

APPENDIX A.—ASSUMPTIONS AND METHODS UNDERLYING THE ACTUARIAL ESTIMATES

This appendix 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 four alternatives and for both the short-range and long-range periods. Some of the economic and demographic assumptions which vary by alternative are summarized in the section entitled "Actuarial Estimates." Further details about the assumptions, methods, and actuarial estimates are contained in Actuarial Studies published by the Office of the Actuary, Social Security Administration, and are available upon request.

TOTAL POPULATION

Projections were made of the population in the Social Security coverage area by age, sex, and marital status as of January 1 of each year 1988 through 2080. The projections started with an estimate of the United States population, including armed forces overseas, as of January 1, 1987, 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 net immigration.

Historically, fertility rates in the U.S. 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 birthrates 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 1.9.

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 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-A and II-B, and III, respectively. For each alternative, the total fertility rate is assumed to reach its ultimate level in 2013. These ultimate values can be compared to those used by the Bureau of the Census for its latest series of population projections. Those fertility rates range from 2.2 to 1.5, with an intermediate assumption of 1.8.¹ A rate of 2.1 would ultimately result in a nearly constant population if net immigration were zero and if death rates were constant.

¹U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1018, "Projections of the Population of the United States By Age, Sex, and Race: 1988-2080," U.S. Government Printing Office, Washington, D.C., January 1989.

Historically, death rates in the U.S. have declined steadily. The age-sex-adjusted death rate—which is 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 1987. 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 2013 and later. The intermediate set, which is used for both alternatives II-A and II-B, is considered to be the one closest to average expectations. The average annual percentage reductions used for alternative I are smaller than those for alternatives II-A and II-B, while those used for alternative III are greater. Between 1988 and 2013, the reductions in central death rates for alternatives II-A and II-B are assumed to change gradually from the average annual reductions by age, sex, and cause of death observed between 1968 and 1986, to the ultimate annual percentage reductions by age, sex, and cause of death assumed for 2013 and later. Alternative I reductions are assumed to change gradually from 50 percent of the average annual reductions observed between 1968 and 1986, while alternative III reductions are assumed to change gradually from 150 percent of the average annual reductions observed between 1968 and 1986. The age-sex-adjusted death rate (for all causes combined) declined at an average rate of 1.6 percent per year between 1968 and 1986.

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 0.9 percent between 1988 and 2063 for alternatives I, II-A and II-B, and III, respectively. Death rates for AIDS were included throughout the projection period, with rates for years prior to 1993 based on estimates by the Centers for Disease Control, Public Health Service. For alternatives II-A and II-B and alternative III, death rates due to AIDS were assumed to increase until around the year 2000 to levels of about 4 and 8 times the estimated 1988 values, respectively. Thereafter, as a result of assumed behavioral changes and medical developments, rates were assumed to decline rapidly to about one-half of their peak value and then to remain relatively constant. For alternative I, the death rates due to AIDS remain about the same as their estimated 1988 value through 1991. Thereafter, the rates decline rapidly to about one-half of their estimated 1988 value and then remain relatively constant.

Beginning with 1989, net immigration is assumed to be 750,000, 600,000, and 450,000 persons per year for alternatives I, II-A and II-B, and III, respectively. Of these net numbers of immigrants, 450,000, 400,000, and 350,000, respectively, are assumed to be legal, and the remainders are assumed to be other-than-legal. For 1987 and 1988, the net legal immigration is assumed to be 400,000 persons per year and, consistent with the estimates of other-than-legal immigration made by

the Bureau of the Census since the 1980 Census, net other-than-legal immigration is assumed to be 200,000 persons per year.

Table A1 shows the projected population as of July 1 by broad age group, for the four 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 and sex. Marriage and divorce rates were based on recent data from the National Center for Health Statistics.

TABLE A1.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS, BY ALTERNATIVE AND BROAD AGE GROUP, CALENDAR YEARS 1950-2065

Calendar year	Population (in thousands)				Dependency ratio	
	Under 20	20-64	65 and over	Total	Aged ¹	Total ²
Past experience:						
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	80,885	113,073	20,892	214,850	185	900
1975	78,787	122,639	23,227	224,653	189	832
1980	74,924	134,202	26,117	235,243	195	753
1985	73,134	144,988	28,960	247,081	200	704
Alternative I:						
1990	74,418	152,719	31,945	259,082	209	696
1995	76,997	159,749	33,998	270,745	213	695
2000	79,065	167,585	34,766	281,417	207	679
2005	80,048	176,074	35,650	291,772	202	657
2010	81,373	182,925	38,167	302,465	209	653
2015	83,854	186,197	43,458	313,509	223	684
2020	87,024	186,937	50,095	324,056	268	734
2025	89,981	186,266	57,388	333,635	308	791
2030	92,306	187,120	62,822	342,248	336	829
2035	94,244	191,125	64,828	350,197	339	832
2040	96,570	196,536	64,704	357,810	329	821
2045	99,367	201,790	64,207	365,364	318	811
2050	102,260	206,106	64,796	373,162	314	811
2055	104,927	210,518	66,075	381,520	314	812
2060	107,409	215,744	67,481	390,634	313	811
2065	109,955	221,775	68,702	400,431	310	806
Alternatives II-A and II-B:						
1990	74,289	152,569	31,965	258,823	210	696
1995	76,068	158,954	34,258	269,280	216	694
2000	76,772	166,033	35,460	278,265	214	676
2005	75,836	173,808	36,842	286,487	212	648
2010	74,653	179,983	39,825	294,461	221	636
2015	74,363	182,087	45,563	302,012	250	659
2020	74,856	181,105	52,666	308,638	291	704
2025	75,258	178,188	60,482	313,928	339	762
2030	75,094	176,223	66,486	317,803	377	803
2035	74,636	176,751	69,041	320,428	391	813
2040	74,345	176,266	69,430	322,044	389	807
2045	74,370	179,188	69,358	322,916	387	802
2050	74,502	178,617	70,260	323,378	393	810
2055	74,499	177,567	71,714	323,780	404	823
2060	74,340	177,163	72,668	324,372	411	831
2065	74,172	177,524	73,482	325,179	414	832
Alternative III:						
1990	74,156	152,429	31,985	256,571	210	696
1995	75,092	158,286	34,511	267,888	218	692
2000	74,355	164,585	36,113	275,053	219	671
2005	71,422	171,298	37,953	280,674	222	639
2010	67,719	176,644	41,430	285,792	235	618
2015	64,813	177,641	47,720	290,173	269	633
2020	62,956	175,067	55,453	293,475	317	676
2025	61,219	170,049	64,019	295,287	376	736
2030	59,119	165,468	70,879	295,465	428	786
2035	56,924	162,800	74,361	294,085	457	806
2040	54,822	160,732	75,755	291,310	471	812
2045	53,016	157,674	76,675	287,364	486	823
2050	51,427	152,699	78,456	282,582	514	851
2055	49,871	146,882	80,591	277,344	549	888
2060	48,281	141,840	81,859	271,980	577	912
2065	46,728	137,825	82,083	266,636	596	935

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.

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 Federal civilian employment that will result from the 1983 Social Security Amendments and the subsequent opportunity offered to Federal civilian employees, who were hired before 1984, to become covered under the OASDI program.

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 2065 for alternatives I, II-A, II-B, and III are 1.3, 2.0, 2.2, and 2.3 percentage points lower, respectively, than the 1988 level of 76.6 percent. For women, the projected age-adjusted labor force participation rates increase for all of the alternatives. The projected rates for 2065 are 4.9, 2.1, 1.6, and 0.3 percentage points, respectively, above the 1988 level of 56.6 percent.

The total age-sex-adjusted unemployment rate averaged 6.0 percent for the 30 years 1958-87 and 7.1 percent for the 10 years 1978-87. The ultimate total age-sex-adjusted unemployment rate is assumed to be 5.0, 5.5, 6.0, and 7.0 percent for alternatives I, II-A, II-B, and III, respectively. For alternatives I, II-A, and II-B, the unemployment rate is assumed to change gradually from its 1988 level of 5.5 percent, reaching its ultimate level by 2000. For alternative III, the unemployment rate is assumed to peak in 1990 and again in 1993, because of assumed recessions, and thereafter to decline gradually, reaching its ultimate level by 2000.

The projected age-adjusted coverage rate for men changes from its 1988 level of 74.2 percent to 75.2, 74.3, 73.7, and 72.4 percent in 2065 on the basis of alternatives I, II-A, II-B, and III, respectively. For women, it increases from its 1988 level of 57.2 percent to 62.9, 60.1, 59.4, and 57.7 percent for alternatives I, II-A, II-B, and III, respectively.

AVERAGE EARNINGS AND INFLATION

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, GNP, 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 in table 10 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 30 years 1958-87, annual increases in productivity for the total U.S. economy averaged 1.7 percent, the result of average annual increases of 2.6, 1.6, and 0.9 percent for the 10-year periods 1958-67, 1968-77 and 1978-87, respectively. Meanwhile, the average annual rate of change in average real earnings was an increase of 0.9 percent for the 30 years 1958-87, the result of average annual increases of 2.3 and 0.5 percent, and an average annual decrease of 0.1 percent, respectively, for the aforementioned 10-year periods. The change in the linkage between annual increases in productivity and real earnings averaged 0.8 percent for the 30 years 1958-87, and 0.3, 1.1, and 1.0 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, the extent to which workers share in the value of production, and the proportion of employee compensation paid as wages.

The ultimate annual increases in productivity for all sectors—wage-and-salary workers, self-employed persons, and the total economy—are assumed to be 2.2, 1.9, 1.7, and 1.4 percent for alternatives I, II-A, II-B, and III, respectively. The corresponding ultimate annual rates of change in the linkage for wage-and-salary workers are assumed not to change for alternative I and to be declines of 0.2, 0.4, and 0.6 percent for alternatives II-A, II-B, and III, respectively. This linkage is made up of assumed annual decreases of 0.0, 0.1, 0.2, and 0.3 percent in average hours worked per year, and 0.0, 0.1, 0.2, and 0.3 percent annual declines in wages as a share of compensation, for alternatives I, II-A, II-B, and III, respectively. No ultimate change is assumed for the historically stable ratio of employee compensation to GNP. The resulting ultimate real-wage differentials are 2.2, 1.7, 1.3, and 0.8 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.

For alternative II-A, the CPI is assumed to increase ultimately at an annual rate of 3.0 percent. For alternative II-B, the CPI is assumed to increase ultimately at an annual rate of 4.0 percent, which is somewhat lower than the average annual increase of 4.7 percent experienced between 1958 and 1988. The ultimate increases in the average annual CPI for alternatives I and III of 2.0 percent and 5.0 percent, respectively, were chosen to include a reasonable range of possible values. Ultimate annual increases in the GNP price deflator are assumed to be the same, for each alternative, as for the CPI.

The ultimate increases in average annual wages in covered employment are assumed to be 4.2, 4.7, 5.3, and 5.8 percent, for alternatives I, II-A, II-B, and III, respectively. These were obtained, for each alternative, by adding the assumed annual percentage increase in the CPI to the 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.

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 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.

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.

INSURED POPULATION

There are three 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, based on the requirement for fully insured status, past and projected coverage rates, and their historical relationships to fully insured rates. 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 75.6 on January 1, 1989, to 90.3, 90.0, 89.8, and 89.4 on January 1, 2061, based on alternatives I, II-A, II-B, and III, respectively. The increase for females is projected to be much greater than the increase for males. Based on alternative II-B, for example, the percentage for males is projected to increase only slightly during this period from 92.1 to 94.0, while that for females is projected to increase more substantially from 63.7 to 86.7. The percentage of fully insured persons under the normal retirement age who are disability insured is projected to change only slightly from 86.0 on January 1, 1989, to 85.9, 85.5, 85.4, and 84.8 on January 1, 2061, for alternatives I, II-A, II-B, and III, respectively.

The fully insured population by age and sex was further subdivided by marital status, by 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.

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.

In the short-range period, the numbers of retired-worker beneficiaries were developed by applying award rates to the numbers of persons who are insured but not yet retired, and by applying termination rates to the numbers of persons already receiving retired-worker benefits. In the long range, the numbers of retired-worker beneficiaries who are not converted from disabled-worker beneficiaries were projected as a percentage of the aged fully insured population less those persons entitled to disability or widow(er)'s benefits (i.e., the exposed population). The percentages for ages 70 and over are assumed to be 100, because the retirement earnings test and delayed retirement credit do not apply after age 70. For 1990, the retired-worker beneficiaries as a percentage of the exposed population for ages 65 through 69 are assumed to increase, reflecting the change that will be effective then in benefit withholding under the retirement earnings test. The percentages for ages 62 through 69 are assumed to change for two reasons. They were adjusted upward through the year 2000, continuing the trend toward earlier retirement. They were further adjusted in the long-range period, 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 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 two adjustments is to increase the percentages at ages 62 through 69 into the 1990s and then to decrease the percentages. Ultimate percentages are assumed to be 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 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 was deceased.

In the short-range period, the numbers of mother-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-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 A2 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 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 wives and widows.

TABLE A2.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1945-2065
[in thousands]

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Past experience:								
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
Alternative I:								
1989	24,315	3,114	428	5,092	315	1,783	7	35,054
1990	24,920	3,138	427	5,149	314	1,771	6	35,724
1995	26,337	3,199	453	5,327	312	1,821	4	37,454
2000	27,323	3,179	486	5,315	281	1,898	4	38,486
2005	28,767	2,951	528	5,261	267	1,928	4	39,706
2010	31,879	2,775	586	5,299	252	1,937	4	42,733
2015	37,263	2,749	654	5,375	238	1,958	4	48,241
2020	43,731	2,857	719	5,505	228	1,992	4	55,036
2025	49,474	2,963	769	5,664	230	2,040	4	61,143
2030	53,713	2,957	810	5,738	232	2,083	4	65,536
2035	55,740	2,863	837	5,724	234	2,111	4	67,514
2040	55,950	2,697	848	5,632	235	2,135	4	67,501
2045	55,991	2,613	867	5,524	237	2,165	4	67,402
2050	56,686	2,605	897	5,408	241	2,203	4	68,045

TABLE A2.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1945-2065 (Cont.)
[In thousands]

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Alternative I:								
(Cont.)								
2055	57,889	2,654	933	5,313	245	2,240	4	69,278
2060	59,163	2,706	963	5,273	249	2,274	4	70,633
2065	60,362	2,754	986	5,297	252	2,305	4	71,959
Alternative II-A:								
1989	24,322	3,114	428	5,093	315	1,781	7	35,059
1990	24,942	3,141	427	5,153	313	1,765	6	35,746
1995	26,558	3,221	451	5,365	307	1,788	4	37,694
2000	27,892	3,273	486	5,331	278	1,813	4	39,077
2005	29,720	3,095	527	5,289	261	1,773	4	40,670
2010	32,180	2,957	576	5,337	246	1,708	4	44,008
2015	38,929	2,956	632	5,422	236	1,664	4	49,844
2020	45,792	3,096	678	5,562	232	1,639	4	57,003
2025	51,926	3,237	707	5,741	233	1,629	4	63,476
2030	56,643	3,272	726	5,858	230	1,621	4	68,355
2035	59,136	3,214	733	5,920	225	1,608	4	70,840
2040	59,764	3,072	723	5,923	220	1,587	4	71,292
2045	60,103	3,014	720	5,911	215	1,566	4	71,532
2050	60,994	3,036	728	5,870	211	1,548	4	72,390
2055	62,204	3,106	741	5,799	208	1,529	4	73,590
2060	63,197	3,157	749	5,735	204	1,508	4	74,553
2065	63,827	3,182	749	5,703	200	1,485	4	75,149
Alternative II-B:								
1989	24,322	3,114	428	5,093	315	1,781	7	35,059
1990	24,942	3,141	427	5,153	313	1,765	6	35,746
1995	26,558	3,221	451	5,365	307	1,788	4	37,694
2000	27,890	3,273	486	5,331	278	1,813	4	39,074
2005	29,714	3,097	527	5,289	261	1,773	4	40,664
2010	33,165	2,963	576	5,338	246	1,707	4	43,999
2015	38,908	2,964	631	5,424	236	1,662	4	49,829
2020	45,761	3,106	677	5,564	232	1,637	4	56,982
2025	51,884	3,251	706	5,744	233	1,627	4	63,449
2030	56,587	3,292	726	5,863	230	1,619	4	68,321
2035	59,065	3,240	733	5,926	225	1,606	4	70,799
2040	59,677	3,105	722	5,931	219	1,585	4	71,243
2045	59,999	3,053	719	5,922	215	1,563	4	71,475
2050	60,871	3,082	727	5,885	211	1,545	4	72,325
2055	62,066	3,158	740	5,817	208	1,526	4	73,518
2060	63,047	3,213	747	5,755	204	1,505	4	74,476
2065	63,669	3,240	748	5,727	200	1,482	4	75,069
Alternative III:								
1989	24,329	3,115	428	5,095	314	1,778	7	35,065
1990	24,965	3,143	426	5,157	312	1,758	6	35,768
1995	26,771	3,242	450	5,402	300	1,750	4	37,918
2000	28,414	3,363	486	5,337	275	1,734	4	39,612
2005	30,579	3,240	522	5,307	259	1,656	4	41,566
2010	34,383	3,157	560	5,366	239	1,523	4	45,233
2015	40,565	3,202	602	5,458	220	1,406	4	51,459
2020	47,947	3,394	631	5,601	207	1,318	4	59,103
2025	54,841	3,597	641	5,778	199	1,259	4	66,118
2030	60,102	3,707	641	5,896	189	1,215	4	71,754
2035	63,425	3,722	631	5,982	177	1,176	4	75,116
2040	64,934	3,645	604	6,026	165	1,128	4	76,506
2045	66,084	3,644	585	6,055	153	1,080	4	77,606
2050	67,683	3,729	577	6,038	144	1,034	4	79,208
2055	69,357	3,849	575	5,941	135	987	4	80,848
2060	70,425	3,922	569	5,810	126	942	4	81,797
2065	70,718	3,933	556	5,688	118	896	4	81,914

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 14,116 as of December 31, 1988, and is estimated to be fewer than 200 by the turn of the century. Totals do not necessarily equal the sums of rounded components.

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, 1988, 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, 1987. The numbers of new entitlements during each year were projected by applying assumed disability incidence rates. In the short-range period, an age-adjusted rate was applied to the total age-adjusted disability insured population for each sex. In the long-range period, 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, overall termination rates for each sex were projected based on recent experience and on expected changes in the administration of the DI program. In the long-range period, the numbers of terminations were projected by applying assumed death and recovery rates, by age, sex, and duration of entitlement, to the entitled disabled-worker population, and adding the number of disabled-worker beneficiaries automatically converted to retired-worker beneficiaries at the normal retirement age (currently, age 65).

The disability incidence rates, which declined during 1975-82, increased during 1983-85, and remained steady during 1986-88, are assumed to resume the increasing trend in 1989. The rates are assumed to increase significantly faster for males than for females during the next decade as workers afflicted by AIDS become disabled-worker beneficiaries. The specific ultimate levels assumed are determined in two stages. First, under an assumption of a constant normal retirement age of 65, the incidence rates are projected to increase through 2010. These levels, for alternatives II-A and II-B, are about 17 percent for males and 20 percent for females higher than the average rates for 1984-86. This produces age-adjusted rates in 2010 of 5.2 per thousand for males and 3.6 per thousand for females, and an age-sex-adjusted rate of 4.6 per thousand. Next, because of the increase in the normal retirement age, further increases are projected in incidence rates at ages over 60. These combined projected increases cause the total gross incidence rate to increase from the current 1988 levels of 4.4 per thousand for males and 3.0 per thousand for females to 7.6 per thousand for males and 5.4 per thousand for females in the year 2026 when the normal retirement age has reached its ultimate level of 67.

For the other alternatives, the disability incidence rates are assumed to follow patterns through time similar to the one for alternatives II-A and II-B. For alternative I, the stage one levels are assumed to be higher by about one percent for both males and females than the average for 1984-86. The 2026 total gross incidence rates are assumed to be 6.5 per thousand for males and 4.4 per thousand for females. For alternative III, the stage one levels are assumed to be higher by about 38 percent for males and 43 percent for females. This level is approximately 80 percent of the rate experienced in 1974, when incidence rates attained their highest level. The 2026 total gross incidence rates are assumed to be 9.1 per thousand for males and 6.5 per thousand for females.

The overall termination rates were projected quarterly in the short-range period. For alternatives II-A and II-B, the rates were projected to increase from the relatively low levels of 1984-88, to levels comparable to the average experienced over the last decade. For alternative III, the termination rates increase more slowly and to lower levels, whereas for alternative I the termination rates increase more quickly and to higher levels.

In the long-range period, the death 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 alternatives II-A and II-B, they reach levels in 2065 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 exist. The recovery rates are assumed to increase from 1988 levels until 1995, when they attain ultimate levels about 15 percent higher than those experienced during the period 1977-80, thereby allowing for the estimated effect of the periodic reviews required by provisions of law first enacted in 1980, and amended in 1983 and 1984.

For alternative I, the death rates in 2065 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 30 percent higher than those of the same period. For alternative III, the death rates in 2065 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 equal to 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 A3 shows the projected numbers of beneficiaries under the DI program.

TABLE A3.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1960-2065
(In thousands)

Calendar year	Disabled workers	Auxiliaries			Total
		Wife-husband	Child		
Past experience:					
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
Alternative I:					
1989	2,867	275	958		4,100
1990	2,883	270	956		4,109
1995	3,035	260	975		4,271
2000	3,494	269	1,080		4,843
2005	4,074	283	1,133		5,490
2010	4,730	294	1,159		6,183
2015	5,118	283	1,180		6,581
2020	5,300	281	1,215		6,795
2025	5,612	305	1,270		7,187
2030	5,527	293	1,315		7,134
2035	5,474	285	1,346		7,105
2040	5,558	280	1,377		7,215
2045	5,827	295	1,416		7,537
2050	6,005	306	1,462		7,772
2055	6,127	315	1,510		7,953
2060	6,228	320	1,555		8,103
2065	6,407	327	1,598		8,333
Alternative II-A:					
1989	2,883	276	961		4,120
1990	2,924	273	967		4,164
1995	3,238	281	1,044		4,562
2000	3,835	312	1,193		5,340
2005	4,590	346	1,267		6,203
2010	5,443	377	1,286		7,106
2015	5,972	383	1,287		7,641
2020	6,217	396	1,294		7,906
2025	6,584	433	1,320		8,337
2030	6,467	420	1,338		8,225
2035	6,383	410	1,345		8,138
2040	6,449	403	1,345		8,196
2045	6,709	419	1,348		8,476
2050	6,823	430	1,356		8,609
2055	6,816	434	1,366		8,616
2060	6,746	429	1,373		8,548
2065	6,768	428	1,378		8,573
Alternative II-B:					
1989	2,883	276	961		4,120
1990	2,924	273	967		4,164
1995	3,237	281	1,043		4,561
2000	3,833	312	1,192		5,337
2005	4,585	346	1,266		6,197
2010	5,434	378	1,283		7,095
2015	5,960	382	1,283		7,626
2020	6,202	396	1,290		7,887
2025	6,565	433	1,315		8,314
2030	6,446	421	1,334		8,201
2035	6,360	411	1,340		8,112
2040	6,425	404	1,340		8,168
2045	6,683	421	1,343		8,447
2050	6,797	432	1,351		8,579
2055	6,790	436	1,361		8,587
2060	6,720	431	1,368		8,518
2065	6,742	430	1,373		8,544

TABLE A3.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1960-2065 (Cont.)
[In thousands]

Calendar year	Disabled workers	Auxiliaries			Total
		Wife-husband	Child		
Alternative III:					
1989	2,916	280	974		4,170
1990	2,998	280	990		4,269
1995	3,617	317	1,168		5,102
2000	4,295	362	1,342		5,998
2005	5,285	414	1,446		7,145
2010	6,393	461	1,447		8,300
2015	7,097	470	1,412		8,979
2020	7,418	485	1,377		9,279
2025	7,853	528	1,353		9,743
2030	7,699	508	1,348		9,555
2035	7,587	491	1,327		9,406
2040	7,641	477	1,292		9,409
2045	7,891	493	1,256		9,640
2050	7,902	500	1,225		9,627
2055	7,696	492	1,197		9,385
2060	7,368	469	1,169		9,006
2065	7,164	454	1,140		8,758

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

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, because of 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 1983.

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.

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 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.

ADMINISTRATIVE EXPENSES

The projection of administrative expenses through 1998 was based on assumed increases in average wages, increases in the CPI, and increases in the number of beneficiaries. For years after 1998, administrative expenses are assumed to increase with the numbers of beneficiaries and with average earnings in covered employment, taking into account assumed increases in productivity.

RAILROAD RETIREMENT FINANCIAL INTERCHANGE

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 \$3-4 billion and an average annual long-range cost of 0.04 percent of taxable payroll to the OASDI program.

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 1998. 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.

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 additional adjustments will be made in 1990 and every fifth year thereafter. The adjustments for 1990 were estimated based on the change in interest rates since the determination of the adjustments in 1985. No adjustments after 1990 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.

INCOME FROM TAXATION OF BENEFITS

The OASI and DI Trust Funds are credited with the additional income taxes attributable to the partial taxation of 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 OASDI 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.

APPENDIX B.—SENSITIVITY ANALYSIS

This appendix presents estimates which illustrate the sensitivity of the level-financing estimates to changes in selected individual assumptions. Although the estimates based on the four alternative sets of assumptions illustrate variations that result from different combinations of assumptions, they do not show variations that result from changes in any single assumption. In this sensitivity analysis, alternative II-B is used as the reference point, and one assumption at a time within that alternative is varied. Similar variations in the selected assumptions within the other alternatives would result in similar relative variations in the estimates.

Each table which follows shows the effects of changing the particular assumption under consideration on the OASDI income rates, cost rates, and actuarial balances. Because the income rate varies only slightly with changes in assumptions, it is not considered in the discussion of the tables. The change in each of the actuarial balances is approximately equal to the change in the corresponding cost rate, but in the opposite direction.

TOTAL FERTILITY RATE

Table B1 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the ultimate total fertility rate. These assumptions are that the ultimate total fertility rate will be 1.6 children per woman (as assumed for alternative III), 1.9 (as assumed for alternatives II-A and II-B), and 2.2 (as assumed for alternative I). The rate is assumed to change gradually from its current level and to reach the various ultimate values in 2013.

TABLE B1.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS FERTILITY ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Ultimate total fertility rate ¹		
	1.6	1.9	2.2
Income rate:			
25-year: 1989-2013	12.91	12.91	12.91
50-year: 1989-2038	12.97	12.96	12.96
75-year: 1989-2063	13.04	13.02	12.99
Cost rate:			
25-year: 1989-2013	10.49	10.52	10.55
50-year: 1989-2038	12.64	12.52	12.42
75-year: 1989-2063	14.24	13.72	13.24
Actuarial balance:			
25-year: 1989-2013	+ 2.42	+ 2.39	+ 2.36
50-year: 1989-2038	+ 33	+ 44	+ 54
75-year: 1989-2063	-1.20	- 70	- .24

¹The total fertility rate for any year is the average number of children who would be born to a woman in her lifetime if she were to experience the birthrates by age observed in, or assumed for, the selected year, and if she were to survive the entire child-bearing period. The ultimate total fertility rate is assumed to be reached in 2013.

For the 25-year period, the cost rate for the three fertility assumptions varies by only 0.06 percent of taxable payroll. In contrast, the 75-year cost rate varies over a wide range, decreasing from 14.24 to 13.24 percent, as the assumed ultimate total fertility rate increases from 1.6 to 2.2. Similarly, while the 25-year actuarial balance varies by only 0.06 percent of taxable payroll, the 75-year actuarial balance varies over a much wider range—from -1.20 to -0.24 percent.

During the 25-year period, changes in fertility affect the working population only slightly and result in relatively minor changes in the number of child beneficiaries. Hence, the program cost is affected only slightly. For the 75-year long-range period, however, changes in fertility have a relatively greater impact on the labor force than on the beneficiary population. As a result, an increase in fertility significantly reduces the cost rate. Each increase of 0.1 in the ultimate total fertility rate increases the long-range actuarial balance by about 0.16 percent of taxable payroll.

DEATH RATES

Table B2 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about future reductions in death rates. The analysis was developed by varying the percentage decrease assumed to occur during 1989-2063 in the age-sex-adjusted death rate. The decreases assumed for this period are about 18 percent (as assumed for alternative I), 34 percent (as assumed for alternatives II-A and II-B), and 51 percent (as assumed for alternative III).

TABLE B2.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS DEATH-RATE ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Reduction in death rates ¹		
	18 percent	34 percent	51 percent
Income rate:			
25-year: 1989-2013	12.91	12.91	12.92
50-year: 1989-2038	12.95	12.96	12.98
75-year: 1989-2063	12.99	13.02	13.05
Cost rate:			
25-year: 1989-2013	10.39	10.52	10.66
50-year: 1989-2038	12.14	12.52	12.96
75-year: 1989-2063	13.09	13.72	14.54
Actuarial balance:			
25-year: 1989-2013	+2.52	+2.39	+2.26
50-year: 1989-2038	+ .81	+ .44	+ .02
75-year: 1989-2063	- .10	- .70	-1.49

¹The measure of the reduction in death rates is the decrease in the age-sex-adjusted death rate during 1989-2063.

The variation in cost for the 25-year period is less pronounced than the variation for the 75-year period because the decreases in death rates are assumed to occur gradually and because of the specific changes in the age composition of the population that are projected to occur. The 25-year cost rate increases from 10.39 percent (for 18-percent lower ultimate death rates) to 10.66 percent (for 51-percent lower ultimate rates). The long-range cost rate increases from 13.09 to 14.54 percent. The actuarial balance decreases from +2.52 to +2.26 percent for the 25-year period, and from -0.10 to -1.49 percent for the 75-year period.

Lower death rates cause both the income (as well as taxable payroll) and the outgo of the OASDI program to be higher than they would otherwise be. The relative increase in outgo, however, exceeds the relative increase in taxable payroll. For any given year, reductions in the death rates for people who have attained the normal retirement age (people whose death rates are the highest) increase the number of retired-worker beneficiaries (and, therefore, the amount of retirement benefits paid) without adding significantly to the number of covered

workers (and, therefore, to the taxable payroll). Although reductions for people aged 50 to normal retirement age do result in significant increases to the taxable payroll, those increases are not large enough to offset the sum of the additional retirement benefits mentioned above and the disability benefits paid to additional beneficiaries in this pre-retirement age group. At ages under 50, death rates are so low that even substantial reductions would not result in significant increases in the numbers of covered workers or beneficiaries. Consequently, if death rates for all ages are lowered by about the same relative amount, outgo increases at a rate greater than the rate of growth in payroll, thereby resulting in higher cost rates. Each additional 10-percent reduction in the age-sex-adjusted death rate assumed to occur in 1989-2063, relative to the 34-percent reduction assumed for alternative II-B, decreases the long-range actuarial balance by about 0.40 percent of taxable payroll.

NET IMMIGRATION

Table B3 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the magnitude of net immigration. These assumptions are that the annual net immigration will be 450,000 persons (as assumed for alternative III), 600,000 persons (as assumed for alternatives II-A and II-B), and 750,000 persons (as assumed for alternative I).

TABLE B3.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS NET-IMMIGRATION ASSUMPTIONS
[As a percentage of taxable payroll]

Calendar years	Net immigration per year		
	450,000	600,000	750,000
Income rate:			
25-year: 1989-2013	12.92	12.91	12.91
50-year: 1989-2038	12.97	12.96	12.96
75-year: 1989-2063	13.02	13.02	13.01
Cost rate:			
25-year: 1989-2013	10.59	10.52	10.46
50-year: 1989-2038	12.66	12.52	12.39
75-year: 1989-2063	13.88	13.72	13.57
Actuarial balance:			
25-year: 1989-2013	+2.33	+2.39	+2.45
50-year: 1989-2038	+0.31	+0.44	+0.57
75-year: 1989-2063	-0.86	-0.70	-0.56

For all three periods, the cost rate decreases with increasing rates of net immigration. For the 25-year period, the cost rate decreases from 10.59 percent of taxable payroll (for annual net immigration of 450,000 persons) to 10.46 percent (for annual net immigration of 750,000 persons). For the 50-year period, it decreases from 12.66 percent to 12.39 percent, and for the 75-year period, it decreases from 13.88 percent to 13.57 percent. The actuarial balance increases from +2.33 to +2.45 percent for the 25-year period, from +0.31 to +0.57 for the 50-year period, and from -0.86 to -0.56 percent for the 75-year period.

The cost rate decreases with increasing rates of net immigration because immigration occurs at relatively young ages, thereby increasing the numbers of covered workers earlier than the numbers of beneficiaries. Each additional group of 100,000 immigrants relative to the 600,000 net immigration assumed for alternative II-B, increases the long-range actuarial balance by about 0.10 percent of taxable payroll.

REAL-WAGE DIFFERENTIAL

Table B4 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the real-wage differential. These assumptions are that the ultimate real-wage differential will be 0.8 percentage point (as assumed for alternative III), 1.3 percentage points (as assumed for alternative II-B), 1.7 percentage points (as assumed for alternative II-A), and 2.2 percentage points (as assumed for alternative I). In each case, the ultimate annual increase in the CPI is assumed to be 4.0 percent (as assumed for alternative II-B), yielding ultimate percentage increases in average annual wages in covered employment of 4.8, 5.3, 5.7, and 6.2 percent, respectively.

TABLE B4.— ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES,
BASED ON ALTERNATIVE II-B WITH VARIOUS REAL-WAGE ASSUMPTIONS
[As a percentage of taxable payroll]

Calendar years	Ultimate percentage increase in wages-CPI ¹			
	4.8-4.0	5.3-4.0	5.7-4.0	6.2-4.0
Income rate:				
25-year: 1989-2013	12.93	12.91	12.90	12.88
50-year: 1989-2038	12.99	12.96	12.94	12.92
75-year: 1989-2063	13.05	13.02	12.99	12.96
Cost rate:				
25-year: 1989-2013	10.87	10.52	10.25	9.92
50-year: 1989-2038	13.00	12.52	12.15	11.68
75-year: 1989-2063	14.24	13.72	13.30	12.77
Actuarial balance:				
25-year: 1989-2013	+2.07	+2.39	+2.64	+2.96
50-year: 1989-2038	-0.01	+0.44	+0.80	+1.24
75-year: 1989-2063	-1.20	-0.70	-0.31	+0.20

¹The first value in each pair is the assumed ultimate annual percentage increase in average wages in covered employment. The second value is the assumed ultimate annual percentage increase in the Consumer Price Index. The difference between the two values is the real-wage differential.

For the 25-year period, the cost rate decreases from 10.87 percent (for a real-wage differential of 0.8 percentage point) to 9.92 percent (for a differential of 2.2 percentage points). For the 50-year period, it decreases from 13.00 to 11.68 percent, and for the 75-year period it decreases from 14.24 to 12.77 percent. The actuarial balance increases from +2.07 to +2.96 percent for the 25-year period, from -0.01 to +1.24 for the 50-year period, and from -1.20 to +0.20 percent for the 75-year period.

The cost rate decreases with increasing real-wage differentials, because the higher real-wage levels increase the taxable payroll, while benefit increases are not affected. Although the initial benefit levels are higher because of the higher wages, these increases are more than offset by the increases in the taxable payroll of future workers. Each 0.5-percentage-point increase in the assumed real-wage differential increases the long-range actuarial balance by about 0.50 percent of taxable payroll.

CONSUMER PRICE INDEX

Table B5 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the rate of increase for the Consumer Price Index (CPI). These assumptions are that the ultimate annual increase in the CPI will be 2.0 percent (as assumed for alternative I), 3.0 percent (as assumed for alternative II-A), 4.0 percent (as assumed for alternative II-B), 5.0 percent (as assumed for alternative III), and 6.0 percent. In

each case, the ultimate real-wage differential is assumed to be 1.3 percentage points (as assumed for alternative II-B), yielding ultimate percentage increases in average annual wages in covered employment of 3.3, 4.3, 5.3, 6.3, and 7.3 percent, respectively.

TABLE B5.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS CPI-INCREASE ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Ultimate percentage increases in wages-CPI ¹				
	3.3-2.0	4.3-3.0	5.3-4.0	6.3-5.0	7.3-6.0
Income rate:					
25-year: 1989-2015.....	12.92	12.92	12.91	12.91	12.90
50-year: 1989-2038.....	12.98	12.97	12.96	12.96	12.95
75-year: 1989-2063.....	13.04	13.03	13.02	13.01	13.00
Cost rate:					
25-year: 1989-2013.....	10.75	10.63	10.52	10.41	10.31
50-year: 1989-2038.....	12.89	12.70	12.52	12.35	12.18
75-year: 1989-2063.....	14.15	13.93	13.72	13.51	13.31
Actuarial balance:					
25-year: 1989-2013.....	+2.18	-2.29	+2.39	+2.49	+2.59
50-year: 1989-2038.....	+0.09	+0.27	+0.44	+0.61	+0.77
75-year: 1989-2063.....	-1.12	-0.91	-0.70	-0.51	-0.31

¹The first value in each pair is the assumed ultimate annual percentage increase in average wages in covered employment. The second value is the assumed ultimate annual percentage increase in the Consumer Price Index.

For all three periods, the cost rate decreases with greater assumed rates of increase in the CPI. For the 25-year period, the cost rate decreases from 10.75 (for CPI increases of 2.0 percent) to 10.31 percent (for CPI increases of 6.0 percent). For the 50-year period, it decreases from 12.89 to 12.18 percent, and for the 75-year period, it decreases from 14.15 to 13.31 percent. The actuarial balance increases from +2.18 to +2.59 percent for the 25-year period, from +0.09 to +0.77 for the 50-year period, and from -1.12 to -0.31 percent for the 75-year period.

The patterns described above result primarily from the time lag between the effects of the CPI changes on taxable payroll and on benefit payments. When assuming a greater rate of increase in the CPI (in conjunction with a constant real-wage differential), the effect on taxable payroll of the implied greater rate of increase in average wages is experienced immediately, while the effect on benefits of the greater rate of increase in the CPI is experienced with a lag of about 1 year. In addition, the effect on benefits of the greater rate of increase in average wages is experienced no sooner than 2 years later. Thus, the higher taxable payrolls have a stronger effect than the higher benefits, thereby resulting in lower cost rates. The effect of each 1.0-percentage-point increase in the rate of change assumed for the CPI is an increase in the long-range actuarial balance of about 0.20 percent of taxable payroll.

REAL-INTEREST RATE

Table B6 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the annual real-interest rate. These assumptions are that the ultimate annual real-interest rate will be 1.0 percent, 1.5 percent (as assumed for alternative III), 2.0 percent (as assumed for alternative II-B), 2.5 percent (as assumed for alternative II-A), and 3.0 percent (as assumed for alternative I). In each case, the ultimate annual increase in the CPI is assumed to be 4.0 percent (as assumed for alternative II-B), resulting in ultimate annual yields of 5.0, 5.6, 6.1, 6.6, and 7.1 percent, respectively.

TABLE B6.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS REAL-INTEREST ASSUMPTIONS
[As a percentage of taxable payroll]

Calendar years	Ultimate annual real-interest rate				
	1.0 percent	1.5 percent	2.0 percent	2.5 percent	3.0 percent
Income rate:					
25-year: 1989-2013.....	12.90	12.90	12.91	12.92	12.93
50-year: 1989-2038.....	12.97	12.96	12.96	12.96	12.97
75-year: 1989-2063.....	13.03	13.02	13.02	13.01	13.00
Cost rate:					
25-year: 1989-2013.....	10.53	10.52	10.52	10.52	10.52
50-year: 1989-2038.....	12.84	12.68	12.52	12.37	12.23
75-year: 1989-2063.....	14.28	14.00	13.72	13.45	13.18
Actuarial balance:					
25-year: 1989-2013.....	+ 2.37	+ 2.38	+ 2.39	+ 2.40	+ 2.41
50-year: 1989-2038.....	+ .12	+ .28	+ .44	+ .59	+ .74
75-year: 1989-2063.....	-1.24	- .97	- .70	- .44	- .18

For the 25-year period, the cost rate decreases slightly with increasing real-interest rates from 10.53 percent (for an ultimate real-interest rate of 1.0 percent) to 10.52 percent (for an ultimate real-interest rate of 3.0 percent). For the 50-year period, it decreases from 12.84 to 12.23 percent, and for the 75-year period, it decreases from 14.28 to 13.18 percent. The actuarial balance increases from +2.37 to +2.41 percent for the 25-year period, from +0.12 to +0.74 percent for the 50-year period, and from -1.24 to -0.18 percent for the 75-year period. Each 0.5-percentage-point increase in the assumed real-interest rate increases the long-range actuarial balance by about 0.26 percent of taxable payroll.

DISABILITY INCIDENCE RATES

Table B7 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions concerning future disability incidence rates. These assumptions provide that the ultimate annual age-sex-adjusted disability incidence rate will be about 1 percent higher for both men and women than the average of the corresponding annual rates experienced during 1984-86 (as assumed for alternative I), about 17 percent higher for men and 20 percent higher for women than such experience (as assumed for alternatives II-A and II-B), and about 38 percent higher for men and 43 percent higher for women than such experience (as assumed for alternative III). The rates are assumed to change gradually from their current levels and to reach their ultimate values in 2010.

TABLE B7.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS DISABILITY INCIDENCE ASSUMPTIONS
[As a percentage of taxable payroll]

Calendar years	Disability incidence rates based on alternative—		
	I	II-A and II-B	III
Income rate:			
25-year: 1989-2013.....	12.91	12.91	12.91
50-year: 1989-2038.....	12.96	12.96	12.97
75-year: 1989-2063.....	13.01	13.02	13.02
Cost rate:			
25-year: 1989-2013.....	10.44	10.52	10.63
50-year: 1989-2038.....	12.38	12.52	12.71
75-year: 1989-2063.....	13.56	13.72	13.93
Actuarial balance:			
25-year: 1989-2013.....	+ 2.47	+ 2.39	+ 2.28
50-year: 1989-2038.....	+ .58	+ .44	+ .26
75-year: 1989-2063.....	- .54	- .70	- .91

For the 25-year period, the cost rate increases with increasing disability incidence rates from 10.44 percent (for the relatively low rates assumed for alternative I) to 10.63 percent (for the relatively high rates assumed for alternative III). For the 50-year period, it increases from 12.38 to 12.71 percent, and for the 75-year period, it increases from 13.56 to 13.93 percent. The actuarial balance decreases from +2.47 to +2.28 percent for the 25-year period, from +0.58 to +0.26 percent for the 50-year period, and from -0.54 to -0.91 percent for the 75-year period.

DISABILITY TERMINATION RATES

Table B8 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about future disability termination rates.

For all four alternatives, death-termination rates by age and sex are assumed to decline throughout the 75-year period. At the end of that period, they reach levels that, in comparison to the corresponding annual rates experienced during the base period, 1977-80, are lower by about 20 percent for males and 10 percent for females for alternative I, lower by about 30 percent for males and 20 percent for females for alternatives II-A and II-B, and lower by about 45 percent for males and 35 percent for females for alternative III.

For all four alternatives, ultimate recovery-termination rates by age and sex are assumed to be attained in 1995. For alternative I, they are about 30 percent higher than the corresponding rates experienced during the base period. For alternative III, they are about the same as the base-period rates. For alternatives II-A and II-B, such rates are about 15 percent higher than those experienced in the base period, in order to reflect the effects of the additional periodic reviews that began in 1981.

TABLE B8.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES,
BASED ON ALTERNATIVE II-B WITH VARIOUS DISABILITY TERMINATION ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Disability termination rates based on alternative—		
	I	II-A and II-B	III
<i>Income rate:</i>			
25-year: 1989-2013	12.91	12.91	12.91
50-year: 1989-2038	12.96	12.96	12.96
75-year: 1989-2063	13.02	13.02	13.02
<i>Cost rate:</i>			
25-year: 1989-2013	10.50	10.52	10.56
50-year: 1989-2038	12.49	12.52	12.58
75-year: 1989-2063	13.67	13.72	13.78
<i>Actuarial balance</i>			
25-year: 1989-2013	+2.42	+2.39	+2.36
50-year: 1989-2038	+ .48	+ .44	+ .39
75-year: 1989-2063	-.66	-.70	-.77

For the 25-year period, the cost rate increases with decreasing disability termination rates from 10.50 percent (for the relatively high rates assumed for alternative I) to 10.56 percent (for the relatively low rates assumed for alternative III). For the 50-year period, it increases from 12.49 to 12.58 percent, and for the 75-year period, it increases from 13.67 to 13.78 percent. The actuarial balance decreases from +2.42 to +2.36 percent for the 25-year period, from +0.48 to +0.39 percent for the 50-year period, and from -0.66 to -0.77 percent for the 75-year period.