment at age 22 and the worker's earnings increase each year at the same rate as the average wage. The steady worker is assumed to stay employed, except for periods of disability, until death, or until retirement at age 65. For the steady earnings pattern, the following four levels of earnings are presented in tables 2, 3, 4, and 5.

- **Low**: Annual earnings are equal to 45 percent of the average wage.
- **Average**: Annual earnings are equal to the average wage.
- **High**: Annual earnings are equal to 160 percent of the average wage[3].
- **Maximum**: Annual earnings are equal to the OASDI Contribution and Benefit Base[4].

The OASDI benefit levels associated with these four earnings levels "best represent"[5] different proportions of the male, as compared with the female, worker populations. The table below summarizes the representation of actual male and female retirees in 1999 by these four cases. This table is further discussed in the section "Discussion of Worker Earnings and Benefit Levels".

Table 1.—Comparison of PIA Levels for Actual Workers Retiring in 1999 with PIA Levels for Hypothetical Steady Earnings Cases Retiring in 1999

	Percent with this PIA[1] or less			Percent with PIA "best represented" by level[2]		
	Male	Female	Total	Male	Female	Total
Low.....	10.0	48.4	27.8	20.0	71.7	44.0
Average	33.9	86.5	58.3	28.5	21.7	25.3
High	75.2	98.6	86.0	41.1	6.2	24.9
Maximum..	100.0	100.0	100.0	10.4	.3	5.7

[1] Primary Insurance Amount. The PIA is the full (that is, unreduced) monthly benefit level, which is payable to disabled workers and to retired workers who become entitled at normal retirement age.

[2] May not add to 100 percent due to rounding.

It should be noted that the percentages indicated above reflect the status of workers retiring in 1999, and that these percentages would be different for workers retiring in earlier or later years. For example, the increasing employment rates for women over the last several decades is expected to result in relatively greater increases in career-average earnings for women than for men in the future. Therefore, the difference in the distributions of male and female retired workers by benefit levels is expected to diminish in the future.

In actuality, the year-to-year earnings of most workers do not follow these steady earnings patterns. Career earnings often start out at a relatively low level in the early years of employment, increase rapidly and peak in mid career, and then level off or even decline somewhat in later years. In addition, workers do not necessarily work in every year after entering the labor force and prior to disability, death, or retirement. To reflect these patterns, alternative cases, which are designated as scaled, are presented. These scaled cases were developed using available sample earnings data for workers who are fully insured under the OASDI program. They take into account changes in earnings levels by age as well as periods of unemployment or withdrawal from the labor force. However, "maximum" workers are assumed to have steady maximum earnings starting at age 22 and thus equal to the steady worker cases.

To maintain comparability with the hypothetical steady worker cases that have been used in the past, earnings for the scaled workers were adjusted to produce equivalent Social Security retirement benefit levels. For each earnings level (low, medium, or high), year of birth, and marital status, the earnings of the worker with the scaled earnings pattern is multiplied by that constant factor which produces the same AIME[6] (and, consequently, the same Social Security retirement benefit) as the corresponding worker with steady earnings[7].

[3] For certain historical years, earnings of 160 percent of the average wage would exceed the OASDI Contribution and Benefit Base; amounts above such Contribution and Benefit Base are not included in the computation of internal rate of return.

[4] The OASDI Contribution and Benefit Base, also known as the "wage base" and as the "taxable maximum", is the annual dollar amount above which earnings in employment covered under the OASDI program are neither taxable nor creditable for benefit computation purposes. Further information about the OASDI Contribution and Benefit Base can be found at http://www.ssa.gov/OACT/COLA/CBB.html.

[5] In this context, an actual worker is said to "best represented" by a particular hypothetical worker if that hypothetical worker's PIA is closest to the actual worker's PIA. As an illustration, table 1 shows that 44.0 percent of actual retirees have a PIA that is closer to the PIA of the low-earning worker than to any other, and are thus said to be best represented by the low-earning worker.

[6] Average Indexed Monthly Earnings. The AIME value represents the beneficiary's average monthly earnings after indexing for wage growth in the economy in his or her highest years of earnings. The procedure for calculating the AIME is illustrated at http://www.ssa.gov/OACT/. Select "Compute Your Own Benefit".

The resulting internal rate of return for the scaled worker turns out to be somewhat higher than that for the corresponding steady worker, even though retirement benefits are the same. As shown in the Appendix, more earnings are paid later in life for the scaled worker, making the average time between when taxes are paid and when benefits are received less than for the steady worker. This shorter period of time between when taxes are paid and benefits are received for scaled workers results in a higher internal rate of return. However, for disability benefits no uniform relationship between internal rates of return for steady and scaled earnings records is evident.

For this note, internal rates of return were determined for two specifications of the OASDI program, *Present Law* and *PL PAYGO*. The *Present Law* specification is based on the taxes and benefits specified in present law, assuming no future legislative changes. However, the program income and assets under present law are projected to be inadequate to fully pay all benefits through the 75-year projection period. Therefore we also present an analysis based on a set of modified payroll-tax rates, called *PL PAYGO*. Under the *PL PAYGO* specification, payroll-tax rates are assumed to be increased as needed so that present-law benefits would always be payable and that the amount of assets in the combined OASI and DI Trust Funds would always equal at least one year's outgo. The *PL PAYGO* payroll-tax rates begin to increase over the *Present Law* rates in 2025 and reach 17.2 percent by 2060. The schedule of tax rates for *Present Law* and for *PL PAYGO*, under the intermediate assumptions of the 2001 Trustees Report, are shown below.

OASDI Payroll Tax Rates, for Employee and Employer Combined

	Present Law	PL PAYGO
2000-2024	12.40	12.40
2025-2029	12.40	13.10
2030-2049	12.40	15.80
2050-2059	12.40	16.50
2060-2075	12.40	17.20

It is expected that further increases in *PL PAYGO* tax rates would be needed after 2075 due to continuing increases in life expectancy. Internal rates of return for the first six cohorts studied are the same for both *Present Law* and *PL PAYGO* as these cohorts all reach age 65 prior to 2025.

The hypothetical workers presented in this note are grouped by sex and marital status into four categories: single males, single females, one-earner couples where only the husband is employed, and two-earner couples. The single-earner examples are presented for all four earnings levels listed above. The two-earner couples are presented at five earnings combinations as follows:

(1) Husband high, wife high;

(2) Husband high, wife average;

(3) Husband average, wife average;

(4) Husband average, wife low; and

(5) Husband low, wife low.

Each worker is assumed to enter the labor market on his or her 22nd birthday if earnings are steady, 21st if they are scaled. Because labor force participation rates are relatively low at younger ages, steady workers are assumed to start at a higher age than the scaled workers, who reflect varying probabilities of employment. The wife and husband of each couple are assumed to have the same date of birth. Each marriage is assumed to occur on the joint 22nd birthday of the wife and husband and to continue for life. Two children are assumed, one born on the joint 25th birthday of the wife and husband, and one born on the joint 27th birthday of the wife and husband. All types of retirement, disability, and survivor benefits are considered, except for benefits to student children, benefits to disabled-adult children, and benefits to parents based on caring for a disabled-adult child. Omission of these benefits results in a negligible understatement of the real internal rate of return.

The mortality rates and disability incidence and termination rates used in these computations are taken from historical data, and from the intermediate projections of the 2001 Trustees Report by age, sex, and date of birth. No mortality is assumed for children through age 18 in this analysis. Assuming that marriages are lifelong means that the effects of divorce and of remarriage after death and divorce are not explicitly reflected. However, because each individual may receive a total benefit equal only to the highest of any spouse, widow(er), or worker benefit that may be available, this omission is of minor consequence. Benefit increases and earnings levels are based on actual data for the past and the 2001 Trustees Report assumptions for the future.

[7] An exposition of the procedures for calculating the salary scale factors is presented in Appendix of this note. The salary scale factor values are presented in table A6.

Analysis of Results

The following tables present the calculated internal rates of return. The tables are intended to facilitate comparison of rates of return across different family groups, different years of birth, different career-average levels of earnings, and whether the earnings pattern is steady or scaled.

Table 2.—Internal Real Rates of Return for Various Earnings Level Workers Under Present Law OASDI Program
(Percent)

Earnings level	Year of birth	Year attains age 65	Steady earnings pattern				Scaled earnings pattern			
			Single male	Single female	One-earner couple	Two-earner couple[1]	Single male	Single female	One-earner couple	Two-earner couple[1]
Low	1920	1985	4.29	5.13	7.94	5.03	4.32	5.17	8.07	5.07
	1930	1995	3.04	3.68	6.12	3.73	3.11	3.77	6.20	3.80
	1937	2002	2.78	3.33	5.58	3.39	2.95	3.51	5.78	3.55
	1943	2008	2.66	3.17	5.27	3.21	2.87	3.38	5.54	3.41
	1949	2014	2.73	3.21	5.27	3.22	2.93	3.42	5.51	3.41
	1955	2020	2.75	3.22	5.18	3.20	2.93	3.41	5.41	3.37
	1964	2029	2.67	3.10	4.95	3.09	2.86	3.29	5.16	3.25
	1973	2038	2.72	3.13	4.90	3.10	2.91	3.32	5.12	3.27
	1985	2050	2.85	3.19	4.98	3.19	3.05	3.40	5.21	3.37
	1997	2062	2.97	3.28	4.99	3.28	3.18	3.48	5.22	3.46
	2004	2069	3.03	3.32	5.01	3.33	3.24	3.53	5.25	3.51
Average (Medium)	1920	1985	2.69	3.61	6.41	3.39	2.81	3.74	6.59	3.53
	1930	1995	1.91	2.62	5.03	2.56	1.99	2.71	5.12	2.63
	1937	2002	1.74	2.35	4.58	2.32	1.88	2.50	4.75	2.45
	1943	2008	1.64	2.21	4.29	2.16	1.82	2.39	4.50	2.33
	1949	2014	1.71	2.25	4.26	2.18	1.88	2.42	4.48	2.34
	1955	2020	1.73	2.25	4.19	2.15	1.88	2.41	4.39	2.31
	1964	2029	1.65	2.13	3.97	2.05	1.80	2.28	4.16	2.20
	1973	2038	1.71	2.16	3.94	2.08	1.87	2.32	4.13	2.23
	1985	2050	1.85	2.24	4.02	2.18	2.01	2.40	4.23	2.34
	1997	2062	1.98	2.32	4.04	2.28	2.14	2.49	4.25	2.44
	2004	2069	2.04	2.37	4.07	2.33	2.21	2.54	4.27	2.49
High	1920	1985	2.37	3.34	6.07	3.06	2.51	3.47	6.24	3.21
	1930	1995	1.52	2.29	4.68	2.15	1.55	2.32	4.70	2.18
	1937	2002	1.30	1.96	4.17	1.85	1.30	1.96	4.16	1.85
	1943	2008	1.13	1.74	3.80	1.63	1.16	1.77	3.83	1.66
	1949	2014	1.10	1.68	3.66	1.56	1.21	1.79	3.80	1.66
	1955	2020	1.07	1.63	3.54	1.49	1.22	1.78	3.73	1.64
	1964	2029	1.01	1.51	3.32	1.40	1.15	1.65	3.50	1.53
	1973	2038	1.08	1.55	3.30	1.44	1.22	1.70	3.49	1.58
	1985	2050	1.21	1.63	3.39	1.54	1.37	1.79	3.59	1.69
	1997	2062	1.34	1.72	3.42	1.64	1.50	1.88	3.61	1.79
	2004	2069	1.41	1.77	3.44	1.69	1.57	1.93	3.64	1.85
Maximum[2]	1920	1985	2.26	3.24	6.01		2.26	3.24	6.01	
	1930	1995	1.13	1.95	4.43		1.13	1.95	4.43	
	1937	2002	.82	1.55	3.83		.82	1.55	3.83	
	1943	2008	.58	1.26	3.37		.58	1.26	3.37	
	1949	2014	.50	1.14	3.15		.50	1.14	3.15	
	1955	2020	.38	.98	2.90		.38	.98	2.90	
	1964	2029	.25	.79	2.58		.25	.79	2.58	
	1973	2038	.32	.83	2.58		.32	.83	2.58	
	1985	2050	.46	.91	2.66		.46	.91	2.66	
	1997	2062	.60	1.00	2.69		.60	1.00	2.69	
	2004	2069	.67	1.05	2.72		.67	1.05	2.72	

[1] Both spouses are assumed to have the indicated earnings level.

[2] Maximum workers are assumed to be steady workers starting at age 22.

Table 3.—Internal Real Rates of Return for Various Earnings Level Workers Under PL PAYGO Modified OASDI Program

(Percent)

Earnings level	Year of birth	Year attains age 65	Steady earnings pattern				Scaled earnings pattern			
			Single male	Single female	One-earner couple	Two-earner couple[1]	Single male	Single female	One-earner couple	Two-earner couple[1]
Low	1920	1985	4.29	5.13	7.94	5.03	4.32	5.17	8.07	5.07
	1930	1995	3.04	3.68	6.12	3.73	3.11	3.77	6.20	3.80
	1937	2002	2.78	3.33	5.58	3.39	2.95	3.51	5.78	3.55
	1943	2008	2.66	3.17	5.27	3.21	2.87	3.38	5.54	3.41
	1949	2014	2.73	3.21	5.27	3.22	2.93	3.42	5.51	3.41
	1955	2020	2.75	3.22	5.18	3.20	2.93	3.41	5.41	3.37
	1964	2029	2.66	3.09	4.94	3.08	2.85	3.28	5.16	3.25
	1973	2038	2.60	3.02	4.82	2.99	2.80	3.22	5.05	3.17
	1985	2050	2.52	2.89	4.73	2.87	2.69	3.07	4.94	3.02
	1997	2062	2.36	2.69	4.46	2.66	2.50	2.85	4.63	2.79
	2004	2069	2.23	2.55	4.26	2.51	2.39	2.71	4.45	2.65
Average (Medium)	1920	1985	2.69	3.61	6.41	3.39	2.81	3.74	6.59	3.53
	1930	1995	1.91	2.62	5.03	2.56	1.99	2.71	5.12	2.63
	1937	2002	1.74	2.35	4.58	2.32	1.88	2.50	4.75	2.45
	1943	2008	1.64	2.21	4.29	2.16	1.82	2.39	4.50	2.33
	1949	2014	1.71	2.25	4.26	2.18	1.88	2.42	4.48	2.34
	1955	2020	1.73	2.25	4.19	2.15	1.88	2.41	4.39	2.31
	1964	2029	1.64	2.12	3.96	2.04	1.80	2.28	4.15	2.19
	1973	2038	1.57	2.03	3.85	1.94	1.74	2.21	4.05	2.11
	1985	2050	1.48	1.90	3.75	1.82	1.62	2.04	3.92	1.95
	1997	2062	1.33	1.71	3.48	1.63	1.45	1.84	3.63	1.74
	2004	2069	1.22	1.59	3.31	1.50	1.35	1.72	3.47	1.63
High	1920	1985	2.37	3.34	6.07	3.06	2.51	3.47	6.24	3.21
	1930	1995	1.52	2.29	4.68	2.15	1.55	2.32	4.70	2.18
	1937	2002	1.30	1.96	4.17	1.85	1.30	1.96	4.16	1.85
	1943	2008	1.13	1.74	3.80	1.63	1.16	1.77	3.83	1.66
	1949	2014	1.10	1.68	3.66	1.56	1.21	1.79	3.80	1.66
	1955	2020	1.07	1.63	3.54	1.49	1.22	1.78	3.73	1.64
	1964	2029	.99	1.50	3.32	1.38	1.13	1.64	3.50	1.52
	1973	2038	.91	1.40	3.20	1.28	1.08	1.57	3.40	1.44
	1985	2050	.82	1.26	3.10	1.15	.95	1.40	3.27	1.28
	1997	2062	.68	1.09	2.84	.98	.79	1.21	2.98	1.09
	2004	2069	.58	.98	2.68	.86	.71	1.11	2.84	.99
Maximum[2]	1920	1985	2.26	3.24	6.01		2.26	3.24	6.01	
	1930	1995	1.13	1.95	4.43		1.13	1.95	4.43	
	1937	2002	.82	1.55	3.83		.82	1.55	3.83	
	1943	2008	.58	1.26	3.37		.58	1.26	3.37	
	1949	2014	.50	1.14	3.15		.50	1.14	3.15	
	1955	2020	.38	.98	2.90		.38	.98	2.90	
	1964	2029	.23	.77	2.57		.23	.77	2.57	
	1973	2038	.14	.67	2.46		.14	.67	2.46	
	1985	2050	.03	.52	2.34		.03	.52	2.34	
	1997	2062	-.10	.36	2.10		-.10	.36	2.10	
	2004	2069	-.18	.25	1.95		-.18	.25	1.95	

[1] Both spouses are assumed to have the indicated earnings level.

[2] Maximum workers are assumed to be steady workers starting at age 22.

Table 4.—Internal Real Rates of Return for Two-Earner Couples With Selected Earnings Levels Under Present Law OASDI Program

(Percent)

Year of birth	Year attains age 65	Steady earnings pattern					Scaled earnings pattern				
		H: low W: low	H: avg. W: low	H: avg. W: avg.	H: high W: avg.	H: high W: high	H: low W: low	H: avg. W: low	H: avg. W: avg.	H: high W: avg.	H: high W: high
1920	1985	5.03	4.64	3.39	3.49	3.06	5.07	4.79	3.53	3.57	3.21
1930	1995	3.73	3.52	2.56	2.60	2.15	3.80	3.60	2.63	2.64	2.18
1937	2002	3.39	3.19	2.32	2.32	1.85	3.55	3.34	2.45	2.38	1.85
1943	2008	3.21	3.00	2.16	2.12	1.63	3.41	3.19	2.33	2.21	1.66
1949	2014	3.22	3.00	2.18	2.08	1.56	3.41	3.18	2.34	2.22	1.66
1955	2020	3.20	2.96	2.15	2.03	1.49	3.37	3.12	2.31	2.17	1.64
1964	2029	3.09	2.81	2.05	1.90	1.40	3.25	2.96	2.20	2.04	1.53
1973	2038	3.10	2.81	2.08	1.92	1.44	3.27	2.97	2.23	2.06	1.58
1985	2050	3.19	2.89	2.18	2.01	1.54	3.37	3.06	2.34	2.17	1.69
1997	2062	3.28	2.96	2.28	2.10	1.64	3.46	3.13	2.44	2.25	1.79
2004	2069	3.33	3.00	2.33	2.14	1.69	3.51	3.17	2.49	2.30	1.85

Table 5.—Internal Real Rates of Return for Two-Earner Couples With Selected Earnings Levels Under PL PAYGO Modified OASDI Program

(Percent)

Year of birth	Year attains age 65	Steady earnings pattern					Scaled earnings pattern				
		H: low W: low	H: avg. W: low	H: avg. W: avg.	H: high W: avg.	H: high W: high	H: low W: low	H: avg. W: low	H: avg. W: avg.	H: high W: avg.	H: high W: high
1920	1985	5.03	4.64	3.39	3.49	3.06	5.07	4.79	3.53	3.57	3.21
1930	1995	3.73	3.52	2.56	2.60	2.15	3.80	3.60	2.63	2.64	2.18
1937	2002	3.39	3.19	2.32	2.32	1.85	3.55	3.34	2.45	2.38	1.85
1943	2008	3.21	3.00	2.16	2.12	1.63	3.41	3.19	2.33	2.21	1.66
1949	2014	3.22	3.00	2.18	2.08	1.56	3.41	3.18	2.34	2.22	1.66
1955	2020	3.20	2.96	2.15	2.03	1.49	3.37	3.12	2.31	2.17	1.64
1964	2029	3.08	2.80	2.04	1.88	1.38	3.25	2.95	2.19	2.03	1.52
1973	2038	2.99	2.69	1.94	1.78	1.28	3.17	2.86	2.11	1.94	1.44
1985	2050	2.87	2.57	1.82	1.65	1.15	3.02	2.71	1.95	1.78	1.28
1997	2062	2.66	2.35	1.63	1.45	0.98	2.79	2.47	1.74	1.57	1.09
2004	2069	2.51	2.20	1.50	1.33	0.86	2.65	2.33	1.63	1.45	0.99

The above tables present results for single males, single females, one-earner couples, and two-earner couples respectively for both the steady and scaled earnings patterns and for both the *Present Law* and *PL PAYGO* OASDI program specifications. For each sex, marital status, and year-of-birth cohort the internal rates of return decrease as earnings increase. This is because the benefit formula is weighted toward beneficiaries with lower earnings. Females have lower mortality than males resulting in longer life after retirement and therefore higher internal rates of return even when earnings levels are the same. This effect is only partially offset by lower rates of disability for women. The one-earner couples have the highest rates of return because of the auxiliary spouse, child, and widow(er) benefits payable based on one earnings record.

For two-earner couples the internal rates of return generally fall between the corresponding rates for single male and single female workers, and are much closer to the rates for females. Where both spouses have the same earnings (tables 2 and 3), the internal rate of return for the two-earner couple is closer to the higher (female) single internal rate of return because of the inclusion of child benefits not reflected for single cases. Where spouses have different earnings levels (tables 4 and 5), the two-earner internal rate of return is closer to the single female internal rate of return. This is for the reason stated above, plus the fact that a significant additional surviving spouse benefit may be payable to the lower earner (female in these examples). For the cases chosen for this note, the wife's retired worker benefit is more than half of that of her husband's, so no spouse's benefit is payable.

It should be noted that this note does not include cases where a single individual has children, an increasingly common occurrence. Future analyses will address these cases. For now, it can be assumed that the internal rate of return for such cases would fall between those for the single worker and one-earner couple.

Comparing two hypothetical cases that only differ by whether career earnings are steady or scaled, the internal rates of return are higher for the scaled worker than for the steady

worker. The career earnings of the scaled worker are designed to produce the same average indexed monthly earnings at age 65 as those of the steady worker. Thus, the present value of benefits is nearly the same for both cases, only differing because of the different benefit levels paid due to disability and premature death. The present value of payroll taxes, however, is lower for the scaled worker. This is because career earnings for the scaled worker are more concentrated at higher ages, leaving less time between contributions and benefit payments, on average.

Based on general considerations of the rising tax rates of the OASDI Program (combined employer and employee tax went from 2 percent in 1940 to 12.4 percent starting in 1990), and the declining relative value of benefits due to an increase in the retirement age, one might expect that the internal rate of return would decline steadily as the year of birth advances. Tables 2, 3, 4, and 5 show internal rates of return for a series of birth cohorts for 68 combinations of sex, marital status, earnings level, and projected tax rates (*Present Law* and *PL PAYGO*), which permit us to test this expectation. Every one of the 68 combinations show substantial decreases in the internal rates of return for the first four year-of-birth cohorts (1920, 1930, 1937, and 1943), but for subsequent birth cohorts the expectation is not always borne out. For the *Present Law* tax schedule combinations (tables 2 and 4), the internal rates of return *increase* continually beginning with the 1985 birth cohort, due to improving mortality rates combined with a fixed Normal Retirement Age (NRA) and a fixed tax rate. For the years between—the birth cohorts 1949, 1955, 1964, and 1973—there is no consistency from series to series. For the *PL PAYGO* tax schedule combinations (tables 3 and 5), the internal rate of return *decreases* continually beginning with the 1964 birth cohort in table 3 and the 1955 cohort in table 5. These decreases in the internal rates of return for successive birth cohorts may reasonably be attributed to the increasing tax rates under *PL PAYGO* for years beginning 2025. For the years between—1949 and 1955—as with the in-between years for the *Present Law* schedule, again there is no consistent pattern from series to series.[8]

The NRA was set at age 65 in the original Social Security Act of 1935. Increases in the NRA have already started, as of 2000, as specified by the Social Security Amendments of 1983. The NRA is scheduled to be age 65 for those born before 1938, to increase by two months each year for those born from 1938 through 1943, to remain at age 66 for those born from 1944 through 1954, and then to again increase by two months each year until reaching age 67 for those born in 1960. The NRA is currently scheduled to remain at age 67 for those born after 1960.

[8] For the "in-between years" of the series of tables 2, 3, 4, and 5, the factors affecting the internal rate of return, and their qualitative effects, are known (all factors of one year in relation to a comparison year): mortality improvements increase the internal rate of return; benefit increases (decreases—including an increase in the NRA) increase (decrease) the internal rate of return; and tax increases decrease the internal rate of return. However, an explanation of the intermediate ups and downs of each series would require quantitative measures of the different effects of each factor. The development and analysis of such measures is beyond the scope of this note.

The table below presents the projected increases in average wages, and the cost-of-living benefit increases, assumed for the intermediate assumptions of the 2001 Trustees Report. Average wage increases are used to determine the benefit formula adjustments so that initially awarded benefit levels (PIAs) generally increase from year-to-year as average wage levels increase. Benefits for those already on the rolls are increased with the cost-of-living benefit increase. Future increases in the average wage are assumed to be greater than future increases in the cost of living, reflecting an assumed positive growth in real earnings. Greater real wage increases tend to lead to higher internal rates of return under a pay-as-you-go financed program like OASDI. The rates of return are also affected by changes in mortality and disability incidence and termination rates. Internal rates of return will generally increase with improvements in mortality and worsening of disability incidence experience under a pay-as-you-go financed program like OASDI.

Table 6.—Average Wage and Cost-of-Living Benefit Increases Under the Intermediate Assumptions of the 2001 Trustees Report

Year	Average wage increase	Cost-of-living benefit increase
2001	4.9	2.8
2002	4.7	2.9
2003	4.3	3.0
2004	4.3	3.1
2005	4.4	3.2
2006	4.4	3.3
2007	4.2	3.3
2008	4.2	3.3
2009	4.3	3.3
2010+	4.3	3.3

Discussion of Worker Earnings and Benefit Levels

The scaled earnings pattern was developed to address the fact that the steady earnings pattern is not realistic for computing benefit levels under some proposals. In developing the scaled earnings pattern, we focused on the relative level of earnings, and relative probability of having any earnings, by age of worker. A separate issue is the general level of earnings over a worker's entire career. To remain consistent with past benefit illustrations, we set the overall career earnings levels for the low, medium, and high scaled earnings patterns at levels that are equivalent to those of the corresponding hypothetical steady earners.

In order to properly interpret the meaning of values for these hypothetical workers, it is useful to know where, in the distribution of actual benefit levels, the benefits for our hypothetical workers fall. A hypothetical steady average worker retiring at age 62 in 1999 would have a PIA of $1,025.00. Similar steady low-wage and high-wage workers would have PIAs of $622.50 and $1,329.20, respectively. Based on a

1-percent sample of new retired worker awards in 1999[9], we find that about 28 percent of these new retirees receive benefits at or below that for a steady low-wage worker, 30 percent receive benefits between those for steady low-wage and steady average-wage workers, 28 percent receive benefits between those for a steady average and steady high wage worker, and 14 percent receive benefits over the level for a steady high wage worker. In total, about 58 percent of retirees receive benefits less than those of the hypothetical steady average worker and 42 percent receive higher benefits.

The distribution of actual benefits is quite different for newly awarded male, as compared with newly awarded female, retired workers. The benefit for the hypothetical steady average worker is low in the distribution of actual male retiree benefits, but is high in the distribution of female retiree benefits. Approximately 66 percent of males retiring in 1999 received benefits higher than that of the steady average worker, while 87 percent of females received benefits below that level. This is fairly consistent with an earlier note[10] that found that 60 percent of males retiring at age 62 in 1982 had benefits over that of a corresponding steady average worker.

Also of interest is the percentage of actual retirees that is "best represented"[5] by each type of hypothetical worker provided in table 1. Approximately 44 percent of 1999 newly-awarded retired workers are best represented by the hypothetical low-wage worker, 25 percent by the average-wage worker, 25 percent by the high-wage worker, and 6 percent by the maximum-wage worker. Approximately 6 percent of workers retiring in 1999 received benefits that were less than half the benefit of a hypothetical low-wage-steady worker. Considering males alone, approximately 20 percent are best represented by the low-wage earner, 28 percent by the average-wage earner, 41 percent by the high-wage earner, and 10 percent by the maximum-wage earner. Only 2 percent of these male retirees receive benefits less than half that of a low-wage-steady worker. For females, the corresponding values are: 72 percent are best represented by the low-wage earner, 22 percent by the average-wage earner, 6 percent by the high-wage earner, and under 1 percent by the maximum-wage earner. Just over 10 percent of these female retirees had benefits that were under half that of the low-wage earner. The median PIA for males retiring in 1999 falls between the hypothetical steady average and high workers. However, the median PIA for females is closest to that of the hypothetical low-wage earner, and may be said to be best represented by this earnings pattern.

[9] For comparability in these calculations, the benefits of workers retiring at ages other than 62 were adjusted by wage indexing to make them equivalent to those of age 62 retirees.

[10] Actuarial Note 121, *Primary Insurance Amount for an Average Male Worker*, by Bertram M. Kestenbaum.

Conclusions

In this note we present internal real rates of return over time for various illustrative demographic groups and earnings levels. However, we recognize that a variety of other approaches, methods and assumptions can be used in this type of analysis. We believe these hypothetical examples provide useful insight into how internal rates of return vary over generations, and by sex, earnings level and pattern, and marital status.

Realistic earnings patterns are essential in determining realistic internal rates of return for workers and for computing accumulations of and distributions from individual accounts under a number of proposals. Because scaled earnings patterns concentrate earnings somewhat later in a career than do steady earner patterns, the scaled pattern results in slightly higher internal real rates of return under the OASDI program, and slightly lower accumulations for individual accounts

The significance of the internal rate of return must be kept in proper perspective. A higher internal rate of return does not necessarily mean a higher monthly benefit, even for two individuals with the same earnings. As one example, consider a man and a woman with the same earnings. A woman born in 1975 may expect to live 20.13 years after the Normal Retirement Age of 67. Her male counterpart born in 1975 may expect to live 17.16 years after age 67[11]. Her expected number of years of life after age 67 exceeds that of her male counterpart by 17 percent, and, as a result, her internal rate of return is considerably more than her male counterpart with the same earnings record[12]. However, the monthly benefit she receives is exactly the same as for her male counterpart. Her higher internal rate of return derives solely from her longer expected lifetime.

Based on the provisions for benefits in the Social Security Act that have evolved since 1935, it is clear that the goal for the program has been to provide similarly adequate monthly benefits for men and women, and for married and non-married workers. The goal has not been to provide similar internal rates of return for these groups. Thus, while this note illustrates the fact that the internal rate of return does and has varied considerably, it is clear that this variation was both expected and intended.

[11] Based on 2001 Trustees Report intermediate mortality assumptions.

[12] For example if she is single with a medium earnings record, her internal rate of return is about 25 percent more than her male counterpart.

Appendix

METHODOLOGY FOR DEVELOPING SCALED WORKER FACTORS

Introduction

Hypothetical earnings histories have traditionally been used by the Office of the Chief Actuary to illustrate a range of benefit levels, replacement rates, money's worth measures, time to recover contributions, and internal rates of return under the Social Security program. These illustrations have long been used to evaluate the program under present law, but have increasingly been used to evaluate the effects of possible alternatives. The traditional hypothetical workers that have been used are "steady" workers. They have been assumed to work steadily beginning at age 22, until retirement, death, or disability, and to have a steady amount of earnings relative to the official SSA Average Wage Index (AWI) each year. For example, the "steady average" worker is assumed to earn the AWI for every working year. Similarly, the "steady low" worker is assumed to earn 45 percent of the AWI for every working year, and the "steady high" worker is assumed to earn 160 percent of the AWI for every working year. The "steady maximum" worker is assumed to earn the maximum taxable earnings (the "earnings base") in every working year.

These hypothetical steady earnings histories tend to over-represent the proportion of actual lifetime earnings received at younger ages and under-represent the proportion received at prime working ages for most workers. Sample data show that it is fairly typical for workers' earnings to start out relatively low at young ages, to rise rapidly as they initially gain experience, and then to increase more gradually, or level off, at older ages.

Though somewhat unrepresentative, the hypothetical steady workers have the advantage of simplicity, and are adequate for analyzing relative benefit levels under present law and many alternative plans, both across earnings levels and over time. However, these illustrations are not fully satisfactory for making comparisons of benefits under individual account plans, or other plans where benefits are dependent on the timing as well as the amount of earnings.

Over-representing early earnings tends to bias downward estimates of the internal rate of return of the present-law program, while at the same time biasing upward estimates of benefit levels under plans with individual accounts. To avoid these biases, the Office of the Chief Actuary has developed "scaled worker" hypothetical earnings histories. These earnings histories reflect the more typical patterns of work and earnings levels of actual workers over their careers.

This appendix describes how the scaled worker factors used in determining the hypothetical scaled earnings histories have been developed. For a given age the fundamental unit, which we call "normalized earnings", is the ratio of a worker's annual earnings at that age to the same year's AWI. Normalized earnings for a given age can be combined and averaged over time.

Three sets of scaled worker factors have been developed, representing low, medium, and high lifetime earnings. (Maximum workers are assumed to work steadily at the OASDI taxable maximum, as before.) Initially, one set of *raw scaled factors* is developed using earnings from the Continuous Work History Sample (CWHS). Then, the *raw scaled factors* are adjusted so as to produce the same Average Indexed Monthly Earnings (AIME)[13] values as those calculated for low, average, and high earning steady workers. This approach has been selected in order to provide continuity with previous estimates for steady workers. Because these adjusted lifetime earnings levels are not designed to represent any particular points in the distribution(s) for actual workers, familiarity with where these hypothetical earnings histories fall in the actual distribution is important. This is discussed in the section entitled "Discussion of Worker Earnings and Benefit Levels" on page 7 of this note.

Developing *Raw Scaled Factors* from Earnings in the CWHS

Development of the *raw scaled factors* occurs in three steps:

(1) Determine which workers in the CWHS to include in the study,

(2) Tabulate the earnings for these workers, and

(3) Develop the *raw scaled factors* from the tabulated earnings.

Determine Which Workers in the CWHS to Include in the Study.

The CWHS is a 1-percent sample of workers who have paid FICA taxes sometime during their lifetime. It is updated annually by the Office of Research, Evaluation, and Statistics. The factors in this actuarial note are developed using the 1998 version of the CWHS.

Because the CWHS contains earnings for all persons who have paid FICA taxes sometime during their lifetime, it is important to limit analysis only to workers who are likely to be eligible for retirement or disability benefits, or have dependents eligible for survivors benefits. To include only those workers, we used the status of *presently fully insured*. Basically, a worker is considered *presently fully insured* if he or

[13] The AIME value represents the beneficiary's average monthly earnings, after indexing for wage growth in the economy, in his or her highest years of earnings.

she has a total number of quarters of coverage (QCs)[14] at least equal to the number of years after attainment of age 21 through the last year considered in the analysis (in this case 1997). A further requirement is that the worker has a minimum of 6 QCs. Since *permanent fully insured* status is achieved with 40 QCs, any worker with 40 QCs is *presently fully insured* no matter how many years have elapsed since age 21. Any worker who is classified as *presently fully insured* is likely to be eligible for a Social Security retirement benefit if he or she survives to eligibility age.

Tabulate Earnings

The 1998 CWHS file contains FICA earnings for years 1951 through 1998. Due to posting delays, the earnings for 1998 in this file are less complete than for earlier years and were not used in our analysis. For each of the workers classified as *presently fully insured*, earnings in years 1988 through 1997 for which the worker is age 21 or over are included. Each year of earnings is classified by age of worker and is expressed as the ratio of the earnings to the AWI for the year.

Scaled factors were developed to take into account both the variations in earnings by age and the probabilities that workers may have years with zero earnings. Years with zero earnings are included among the earnings records selected. However, years in which the worker was deceased[15] or receiving a primary Social Security benefit are not included.

Develop Raw Scaled Factors

To normalize earnings from different years, annual earnings amounts for each year are divided by the AWI for that year. For each *presently fully insured* worker, normalized earnings are tabulated by age for each age 21 and over for years 1988-97, as described in the preceding paragraph. The normalized earnings are summed by age and a corresponding worker count is kept. The *raw scaled factors* are determined by dividing the tabulated sum for each age by the corresponding worker count. The tabulated amounts, corresponding worker counts, and computed *raw scaled factors* are shown in table A1.

[14] The QC is the basic unit for determining whether a worker is insured for Social Security benefits. In 1997, for example, a worker needed to have $670 in covered earnings to obtain a QC. Workers can earn up to 4 QC's per calendar year. Since 1978 the amount of covered earnings required to obtain a QC has been automatically indexed each year with the growth in the SSA official average wage index. See http://www.ssa.gov/OACT/COLA/QC.html for more information, including a list of historical QC amounts.

[15] Data concerning worker deaths was taken from the CWHS. Death data in the CWHS may be somewhat understated.

Table A1.—Aggregate Normalized Earnings (Ratio of Annual Earnings to Current AWI), Count of *Presently Fully Insured* Workers in Sample, and *Raw Scaled Factors*; by Age

Age	Aggregate of normalized earnings (1)	Number of earners at age (2)	Raw scaled factor (1)÷(2) (3)
21	105,404	342,946	0.307
22	128,562	352,727	.364
23	161,731	362,655	.446
24	193,283	373,277	.518
25	220,435	383,352	.575
26	245,216	393,115	.624
27	266,792	399,642	.668
28	284,844	404,616	.704
29	299,951	409,471	.733
30	314,626	415,055	.758
31	328,142	420,734	.780
32	339,568	424,949	.799
33	348,564	426,454	.817
34	354,484	425,037	.834
35	358,540	421,955	.850
36	359,675	417,244	.862
37	359,765	410,579	.876
38	357,027	401,947	.888
39	354,024	393,953	.899
40	351,362	386,016	.910
41	350,100	379,024	.924
42	343,972	368,139	.934
43	332,605	353,013	.942
44	320,899	338,459	.948
45	311,183	326,300	.954
46	300,599	313,654	.958
47	287,368	299,228	.960
48	273,994	285,300	.960
49	258,234	270,691	.954
50	242,447	255,910	.947
51	223,384	238,498	.937
52	208,734	225,677	.925
53	197,737	217,407	.910
54	186,183	208,673	.892
55	172,557	198,292	.870
56	158,222	188,626	.839
57	147,643	182,183	.810
58	138,212	176,889	.781
59	129,020	171,878	.751
60	119,072	167,233	.712
61	108,495	163,414	.664
62	78,296	92,170	.849
63	59,908	70,074	.855
64	49,498	59,841	.827

Adjust *Raw Scaled Factors* to Match Steady Worker AIME Values

Adjustment of the *raw scaled factors* occurs in four steps:

(1) Calculate *preliminary adjusted scaled factors* from the *raw scaled factors*;

(2) Construct the earnings record and calculate the AIME for a hypothetical scaled worker using the *preliminary adjusted scaled factors*;

(3) Determine AIME values for low, average, and high steady workers; and

(4) Calculate low, medium, and high *scaled factors* from the *preliminary adjusted scaled factors* that would give hypothetical scaled workers the same AIME values as hypothetical steady workers.

Calculating Preliminary Adjusted Scaled Factors from Raw Scaled Factors

The following values, based on table A1, show that there is an accelerating decline in raw factors at ages 59 through 61, followed by increases at ages 62 and 63:

Age	Raw factor	Difference
55	0.870	
56	.839	-0.031
57	.810	-.029
58	.781	-.029
59	.751	-.030
60	.712	-.039
61	.664	-.048
62	.849	+.185
63	.855	+.006
64	.827	-.028

Definitive information is not available at this time on reasons for these changes after age 59. However, it seems reasonable to assume that some of the decline in the raw factors at ages 59 through 61 is due to retirement (total or partial) of some workers before they became entitled to their OASDI retirement benefits at age 62. The increases in the raw factors at ages 62 and 63 may reasonably be attributed to the fact that healthier, higher-wage workers, and workers who have maintained consistent employment at higher ages, are more likely to delay entitlement to OASDI benefits until after age 62. The earnings of many non-workers, low-wage workers, or less-healthy workers have been removed from the tabulated group starting at age 62 because they have started to receive retirement benefits under Social Security.

Due to the inconsistency of the data for ages over 61, a smoother set of "adjusted" raw factors was used for ages 62-64. The factors were developed assuming that wages for workers over age 61 would stay constant in nominal dollars, thus decreasing in real (constant) dollars. To develop *preliminary adjusted scaled factors, the preliminary adjusted scaled factors* are set equal to the *raw scaled factors* for ages up to 61, and then the factors for ages 62 and over are calculated so that earnings in nominal dollars would stay constant at the level for age 61. For example, the preliminary adjusted factor for age 62 is calculated by dividing the factor for age 61 by the ultimate assumed annual increase in average wages under the intermediate assumptions of the 2001 Trustees Report. The calculation of the *preliminary adjusted scaled factors* for ages 62-64 is shown in table A2.

This approach, while providing an imperfect approximation for all types of workers, was adopted in order to avoid having different scales for workers who become entitled to OASDI benefits at different ages.

Table A2.—Scaled Factor Adjustments Made for Ages After 61

Age	61	62	63	64
Raw scaled factor	0.664	0.849	0.855	0.827
Ultimate AWI increase since age 61, based on 2001 Trustees Report, Intermediate Assumptions	1.000	1.043	$(1.043)^2$	$(1.043)^3$
Preliminary adjusted scaled factor (age 61 raw scaled factor) /(Ultimate AWI increase)	0.664	0.637	0.610	0.585

Construct the Earnings Record and Calculate the AIME for a Hypothetical Scaled Worker Using the Preliminary Adjusted Scaled Factors

This hypothetical scaled worker is assumed to have date of birth January 2, 1950, to have earnings from age 21 through age 64, and to retire at age 65. Earnings for each year are calculated by multiplying the *preliminary adjusted scaled factor* for that age by the AWI value for the corresponding year. This hypothetical scaled worker based on the *preliminary adjusted scaled factors* turns age 22 in 1972. So the age 22 factor of 0.364 is multiplied by the 1972 AWI of $7,133.80 to obtain annual earnings of $2,596.70. Table A3 shows the *preliminary adjusted scaled factors*, AWI amounts, and corresponding hypothetical earnings for this hypothetical worker. The earnings record thus constructed has an AIME value of $3,526 for this worker.

Table A3.—Computation of the Earnings Record and the AIME for the Theoretical Scaled Worker Born in 1950 Based on the Preliminary Adjusted Scaled Factors and the AWI Series

Year	Age	Preliminary adjusted scaled factors (1)	AWI for current year (2)	Estimated earnings for current year (1)*(2) (3)
1971	21	0.307	$6,497.08	$1,994.60
1972	22	.364	7,133.80	2,596.70
1973	23	.446	7,580.16	3,380.75
1974	24	.518	8,030.76	4,159.93
1975	25	.575	8,630.92	4,962.78
1976	26	.624	9,226.48	5,757.32
1977	27	.668	9,779.44	6,532.67
1978	28	.704	10,556.03	7,431.45
1979	29	.733	11,479.46	8,414.44
1980	30	.758	12,513.46	9,485.20
1981	31	.780	13,773.10	10,743.02
1982	32	.799	14,531.34	11,610.54
1983	33	.817	15,239.24	12,450.46
1984	34	.834	16,135.07	13,456.65
1985	35	.850	16,822.51	14,299.13
1986	36	.862	17,321.82	14,931.41
1987	37	.876	18,426.51	16,141.62
1988	38	.888	19,334.04	17,168.63
1989	39	.899	20,099.55	18,069.50
1990	40	.910	21,027.98	19,135.46
1991	41	.924	21,811.60	20,153.92
1992	42	.934	22,935.42	21,421.68
1993	43	.942	23,132.67	21,790.98
1994	44	.948	23,753.53	22,518.35
1995	45	.954	24,705.66	23,569.20
1996	46	.958	25,913.90	24,825.52
1997	47	.960	27,426.00	26,328.96
1998	48	.960	28,861.44	27,706.98
1999	49	.954	30,469.84	29,068.23
2000	50	.947	32,104.67	30,403.12
2001	51	.937	33,680.35	31,558.49
2002	52	.925	35,277.03	32,631.25
2003	53	.910	36,781.09	33,470.79
2004	54	.892	38,372.33	34,228.12
2005	55	.870	40,044.65	34,838.85
2006	56	.839	41,799.45	35,069.74
2007	57	.810	43,575.71	35,296.33
2008	58	.781	45,416.27	35,470.11
2009	59	.751	47,350.68	35,560.36
2010	60	.712	49,366.08	35,148.65
2011	61	.664	51,488.82	34,188.58
2012	62	.637	53,702.84	34,188.58
2013	63	.610	56,012.06	34,188.58
2014	64	.585	58,420.58	34,188.58
AIME				3,526

Determine AIME Values for Low, Average, and High Steady Workers

AIME values are determined for three different steady workers, denoted as low, average, and high steady workers. All three steady workers are assumed to be born on January 2, 1950, to retire February 1, 2015, and to have steady earnings from age 22 (1972) through age 64 (2014). The only difference among the three is the level of earnings. For the low steady worker, each year of earnings is assumed to equal 45 percent of the AWI. For the average steady worker, each year of earnings is assumed to equal the AWI. For the high steady worker, each year of earnings is assumed to equal 160 percent of AWI. For years in which actual historical AWI values are not available, we use the AWI levels assumed for the intermediate assumptions of the 2001 Trustees Report. The earnings records, along with calculated AIMEs, for our three steady workers are given in table A4, as follows:

Table A4.—Three Hypothetical Steady Workers Born in 1950: Their Earnings and Their AIMEs

Year	Age	AWI	Low Worker 45% of AWI	Average Worker 100% of AWI	High Worker 160% of AWI
1971	21	$6,497.08	$2,923.69	$6,497.08	$7,800.00
1972	22	7,133.80	3,210.21	7,133.80	9,000.00
1973	23	7,580.16	3,411.07	7,580.16	10,800.00
1974	24	8,030.76	3,613.84	8,030.76	12,849.22
1975	25	8,630.92	3,883.91	8,630.92	13,809.47
1976	26	9,226.48	4,151.92	9,226.48	14,762.37
1977	27	9,779.44	4,400.75	9,779.44	15,647.10
1978	28	10,556.03	4,750.21	10,556.03	16,889.65
1979	29	11,479.46	5,165.76	11,479.46	18,367.14
1980	30	12,513.46	5,631.06	12,513.46	20,021.54
1981	31	13,773.10	6,197.90	13,773.10	22,036.96
1982	32	14,531.34	6,539.10	14,531.34	23,250.14
1983	33	15,239.24	6,857.66	15,239.24	24,382.78
1984	34	16,135.07	7,260.78	16,135.07	25,816.11
1985	35	16,822.51	7,570.13	16,822.51	26,916.02
1986	36	17,321.82	7,794.82	17,321.82	27,714.91
1987	37	18,426.51	8,291.93	18,426.51	29,482.42
1988	38	19,334.04	8,700.32	19,334.04	30,934.46
1989	39	20,099.55	9,044.80	20,099.55	32,159.28
1990	40	21,027.98	9,462.59	21,027.98	33,644.77
1991	41	21,811.60	9,815.22	21,811.60	34,898.56
1992	42	22,935.42	10,320.94	22,935.42	36,696.67
1993	43	23,132.67	10,409.70	23,132.67	37,012.27
1994	44	23,753.53	10,689.09	23,753.53	38,005.65
1995	45	24,705.66	11,117.55	24,705.66	39,529.06
1996	46	25,913.90	11,661.26	25,913.90	41,462.24
1997	47	27,426.00	12,341.70	27,426.00	43,881.60
1998	48	28,861.44	12,987.65	28,861.44	46,178.30
1999	49	30,469.84	13,711.43	30,469.84	48,751.74
2000	50	32,104.67	14,447.10	32,104.67	51,367.47
2001	51	33,680.35	15,156.16	33,680.35	53,888.56
2002	52	35,277.03	15,874.66	35,277.03	56,443.25
2003	53	36,781.09	16,551.49	36,781.09	58,849.74
2004	54	38,372.33	17,267.55	38,372.33	61,395.73
2005	55	40,044.65	18,020.09	40,044.65	64,071.44
2006	56	41,799.45	18,809.75	41,799.45	66,879.12
2007	57	43,575.71	19,609.07	43,575.71	69,721.14
2008	58	45,416.27	20,437.32	45,416.27	72,666.03
2009	59	47,350.68	21,307.81	47,350.68	75,761.09
2010	60	49,366.08	22,214.74	49,366.08	78,985.73
2011	61	51,488.82	23,169.97	51,488.82	82,382.11
2012	62	53,702.84	24,166.28	53,702.84	85,924.54
2013	63	56,012.06	25,205.43	56,012.06	89,619.30
2014	64	58,420.58	26,289.26	58,420.58	93,472.93
AIME			1,874	4,166	6,666

Calculate Low, Medium, and High Scaled Factors from the Preliminary Adjusted Scaled Factors

To maintain continuity with each of the three steady worker estimates, the *preliminary adjusted scaled factors* are further adjusted so that the AIME value for the scaled worker matches the AIME value for the corresponding steady worker. This requires three separate calculations, one each for the low, medium, and high earnings cases. For example, the *scaled factors* for the hypothetical medium scaled worker are determined by multiplying:

(1) The *preliminary adjusted scaled factors* for ages 22 through 64, by;

(2) The ratio of the average steady worker AIME to the scaled worker AIME.

Repeating the above procedure with low and high steady worker AIME values, we obtain the final *scaled factors* for the low and high workers. Table A5 gives the details of the calculation of the three AIME ratios.

Table A5.—Table of Key AIME Ratios Used to Fit Scaled Worker Calculations to Steady Worker Values

Case	Year of birth 1950, steady worker AIME (1)	Year of birth 1950, scaled worker AIME based on table A3 (2)	Ratio (1)÷(2) (3)
1. Steady worker, year of birth 1950, AIME is **Low**	$1,874	$3,526	0.532
2. Steady worker, year of birth 1950, AIME is **Average**.....	4,166	3,526	1.182
3. Steady worker, year of birth 1950, AIME is **High**	6,666	3,526	1.891

Table A6 shows the calculation of the final *scaled factors*, combining the *preliminary adjusted scaled factors* and the AIME ratios.

Table A6.—Calculation of Final Scaled Factors

		Earnings level		
		Low	Medium	High
Adjustment factors →		0.532	1.182	1.891
Age	Preliminary adjusted scaled factors	Final scaled factors		
21	0.307	0.163	0.363	0.581
22	.364	.193	.430	.688
23	.446	.237	.527	.843
24	.518	.275	.612	.979
25	.575	.306	.679	1.087
26	.624	.332	.737	1.180
27	.668	.355	.789	1.263
28	.704	.374	.832	1.331
29	.733	.390	.866	1.386
30	.758	.403	.896	1.433
31	.780	.415	.922	1.475
32	.799	.425	.944	1.511
33	.817	.434	.965	1.545
34	.834	.443	.985	1.577
35	.850	.452	1.004	1.607
36	.862	.458	1.018	1.630
37	.876	.466	1.035	1.656
38	.888	.472	1.049	1.679
39	.899	.478	1.062	1.700
40	.910	.484	1.075	1.720
41	.924	.491	1.092	1.747
42	.934	.496	1.104	1.766
43	.942	.501	1.113	1.781
44	.948	.504	1.120	1.792
45	.954	.507	1.127	1.804
46	.958	.509	1.132	1.811
47	.960	.510	1.134	1.815
48	.960	.510	1.134	1.815
49	.954	.507	1.127	1.804
50	.947	.503	1.119	1.790
51	.937	.498	1.107	1.771
52	.925	.492	1.093	1.749
53	.910	.484	1.075	1.720
54	.892	.474	1.054	1.686
55	.870	.462	1.028	1.645
56	.839	.446	.991	1.586
57	.810	.430	.957	1.531
58	.781	.415	.923	1.477
59	.751	.399	.887	1.420
60	.712	.378	.841	1.346
61	.664	.353	.785	1.255
62	.637	.339	.753	1.204
63	.610	.324	.721	1.153
64	.585	.311	.691	1.106

Developing Hypothetical Worker Earnings from Factors

Given a year of birth, and an earnings level for scaled workers, classified as either low, medium, or high workers, annual earnings can be obtained by taking the relevant set of *scaled factors* and multiplying them by the AWIs in the corresponding years. Consider as an example a low earnings worker born in 1970. To determine earnings for this worker at age 22, the *scaled factor* for the low worker at age 22 would be multiplied by the AWI in 1992, the year in which the worker turns 22. Because the hypothetical workers are born in January, a year of age corresponds to a calendar year. Therefore, a worker born on January 2, 1970 would be age 22 throughout 1992. Earnings for other ages are determined in the same manner. In this manner, a series of low, medium, and high scaled earnings can be developed for any hypothetical year of birth. Table A7 carries out the calculation of hypothetical scaled worker earnings for the high earnings workers for the selected years of birth 1930, 1949, and 1997.

Table A7.—Calculation of Scaled Earnings for High Earnings Workers for Years of Birth 1930, 1949, and 1997

Year of birth →		1930		1949		1997	
	Final scaled factors for high earner	AWI	Age-scaled earnings (1)*(2)	AWI	Age-scaled earnings (1)*(4)	AWI	Age-scaled earnings (1)*(6)
Age	(1)	(2)	(3)	(4)	(5)	(6)	(7)
22	0.688	$2,973.32	$2,046.10	$6,497.08	$4,470.98	$72,108.66	$49,621.72
23	.843	3,139.44	2,647.10	7,133.80	6,015.04	75,209.33	63,414.65
24	.979	3,155.64	3,090.30	7,580.16	7,423.20	78,443.33	76,819.02
25	1.087	3,301.44	3,588.84	8,030.76	8,729.86	81,816.39	88,938.78
26	1.180	3,532.36	4,167.09	8,630.92	10,181.80	85,334.50	100,668.19
27	1.263	3,641.72	4,599.03	9,226.48	11,651.87	89,003.88	112,400.54
28	1.331	3,673.80	4,889.58	9,779.44	13,015.76	92,831.05	123,551.76
29	1.386	3,855.80	5,343.20	10,556.03	14,628.09	96,822.78	134,172.81
30	1.433	4,007.12	5,742.28	11,479.46	16,450.29	100,986.16	144,715.17
31	1.475	4,086.76	6,026.38	12,513.46	18,452.49	105,328.57	155,318.72
32	1.511	4,291.40	6,482.29	13,773.10	20,804.70	109,857.70	165,943.51
33	1.545	4,396.64	6,790.88	14,531.34	22,444.54	114,581.58	176,978.24
34	1.577	4,576.32	7,215.48	15,239.24	24,027.71	119,508.59	188,429.19
35	1.607	4,658.72	7,486.32	16,135.07	25,928.22	124,647.45	200,302.02
36	1.630	4,938.36	8,047.72	16,822.51	27,414.55	130,007.30	211,864.41
37	1.656	5,213.44	8,633.99	17,321.82	28,686.70	135,597.61	224,563.49
38	1.679	5,571.76	9,353.81	18,426.51	30,934.21	141,428.31	237,428.21
39	1.700	5,893.76	10,016.94	19,334.04	32,859.83	147,509.72	250,705.19
40	1.720	6,186.24	10,642.68	20,099.55	34,578.86	153,852.64	264,685.01
41	1.747	6,497.08	11,349.41	21,027.98	36,732.67	160,468.30	280,313.64
42	1.766	7,133.80	12,596.53	21,811.60	38,513.89	167,368.44	295,531.27
43	1.781	7,580.16	13,499.33	22,935.42	40,845.16	174,565.28	310,879.28
44	1.792	8,030.76	14,392.89	23,132.67	41,458.84	182,071.59	326,312.36
45	1.804	8,630.92	15,566.41	23,753.53	42,840.99	189,900.67	342,497.87
46	1.811	9,226.48	16,710.31	24,705.66	44,745.05	198,066.40	358,723.08
47	1.815	9,779.44	17,748.77	25,913.90	47,031.30	206,583.25	374,929.26
48	1.815	10,556.03	19,158.21	27,426.00	49,775.62	215,466.33	391,051.22
49	1.804	11,479.46	20,703.93	28,861.44	52,053.43	224,731.39	405,317.27
50	1.790	12,513.46	22,403.22	30,469.84	54,551.05	234,394.84	419,644.01
51	1.771	13,773.10	24,398.00	32,104.67	56,870.99	244,473.81	433,066.84
52	1.749	14,531.34	25,411.51	33,680.35	58,898.11	254,986.19	445,904.03
53	1.720	15,239.24	26,217.28	35,277.03	60,689.90	265,950.59	457,536.09
54	1.686	16,135.07	27,209.38	36,781.09	62,025.81	277,386.47	467,770.82
55	1.645	16,822.51	27,668.97	38,372.33	63,113.23	289,314.09	475,851.93
56	1.586	17,321.82	27,475.05	40,044.65	63,516.92	301,754.59	478,628.82
57	1.531	18,426.51	28,217.02	41,799.45	64,008.64	314,730.04	481,954.70
58	1.477	19,334.04	28,546.75	43,575.71	64,339.62	328,263.43	484,681.61
59	1.420	20,099.55	28,537.06	45,416.27	64,481.39	342,378.76	486,104.62
60	1.346	21,027.98	28,304.83	47,350.68	63,736.65	357,101.05	480,677.86
61	1.255	21,811.60	27,380.33	49,366.08	61,969.75	372,456.39	467,548.33
62	1.204	22,935.42	27,620.35	51,488.82	62,006.24	388,472.02	467,823.65
63	1.153	23,132.67	26,677.10	53,702.84	61,931.28	405,176.31	467,258.15
64	1.106	23,753.53	26,270.42	56,012.06	61,947.02	422,598.90	467,376.88