

H. ASSUMPTIONS AND METHODS UNDERLYING THE ACTUARIAL ESTIMATES

This section describes the assumptions and methods which underlie the actuarial estimates in this report. Unless specifically stated otherwise, the assumptions and methods were used for each of the three alternatives and for both the short-range and long-range periods. Some of the principal economic and demographic assumptions which vary by alternative are summarized in section II.D. Further details about the assumptions, methods, and actuarial estimates are contained in Actuarial Studies published by the Office of the Actuary, Social Security Administration, which are available upon request.

1. Total Population

Projections were made of the population in the Social Security Area by age, sex, and marital status as of January 1 of each year 1992 through 2080. The projections started with an estimate of the United States population, including armed forces overseas, as of January 1, 1991, based on data from the Bureau of the Census. This population estimate was adjusted for net census undercount and increased for other U.S. citizens living abroad and for populations in the geographic areas covered by the OASDI program but not included in the U.S. population. This population was then projected using assumed rates of birth, death, marriage, and divorce and assumed levels of migration.

Historically, fertility rates in the United States have fluctuated widely. The total fertility rate is defined to be the average number of children that would be born to a woman in her lifetime if she were to experience the birth rates by age observed in, or assumed for, the selected year, and if she were to survive the entire child-bearing period. The total fertility rate decreased from 3.3 children per woman after World War I to 2.1 during the Great Depression, rose to 3.7 in 1957, and then fell to 1.7 in 1976. Since then, it has risen to a level currently estimated at 2.08 for 1990 and 2.06 for 1991.

These variations in fertility rates have resulted from changes in many factors, including social attitudes, economic conditions, and the use of birth-control methods. Future fertility rates may be expected to remain close to recent levels. The recent historical and projected trends in certain population characteristics are consistent with a

Actuarial Analysis

continued relatively low fertility rate. These trends include the rising percentages of women who have never married, of women who are divorced, and of young women who are in the labor force. Based on consideration of these factors, ultimate total fertility rates of 2.2, 1.9, and 1.6 children per woman were selected for alternatives I, II, and III, respectively. For each alternative, the total fertility rate is assumed to reach its ultimate level in 2017. A rate of 2.1 would ultimately result in a nearly constant population if net immigration were zero and if death rates were constant.

Historically, death rates in the United States, calculated using final data for 1900-89 and provisional data for 1990 and 1991, show a steady declining trend. The age-sex-adjusted death rate—which is calculated here as the crude rate that would occur in the enumerated total population as of April 1, 1980, if that population were to experience the death rates by age and sex for the selected year—declined at an average rate of 1.2 percent per year between 1900 and 1990. These reductions in death rates have resulted from many factors, including increased medical knowledge and availability of health-care services, and improvements in personal health-care practices such as diet and exercise. Based on consideration of the likelihood of continued progress in these and other areas, three alternative sets of ultimate annual percentage reductions in central death rates by age, sex, and cause of death were selected for 2017 and later. The intermediate set, which is used for alternative II, is considered to be the one closest to average expectations. Except for those causes of death which primarily affect workers and children, the average annual percentage reductions used for alternative I are smaller than those for alternative II, while those used for alternative III are greater. Between 1991 and 2017, the reductions in central death rates for alternative II are assumed to change gradually from the average annual reductions by age, sex, and cause of death observed between 1968 and 1989, to the ultimate annual percentage reductions by age, sex, and cause of death assumed for 2017 and later. Alternative I reductions are assumed to change gradually from 50 percent of the average annual reductions observed between 1968 and 1989, while alternative III reductions are assumed to change gradually from 150 percent of the average annual reductions observed between 1968 and 1989. The age-sex-adjusted death rate (for all causes combined) de-

clined at an average rate of 1.4 percent per year between 1968 and 1989.

After adjustment for changes in the age-sex distribution of the population, the resulting death rates were projected to decline at an average annual rate of about 0.3 percent, 0.6 percent, and 1.0 percent between 1989 and 2067 for alternatives I, II, and III, respectively.

For calendar years 1991 and 1992, the net legal immigration is assumed to be 528,000 and 630,000 persons per year, respectively. In addition, for these years the net other-than-legal immigration assumption is 200,000 persons per year, which is consistent with the estimates of net other-than-legal immigration made by the Bureau of the Census based on the 1990 Census. The Immigration Act of 1990 increased substantially the number of legal immigrants permitted starting in 1992. For calendar year 1993, net immigration is assumed to be 1,110,000, 845,000, and 675,000 persons per year for alternatives I, II, and III, respectively. Of these net numbers of immigrants, 760,000, 645,000, and 575,000, respectively, are assumed to be legal, and the remainders are assumed to be other-than-legal. As the 1990 legislation changes numbers to be admitted by calendar year, estimates for 1994, 1995 through 1999, and 2000 and later are used. Net immigration for 1994 is assumed to be 1,130,000, 860,000, and 700,000 persons per year for alternatives I, II, and III, respectively. Of these net numbers of immigrants, 780,000, 660,000, and 600,000, respectively, are assumed to be legal, and the remainders are assumed to be other-than-legal. Net immigration for 1995 through 1999 is assumed to be 1,150,000, 875,000, and 700,000 persons per year for alternatives I, II, and III, respectively. Of these net numbers of immigrants, 800,000, 675,000, and 600,000, respectively, are assumed to be legal, and the remainders are assumed to be other-than-legal. Net immigration for 2000 and later is assumed to be 1,100,000, 850,000, and 700,000 persons per year for alternatives I, II, and III, respectively. Of these net numbers of immigrants, 750,000, 650,000, and 600,000, respectively, are assumed to be legal, and the remainders are assumed to be other-than-legal.

Table II.H.1 shows the projected population as of July 1 by broad age group, for the three alternatives. Also shown are tabulated aged dependency ratios (see table footnotes for definitions). Because eligibility for many types of OASDI benefits depends on marital status, the population was projected by marital status, as well as by age

Actuarial Analysis

and sex. Marriage and divorce rates were based on recent data from the National Center for Health Statistics.

TABLE II.H.1.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS, BY ALTERNATIVE AND BROAD AGE GROUP, CALENDAR YEARS 1950-2070

Calendar year	Population (in thousands)				Dependency ratio	
	Under 20	20-64	65 and over	Total	Aged ¹	Total ²
Historical data:						
1950	53,895	92,739	12,752	159,386	0.138	0.719
1960	72,989	99,842	17,250	190,081	.173	.904
1970	80,672	113,184	20,920	214,776	.185	.898
1975	78,428	122,852	23,265	224,545	.189	.828
1980	74,550	134,393	26,143	235,086	.195	.749
1985	73,240	144,548	28,996	246,784	.201	.707
1990	75,097	152,350	31,831	259,278	.209	.702
Alternative I:						
1995	79,294	160,231	33,967	273,493	.212	.707
2000	82,776	169,499	34,798	287,072	.205	.694
2005	84,886	179,540	35,665	300,091	.199	.671
2010	86,775	188,446	38,106	313,326	.202	.663
2015	89,108	194,532	43,395	327,035	.223	.681
2020	92,738	197,930	50,053	340,721	.253	.721
2025	96,563	199,451	57,620	353,634	.289	.773
2030	99,876	201,988	63,649	365,513	.315	.810
2035	102,671	207,500	66,392	376,563	.320	.815
2040	105,485	214,806	66,910	387,201	.311	.803
2045	108,765	222,091	66,964	397,820	.302	.791
2050	112,352	228,325	68,036	408,713	.298	.790
2055	115,886	234,185	70,056	420,127	.299	.794
2060	119,213	240,265	72,721	432,200	.303	.799
2065	122,479	247,492	74,905	444,877	.303	.798
2070	125,889	255,136	76,916	457,941	.301	.795
Alternative II:						
1995	78,889	159,712	34,043	272,645	.213	.707
2000	81,180	167,918	35,170	284,268	.209	.693
2005	81,496	176,931	36,476	294,903	.206	.667
2010	80,955	184,850	39,389	305,193	.213	.651
2015	80,289	189,724	45,172	315,185	.238	.661
2020	80,708	191,288	52,376	324,372	.274	.696
2025	81,450	190,356	60,599	332,406	.318	.746
2030	81,772	189,824	67,385	338,980	.355	.786
2035	81,646	191,639	70,846	344,131	.370	.796
2040	81,567	194,619	71,916	348,102	.370	.789
2045	81,681	197,176	72,365	351,222	.367	.781
2050	81,981	198,135	73,712	353,827	.372	.786
2055	82,262	198,074	75,920	356,256	.383	.799
2060	82,409	197,684	78,650	358,743	.398	.815
2065	82,478	198,302	80,542	361,321	.406	.822
2070	82,585	199,273	81,969	363,826	.411	.826
Alternative III:						
1995	78,547	159,412	34,128	272,087	.214	.707
2000	79,765	166,877	35,549	282,191	.213	.691
2005	78,410	174,963	37,259	290,632	.213	.661
2010	75,588	182,147	40,620	298,355	.223	.638
2015	72,167	186,248	46,911	305,326	.252	.639
2020	69,803	186,480	54,728	311,011	.293	.668
2025	68,027	183,641	63,700	315,368	.347	.717
2030	66,070	180,565	71,416	318,051	.396	.761
2035	63,889	179,166	75,912	318,967	.424	.780
2040	61,898	178,369	77,970	318,236	.437	.784
2045	59,989	176,843	79,302	316,133	.448	.788

TABLE II.H.1.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS, BY ALTERNATIVE AND BROAD AGE GROUP, CALENDAR YEARS 1950-2070 (Cont.)

Calendar year	Population (in thousands)			Total	Dependency ratio	
	Under 20	20-64	65 and over		Aged ¹	Total ²
Alternative III:(Cont.)						
2050.....	58,280	173,330	81,408	313,018	0.470	0.806
2055.....	56,697	168,369	84,240	309,306	.500	.837
2060.....	55,145	162,808	87,385	305,338	.537	.875
2065.....	53,613	158,438	89,219	301,270	.563	.902
2070.....	52,151	154,655	90,215	297,021	.583	.921

¹Population aged 65 and over, divided by population aged 20-64.

²Sum of population aged 65 and over, and population under age 20, divided by population aged 20-64.

Note: Totals do not necessarily equal the sums of rounded components.

2. Covered Population

The number of covered workers in a year is defined as the number of persons who, at any time during the year, have OASDI taxable earnings. Projections of the numbers of covered workers were made by applying projected coverage rates to the projected Social Security Area population. The coverage rates—i.e., the number of covered workers in the year, as a percentage of the population as of July 1—were determined by age and sex using projected labor force participation rates and unemployment rates, and their historical relationships to coverage rates. In addition, the coverage rates were adjusted to reflect the increase in coverage of (1) State and local government employment that will result from the Omnibus Budget Reconciliation Act of 1990 and (2) Federal civilian employment that will result from the 1983 Social Security Amendments.

Labor force participation rates were projected by age and sex, taking into account projections of the percentage of the population that is married, the percentage of the population that is disabled, the number of children in the population, the level of retirement benefits, and the state of the economy. All of these factors vary by alternative. For men, the projected age-adjusted labor force participation rates for the year 2070 for alternatives I, II, and III are 0.7, 1.3, and 2.0 percentage points lower, respectively, than the 1992 level of 76.1 percent. For women, the projected age-adjusted labor force participation rates increase for alternatives I and II and decrease for alternative III. The projected rates for 2070 are 1.9, 0.7, and -1.1

Actuarial Analysis

percentage points, respectively, different from the 1992 level of 58.0 percent.

The total age-sex-adjusted unemployment rate averaged 5.7 percent for the last 30 years 1963-92 and 6.4 percent for the last 10 years 1983-92. The ultimate total age-sex-adjusted unemployment rate is assumed to be 5, 6, and 7 percent for alternatives I, II, and III, respectively. Because the unemployment rate depends on the state of the economy, cyclical trends are reflected in the short-range period. Unemployment levels off to the assumed ultimate age-sex-adjusted rate by the year 2003, for each of the three alternatives.

The projected age-adjusted coverage rate for men changes from its 1992 level of 72.6 percent to 73.9, 73.0, and 71.9 percent in 2070 on the basis of alternatives I, II, and III, respectively. For women, it changes from its 1992 level of 59.2 percent to 61.2, 59.5, and 57.3 percent for alternatives I, II, and III, respectively.

3. Average Earnings, Inflation, and Real Interest Rate

Future increases in average earnings and in the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W, hereinafter denoted as "CPI") will directly affect the OASDI program. Increases in the CPI directly affect the automatic cost-of-living benefit increases, while inflation, in general, affects the nominal levels of average earnings, GDP, and taxable payroll. Average earnings in covered employment for each year have a direct effect on the size of the taxable payroll and on the future level of average benefits. In addition, increases in average wages in the U.S. economy directly affect the indexation, under the automatic-adjustment provisions in the law, of the benefit formulas, the contribution and benefit base, the exempt amounts under the retirement earnings test, the amount of earnings required for a quarter of coverage, and under certain circumstances, the automatic cost-of-living benefit increases.

Increases in average earnings were projected in two components—average earnings of wage-and-salary workers, usually referred to as average wages (and shown for OASDI covered employment in table II.D.1 of this report), and average net earnings of self-employed persons. Each of these was subdivided into increases in real average earnings and increases in the CPI. For simplicity, real-earnings increases are expressed in the form of real-earnings differentials—i.e.,

the percentage increase in average nominal earnings, minus the percentage increase in the CPI.

The assumed ultimate increases in average real earnings are based on analysis of trends in productivity gains and the factors linking productivity gains with increases in average real earnings. For the 40 years 1952-91, annual increases in productivity for the total U.S. economy averaged 1.7 percent, the result of average annual increases of 2.5, 2.4, 1.2, and 0.8 percent for the 10-year periods 1952-61, 1962-71, 1972-81 and 1982-91, respectively. Meanwhile, the average annual rate of change in average real earnings was an increase of 1.1 percent for the 40 years 1952-91, the result of average annual increases of 2.2, 2.1, -1.0, and 1.0 percent, respectively, for the aforementioned 10-year periods. The change in the linkage between annual increases in productivity and real earnings averaged -0.6 percent for the 40 years 1952-91, and -0.3, -0.3, -2.2, and 0.2 percent, respectively, for the aforementioned 10-year periods. The change in the linkage reflects changes in such factors as the average number of hours worked per year, labor's share of total output, the proportion of employee compensation paid as wages, and price adjustment due to the ratio of the GDP implicit price deflator to the CPI.

The average annual rate of change in the average real wage in OASDI covered employment was nearly 1.3 percent over the 40 years 1952-91. However this rate of change varied considerably over this period. The average annual rates of change for the 10 year-periods 1952-61, 1962-71, 1972-81, and 1982-91 were 2.5 percent, 1.8 percent, -0.2 percent and 1.0 percent, respectively.

The ultimate annual increases in productivity for all sectors—wage-and-salary workers, self-employed persons, and the total economy—are assumed to be 1.9, 1.5, and 1.2 percent for alternatives I, II, and III, respectively. The corresponding ultimate annual rates of change in the linkage for wage-and-salary workers are assumed to be declines of 0.2, 0.4, and 0.6 percent for alternatives I, II, and III, respectively. This linkage is made up of assumed annual decreases of 0.1, 0.2, and 0.3 percent in average hours worked per year, and 0.1, 0.2, and 0.3 percent annual declines in wages as a share of compensation, for alternatives I, II, and III, respectively. No ultimate change is assumed for the historically relatively stable ratio of employee compensation to GDP. The resulting ultimate real-wage differentials are 1.7, 1.1, and 0.6 percent. Ultimate annual declines in

the linkage for self-employed persons are smaller because the proportion of reported compensation that is considered earnings remains constant. As a result, ultimate real-earnings differentials for the self-employed are assumed to be higher than for wage-and-salary workers. The corresponding ultimate real-earnings differentials for wage-and-salary workers and self-employed persons, combined, are slightly higher than those assumed for wage-and-salary workers only.

Historically, the CPI has increased, on average, by 4.2 percent for the last 40 years 1953-92, 5.2 percent for the last 30 years 1963-92, 6.1 percent for the last 20 years 1973-92, and 3.6 percent for the last 10 years 1983-92. The 6.1 percent increase during 1973-92 reflects sharp increases in oil prices and their subsequent effect on the overall economy. The ultimate average annual CPI increases of 3.0, 4.0, and 5.0 percent for alternatives I, II, III, respectively, were chosen to include a reasonable range of possible future experiences. The GDP implicit price deflator has increased by 4.2 percent annually for the last 40 years 1953-92, 5.1 percent annually for the last 30 years 1963-92, 6.0 percent annually for the last 20 years 1973-92, and 4.2 percent annually for the last 10 years 1983-92. For this Trustees Report, increases in the GDP implicit price deflator are assumed to be slower by about 0.2 percent, 0.3 percent, and 0.5 percent annually than increases in the CPI-W for alternatives I, II, and III respectively, for the first 10 projection years 1993-2002. The assumed differential between increase in the GDP implicit price deflator and increase in the CPI-W reflects the anticipation of three trends for the first 10 projection years 1993-2002. These are: (1) relatively slower increases in computer prices, which are weighted more heavily in the implicit price deflator, (2) relatively faster increases in energy prices which are weighted more heavily in the CPI, and (3) relatively faster increases in health service prices, which are a larger component of the CPI. However, ultimate annual rates of increase in the GDP implicit price deflator are assumed to be the same, for each alternative, as for the CPI-W.

The ultimate increases in average annual wages in covered employment are assumed to be 4.7, 5.1, and 5.6 percent, for alternatives I, II, and III, respectively. These were obtained, for each alternative, by adding the assumed annual percentage increase in the CPI to the assumed real-wage differential. Ultimate increases in average wages

and earnings for the U.S. economy are very similar to those assumed for average wages in covered employment.

The interest rate considered in this report is the nominal interest rate, which is compounded semiannually, for special U.S. government obligations issuable to the trust funds in each of 12 months of the year. The real interest rate is defined to be the annual (compounded) yield rate for investments in these securities less growth in the CPI-W.

In developing a reasonable range of assumed future real interest rates for the three alternatives, historical experience was examined for the last 40 years, 1952-91, and for each of the 10-year subperiods, 1952-61, 1962-71, 1972-81, and 1982-91. For the 40-year period, the real interest rate averaged 1.9 percent per year. For the four 10-year subperiods, the real interest rates averaged 0.3, 1.7, -0.4, and 6.0 percent per year, respectively. The assumed ultimate real interest rates are 3.0 percent, 2.3 percent, and 1.5 percent for alternatives I, II, and III, respectively. Rates are assumed to trend toward these ultimate values from recent high levels during the next 10 years.

4. Taxable Payroll and Taxes

The taxable payroll for any period is that amount which, when multiplied by the combined employee-employer tax rate, yields the total amount of taxes paid by employees, employers, and the self-employed for work during the period. The taxable payroll is important not just in estimating OASDI income, but also in determining income and cost rates, and actuarial balances. These terms are defined in the introduction to the section entitled "Actuarial Estimates."

In practice, the taxable payroll is calculated as a weighted average of the earnings on which employees, employers, and self-employed persons make contributions to the OASDI program. The weighting takes into account the lower tax rates, as compared to the combined employee-employer rate, which apply to multiple-employer "excess wages," and which did apply, before 1984, to net earnings from self-employment and, before 1988, to tips. For 1983 and later, taxable payroll also includes deemed wage credits for military service. Estimates of taxable earnings for employees, employers, and the self-employed were developed from corresponding estimates of earnings in the U.S. economy, by means of factors which adjust for various

Actuarial Analysis

differences in these measures. The factors adjust total U.S. earnings by removing earnings from noncovered employment, adding earnings from various outlying areas which are covered by Social Security but are not included in published "U.S." data, and removing earnings above the taxable earnings base.

For the 1993 report, a larger than expected decrease in the estimated ratio of taxable earnings to earnings in OASDI covered employment, which was largely due to a significant decrease in the ratio of covered self-employment income to self-employment income for 1990 and 1991, along with the assumption that this ratio will stay at that lower level results in a decrease in the projected level of taxable payroll as compared with estimates in the 1992 report.

Estimates of taxes collected were developed from the corresponding estimates of taxable earnings by applying the employee, employer, or self-employed tax rate, and by taking into account the lag time from the incurrence of tax liability to the collection of taxes.

5. Insured Population

There are three basic types of insured status under the OASDI program: fully insured, currently insured, and disability insured. Fully insured status is required of an aged worker for eligibility to a primary retirement benefit and for the eligibility of that worker's spouse and children to auxiliary benefits. Fully insured status is also required of a deceased worker for the eligibility of the worker's survivors to benefits (with the exception of child survivors and parents of eligible child survivors, in which cases the deceased worker is required to have had either currently insured status or fully insured status). Disability insured status, which is more restrictive than fully insured status, is required of a disabled worker for eligibility to a primary disability benefit and for the eligibility of the worker's spouse and children to auxiliary benefits.

Projections of the percentage of the population that is fully insured were made by age and sex, from estimated distributions of workers by accumulated quarters of coverage based on past and projected coverage rates and amounts of earnings required for quarters of coverage. Currently insured status was disregarded for purposes of these estimates, because the number of cases in which eligibility for benefits is based solely on currently insured status is relatively small.

Projections of the percentage of fully insured persons who are also disability insured were made by age and sex based on past and projected coverage rates, the requirement for disability insured status, and their historical relationships. Finally, the fully insured and disability insured populations were developed from the projected total population by applying the appropriate percentages.

Under this procedure, the percentage of the Social Security Area population aged 62 and over that is fully insured is projected to increase from 77.5 on January 1, 1992, to 91.0, 90.8, and 90.2 on January 1, 2067, based on alternatives I, II, and III, respectively. The increase for females is projected to be significant, while there is a decrease for males. Based on alternative II, for example, the percentage for males is projected to decrease slightly during this period from 93.2 to 92.8, while that for females is projected to increase substantially from 66.2 to 89.2.

The fully insured population by age and sex was further subdivided by marital status, using the variation in labor force participation rates by marital status to estimate the variation in coverage rates by marital status. These coverage rates were then used to estimate the variation in the fully insured rates by marital status.

6. Old-Age and Survivors Insurance Beneficiaries

The numbers of OASI beneficiaries were projected for each type of benefit separately, by the sex of the worker on whose earnings the benefits are based, and by the age of the beneficiary. For selected types of benefits, the numbers of beneficiaries were also projected by marital status.

For the short-range period, the numbers of retired-worker beneficiaries were developed by applying award rates to the aged fully insured population less those persons entitled to retired-worker or widow(er)'s benefits, and by applying termination rates to the numbers of persons already receiving retired-worker benefits. For the long range, the numbers of retired-worker beneficiaries who were not previously converted from disabled-worker beneficiary status were projected as a percentage of the "exposed population," i.e., the aged fully insured population less those persons entitled to or converted from disability benefits and those insured persons entitled to widow(er)'s benefits. The percentages for ages 70 and over were assumed to be

Actuarial Analysis

nearly 100, because the retirement earnings test and delayed retirement credit do not apply after age 70. The percentages for ages 62 through 69 were adjusted in accordance with observed historical and projected short-range trends, and, for each year of attainment of age 62, as a function of the ratio of the monthly benefit amount payable at each age of entitlement to the amount payable at age-70 entitlement. This resulted in a gradual downward adjustment in award rates as the increases in the delayed retirement credit become effective and, beginning in 2000, during the years in which the normal retirement age is scheduled to increase. The net effect of these adjustments is to decrease the percentages of eligible persons who are receiving benefits at each age 62 through 69 to ultimate values, which are reached in 2030. The numbers of retired-worker beneficiaries who are converted from disabled-worker beneficiaries were calculated separately in a manner consistent with the calculation of disabled-worker beneficiaries.

The numbers of aged-spouse beneficiaries were estimated from the population projected by age and sex. The benefits of aged-spouse beneficiaries are based on the earnings records of their husbands or wives, who are referred to as “wage earners.” In the short-range period, a regression equation was used to project the number of aged-spouse beneficiaries, as a proportion of the aged female or male population not receiving retired-worker or aged-widow(er) benefits. In the long-range period, aged-spouse beneficiaries were estimated from the population projected by age, sex, and marital status. To the numbers of spouses aged 62 and over in the population, a series of factors were applied, representing the probabilities that the spouse and the wage earner meet all of the conditions of eligibility—i.e., the probabilities that (1) the wage earner is 62 or over, (2) the wage earner is insured, (3) the wage earner is receiving benefits, (4) the spouse is not receiving a benefit for the care of an entitled child, (5) the spouse is not insured, (6) the spouse is not eligible to receive a significant government pension based on earnings in noncovered employment, and (7) a residual factor.

In addition, the same factors were applied to the numbers of divorced persons aged 62 and over in the population, with three differences. First, an additional factor is required to reflect the probability that the person’s former wage-earner spouse is still alive (otherwise, the person may be entitled to a divorced widow(er)’s benefit). Second, a

factor is required to reflect the probability that the marriage to the wage-earner spouse was at least 10 years in duration. Third, factor (3) was not applied because, effective for January 1985, a divorced person generally need not wait to receive benefits until the former wage-earner spouse is receiving benefits.

The projected numbers of children under age 18, and students aged 18, who are eligible for benefits as children of retired-worker beneficiaries, were based on the projected numbers of children in the population. In the short-range period, a factor was applied, representing the probability that both parents are alive. A regression equation was then used to project the number of children of retired-worker beneficiaries. In the long-range period, entitled children were projected separately by sex of the wage-earner parent. To the numbers of children in the population, factors were applied representing the probabilities that the parent is alive, aged 62 or over, insured, and receiving a retired-worker benefit. Another factor was applied representing the probability that the child is not entitled to a benefit based on the other parent's earnings. For children aged 18, a factor was applied representing the probability that the child is attending a secondary school. The numbers of disabled children aged 18 and over of retired-worker beneficiaries were projected from the adult population in a similar manner, with the inclusion of a factor representing the probability of being disabled since childhood.

In the short-range period, the numbers of young-spouse beneficiaries were projected as a proportion of the projected numbers of child beneficiaries who are either under age 16 or disabled. In the long-range period, young-spouse beneficiaries were projected as a proportion of the projected numbers of child beneficiaries of retired workers, taking into account projected changes in average family size.

The numbers of aged-widow(er) beneficiaries were projected from the population by age and sex. In the short-range period, a regression equation projected the number of aged-widow(er) beneficiaries, as a proportion of the aged female or male population not receiving retired-worker or aged-spouse benefits. In the long-range period, aged-widow(er) beneficiaries were projected from the population by age, sex, and marital status. Four factors were applied to the numbers of widow(er)s in the population aged 60 and over. These factors represent the probabilities that (1) the deceased wage earner was fully

Actuarial Analysis

insured at death, (2) the widow(er) is not receiving a benefit for the care of an entitled child, (3) the widow(er) is not fully insured, and (4) the widow(er)'s benefits are not withheld because of receipt of a significant government pension based on earnings in noncovered employment. In addition, some insured widow(er)s who had not applied for their retired-worker benefits are assumed to receive widow(er) benefits. Also, the same factors were applied to the numbers of divorced persons aged 60 and over in the population, with additional factors representing the probability that the person's former wage-earner spouse is deceased and that the marriage was at least 10 years in duration. In the short-range period, the numbers of disabled-widow(er) beneficiaries were estimated as a proportion of the female or male population aged 50-64. In the long-range period, the numbers were projected for each age 50 through 64 as a percentage of the widowed and divorced populations, adjusted for the insured status of the deceased spouse and the prevalence of disability.

The projected numbers of children under age 18, and students aged 18, who are eligible for benefits as survivors of deceased workers, were based on the projected numbers of children in the population whose mothers or fathers are deceased. In the short-range period, a regression equation was used to project the number of minor-child-survivor beneficiaries as a percentage of such orphaned children. In the long-range period, the numbers of child-survivor beneficiaries were projected in a manner analogous to that for child beneficiaries of retired workers, with the factor representing the probability that the parent is aged 62 or over being replaced by a factor that represented the probability that the parent is deceased.

In the short-range period, the numbers of mother-survivor and father-survivor beneficiaries were projected from the numbers of child-survivor beneficiaries who are either under age 16 or disabled. In the long-range period, mother-survivor and father-survivor beneficiaries were estimated from the numbers of child-survivor beneficiaries, taking into account projected changes in average family size.

The numbers of parent-survivor beneficiaries were projected based on the historical pattern of the numbers of such beneficiaries.

Table II.H.2 shows the projected numbers of beneficiaries under the OASI program. Included among the beneficiaries who receive retired-worker benefits are some persons who also receive a residual

Assumptions & Methods

benefit consisting of the excess of an auxiliary benefit over their retired-worker benefit. Estimates of the numbers of such residual payments were made separately for spouses and widow(er)s.

TABLE II.H.2.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1945-2070

[In thousands]								
Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Historical data:								
1945	518	159	13	94	121	377	6	1,288
1950	1,771	508	46	314	169	653	15	3,477
1955	4,474	1,192	122	701	292	1,154	25	7,961
1960	8,061	2,269	268	1,544	401	1,577	36	14,157
1965	11,101	2,614	461	2,371	472	2,074	35	19,128
1970	13,349	2,668	546	3,227	523	2,688	29	23,030
1975	16,588	2,867	643	3,889	582	2,919	21	27,509
1980	19,562	3,016	639	4,411	562	2,610	15	30,814
1985	22,432	3,069	457	4,863	372	1,917	10	33,120
1986	22,987	3,088	450	4,931	350	1,875	9	33,690
1987	23,440	3,090	440	4,984	329	1,836	8	34,126
1988	23,858	3,086	432	5,029	318	1,810	7	34,539
1989	24,327	3,093	423	5,071	312	1,780	6	35,012
1990	24,838	3,101	422	5,111	304	1,776	6	35,559
1991	25,289	3,104	426	5,158	301	1,791	5	36,074
1992	25,758	3,112	432	5,205	294	1,808	5	36,614
Alternative I:								
1995	26,628	3,122	447	5,375	301	1,878	4	37,754
2000	27,753	3,095	505	5,570	312	2,002	3	39,239
2005	29,153	2,918	563	5,688	290	2,091	3	40,706
2010	32,209	2,685	625	5,810	278	2,111	3	43,720
2015	37,771	2,466	704	5,937	266	2,135	3	49,282
2020	44,570	2,357	783	6,066	258	2,182	3	56,219
2025	50,795	2,331	840	6,195	262	2,254	3	62,679
2030	55,406	2,276	886	6,238	268	2,330	3	67,407
2035	58,002	2,203	926	6,205	273	2,392	3	70,003
2040	58,636	2,111	948	6,133	277	2,437	3	70,545
2045	59,100	2,076	976	6,081	280	2,483	3	71,000
2050	60,215	2,090	1,009	6,046	286	2,537	3	72,186
2055	62,229	2,162	1,057	6,048	293	2,595	3	74,387
2060	64,473	2,235	1,100	6,082	299	2,652	3	76,845
2065	66,448	2,292	1,134	6,163	305	2,705	3	79,051
2070	68,353	2,344	1,164	6,292	310	2,758	3	81,224
Alternative II:								
1995	26,674	3,119	445	5,372	301	1,877	4	37,793
2000	28,021	3,111	501	5,602	309	1,986	3	39,532
2005	29,792	3,018	561	5,696	294	2,009	3	41,373
2010	33,193	2,832	618	5,811	277	1,939	3	44,673
2015	39,126	2,660	687	5,927	267	1,878	3	50,548
2020	46,377	2,586	750	6,041	264	1,849	3	57,871
2025	53,111	2,593	789	6,164	267	1,848	3	64,775
2030	58,359	2,568	815	6,221	267	1,853	3	70,086
2035	61,566	2,516	835	6,230	264	1,853	3	73,266
2040	62,696	2,431	836	6,223	259	1,841	3	74,287
2045	63,460	2,405	838	6,242	254	1,823	3	75,025
2050	64,773	2,432	845	6,264	250	1,808	3	76,374
2055	66,887	2,532	866	6,288	247	1,793	3	78,616
2060	69,078	2,630	883	6,296	244	1,778	3	80,911
2065	70,736	2,696	891	6,321	240	1,760	3	82,645
2070	72,054	2,737	895	6,375	236	1,742	3	84,041

TABLE II.H.2.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1945-2070 (Cont.)

[In thousands]

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Alternative III:								
1995	26,733	3,119	445	5,374	300	1,871	4	37,845
2000	28,290	3,120	498	5,625	308	1,975	3	39,818
2005	30,377	3,115	559	5,711	313	1,986	3	42,065
2010	34,062	2,982	608	5,824	290	1,839	3	45,607
2015	40,341	2,869	666	5,928	266	1,677	3	51,750
2020	48,060	2,844	715	6,020	252	1,563	3	59,456
2025	55,332	2,897	734	6,127	246	1,501	3	66,840
2030	61,381	2,931	741	6,180	238	1,462	3	72,936
2035	65,495	2,936	742	6,211	228	1,430	3	77,046
2040	67,514	2,895	724	6,251	216	1,391	3	78,993
2045	68,976	2,914	705	6,325	204	1,343	3	80,469
2050	70,892	2,990	690	6,386	193	1,294	3	82,447
2055	73,460	3,154	690	6,414	183	1,246	3	85,149
2060	75,922	3,307	688	6,374	173	1,199	3	87,667
2065	77,507	3,402	679	6,321	163	1,152	3	89,227
2070	78,410	3,440	667	6,286	154	1,107	3	90,068

Note: The numbers of beneficiaries do not include certain uninsured persons, most of whom both attained age 72 before 1968 and have fewer than 3 quarters of coverage, in which cases the costs are reimbursed by the general fund of the Treasury. The number of such uninsured persons was 3,682 as of December 31, 1992, and is estimated to be fewer than 500 by the turn of the century. Totals do not necessarily equal the sums of rounded components.

7. Disability Insurance Beneficiaries

The numbers of DI beneficiaries were projected for each type of benefit separately, by the sex of the worker on whose earnings the benefits are based, and the age of the beneficiary. The numbers of disabled-worker beneficiaries were projected from the estimated numbers of such beneficiaries entitled on December 31, 1991, by adding new entitlements and subtracting terminations. The starting numbers of entitled disabled-worker beneficiaries were estimated by age, sex, and duration of entitlement, from the tabulated number of disabled-worker beneficiaries in current-payment status on December 31, 1991. The numbers of new entitlements during each year were projected by applying assumed disability incidence rates. Incidence rates by age and sex were applied to the projected disability insured population (excluding those already entitled to disabled-worker benefits) to obtain new entitlements. The numbers of terminations were projected by applying assumed termination rates to the disabled-worker population. In the short-range period, the numbers of terminations were projected by applying assumed termination rates by reason—death, recovery, and all other—and by age and sex, to the entitled disabled-worker population. In the long-range period, the

numbers of terminations were projected by applying assumed death rates and recovery rates, by age, sex, and duration of entitlement, to the entitled disabled-worker population. The numbers of terminations were then increased, in both the short-range and long-range periods, by the numbers of disabled-worker beneficiaries who would be automatically converted to retired-worker beneficiaries at the normal retirement age (currently, age 65).

Disability incidence rates declined rapidly from historically high levels for 1974-75 to a level less than half as large by the year 1982. From 1982 through 1986, incidence rates increased steadily, regaining about one-fifth of the decline from the prior period. Between 1986 and 1989, incidence rates remained fairly steady. From 1989 to 1992, incidence rates again increased at a rapid pace, reaching a level about midway between the high rates of 1974-75 and the low rates for 1982.

Assumed future levels for disability incidence rates are determined in two stages: (1) rates are first projected from recent levels based on past trends and future expectations, as if the increases scheduled in present law for the normal retirement age (NRA) would not occur, and (2) rates for the year 2000 and later are then adjusted to reflect the scheduled increase in the NRA, which tends to increase incidence rates for persons aged 60 through 64 established in the first stage as well as establishing incidence rates up to the scheduled NRA (ultimately 67).

For the intermediate alternative II assumptions, age-sex-adjusted incidence rates are projected to increase slightly before declining toward their historical average. On a gross basis, the incidence rates are projected to continue increasing over the next 10 years due to the growing proportion of insured workers at the higher ages. Gross rates projected under the first stage increase from 1992 levels by about 10 percent over the next 10 years, reaching a level of about 5.9 per thousand persons exposed (defined as the number of persons who are disability insured but are not currently entitled to disabled worker benefits).

Further increases in incidence rates over age 60 along with rates assumed for persons aged 66 and 67, due to the scheduled increase in the NRA are reflected in the second stage. These adjustments contribute to the overall rise in the gross disability incidence rate

Actuarial Analysis

from a level of 5.3 per thousand exposed for 1992 to an ultimate rate of 6.9 per thousand exposed by the year 2026, at which time the scheduled increase in the NRA will be complete.

For alternative I, the gross disability incidence rate is assumed to decline by about 8 percent over the next 10 years. The 2026 gross incidence rate is assumed to be 5.8 per thousand exposed. For alternative III, the gross disability incidence rate is assumed to increase by about 36 percent over the next 10 years, to a level comparable to the peak experience for 1974-75. The gross incidence rate under alternative III is assumed to reach about 8.8 per thousand exposed by 2026.

In the short-range period, the termination rates were projected by reason—death, recovery, and all other—and by age and sex. For alternative II, the death rates were projected to remain constant, while the rates for recovery and all other terminations were projected to increase from the relatively low levels of 1990-92, by about 30 percent. For alternative III, the death rates decline by about 10 percent, while the rates for recovery and all other terminations increase more slowly and to lower levels. For alternative I, the death rates increase by about 10 percent, while the rates for recovery and all other terminations increase more quickly and to higher levels.

In the long-range period, the death rates and recovery rates were projected by age, sex, and duration of entitlement. For all alternatives, the death rates are assumed to decline steadily throughout the 75-year projection period. For alternative II, they reach levels in 2070 approximately 30 percent lower for males and approximately 20 percent lower for females than those experienced by disabled-worker beneficiaries during 1977-80, the most recent period for which detailed data are available. The recovery rates are assumed to increase from 1990 levels until 2008, when they attain ultimate levels about 5 percent higher than those experienced during the period 1977-80, thereby reflecting the estimated effect of the periodic reviews required by provisions of law first enacted in 1980, and amended in 1983, 1984, and 1990.

For alternative I, the death rates in 2070 are assumed to be roughly 20 percent lower for males and approximately 10 percent lower for females than those experienced by disabled-worker beneficiaries during 1977-80, and the recovery rates are assumed to increase to levels

Assumptions & Methods

25 percent higher than those of the same period. For alternative III, the death rates in 2070 are assumed to be about 45 percent lower for males and approximately 35 percent lower for females than those experienced during 1977-80, and recovery rates are assumed to be 15 percent lower than those experienced during 1977-80.

In the short-range period, the projected numbers of children under age 18, students aged 18, and disabled children aged 18 and over, who are eligible for benefits as children of disabled-worker beneficiaries, were projected by applying quarterly award and termination rates. Awards to the three categories of child beneficiaries were based on the numbers of awards to disabled-worker beneficiaries.

In the long-range period, the projected numbers of minor child and student beneficiaries were based on the projected numbers of children in the population by age. To these numbers of children were applied factors representing the probability that either of their parents is insured and disabled. The numbers of disabled children aged 18 and over were projected as a function of the numbers of disabled-worker beneficiaries and the size of the adult population.

In the short-range period, the numbers of young-spouse beneficiaries were projected by applying quarterly award and termination rates, where awards were based on the numbers of awards to child beneficiaries who are either under age 16 or disabled. The numbers of aged-spouse beneficiaries were also projected by applying quarterly award and termination rates, where awards were based on the number of awards to disabled-worker beneficiaries.

In the long-range period, the numbers of young-spouse beneficiaries were projected as a proportion of the projected numbers of child beneficiaries who are either under age 16 or disabled, taking into account projected changes in family size. The numbers of aged-spouse beneficiaries were projected as a proportion of the numbers of disabled-worker beneficiaries, based on recent experience and allowing for projected changes in marriage rates.

Table II.H.3 shows the projected numbers of beneficiaries under the DI program.

Actuarial Analysis

TABLE II.H.3.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1960-2070

[In thousands]

Calendar year	Disabled worker	Auxiliaries		Total
		Wife-husband	Child	
Historical data:				
1960	455	77	155	687
1965	988	193	558	1,739
1970	1,493	283	889	2,665
1975	2,489	453	1,411	4,352
1980	2,859	462	1,358	4,678
1985	2,656	306	945	3,907
1986	2,727	301	965	3,993
1987	2,786	291	968	4,045
1988	2,830	281	963	4,074
1989	2,895	271	962	4,129
1990	3,011	266	989	4,266
1991	3,195	266	1,052	4,513
1992	3,468	271	1,151	4,890
Alternative I:				
1995	4,100	270	1,305	5,675
2000	4,864	265	1,395	6,524
2005	6,276	301	1,722	8,299
2010	6,852	283	1,590	8,724
2015	6,888	243	1,434	8,566
2020	6,726	221	1,339	8,287
2025	6,810	227	1,326	8,363
2030	6,661	220	1,353	8,235
2035	6,564	217	1,389	8,170
2040	6,648	215	1,426	8,289
2045	7,027	225	1,471	8,722
2050	7,304	233	1,521	9,058
2055	7,563	243	1,578	9,385
2060	7,693	249	1,634	9,576
2065	7,907	255	1,688	9,850
2070	8,204	262	1,740	10,206
Alternative II:				
1995	4,317	285	1,374	5,976
2000	5,548	302	1,576	7,426
2005	6,725	342	1,824	8,890
2010	7,560	341	1,708	9,609
2015	7,826	316	1,554	9,697
2020	7,810	307	1,451	9,568
2025	7,985	324	1,419	9,728
2030	7,834	320	1,420	9,575
2035	7,709	316	1,433	9,458
2040	7,781	312	1,443	9,535
2045	8,185	324	1,452	9,961
2050	8,427	331	1,463	10,221
2055	8,591	342	1,478	10,411
2060	8,526	342	1,491	10,360
2065	8,539	342	1,503	10,383
2070	8,637	344	1,510	10,491

TABLE II.H.3.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1960-2070 (Cont.)

[In thousands]

Calendar year	Disabled worker	Auxiliaries		Total
		Wife-husband	Child	
Alternative III:				
1995	4,519	299	1,438	6,256
2000	6,390	352	1,806	8,548
2005	7,426	412	2,004	9,841
2010	8,710	446	1,929	11,084
2015	9,411	449	1,793	11,654
2020	9,719	461	1,690	11,870
2025	10,121	497	1,638	12,256
2030	10,019	496	1,610	12,126
2035	9,890	489	1,595	11,974
2040	9,964	478	1,573	12,015
2045	10,426	489	1,541	12,457
2050	10,610	494	1,505	12,609
2055	10,618	502	1,475	12,595
2060	10,235	489	1,444	12,167
2065	9,936	474	1,414	11,823
2070	9,749	463	1,382	11,594

Note: Totals do not necessarily equal the sums of rounded components.

8. Average Benefits

Average benefits were projected by type of benefit based on recent historical averages, projected average Primary Insurance Amounts (PIAs), and projected ratios of average benefits to average PIAs. Average PIAs were calculated from projected distributions of beneficiaries by duration from year of award, average awarded PIAs, and increases thereto since the year of award, reflecting automatic benefit increases, recomputations to reflect additional covered earnings, and other factors. Average awarded PIAs were calculated from projected earnings histories, which were developed from the actual earnings histories associated with a sample of awards made in 1988.

For several types of benefits—retired-worker, aged-spouse, and aged-widow(er) benefits—the percentage of the PIA that is payable depends on the age at initial entitlement to benefits. Projected ratios of average benefits to average PIAs for these types of benefits were based on projections of age distributions at initial entitlement.

9. Benefit Payments

For each type of benefit, benefit payments were calculated as the product of a number of beneficiaries and a corresponding average monthly benefit. In the short-range period, benefit payments were

Actuarial Analysis

calculated on a quarterly basis. In the long-range period, all benefit payments were calculated on an annual basis, using the number of beneficiaries on December 31. These amounts were adjusted to include retroactive payments to newly awarded beneficiaries, and other amounts not reflected in the regular monthly benefit payments.

Lump-sum death payments were calculated as the product of (1) the number of such payments, which was projected on the basis of the assumed death rates, the projected fully insured population, and the estimated percentage of the fully insured population that would qualify for benefits, and (2) the amount of the lump-sum death payment, which is \$255 (unindexed in future years).

10. Administrative Expenses

The projection of administrative expenses through 2002 was based on assumed increases in average wages, increases in the CPI, and increases in the number of beneficiaries. For years after 2002, administrative expenses are assumed to increase because of increases in the numbers of beneficiaries and increases in average wages which will more than offset assumed improvements in administrative productivity.

11. Railroad Retirement Financial Interchange

Railroad workers are covered under a separate multi-tiered plan, the first tier being very similar to OASDI coverage. An annual financial interchange between the Railroad Retirement fund and the OASI and DI funds is made reflecting the difference between (1) the amount of OASDI benefits that would be paid to railroad workers and their families if railroad employment had been covered under the OASDI program and (2) the amount of OASDI payroll tax that would be received from railroad workers if they were covered directly under the OASDI program.

The effect of the financial interchange with the Railroad Retirement program was evaluated on the basis of trends similar to those used in estimating the cost of OASDI benefits. The resulting effect was

annual short-range costs of about \$3-5 billion and a long-range summarized cost of 0.03 percent of taxable payroll to the OASDI program.

12. Benefits to Uninsured Persons

The law provides for special monthly cash payments to certain uninsured persons who attained age 72 before 1968 or who have 3 quarters of coverage for each year after 1966 and before the year of attainment of age 72. The numbers of such uninsured persons were projected based on an extrapolation of the historical survival rate of the members of that group. The benefit payable to these uninsured persons is a fixed amount which increases by the percentage benefit increase applicable to regular OASDI benefits. These payments are made from the OASI Trust Fund, which is then reimbursed from the general fund of the Treasury for the costs (including administrative expenses and interest) associated with providing payments to those persons with fewer than 3 quarters of coverage. The nonreimbursable payments are assumed to be insignificant after 2000. Neither the reimbursable payments nor the associated reimbursements are reflected in the cost rates or the income rates. These amounts are reflected, however, in tables which show trust fund operations.

13. Military-Service Transfers

As a result of the 1983 amendments, the OASI and DI Trust Funds received lump-sum payments, in May 1983, for the cost (including administrative expenses) of providing additional benefit payments resulting from noncontributory wage credits for military service performed prior to 1957. Adjustments to the payments were made in 1985 and 1990, and additional adjustments will be made in 1995 and every fifth year thereafter. The adjustments for 1995 were estimated based on the change in interest rates since the determination of the adjustments in 1990. No adjustments after 1995 would be due unless actual interest rates are different from those assumed, or changes are made in the methods used to determine the military-service transfers.

14. Income From Taxation of Benefits

Under present law, the OASI and DI Trust Funds are credited with the additional income taxes attributable to the partial taxation of

Actuarial Analysis

OASDI benefit payments. For the short-range period, income to the trust funds from such taxation was estimated by applying the following two factors to total OASI and DI benefit payments: (1) the percentage of benefit payments that is taxable, and (2) the average tax rate applicable to those benefits. For the long-range period, income to the trust funds from such taxation was projected by applying factors representing the ratio of such income to total OASI and DI benefit payments under varying levels of income thresholds. Because the thresholds are constant in the law, their values in relation to future income and benefit levels decline. These factors were projected based on the results of a model developed by the Office of Tax Analysis, Department of the Treasury, relating OASDI benefit payments to total personal income for a sample of recent tax returns.