

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. Estimates of the trust fund operations during the long-range period expressed in dollar amounts will be published by the Office of the Actuary, shortly after the issuance of this report.

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 1986 through 2065. The projections started with the United States population, including armed forces overseas, on January 1, 1985, based on estimates by the Bureau of the Census. This population estimate was adjusted for net census undercount and increased by the estimated populations in the geographic areas covered by the OASDI program but not included in the U.S. population. The population was then projected using assumed rates of birth and death 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 birth rates by age observed in, or assumed for, the selected year, and if she were to survive the entire childbearing period. The total fertility rate decreased from 3.3 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 been about 1.8 children per woman.

These variations in fertility rates have resulted from changes in social attitudes, economic conditions, and the use of birth-control methods. Future fertility rates may be expected to exceed the present low level, because such a low level has never been experienced in the U.S. for a long period, and because such a level is well below that needed to maintain the size of the population, in the absence of increased net immigration. The recent historical and projected trends in certain population characteristics, however, 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 2.3, 2.0, 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 2011. 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 2.3 to 1.6, with an interme-

diate assumption of 1.9. The ultimate assumption of the Bureau of the Census for the intermediate total fertility rate is lower than that used for this report, but such ultimate rate is not assumed to be reached until 2050. In fact, annual total fertility rates for the intermediate assumption by the Bureau of the Census are higher than those adopted for this report until well after 2000.¹ A rate of 2.1 would ultimately result in a nearly constant population if net immigration were zero and if death rates were constant at levels close to current U.S. experience.

Historically, death rates in the U.S. have steadily declined. 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 1985. These reductions in death rates have resulted from many factors, including increased medical knowledge, increased 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 sex and cause of death were selected for 2011 and later. The intermediate set, which is used for both alternatives II-A and II-B, is considered most likely to be realized. 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 1986 and 2011, these 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 1983, to the ultimate annual percentage reductions by sex and cause of death assumed for 2011 and later. Alternative I reductions are assumed to change gradually from 50 percent of the average annual reductions observed between 1968 and 1983, while alternative III reductions are assumed to change gradually from 150 percent of the average annual reductions observed between 1968 and 1983. The age-sex-adjusted death rate (for all causes combined) declined at an average rate of 1.9 percent per year between 1968 and 1983.

After adjustment for changes in the age-sex distribution of the population, death rates were projected to decline at an average annual rate of about 0.3 percent, 0.6 percent, and 1.2 percent between 1985 and 2060 for alternatives I, II-A and II-B, and III, respectively.

Net legal immigration is assumed to be 600,000, 400,000, and 200,000 persons per year for alternatives I, II-A and II-B, and III, respectively. The estimates prepared by the Bureau of the Census of the illegal population are included in the starting population. In addition, consistent with their estimates of illegal immigration since the 1980 Census, net illegal immigration is assumed to be 200,000 persons per year during 1985 and 1986. However, for years after 1986, no additional allowance is made for aliens who may enter the U.S. illegally.

¹U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 952, "Projections of the Population of the United States By Age, Sex, and Race: 1983-2080," U.S. Government Printing Office, Washington, D.C., May 1984.

Table A1 shows the projected population as of July 1 by broad age group, for the four alternatives. 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 1945-2065

Calendar year	Population (in thousands)				Dependency ratio	
	Under 20	20-64	65 and over	Total	Aged ^a	Total ^a
Past experience:						
1945	48,163	81,295	10,962	140,420	0.135	0.727
1950	53,695	92,739	12,752	159,386	.138	.719
1955	63,438	96,971	15,030	175,439	.155	.809
1960	72,989	99,842	17,250	190,081	.173	.904
1965	79,965	104,958	19,134	204,056	.182	.944
1970	80,881	113,187	20,827	214,895	.184	.899
1975	78,634	122,797	23,288	224,720	.190	.830
1980	74,964	134,239	26,102	235,305	.194	.753
1985	73,191	145,077	28,902	247,170	.199	.704
Alternative I:						
1990	74,041	152,668	31,841	258,551	.209	.694
1995	76,252	159,177	33,906	269,335	.213	.692
2000	78,258	166,377	34,773	279,408	.209	.679
2005	79,481	174,131	35,816	289,428	.206	.662
2010	81,581	179,700	38,671	299,953	.215	.669
2015	84,729	182,027	44,004	310,759	.242	.707
2020	88,266	182,280	50,422	320,967	.277	.761
2025	91,498	181,229	57,644	330,372	.318	.823
2030	94,119	182,062	62,942	339,124	.346	.863
2035	96,571	186,254	64,709	347,535	.347	.866
2040	99,607	191,882	64,367	355,856	.335	.855
2045	103,055	197,562	63,673	364,289	.322	.844
2050	106,490	202,606	64,027	373,124	.316	.842
2055	109,687	208,224	64,831	382,742	.311	.838
2060	112,804	214,663	65,917	393,385	.307	.833
2065	116,106	221,767	67,111	404,983	.303	.826
Alternatives II-A and II-B:						
1990	73,619	152,239	31,911	257,769	.210	.693
1995	74,715	158,169	34,290	267,175	.217	.689
2000	75,053	164,814	35,626	275,493	.216	.672
2005	74,058	172,004	37,144	283,207	.216	.647
2010	73,488	176,764	40,429	290,681	.229	.644
2015	73,905	177,606	46,201	297,713	.260	.676
2020	74,816	175,784	53,099	303,698	.302	.728
2025	75,426	172,101	60,868	308,394	.354	.792
2030	75,442	169,712	68,722	311,875	.393	.836
2035	75,251	170,110	68,988	314,349	.406	.848
2040	75,404	171,551	69,051	316,005	.403	.842
2045	75,869	172,545	68,633	317,046	.398	.837
2050	76,327	172,285	69,163	317,776	.401	.844
2055	76,571	172,135	69,885	318,590	.406	.851
2060	76,678	172,726	70,381	319,785	.407	.851
2065	76,844	173,913	70,649	321,405	.406	.848

TABLE A1.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS, BY ALTERNATIVE AND BROAD AGE GROUP, CALENDAR YEARS 1945-2065 (Cont.)

Calendar year	Population (in thousands)				Dependency ratio	
	Under 20	20-64	65 and over	Total	Aged ¹	Total ²
Alternative III:						
1990.....	73,106	151,810	31,978	256,894	.211	.692
1995.....	72,775	157,145	34,651	264,572	.221	.684
2000.....	70,977	163,202	36,415	270,593	.223	.658
2005.....	67,167	169,799	38,415	275,381	.226	.622
2010.....	63,283	173,665	42,250	279,198	.243	.608
2015.....	60,486	172,746	48,697	281,930	.282	.632
2020.....	58,497	168,433	56,419	283,348	.335	.682
2025.....	56,430	161,564	65,195	283,190	.404	.753
2030.....	54,026	155,251	72,179	281,455	.465	.813
2035.....	51,568	151,089	75,588	278,245	.500	.842
2040.....	49,324	147,630	76,729	273,683	.520	.854
2045.....	47,418	143,302	77,234	267,954	.539	.870
2050.....	45,671	137,170	78,534	261,376	.573	.905
2055.....	43,909	130,860	79,596	254,365	.608	.944
2060.....	42,127	125,578	79,592	247,298	.634	.969
2065.....	40,427	121,178	78,774	240,379	.650	.984

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 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 2065 for alternatives I, II-A, II-B, and III are 1.1, 1.3, 1.4, and 2.0 percentage points lower, respectively, than the 1986 level of 76.8 percent. For women, the projected age-adjusted labor force participation rates increase for all of the alternatives. The projected rates for 2065 are 4.0, 2.7, 2.2, and 1.2 percentage points, respectively, above the 1986 level of 55.2 percent.

The total age-sex-adjusted unemployment rate averaged 5.9 percent for the 30 years 1957-86 and 7.2 percent for the 10 years 1977-86. 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 decline gradually, reaching its ultimate level by 2000. For alternative III, the unemployment rate is assumed to peak in 1988 and again in 1990,

because of assumed recessions, and thereafter to decline gradually, reaching its ultimate level by 2000.

The projected age-adjusted coverage rate for men decreases from its 1986 level of 75.5 percent to 75.4, 75.0, 74.6, and 73.4 percent in 2065 on the basis of alternatives I, II-A, II-B, and III, respectively. For women, it increases from its 1986 level of 55.0 percent to 61.4, 59.8, 59.4, and 57.9 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. 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. 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. 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 1956-85, annual increases in productivity for the total U.S. economy averaged 1.6 percent, the result of average annual increases of 2.5, 1.5, and 0.9 percent for the 10-year periods 1956-65, 1966-75, and 1976-85, respectively. Meanwhile, the average annual rate of change in average real earnings was an increase of 0.9 percent for the 30 years 1956-85, the result of average annual increases of 2.3 and 0.7 percent, and an average annual decrease of 0.4 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 1956-85, and 0.3, 0.7, and 1.3 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 2.4, 2.1, 1.7, and 1.5 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 to be an increase of 0.1 percent for alternative I and declines of 0.1, 0.2, and 0.5 percent for alternatives II-A, II-B, and III, respectively. The resulting ultimate real-wage differentials are 2.5, 2.0, 1.5, and 1.0 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 1956 and 1986. 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 4.5, 5.0, 5.5, and 6.0 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 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. 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 tips and multiple-employer "excess wages," and which did apply, before 1984, to net earnings from self-employment. For 1984 and later, the amounts of earnings for employees, employers, and the self-employed were projected separately. 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, currently, and disability. Fully insured status is required of an aged worker for eligibility to a primary retirement benefit and for the eligibility of the 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 past and projected coverage rates, the requirement for fully insured status, 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 the fully insured population that is 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 75.0 on January 1, 1987, to 90.1, 89.8, 89.6, and 89.2 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 92.8 to 93.7, while that for females is projected to increase more substantially from 62.4 to 86.4. The percentage of the fully insured population aged 20 through 64 that is disability insured is projected to increase only slightly from 84.7 on January 1, 1987, to 85.7, 85.4, 85.3, 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 in the same equations that related total coverage rates to the percentage of the population that is fully insured.

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 population which is insured but not yet retired, and by applying termination rates to the retired workers already receiving benefits. In the long-range, the numbers of retired-worker beneficiaries who were 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 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 at a decreasing rate until 1995, thus continuing the trend toward earlier retirement. They were also adjusted, however, in the long-range period, for each year of birth, as a function of the ratio of the monthly benefit amount payable at each age of entitlement to the amount payable at entitlement age 70. 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 were 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 insured, (5) the spouse is not earning enough to have his or her benefits withheld, (6) the spouse is not eligible to receive a significant governmental 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 two 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, factor (3) was not applied because, effective for January 1985, divorced persons generally need not wait to receive benefits until their former wage-earner spouses are 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 then was used to project the number of children of retired-worker beneficiaries. In the long-range period, three factors were applied to the numbers of children, representing the probabilities that their parents are both alive and that at least one parent is insured and is receiving retired-worker benefits. The numbers of disabled children aged 18 and over of retired-worker beneficiaries were projected as a percentage of the adult population.

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 minor-child beneficiaries, 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. Three 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 fully insured, and (3) the widow(er)'s benefits are not withheld under the retirement earnings test, because of receipt of a mother's (father's) benefit, or because of eligibility for a governmental 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 an additional factor representing the probability that the person's former wage-earner spouse is deceased.

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 probability that the deceased spouse was insured.

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 number of minor-child survivor beneficiaries was projected by applying two factors, representing the probabilities that the mother or father is dead and was insured at the time of death. The numbers of disabled children aged 18 and over of deceased workers were projected as a percentage of the adult population.

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 minor-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
Alternative I:								
1987	23,547	3,104	442	4,985	348	1,847	8	34,281
1988	24,024	3,120	435	5,039	346	1,816	7	34,788
1989	24,508	3,142	430	5,096	346	1,791	7	35,320
1990	25,093	3,171	426	5,154	348	1,781	6	35,980
1995	26,616	3,215	437	5,389	364	1,851	4	37,876
2000	27,540	2,936	474	4,978	288	1,908	3	38,126
2005	29,103	2,720	529	4,866	275	1,953	3	39,450
2010	32,553	2,581	615	4,751	274	1,991	3	42,767
2015	37,924	2,473	701	4,695	280	2,034	3	48,111
2020	44,339	2,493	773	4,713	287	2,092	3	54,700
2025	50,113	2,522	832	4,780	293	2,155	3	60,698
2030	54,227	2,471	848	4,881	295	2,199	3	64,924
2035	55,977	2,364	860	4,957	299	2,229	3	66,690
2040	55,897	2,212	867	4,965	305	2,260	3	66,508
2045	55,676	2,122	902	4,912	312	2,299	3	66,226
2050	56,067	2,095	939	4,794	319	2,347	3	66,564
2055	56,902	2,110	972	4,687	325	2,396	3	67,395
2060	57,941	2,139	996	4,626	332	2,442	3	68,478
2065	59,104	2,181	1,018	4,642	339	2,487	3	69,774

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 II-A:								
1987	23,564	3,104	442	4,985	347	1,843	8	34,293
1988	24,074	3,120	434	5,038	345	1,808	7	34,826
1989	24,604	3,143	429	5,093	343	1,776	7	35,396
1990	25,246	3,176	426	5,151	344	1,758	6	36,106
1995	27,176	3,226	435	5,380	349	1,773	4	38,343
2000	28,249	3,059	472	4,989	292	1,715	3	38,760
2005	30,153	2,896	518	4,865	274	1,663	4	40,372
2010	33,902	2,797	588	4,759	265	1,620	4	43,935
2015	39,618	2,718	653	4,715	261	1,597	4	49,566
2020	46,431	2,766	701	4,753	260	1,590	3	56,505
2025	52,585	2,830	734	4,859	257	1,590	3	62,859
2030	57,158	2,819	730	5,029	252	1,582	3	67,573
2035	59,318	2,746	719	5,205	247	1,562	4	69,801
2040	59,538	2,617	701	5,332	243	1,538	4	69,974
2045	59,467	2,550	711	5,398	240	1,516	4	69,886
2050	59,892	2,549	724	5,371	237	1,499	4	70,276
2055	60,483	2,572	732	5,315	234	1,481	4	70,822
2060	60,924	2,589	731	5,261	231	1,461	4	71,201
2065	61,215	2,604	728	5,251	227	1,440	4	71,470
Alternative II-B:								
1987	23,564	3,104	442	4,985	347	1,843	8	34,293
1988	24,073	3,120	434	5,038	345	1,808	7	34,825
1989	24,603	3,143	429	5,093	343	1,776	7	35,395
1990	25,245	3,176	426	5,151	344	1,758	6	36,105
1995	27,165	3,227	435	5,380	349	1,773	4	38,332
2000	28,240	3,063	472	4,970	292	1,714	3	38,754
2005	30,141	2,901	518	4,867	274	1,661	4	40,365
2010	33,875	2,808	588	4,762	264	1,618	4	43,918
2015	39,586	2,733	653	4,719	261	1,595	4	49,550
2020	46,394	2,762	701	4,758	260	1,588	3	56,486
2025	52,506	2,846	734	4,867	257	1,588	3	62,803
2030	57,094	2,844	730	5,040	252	1,580	3	67,543
2035	59,236	2,779	718	5,220	246	1,560	4	69,764
2040	59,438	2,656	700	5,351	243	1,535	4	69,927
2045	59,350	2,594	710	5,420	240	1,514	4	69,831
2050	59,761	2,597	723	5,397	237	1,496	4	70,215
2055	60,340	2,624	731	5,345	234	1,479	4	70,756
2060	60,775	2,643	730	5,293	230	1,459	4	71,132
2065	61,066	2,659	727	5,285	227	1,438	4	71,405
Alternative III:								
1987	23,581	3,104	442	4,985	346	1,840	8	34,306
1988	24,123	3,120	434	5,037	343	1,799	7	34,863
1989	24,698	3,144	429	5,091	341	1,761	7	35,470
1990	25,396	3,177	425	5,148	339	1,736	6	36,227
1995	27,693	3,234	433	5,371	334	1,698	4	38,768
2000	28,889	3,183	467	4,951	282	1,536	4	39,312
2005	31,143	3,086	498	4,852	248	1,392	4	41,223
2010	35,266	3,064	547	4,751	225	1,270	4	45,127
2015	41,505	3,054	588	4,714	209	1,179	4	51,253
2020	49,012	3,170	610	4,758	195	1,111	4	58,860
2025	55,932	3,314	618	4,881	181	1,054	4	65,984
2030	61,468	3,398	598	5,083	167	1,002	4	71,720
2035	64,607	3,416	569	5,325	154	945	4	75,021
2040	65,724	3,352	535	5,536	142	885	5	76,178
2045	66,376	3,339	523	5,688	132	827	5	76,891
2050	67,347	3,389	517	5,727	122	774	5	77,881
2055	68,045	3,433	505	5,700	113	723	5	78,523
2060	68,006	3,431	486	5,616	104	673	5	78,321
2065	67,343	3,404	466	5,529	96	626	5	77,470

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 24,687 as of December 31, 1986, and is estimated to be less than 500 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, 1986, by adding new

entitlements, and subtracting terminations. The starting number of entitled disabled-worker beneficiaries was estimated by age, sex, and duration of entitlement. 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). 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 and increased during 1983-86, are assumed to drop slightly in 1987 before resuming the increasing trend in 1988. The incidence rates increase through 2005, when they reach ultimate levels which, for alternatives II-A and II-B, are about 28 percent for males and 35 percent for females higher than the corresponding average rates for 1983-85. This produces age-adjusted rates in 2005 of 5.2 per thousand for males and 3.6 per thousand for females, and an age-sex-adjusted rate of 4.5 per thousand. These adjusted rates are approximately the same as those used in the three prior reports. 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 ultimate levels are assumed to be higher by about 5 percent for males and about 10 percent for females than the average for 1983-85. For alternative III, the ultimate levels are assumed to be higher by about 53 percent for males and 60 percent 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 1984-86, 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 25 percent lower 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 1986 levels until 1990, when they attain ultimate levels about 15 percent higher than those of the same period, 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 10 percent lower 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 50 percent lower 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 and sex of each parent. To these numbers of children were applied factors representing the probability that either of their parents is 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 spouse beneficiaries were projected by applying quarterly award and termination rates. Awards to young-spouse beneficiaries were based on the numbers of awards to child beneficiaries who are either under age 16 or disabled. Awards to aged-spouse beneficiaries 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
Alternative I:					
1987	2,762	298	984		4,044
1988	2,777	297	978		4,052
1989	2,789	297	972		4,059
1990	2,805	298	964		4,067

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 I: (Cont.)				
1995	2,978	314	994	4,286
2000	3,294	304	1,051	4,649
2005	3,883	315	1,095	5,293
2010	4,529	332	1,138	5,999
2015	4,873	335	1,177	6,384
2020	5,050	339	1,226	6,615
2025	5,313	351	1,286	6,950
2030	5,180	348	1,324	6,852
2035	5,087	347	1,352	6,786
2040	5,138	348	1,388	6,874
2045	5,369	361	1,438	7,168
2050	5,516	374	1,490	7,380
2055	5,629	387	1,541	7,556
2060	5,753	397	1,587	7,738
2065	5,949	409	1,634	7,992
Alternative II-A:				
1987	2,774	300	988	4,061
1988	2,810	300	988	4,097
1989	2,845	302	987	4,135
1990	2,885	305	986	4,176
1995	3,182	334	1,053	4,568
2000	3,716	355	1,176	5,246
2005	4,566	385	1,248	6,198
2010	5,484	421	1,296	7,201
2015	5,986	438	1,320	7,744
2020	6,238	458	1,350	8,046
2025	6,562	479	1,386	8,428
2030	6,375	473	1,397	8,246
2035	6,229	465	1,395	8,089
2040	6,246	457	1,395	8,098
2045	6,465	468	1,408	8,342
2050	6,532	477	1,424	8,432
2055	6,498	480	1,436	8,415
2060	6,466	479	1,444	8,389
2065	6,525	480	1,451	8,456
Alternative II-B:				
1987	2,774	300	988	4,061
1988	2,810	300	988	4,097
1989	2,845	302	987	4,135
1990	2,884	305	986	4,176
1995	3,181	333	1,052	4,567
2000	3,713	355	1,175	5,243
2005	4,560	384	1,246	6,190
2010	5,474	420	1,293	7,187
2015	5,973	437	1,317	7,727
2020	6,222	457	1,346	8,025
2025	6,543	478	1,382	8,403
2030	6,354	472	1,393	8,218
2035	6,206	464	1,390	8,060
2040	6,223	456	1,390	8,068
2045	6,440	467	1,403	8,311
2050	6,507	475	1,419	8,401
2055	6,474	479	1,431	8,384
2060	6,441	478	1,439	8,358
2065	6,500	479	1,446	8,424

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:				
1987	2,805	304	1,000	4,109
1988	2,880	309	1,013	4,202
1989	2,957	316	1,028	4,301
1990	3,043	324	1,042	4,410
1995	3,623	384	1,205	5,213
2000	4,188	410	1,301	5,900
2005	4,188	458	1,379	7,163
2010	5,326	512	1,401	8,463
2015	6,549	539	1,383	9,158
2020	7,236	566	1,367	9,509
2025	7,576	590	1,358	9,917
2030	7,970	572	1,326	9,610
2035	7,712	549	1,280	9,322
2040	7,493	523	1,232	9,204
2045	7,450	523	1,196	9,338
2050	7,620	523	1,162	9,199
2055	7,518	502	1,127	8,822
2060	7,193	479	1,089	8,422
2065	6,853	461	1,052	8,156

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 for the OASI program and on an annual basis for the DI program. 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 1996 was based on assumed increases in average wages, increases in the CPI, and increases in the number of beneficiaries. For years after 1996, 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 an average annual short-range cost of about \$3 billion and an average annual long-range cost of 0.03 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 1996. 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. 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. 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 medium-range and long-range estimates to changes in selected individual assumptions. Although the estimates based on the four alternative sets of assumptions illustrate the variations in the estimated actuarial balances resulting from different combinations of assumptions, they do not show the variations resulting 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 actuarial balances.

Each table which follows shows the effects of changing the particular assumption under consideration on the OASDI average income rates, cost rates, and balances. Because the income rate consists mostly of the payroll-tax rate, which is specified in the law, the income rate itself varies only slightly with changes in assumptions. Consequently, it is not considered in the discussion of the tables. The change in each of the balances is approximately equal to the change in the corresponding cost rate—but in the opposite direction.

CONSUMER PRICE INDEX

Table B1 shows the estimated OASDI average income rates, cost rates, and 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 1.5 percentage points (as assumed for alternative II-B), yielding ultimate percentage increases in average annual wages in covered employment of 3.5, 4.5, 5.5, 6.5, and 7.5 percent, respectively.

TABLE B1.—ESTIMATED OASDI AVERAGE INCOME RATES, COST RATES, AND 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				
	3.5-2.0	4.5-3.0	5.5-4.0	6.5-5.0	7.5-6.0
Average income rate:					
1987-2011.....	12.62	12.62	12.61	12.61	12.61
2012-2036.....	12.98	12.97	12.96	12.95	12.94
2037-2061.....	13.13	13.12	13.10	13.09	13.08
1987-2061.....	12.91	12.90	12.89	12.89	12.88
Average cost rate:					
1987-2011.....	10.74	10.62	10.51	10.40	10.29
2012-2036.....	14.68	14.43	14.18	13.95	13.71
2037-2061.....	16.40	16.12	15.85	15.58	15.32
1987-2061.....	13.94	13.72	13.51	13.31	13.11
Balance:					
1987-2011.....	+1.88	+1.99	+2.10	+2.21	+2.32
2012-2036.....	-1.70	-1.46	-1.22	-.99	-.77
2037-2061.....	-3.27	-3.00	-2.74	-2.49	-2.24
1987-2061.....	-1.03	-.82	-.62	-.42	-.23

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 both the medium-range and long-range periods, the average cost rate decreases with greater assumed rates of increase in the CPI. For the

medium-range period, the average cost rate decreases from 10.74 (for CPI increases of 2.0 percent) to 10.29 percent (for CPI increases of 6.0 percent). For the long-range period, it decreases from 13.94 to 13.11 percent. The actuarial balance increases from +1.88 to +2.32 percent for the medium-range period, and from -1.03 to -0.23 percent for the long-range 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-WAGE DIFFERENTIAL

Table B2 shows the estimated OASDI average income rates, cost rates, and 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 1.0 percentage point (as assumed for alternative III), 1.5 percentage points (as assumed for alternative II-B), 2.0 percentage points (as assumed for alternative II-A), and 2.5 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 5.0, 5.5, 6.0, and 6.5 percent, respectively.

TABLE B2.—ESTIMATED OASDI AVERAGE INCOME RATES, COST RATES, AND 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			
	5.0-4.0	5.5-4.0	6.0-4.0	6.5-4.0
Average income rate:				
1987-2011	12.62	12.61	12.60	12.59
2012-2036	13.00	12.96	12.93	12.90
2037-2061	13.16	13.10	13.05	13.01
1987-2061	12.93	12.89	12.86	12.83
Average cost rate:				
1987-2011	10.87	10.51	10.17	9.85
2012-2036	15.13	14.18	13.31	12.52
2037-2061	17.08	15.85	14.73	13.73
1987-2061	14.36	13.51	12.74	12.03
Balance:				
1987-2011	+1.75	+2.10	+2.43	+2.75
2012-2036	-2.13	-1.22	-.39	+.38
2037-2061	-3.92	-2.74	-1.68	-.72
1987-2061	-1.43	-.62	+.12	+.80

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 medium-range period, the average cost rate decreases from 10.87 percent (for a real-wage differential of 1.0 percentage point) to 9.85 percent (for a differential of 2.5 percentage points). For the long-range period, it decreases from 14.36 to 12.03 percent. The actuarial balance increases from +1.75 to +2.75 percent for the medium-range period, and from -1.43 to +0.80 percent for the long-range period.

The average 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 0.73 percent of taxable payroll.

TOTAL FERTILITY RATE

Table B3 shows the estimated OASDI average income rates, cost rates, and 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), 2.0 (as assumed for alternatives II-A and II-B), and 2.3 (as assumed for alternative I). The rate is assumed to change gradually from its current level and to reach the various ultimate values in 2011.

TABLE B3.—ESTIMATED OASDI AVERAGE INCOME RATES, COST RATES, AND 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	2.0	2.3
Average income rate:			
1987-2011	12.61	12.61	12.61
2012-2036	12.99	12.96	12.94
2037-2061	13.25	13.10	13.02
1987-2061	12.95	12.89	12.85
Average cost rate:			
1987-2011	10.48	10.51	10.53
2012-2036	14.79	14.18	13.78
2037-2061	18.77	15.85	14.18
1987-2061	14.67	13.51	12.82
Balance:			
1987-2011	+2.13	+2.10	+2.08
2012-2036	-1.80	-1.22	-0.84
2037-2061	-5.52	-2.74	-1.16
1987-2061	-1.72	-.62	+0.03

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 birth rates 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 2011.

For the first 25 years, the average cost rate for the three fertility assumptions varies by only 0.05 percent of taxable payroll. In contrast, the average long-range cost varies over a wide range, decreasing from 14.67 to 12.82 percent, as the assumed ultimate total fertility rate increases from 1.6 to 2.3. Similarly, while the medium-range actuarial balance varies by only 0.05 percent of taxable payroll, the long-range actuarial balance varies over a much wider range—from -1.72 to +0.03 percent.

During the medium-range 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, thereby resulting in significant reductions in cost. Each increase of 0.1 in the ultimate total fertility rate increases the long-range actuarial balance by about 0.25 percent of taxable payroll.

DEATH RATES

Table B4 shows the estimated OASDI average income rates, cost rates, and 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 1985-2060 in the age-sex-adjusted death rate. The decreases assumed for this period are about 22 percent (as assumed for alternative I), 38 percent (as assumed for alternatives II-A and II-B), and 58 percent (as assumed for alternative III).

TABLE B4.—ESTIMATED OASDI AVERAGE INCOME RATES, COST RATES, AND BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS DEATH-RATE ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Reduction in death rates ¹		
	22 percent	38 percent	58 Percent
Average income rate:			
1987-2011	12.60	12.61	12.61
2012-2036	12.93	12.96	13.00
2037-2061	13.05	13.10	13.19
1987-2061	12.86	12.89	12.93
Average cost rate:			
1987-2011	10.35	10.51	10.67
2012-2036	13.57	14.18	14.96
2037-2061	14.73	15.85	17.64
1987-2061	12.88	13.51	14.42
Balance:			
1987-2011	+2.25	+2.10	+1.94
2012-2036	-.64	-1.22	-1.97
2037-2061	-1.68	-2.74	-4.45
1987-2061	-.02	-.62	-1.49

¹The measure of the reduction in death rates is the decrease in the age-sex-adjusted death rate during 1985-2061.

Because the decreases in death rates are assumed to occur gradually, the variation in program cost for the medium-range period is less pronounced than the variation for the long-range period. The medium-range cost rate increases from 10.35 percent (for 22-percent lower ultimate death rates) to 10.67 percent (for 58-percent lower ultimate rates). The long-range cost rate increases from 12.88 to 14.42 percent. The actuarial balance decreases from +2.25 to +1.94 percent for the medium-range period, and from -0.02 to -1.49 percent for the long-range period.

Lower death rates cause both the income and the outgo of the OASDI program to be higher than they would otherwise be. The outgo, however, increases more rapidly than the income for both the medium- and long-range periods. Reductions in the death rates for people who have attained the normal retirement age (people whose death rates are the highest) extend the length of time that retirement benefits are paid. Although an increase in taxable payroll results from lower death rates at ages 50 through the normal retirement age, this is more than offset by

the additional retirement and disability benefits which subsequently result. 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 by age are lower by 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 1985-2060, relative to the 38-percent reduction assumed for alternative II-B, decreases the long-range actuarial balance by about 0.40 percent of taxable payroll.

NET LEGAL IMMIGRATION

Table B5 shows the estimated OASDI average income rates, cost rates, and balances, on the basis of alternative II-B with various assumptions about the magnitude of net legal immigration. These assumptions are that the annual net immigration will be 200,000 persons (as assumed for alternative III), 400,000 persons (as assumed for alternatives II-A and II-B), 600,000 persons (as assumed for alternative I), and 800,000 persons.

TABLE B5.—ESTIMATED OASDI AVERAGE INCOME RATES, COST RATES, AND BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS NET-LEGAL-IMMIGRATION ASSUMPTIONS
[As a percentage of taxable payroll]

Calendar years	Net legal immigration per year			
	200,000	400,000	600,000	800,000
Average income rate:				
1987-2011	12.62	12.61	12.61	12.61
2012-2036	12.97	12.96	12.95	12.94
2037-2061	13.12	13.10	13.09	13.08
1987-2061	12.90	12.89	12.89	12.88
Average cost rate:				
1987-2011	10.57	10.51	10.45	10.39
2012-2036	14.45	14.18	13.94	13.71
2037-2061	16.15	15.85	15.57	15.33
1987-2061	13.72	13.51	13.32	13.15
Balance:				
1987-2011	+2.04	+2.10	+2.16	+2.22
2012-2036	-1.47	-1.22	-.99	-.77
2037-2061	-3.03	-2.74	-2.48	-2.25
1987-2061	-.82	-.62	-.44	-.27

For both the medium-range and long-range periods, the average cost rate decreases with increasing rates of net immigration. For the medium-range period, the average cost rate decreases from 10.57 percent of taxable payroll (for annual net immigration of 200,000 persons) to 10.39 percent (for annual net immigration of 800,000 persons). For the long-range period, it decreases from 13.72 percent to 13.15 percent. The actuarial balance increases from +2.04 to +2.22 percent for the medium-range period, and from -0.82 to -0.27 percent for the long-range period.

The average 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 assumed to enter the country annually, relative to the 400,000 net immigration assumed for alternative II-B, increases the long-range actuarial balance by about 0.10 percent of taxable payroll.

DISABILITY INCIDENCE RATES

Table B6 shows the estimated OASDI average income rates, cost rates, and balances, on the basis of alternative II-B with various assumptions about future disability incidence rates. These assumptions are that the ultimate annual age-sex-adjusted disability incidence rate will be about 5 percent higher for men and 10 percent higher for women than the average of the corresponding annual rates experienced during 1983-85 (as assumed for alternative I), about 28 percent higher for men and 35 percent higher for women than such experience (as assumed for alternatives II-A and II-B), and about 53 percent higher for men and 60 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 2005.

TABLE B6.—ESTIMATED OASDI AVERAGE INCOME RATES, COST RATES, AND 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
Average income rate:			
1987-2011	12.61	12.61	12.62
2012-2036	12.95	12.96	12.96
2037-2061	13.09	13.10	13.12
1987-2061	12.88	12.89	12.90
Average cost rate:			
1987-2011	10.40	10.51	10.63
2012-2036	13.88	14.18	14.50
2037-2061	15.54	15.85	16.17
1987-2061	13.27	13.51	13.76
Balance:			
1987-2011	+2.21	+2.10	+1.99
2012-2036	-.93	-1.22	-1.52
2037-2061	-2.44	-2.74	-3.05
1987-2061	-.39	-.62	-.86

For the medium-range period, the average cost rate increases with increasing disability incidence rates from 10.40 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 long-range period, it increases from 13.27 to 13.76 percent. The actuarial balance decreases from +2.21 to +1.99 percent for the medium-range period, and from -0.39 to -0.86 percent for the long-range period.

DISABILITY TERMINATION RATES

Table B7 shows the estimated OASDI average income rates, cost rates, and 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 projection 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 about 10 percent lower for alternative I, about 25 percent lower for alternatives II-A and II-B, and about 50 percent lower for alternative III.

For all four alternatives, ultimate recovery-termination rates by age and sex are assumed to be attained in 1990. 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 B7.—ESTIMATED OASDI AVERAGE INCOME RATES, COST RATES, AND 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
Average income rate:			
1987-2011	12.61	12.61	12.61
2012-2036	12.96	12.96	12.97
2037-2061	13.10	13.10	13.11
1987-2061	12.89	12.89	12.90
Average cost rate:			
1987-2011	10.48	10.51	10.55
2012-2036	14.11	14.18	14.28
2037-2061	15.76	15.85	15.98
1987-2061	13.45	13.51	13.60
Balance:			
1987-2011	+2.13	+2.10	+2.07
2012-2036	-1.15	-1.22	-1.32
2037-2061	-2.66	-2.74	-2.87
1987-2061	-.56	-.62	-.71

For the medium-range period, the average cost rate increases with decreasing disability termination rates from 10.48 percent (for the relatively high rates assumed for alternative I) to 10.55 percent (for the relatively low rates assumed for alternative III). For the long-range period, it increases from 13.45 to 13.60 percent. The actuarial balance decreases from +2.13 to +2.07 percent for the medium-range period, and from -0.56 to -0.71 percent for the long-range period.