Old Age Security Program

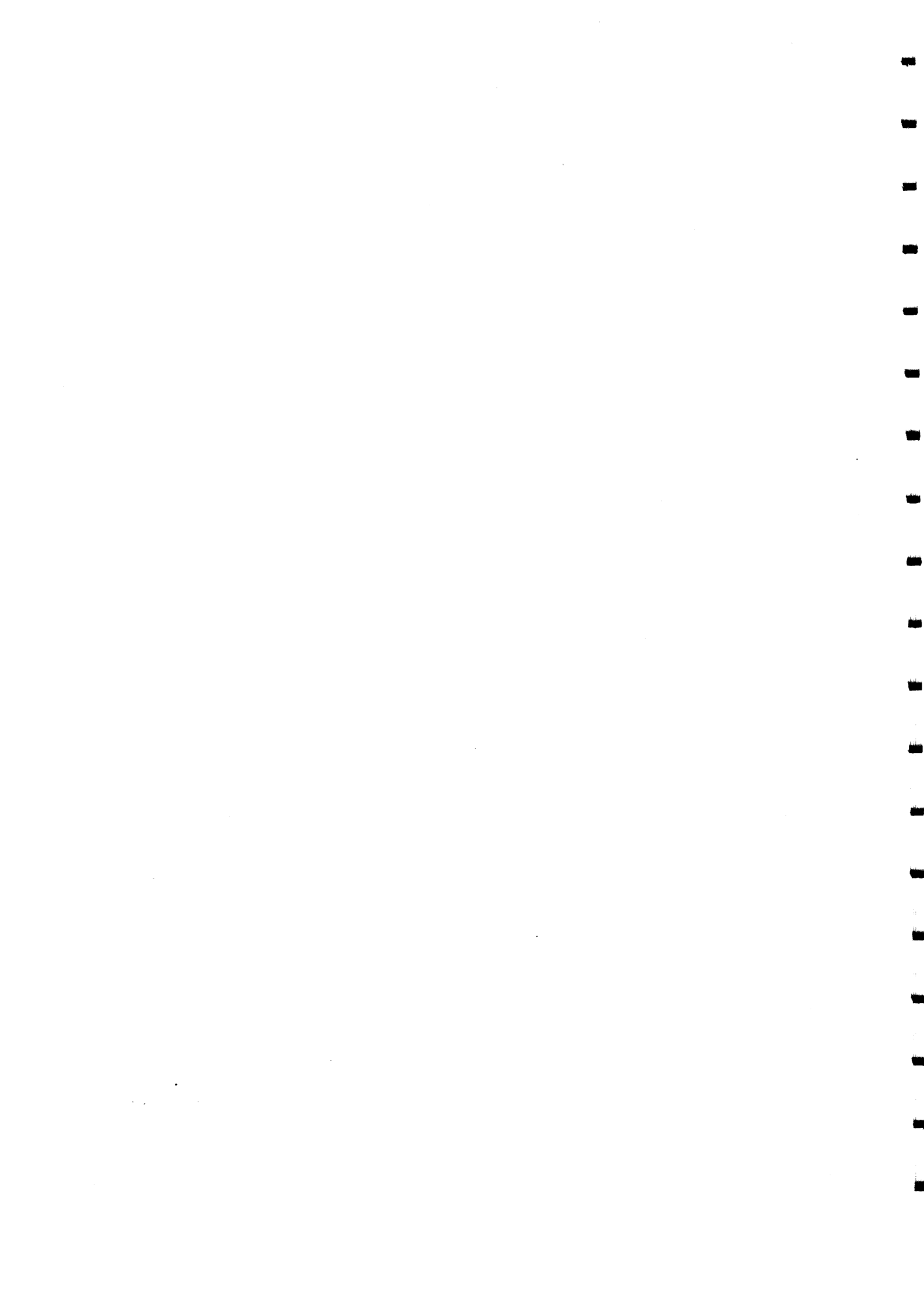# Second
Actuarial Report

as at 31 December 1991

Canada
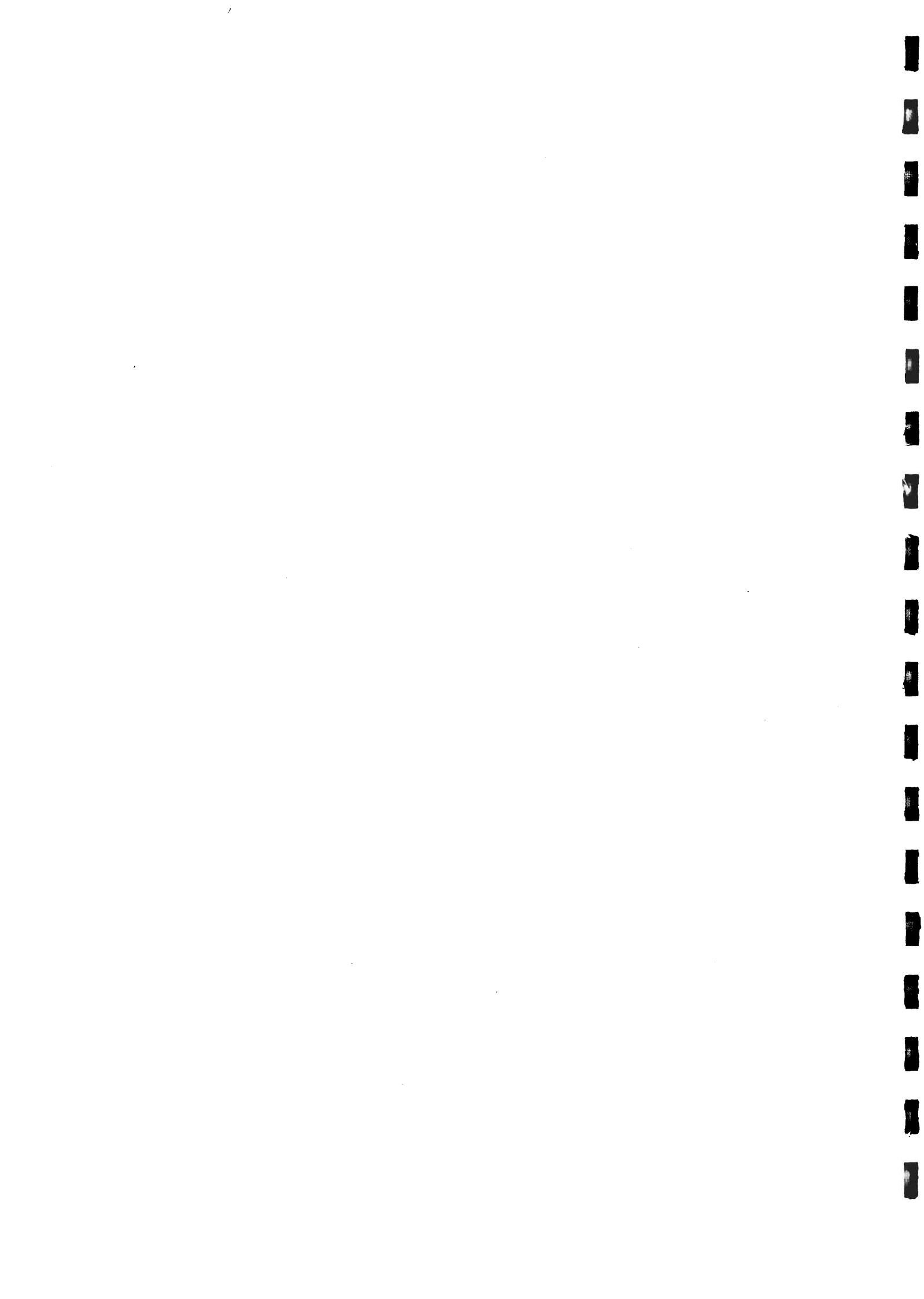
OLD AGE SECURITY PROGRAM

SECOND STATUTORY ACTUARIAL REPORT AS AT 31 DECEMBER 1991

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APPENDICES

OLD AGE SECURITY PROGRAM

SECOND STATUTORY ACTUARIAL REPORT

AS AT 31 DECEMBER 1991

I- Introduction

This is the Second Statutory Actuarial Report since the inception of the Old Age Security (OAS) in 1951. It has been prepared in compliance with the Public Pensions Reporting Act which requires the Chief Actuary in the Office of the Superintendent of Financial Institutions to conduct actuarial reviews in respect of the pension plan established under Part I of the Old Age Security Act not later than as at 31 December 1988 and, thereafter, every three years. The previous triennial report is the First Actuarial Report, as at 31 December 1988, which was tabled in the House of Commons on 23 October 1990.

For Parts II (the Guaranteed Income Supplement) and II.1 (the Spouse's Allowance) of the Old Age Security Act, the date of the first report is to be fixed by the Governor in Council.

No amendment with a material effect on OAS financial projections has been made since the preparation of the previous report.

II-   Key Ultimate Demographic and Economic Assumptions

The full set of assumptions (demographic and economic, short-term and ultimate, key and secondary) underlying the main financial projections of this report is described in Appendix B.

The subset of main key ultimate assumptions is briefly described below. The year indicated in brackets corresponds to the ultimate year, i.e., the first year within the projection period (1992 to 2100) for which the values specified by the assumptions become constant.

	Previous Report	This Report
Rate of increase in earnings:	4.8% (1996)	4.5% (2000)
Rate of increase in prices:	3.5% (1996)	3.5% (2000)
Mortality:	1985-87 Canada Life Tables adjusted for improvements in life expectancy (2100)	1985-87 Canada Life Tables adjusted for improvements in life expectancy (2100)
Net annual immigration (% of population):	0.4%	0.4%
Total fertility rate:	1.85 (2010)	1.85 (2000)

III- Results of the Actuarial Examination

1. Main Findings

The OAS costs, expressed in dollar amounts or as a percentage of total employment earnings, are affected by the key economic and demographic assumptions used in the estimates. However, the dollar amount of benefits are not affected by the assumed annual rate of increase in average earnings. Although it is useful to express the total cost as a percentage of total employment earnings in Canada, it should be noted that the OAS program is financed from general federal tax revenues.

(a) Economic

Being of a flat-rate nature, OAS benefits are not related to earnings. They vary in accordance with the rate of inflation. Consequently, the costs, expressed as a percentage of total employment earnings, are affected by the differential between the assumed rates of increase in earnings and prices. (The Main Table assumes a differential of 1.0% in the ultimate period.) A decrease in the differential between the assumed rates of increase in earnings and prices produces an increase in costs expressed as a percentage of total employment earnings. Conversely, an increase in the differential produces a decrease in costs.

(b) Demographic

The demographic assumptions with respect to continual reductions in future mortality and an ultimate level of fertility lower than the one that has prevailed, on average, for the current population, contribute to a population-aging process that causes cost increases as long as the process continues. Immigration has effects on costs which vary from one year to the next, depending on the age distribution of all immigrants in the population (especially proportions under and over age 65). But on the basis of the assumed levels of net immigration, these effects are generally very small.

Due to the important drop in fertility rates from 1900 to 1935, OAS projected costs decrease from 4.29% for 1993 to 3.91% for 2005. However, the net effect of economic and demographic ultimate assumptions is an increase in costs shown in the main table from 4.26% of total employment earnings in 1992 to 5.59% in 2030 followed by a gradual decrease reaching the current levels around 2060. The gradual decrease continues to the end of the projection period (2100) when the total costs becomes 3.13% of total employment earnings. This decrease takes place even though the effect of the low assumed fertility rates would have stabilized by 2060. The reason for the continual decrease in total costs as a percentage of employment earnings is that the effect of the assumed 1.0% differential between earnings and prices is greater than the effect of the assumed decreases in the rates of mortality.

MAIN TABLE OF FINANCIAL PROJECTIONS

YEAR	POPULATION AGED 65 AND OVER #	NUMBER OF BENE- FICIARIES #	AVERAGE BENEFIT $	TOTAL BENEFITS $ M	ADMINIS- TRATIVE EXPENSES $ M	TOTAL EXPEN- DITURES $ M	TOTAL COST AS A % OF TOTAL EARNINGS %
1992	3252849	3212188	4454	14308	50	14358	4.26
1993	3332016	3290365	4542	14945	52	14997	4.29
1994	3405555	3362984	4639	15601	55	15655	4.27
1995	3484116	3440563	4733	16285	57	16342	4.19
1996	3560448	3515941	4825	16964	59	17023	4.07
1997	3631603	3586207	4913	17620	62	17681	4.07
1998	3699320	3653077	5025	18355	64	18420	4.05
1999	3755008	3708069	5167	19160	67	19227	4.02
2000	3811156	3763515	5339	20095	70	20165	3.99
2005	4100880	4049617	6342	25681	90	25771	3.91
2010	4555831	4498882	7532	33884	119	34003	3.99
2015	5301202	5234936	8945	46828	164	46992	4.33
2020	6161937	6084912	10624	64648	226	64874	4.76
2025	7104729	7015920	12618	88529	310	88839	5.23
2030	8018745	7918510	14987	118671	415	119087	5.59
2035	8401219	8296203	17799	147667	517	148184	5.49
2040	8523507	8416962	21140	177935	623	178558	5.18
2045	8551827	8444928	25108	212033	742	212775	4.85
2050	8596912	8489449	29820	253156	886	254042	4.58
2055	8771621	8661975	35417	306781	1074	307854	4.40
2060	9072217	8958813	42064	376846	1319	378165	4.29
2065	9307098	9190758	49959	459162	1607	460769	4.14
2070	9490297	9371668	59336	556075	1946	558021	3.95
2075	9675169	9554228	70472	673308	2357	675665	3.78
2080	9899471	9775726	83699	818218	2864	821082	3.64
2085	10167647	10040551	99408	998112	3493	1001605	3.51
2090	10444244	10313690	118066	1217692	4262	1221954	3.39
2095	10696847	10563136	140225	1481215	5184	1486399	3.26
2100	10931549	10794904	166543	1797818	6292	1804110	3.13

2. Comparison with the Previous Report

Notwithstanding the relative recency of the previous actuarial examination of the OAS (i.e., the first report as at 31 December 1988), several new factors have affected the current examination as at 31 December 1991, some positively, some negatively. One way of analysing the effect of these various factors on the previous report's projections is by looking at the step-by-step evolution of the total annual dollar amount of expenditures and of its value relative to earnings (i.e., the ratio of the year's expenditure to the year's total employment earnings) from the previous report to this report.

The two charts below presents a concise application of this approach.

The first chart on expenditures expressed in relation to total employment earnings indicates that refinements in the methodology used for the projection of employment earnings and for the CPI indexation of benefits have contributed to a constant difference in the cost relative to earnings of about 0.4%. Other factors contributing to the increase in the projected cost relative to earnings are:

(a)   in the short term: the assumed impact of the early 1990s economic recession. The main source of this impact is the reduced employment earnings from 1992 to 1995, attributable to the assumed sustained high levels of unemployment until 1995.

(b)   in the medium and long terms: the 0.3% (i.e., from 1.3% to 1.0%) decrease in the assumed gap between the rates of increase in earnings and prices.

The second chart on expenditures expressed in current dollars indicates that the overall effect of recent experience and of changes in assumptions and methodology is relatively small. Hence, the projections of this report, expressed in dollars, are not materially different from those of the previous report.

RECONCILIATION OF COSTS RELATIVE TO EARNINGS

	1992 %	1995 %	2000 %	2025 %	2050 %	2100 %
First Report rates:	3.65	3.69	3.59	4.50	3.72	2.12
I- Data						
A- Demographic	0.00	0.00	-0.01	-0.12	-0.17	-0.01
B- Economic	-0.05	-0.10	-0.10	-0.12	-0.10	-0.06
C- Benefits in pay	0.03	0.03	0.03	0.04	0.04	0.03
Sub-Total I	-0.02	-0.07	-0.08	-0.20	-0.23	-0.04
II- Assumptions						
A- Demographic (1)	0.00	0.00	0.00	0.00	0.00	0.00
B- Economic (2)	0.32	0.20	0.12	0.48	0.69	0.77
Sub-Total II	0.32	0.20	0.12	0.48	0.69	0.77
III- Methodology (3)	0.31	0.37	0.36	0.45	0.40	0.28
Total I + II + III	0.61	0.50	0.40	0.73	0.86	1.01
Second Report rates:	4.26	4.19	3.99	5.23	4.58	3.13

(1) The minor effect of the change in the assumed ultimate year for fertility rates from 2010 to 2000 is included in I-A- above.

(2) 1992 to 1995: most of the effect shown is due to the recession of the early 1990s;
2000 and later: all of the effect shown is due to the reduction from 1.3% to 1% in the assumed ultimate gap between earnings and prices rates of increase.

(3) The main two refinements concern the CPI indexation factor and the projection of employment earnings; see Appendix B.

RECONCILIATION OF ANNUAL EXPENDITURES
(MILLIONS OF DOLLARS)

	1992 $	1995 $	2000 $	2025 $	2050 $	2100 $
First Report expenditures:	14,343	16,801	21,867	96,196	274,886	1886,458
I- Data						
A- Demographic	(8)	(23)	(66)	(157)	(270)	60,150
B- Economic	299	(155)	(1,190)	(5,236)	(14,962)	(102,684)
C- Benefits in pay	130	148	183	807	2,309	16,394
Sub-Total I	421	(30)	(1,073)	(4,586)	(12,923)	(26,140)
II- Assumptions						
A- Demographic (1)	---	---	---	---	---	---
B- Economic (2)	86	98	121	533	1,525	10,835
Sub-Total II	86	98	121	533	1,525	10,835
III- Methodology (3)	(492)	(527)	(750)	(3,304)	(9,446)	(67,043)
Total I + II + III	15	(459)	(1,702)	(7,357)	(20,844)	(82,348)
Second Report expenditures:	14358	16,342	20,165	88,839	254,042	1,804,110

(1) The minor effect of the change in the assumed ultimate year for fertility rates from 2010 to 2000 is included in I-A- above.

(2) Eligibility rates (from 0.98 to 0.9875)

(3) Mainly from a refinement concerning the CPI indexation factor; see Appendix B.

3. Sensitivity of Results to Assumptions

The projections in the five auxiliary tables below have been prepared to provide an indication of the degree to which the results of this report depend on each of its key assumptions. The differences between the results shown in the main table and in those of one or more given auxiliary tables can also serve as the basis for deriving a reasonable approximation of the projected effect of larger or smaller changes in the value specified by one or more of the key assumptions. However, any such calculation does not take into account either the extent to which the effect of changing a given assumption may not be strictly linear, or the interaction effect that may come into play when more than one assumption is changed.

Each of the five auxiliary tables is based on a set of assumptions that differs in the following respects from the set underlying the main table:

Auxiliary table 1:   0.1 arithmetic increase in the total ultimate **fertility** rate, i.e., 1.95 instead of 1.85.

Auxiliary table 2:   10% geometric increase in the **net immigration** to Canada (for 1986, 115,500 or 0.44% of the Canada population, instead of 105,000 or 0.4% of the Canada population).

Auxiliary table 3:   **improvements in life expectancy:** 10% geometric decrease in each of the annual mortality reduction factors assumed for 1987 and later years
(i.e., a reduction factor of 0.8 would be decreased to 0.72).

Auxiliary table 4:   0.25% arithmetic increase in the ultimate annual rate of increase in **earnings** (i.e., 4.75% instead of 4.5%).

Auxiliary table 5:   0.25% arithmetic decrease in the ultimate annual rate of increase in **prices** (i.e., 3.25% instead of 3.5%).

The following table shows sample costs, expressed as percentages of total employment earnings, as taken from the main table and each of the five auxiliary tables.

YEAR	Main Table	AUXILIARY TABLES				
		Table 1	Table 2	Table 3	Table 4	Table 5
	%	%	%	%	%	%
1992	4.26	4.26	4.25	4.25	4.26	4.26
1993	4.29	4.29	4.28	4.29	4.29	4.29
1994	4.27	4.27	4.26	4.26	4.27	4.27
1995	4.19	4.19	4.18	4.19	4.19	4.19
1996	4.07	4.07	4.05	4.06	4.07	4.07
1997	4.07	4.07	4.05	4.05	4.07	4.07
1998	4.05	4.05	4.03	4.03	4.05	4.05
1999	4.02	4.02	4.00	4.00	4.02	4.02
2000	3.99	3.99	3.97	3.97	3.98	3.98
2025	5.23	5.18	5.16	5.18	4.92	4.92
2050	4.58	4.38	4.51	4.50	4.05	4.05
2100	3.13	2.96	3.08	3.05	2.46	2.45

AUXILIARY TABLE 1 (fertility rate: +0.1)
(in millions of dollars)

YEAR	POPULATION AGED 65 AND OVER #	NUMBER OF BENE- FICIARIES #	AVERAGE BENEFIT $	TOTAL BENEFITS $ M	ADMINIS- TRATIVE EXPENSES $ M	TOTAL EXPEN- DITURES $ M	TOTAL COST AS A % OF TOTAL EARNINGS %
1992	3252849	3212188	4454	14308	50	14358	4.26
1993	3332016	3290365	4542	14945	52	14997	4.29
1994	3405555	3362984	4639	15601	55	15655	4.27
1995	3484116	3440564	4733	16285	57	16342	4.19
1996	3560450	3515943	4825	16964	59	17023	4.07
1997	3631605	3586209	4913	17620	62	17681	4.07
1998	3699329	3653086	5025	18355	64	18420	4.05
1999	3755021	3708082	5167	19160	67	19227	4.02
2000	3811172	3763531	5339	20095	70	20165	3.99
2005	4100984	4049721	6342	25681	90	25771	3.91
2010	4556150	4499197	7532	33887	119	34005	3.99
2015	5301910	5235636	8945	46835	164	46998	4.33
2020	6163225	6086183	10624	64661	226	64888	4.74
2025	7106877	7018040	12618	88556	310	88866	5.18
2030	8022150	7921872	14987	118722	416	119137	5.51
2035	8406465	8301383	17799	147759	517	148276	5.37
2040	8531431	8424788	21140	178100	623	178724	5.04
2045	8563464	8456419	25108	212322	743	213065	4.68
2050	8613451	8505781	29820	253643	888	254531	4.38
2055	8794385	8684454	35417	307577	1077	308653	4.18
2060	9126900	9012812	42064	379117	1327	380444	4.06
2065	9437982	9320006	49959	465619	1630	467249	3.91
2070	9712681	9591272	59336	569105	1992	571097	3.75
2075	9982347	9857566	70472	694685	2431	697116	3.58
2080	10288452	10159845	83699	850368	2976	853345	3.44
2085	10642555	10509522	99408	1044731	3657	1048388	3.32
2090	11015942	10878241	118066	1284346	4495	1288841	3.21
2095	11375358	11233165	140225	1575170	5513	1580683	3.09
2100	11720173	11573670	166543	1927516	6746	1934262	2.96

AUXILIARY TABLE 2 (net immigration: +10%)
(in millions of dollars)

YEAR	POPULATION AGED 65 AND OVER #	NUMBER OF BENE- FICIARIES #	AVERAGE BENEFIT $	TOTAL BENEFITS $ M	ADMINIS- TRATIVE EXPENSES $ M	TOTAL EXPEN- DITURES $ M	TOTAL COST AS A % OF TOTAL EARNINGS %
1992	3253718	3213045	4454	14312	50	14362	4.25
1993	3333240	3291573	4542	14951	52	15003	4.28
1994	3407194	3364603	4639	15608	55	15663	4.26
1995	3486226	3442646	4733	16295	57	16352	4.18
1996	3563086	3518547	4825	16976	59	17036	4.05
1997	3634822	3589386	4913	17635	62	17697	4.05
1998	3703182	3656891	5025	18375	64	18439	4.03
1999	3759558	3712563	5167	19183	67	19250	4.00
2000	3816447	3768740	5339	20123	70	20193	3.97
2005	4110603	4059220	6342	25742	90	25832	3.89
2010	4571330	4514188	7532	34000	119	34119	3.96
2015	5324603	5258044	8945	47035	165	47200	4.29
2020	6196793	6119332	10624	65013	228	65241	4.71
2025	7156276	7066822	12618	89171	312	89483	5.16
2030	8092418	7991262	14987	119762	419	120181	5.51
2035	8500894	8394632	17799	149419	523	149942	5.40
2040	8651008	8542869	21140	180597	632	181229	5.10
2045	8708195	8599341	25108	215910	756	216666	4.78
2050	8782911	8673123	29820	258634	905	259539	4.51
2055	8988439	8876082	35417	314364	1100	315464	4.34
2060	9322736	9206201	42064	387252	1355	388607	4.23
2065	9593510	9473590	49959	473292	1657	474949	4.07
2070	9814239	9691559	59336	575056	2013	577069	3.89
2075	10037961	9912485	70472	698555	2445	701000	3.72
2080	10302591	10173807	83699	851537	2980	854517	3.58
2085	10612994	10480331	99408	1041830	3646	1045476	3.46
2090	10934018	10797342	118066	1274795	4462	1279257	3.34
2095	11233216	11092800	140225	1555487	5444	1560931	3.21
2100	11516522	11372565	166543	1894023	6629	1900652	3.08

AUXILIARY TABLE 3 (improvement in life expectancy: -10%)
(in millions of dollars)

YEAR	POPULATION AGED 65 AND OVER #	NUMBER OF BENE- FICIARIES #	AVERAGE BENEFIT $	TOTAL BENEFITS $ M	ADMINIS- TRATIVE EXPENSES $ M	TOTAL EXPEN- DITURES $ M	TOTAL COST AS A % OF TOTAL EARNINGS %
1992	3249374	3208756	4454	14293	50	14343	4.25
1993	3327453	3285859	4542	14925	52	14977	4.29
1994	3399765	3357267	4639	15574	55	15629	4.26
1995	3476968	3433505	4733	16252	57	16309	4.19
1996	3551824	3507425	4825	16922	59	16982	4.06
1997	3621411	3576143	4913	17570	61	17632	4.05
1998	3687465	3641370	5025	18297	64	18361	4.03
1999	3741399	3694630	5167	19090	67	19157	4.00
2000	3795733	3748286	5339	20014	70	20084	3.97
2005	4075472	4024528	6342	25522	89	25611	3.89
2010	4519222	4462731	7532	33612	118	33730	3.97
2015	5251920	5186269	8945	46393	162	46555	4.30
2020	6098435	6022204	10624	63981	224	64205	4.72
2025	7024681	6936871	12618	87531	306	87838	5.18
2030	7919383	7820390	14987	117201	410	117611	5.53
2035	8282283	8178754	17799	145577	510	146086	5.42
2040	8385564	8280743	21140	175055	613	175668	5.11
2045	8396883	8291921	25108	208191	729	208920	4.78
2050	8427923	8322573	29820	248180	869	249049	4.50
2055	8590914	8483526	35417	300461	1052	301512	4.33
2060	8880401	8769395	42064	368878	1291	370169	4.22
2065	9103728	8989930	49959	449129	1572	450701	4.06
2070	9273256	9157339	59336	543358	1902	545259	3.88
2075	9441645	9323624	70472	657057	2300	659357	3.70
2080	9648265	9527661	83699	797455	2791	800246	3.56
2085	9898745	9775009	99408	971715	3401	975116	3.44
2090	10158175	10031196	118066	1184339	4145	1188485	3.32
2095	10393866	10263942	140225	1439260	5037	1444298	3.19
2100	10610918	10478280	166543	1745086	6108	1751194	3.05

AUXILIARY TABLE 4 (earnings: +0.25%)
(in millions of dollars)

YEAR	POPULATION AGED 65 AND OVER #	NUMBER OF BENE- FICIARIES #	AVERAGE BENEFIT $	TOTAL BENEFITS $ M	ADMINIS- TRATIVE EXPENSES $ M	TOTAL EXPEN- DITURES $ M	TOTAL COST AS A % OF TOTAL EARNINGS %
1992	3252849	3212188	4454	14308	50	14358	4.26
1993	3332016	3290365	4542	14945	52	14997	4.29
1994	3405555	3362984	4639	15601	55	15655	4.27
1995	3484116	3440563	4733	16285	57	16342	4.19
1996	3560448	3515941	4825	16964	59	17023	4.07
1997	3631603	3586207	4913	17620	62	17681	4.07
1998	3699320	3653077	5025	18355	64	18420	4.05
1999	3755008	3708069	5167	19160	67	19227	4.02
2000	3811156	3763515	5339	20095	70	20165	3.98
2005	4100880	4049617	6342	25681	90	25771	3.86
2010	4555831	4498882	7532	33884	119	34003	3.89
2015	5301202	5234936	8945	46828	164	46992	4.17
2020	6161937	6084912	10624	64648	226	64874	4.53
2025	7104729	7015920	12618	88529	310	88839	4.92
2030	8018745	7918510	14987	118671	415	119087	5.19
2035	8401219	8296203	17799	147667	517	148184	5.04
2040	8523507	8416962	21140	177935	623	178558	4.70
2045	8551827	8444928	25108	212033	742	212775	4.35
2050	8596912	8489449	29820	253156	886	254042	4.05
2055	8771621	8661975	35417	306781	1074	307854	3.85
2060	9072217	8958813	42064	376846	1319	378165	3.71
2065	9307098	9190758	49959	459162	1607	460769	3.53
2070	9490297	9371668	59336	556075	1946	558021	3.34
2075	9675169	9554228	70472	673308	2357	675665	3.15
2080	9899471	9775726	83699	818218	2864	821082	3.00
2085	10167647	10040551	99408	998112	3493	1001605	2.86
2090	10444244	10313690	118066	1217692	4262	1221954	2.73
2095	10696847	10563136	140225	1481215	5184	1486399	2.60
2100	10931549	10794904	166543	1797818	6292	1804110	2.46

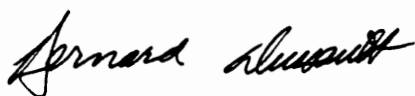## AUXILIARY TABLE 5 (prices: -0.25%)
(in millions of dollars)

YEAR	POPULATION AGED 65 AND OVER #	NUMBER OF BENE- FICIARIES #	AVERAGE BENEFIT $	TOTAL BENEFITS $ M	ADMINIS- TRATIVE EXPENSES $ M	TOTAL EXPEN- DITURES $ M	TOTAL COST AS A % OF TOTAL EARNINGS %
1992	3252849	3212188	4454	14308	50	14358	4.26
1993	3332016	3290365	4542	14945	52	14997	4.29
1994	3405555	3362984	4639	15601	55	15655	4.27
1995	3484116	3440563	4733	16285	57	16342	4.19
1996	3560448	3515941	4825	16964	59	17023	4.07
1997	3631603	3586207	4913	17620	62	17681	4.07
1998	3699320	3653077	5025	18355	64	18420	4.05
1999	3755008	3708069	5167	19160	67	19227	4.02
2000	3811156	3763515	5331	20062	70	20133	3.98
2005	4100880	4049617	6255	25331	89	25420	3.86
2010	4555831	4498882	7340	33021	116	33137	3.89
2015	5301202	5234936	8613	45087	158	45245	4.17
2020	6161937	6084912	10106	61496	215	61711	4.53
2025	7104729	7015920	11859	83200	291	83491	4.92
2030	8018745	7918510	13915	110188	386	110573	5.19
2035	8401219	8296203	16328	135463	474	135937	5.03
2040	8523507	8416962	19160	161267	564	161832	4.70
2045	8551827	8444928	22482	189861	665	190526	4.35
2050	8596912	8489449	26381	223960	784	224744	4.05
2055	8771621	8661975	30956	268138	938	269076	3.85
2060	9072217	8958813	36324	325418	1139	326557	3.71
2065	9307098	9190758	42623	391736	1371	393107	3.53
2070	9490297	9371668	50014	468715	1641	470356	3.33
2075	9675169	9554228	58687	560710	1962	562672	3.15
2080	9899471	9775726	68864	673197	2356	675553	2.99
2085	10167647	10040551	80806	811336	2840	814176	2.86
2090	10444244	10313690	94819	977930	3423	981352	2.73
2095	10696847	10563136	111261	1175268	4113	1179381	2.59
2100	10931549	10794904	130555	1409331	4933	1414264	2.45

IV- Actuarial Opinion

In my opinion, for the purposes of this actuarial report,

(a) the data on which the valuation is based are sufficient and reliable for the purpose of the valuation;

(b) the assumptions used are adequate and appropriate; and

(c) the valuation methodology employed is consistent with sound actuarial principles.

This report has been prepared and this opinion given in accordance with generally accepted actuarial principles and the Recommendations of the Canadian Institute of Actuaries.

Bernard Dussault, B.Sc, F.S.A., F.C.I.A.
Acting Chief Actuary

Ottawa, Canada
24 June 1993

APPENDIX A

MAIN PROVISIONS OF THE OLD AGE SECURITY PROGRAM

1. INTRODUCTION

The Old Age Security Act came into force in December 1951; it is an important element of Canada's retirement income system. The other important element is the Canada Pension Plan.

Benefits provided pursuant to the Old Age Security Act include the Old Age Security Pension (OAS), the Guaranteed Income Supplement (GIS) and the Spouse's Allowance (SPA).

This report covers only the OAS program.

2. FINANCING

The OAS program is currently financed from federal general tax revenues.

3. BENEFITS

The OAS pension is a monthly benefit payable to eligible individuals from age 65 until death. To be eligible, previous employment history is not a factor, nor is it necessary to be retired.

(a) **Eligibility**

Eligibility for an OAS pension is determined at the time of review of an individual's application following attainment of age 65. To be eligible at time of review, an individual must,

(i) if then a Canadian citizen or a legal resident of Canada, have a minimum of 10 years of residence in Canada after reaching age 18, or

(ii) if then neither a Canadian citizen nor a legal resident of Canada, have resided at least 20 years in Canada, as a Canadian citizen or a legal resident of Canada, after reaching age 18.

Periods of residence after reaching age 18 in a country with which Canada has concluded a social security agreement may be used to meet the above residence requirements. However, the amount of the OAS pension, described below, is based only on years of residence in Canada.

(b) Amount of Benefits

The amount of the monthly pension payable during a given quarter of a calendar year to a given eligible individual is equal to the OAS monthly benefit rate then applicable times that individual's benefit proportion.

i) Benefit rate

The OAS monthly benefit rate applicable during each of the four quarters of 1991 was $354.92, $362.37, $369.62 and $373.32, respectively. The OAS monthly benefit rate is adjusted, but not allowed to decrease, at the beginning of each quarter of each calendar year in line with changes in the Consumer Price Index (CPI). The adjustment applying to the monthly benefit rate of a given years' quarter, producing the monthly benefit rate of the subsequent quarter, is equal to the ratio of:

- the average CPI over the 3-month period ending with the first month of the given quarter, to
- the average CPI over the preceding 3-month period.

ii) Benefit proportion

The benefit proportion is determined once and for all in respect of a given eligible individual when that individual reaches age 65 and is a function of the length of the individual's residence in Canada from age 18 until age 65.

The benefit proportion is equal to one in respect of an eligible person who
- has resided in Canada, from age 18 to 65, for periods that total at least 40 years, or
- has not resided in Canada for at least 40 years, from age 18 to age 65, provided that on 1 July 1977 that person was 25 years of age or over, and
    - was resident in Canada on that date, or
    - had resided in Canada prior to that date and after reaching age 18, or
    - possessed a valid immigration visa on that date.

In such cases, the individual must have resided in Canada for at least 10 years immediately prior to approval of the application. Any absences in the 10-year period may be offset if the applicant had been present in Canada prior to those 10 years, after reaching age 18, for a total period equal to at least three times the length of the absences. In that case, however, the applicant must also have resided in Canada for at least one year immediately prior to the date on which the application for a pension is approved.

An eligible person, who does not meet the requirements for a benefit proportion equal to one, qualifies for a partial pension. A partial pension is earned at the rate of 1/40 of the OAS monthly benefit rate for each complete year of residence in Canada between age 18 and age 65. Once a partial pension is approved, it may not be increased as the result of additional years of residence in Canada.

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APPENDIX B

DATA, ASSUMPTIONS AND METHODOLOGY

TABLE OF CONTENTS

APPENDIX B

DATA, ASSUMPTIONS AND METHODOLOGY

The purpose of Appendix B is to describe the data, the assumptions and the methodology used in making the financial projections, on the Old Age Security program (OAS), that appear in the main body of this report.

-I- POPULATION

1. Data

The following data were used in performing the demographic projections:

(a) **Canadian quinquennial censuses**

Catalogue No. 93-101 published by Statistics Canada is the main reference used regarding the data on Canadian censuses. The census data used for projection purposes consist primarily of the numbers of live persons by age and sex, the proportions of male to female births and the adjustments for undercount. The 1986 Census data, by age and sex, for Canada, serve as the starting point for the projection of the population until year 2100. The calculation of future employment earnings requires population figures not only for 1986 to 2100 but also for years prior to 1986. For this purpose, data are taken from each of the five quinquennial censuses of 1966 to 1986 as well as from the projections made for previous OAS report in respect of the intercensal years (1967-1970, 1972-1975, 1977-1980, 1982-1985, and 1987-1990), but adjusted to account for the actual experience regarding fertility and migration.

(b) **Postcensal data**

In between each Canada quinquennial census, Statistics Canada publishes annually various postcensal data.

i) Data on actual past fertility rates and migration levels, taken from catalogues No. 82-003s14, 82-204 and 91-210, are used as a basis for determining the assumptions required for projecting the actual 1986 population by age and sex. Moreover, previously assumed fertility rates and migration values for the period 1987 to 1990 were replaced by actual values in the projection process that, in a technical sense, starts in 1966.

ii) For methodology validation purposes, the postcensal data taken from Statistics Canada (catalogue No. 91-210), regarding total populations by age and sex for each year from 1987 to 1990, were compared with the demographic projections of the previous report, but with those projections revised for the actual fertility and migration values for these years (see section i) above). The projections so revised closely match actual experience. Across all of the age-sex-year cells, actual/expected ratios range from 0.997 to 1.003. These small discrepancies are caused primarily by minor differences between actual and expected mortality for 1987 to 1990.

(c) Life Tables, Canada and the Provinces, 1985-1987

These tables, published quinquennially by Statistics Canada (catalogue No. 82-003S), are used as a basis for the determination of the assumptions, regarding mortality rates, required for projecting the population into the future.

(d) The November 1988, 1989, 1990 and 1991 Reports of the Subcommittee on Modelling, Canadian Institute of Actuaries' (CIA) Task Force on AIDS.

These studies are the main reference used to estimate the effect of AIDS on mortality rates.

(e) Actuarial Study No. 102

This study, conducted by the Social Security Administration in the U.S.A, shows the extent to which mortality rates could be expected to decrease annually from now until year 2100. These annual rates of decrease were determined by analysing the current trends in mortality decrease separately for each of 10 broad causes of death.

2. Demographic Assumptions

The main table of financial projections, shown in the main body of this report, is based on a single set of realistic demographic assumptions. The demographic assumptions described below relate to this main table, but not to the Auxiliary Tables.

(a) Fertility

The fertility rate for a given age corresponds to the number of live births per female at the given age. The total fertility rate corresponds to the sum of all live births per female over the entire period of reproductive ages. For convenience, such rates are multiplied by 1,000 in the table below.

The actual Canada total fertility rate of 1.826 for 1990 is 9% higher than that assumed in the previous OAS actuarial report. The total Canada fertility rate is therefore approaching its previously assumed ultimate (2010) level of 1.85 more rapidly than anticipated. Considering the recency of these developments and the long-term period over which assumptions apply, the ultimate total fertility rate of 1.85 used in the previous actuarial report has been maintained. However, the year from which this ultimate rate is assumed to apply has been changed from 2010 to 2000. For 1991 to 1999, the assumed rate was calculated by linear interpolation between the actual 1990 value of 1.826 and the assumed value of 1.85 for year 2000. The distribution of assumed ultimate total fertility rate of 1.85 into age-

specific rates was made using the corresponding proportions of the 1990 experience.

In accordance with past experience, the assumed ratio of male to female births was taken as 1.056.

FERTILITY RATES
CANADA

Age Group	1970	1975	1980	1985	1990	2000+
15-19	42.8	35.3	27.6	23.7	26.6	26.9
20-24	143.3	112.7	100.1	85.3	85.5	86.6
25-29	147.2	131.2	129.4	125.3	132.2	133.9
30-34	81.8	64.4	69.3	74.6	88.1	89.3
35-39	39.0	21.6	19.4	21.8	28.8	29.2
40-44	11.3	4.8	3.1	3.0	3.9	4.0
45-49	0.9	0.4	0.2	0.1	0.1	0.1
Total	2,331.5	1,852.0	1,745.5	1,669.0	1,826.0	1,850.0

(table header: calendar year)

(b) Mortality (Canada Life Tables, mortality reductions, AIDS)

Canada Life Tables for 1990-1992 were not yet available when this report was completed. Therefore, mortality rates shown in Life Tables, Canada and the Provinces, 1985-1987 (see section 1(c) above), assumed to be applicable for 1986, were used as the starting point for mortality assumptions. The 1985-1987 Canada Life Tables for Canada and the ultimate mortality tables consist of one-year probabilities of mortality for individual ages from 0 to 106.

To reflect anticipated sustained improvements in life expectancy, the 1986 mortality rates were projected to the year 2100 using the following annual rates of decrease:

i) For 1987 to 2010, the annual rates of decrease, varying by age, sex and calendar year, were determined by linear interpolation between:
   - the average reduction rates experienced in Canada between 1976 and 1986, and
   - the constant reduction rates, described in ii) below, in respect of the period running from 2011 to 2100.

ii)   For 2011 and later years, the annual rates of decrease, varying by age and sex only, not by calendar year, are those identified as *Alternative II (medium)* in Actuarial Study No. 102 (see section 1(e) above).

To account for AIDS, male mortality was increased for the years 1989 to 2018 by the increments estimated by the Canadian Institute of Actuaries (see section 1(d) above). A constant level of new infections is assumed to hold from 1984 to 1988 and to decrease gradually from that level to 0 in 1999. Subsequent studies of the CIA's Task Force on AIDS for 1989 to 1991 have also been examined. These studies show average extra mortality lower than that of the 1988 study; however, recent trends indicate that AIDS-related extra mortality might return, after 1991, to levels previously assumed. For these reasons, the assumptions of the first OAS actuarial report were maintained for this report. On the basis of the cumulative number of deaths attributable to AIDS (as reported by the Federal Centre for AIDS), female mortality was also increased, but by only 10% of the above increments for males.

Life Expectancies (longevity expressed in number of years) resulting from the above mortality assumptions are shown below for Canada as a whole.

Year	At birth		At age 65		calculation basis
	males	females	males	females	
1986	73.0	79.7	14.9	19.1	without improvements in life expectancy
1986	77.8	84.6	15.7	20.4	with improvements in life expectancy
2100	80.3	86.9	19.3	24.5	without improvements in life expectancy

The first table below sets out sample values of the ultimate mortality rates as well as sample values of mortality rates of the 1985-87 Canada Life Tables, all before AIDS adjustments. The second table shows sample values of the extra mortality assumed to apply in connection with AIDS.

MORTALITY RATES
(before AIDS adjustments)
(number of annual deaths per 1,000 persons)

	MALES	
Age	1985-87 Canada Life Tables	Rates Assumed for Year 2100
0	8.58	2.24
1	0.67	0.27
5	0.30	0.12
10	0.18	0.08
20	1.30	0.64
30	1.30	0.83
40	1.97	0.95
50	5.32	2.50
60	14.68	7.75
70	36.73	21.21
80	86.65	52.59
90	191.97	114.49
95	276.51	162.25
100	359.43	203.23
105	796.02	512.26

	FEMALES	
Age	1985-87 Canada Life Tables	Rates Assumed for Year 2100
0	6.78	1.61
1	0.62	0.24
5	0.22	0.07
10	0.14	0.05
20	0.42	0.20
30	0.51	0.26
40	1.12	0.53
50	3.12	1.68
60	7.51	4.23
70	18.67	10.23
80	51.73	27.19
90	144.15	72.61
95	230.03	117.16
100	322.72	163.52
105	785.62	454.91

EXTRA MORTALITY RATES IN RESPECT OF AIDS (*)
(number of annual deaths per 1,000 persons)

Age	CALENDAR YEAR				
	1995	2000	2005	2010	2015
25	0.33	0.38	-	-	-
30	0.80	0.90	0.62	-	-
35	0.60	0.86	0.59	0.29	-
40	0.46	0.50	0.44	0.21	0.07
45	0.34	0.35	0.23	0.14	0.05
50	0.23	0.25	0.16	0.08	0.03
55	0.19	0.17	0.12	0.05	0.02
60	0.16	0.15	0.08	0.04	0.01

(*) 100% of these increases apply to male mortality rates;
only 10% apply to female rates.

(c) Migration

Immigration and emigration are generally recognized to be volatile parameters of future population growth, since they are subject to a variety of demographic, economic, social and political factors; immigration, especially, is subject to government control. During the period from 1 June 1973 to 31 May 1990, for example, annual immigration to Canada varied from 83,000 to 214,000, and annual emigration out of Canada is estimated to have fluctuated between 37,000 and 84,000. Net annual Canadian immigration during the most recent 10-year period averaged 82,947.

For purposes of this report it was decided, for 1986, to assume 155,000 immigrants to Canada and 50,000 emigrants leaving Canada. Both these figures were increased with time so as to maintain a constant ratio of net immigration to total current Canadian population of 0.4%.

The distributions of immigrants and emigrants by age group and sex used for purposes of the projections in the previous report were based on Statistics Canada data for 1983-1988. The corresponding distributions averaged over the period 1986 to 1990, used for purposes of this report, and shown below for all of Canada, also indicate average ages somewhat higher for immigrants than for emigrants.

DISTRIBUTIONS OF IMMIGRANTS AND EMIGRANTS
(1986-1990 average)

Age group	Immigrants		Emigrants	
	males (%)	females (%)	males (%)	females (%)
0- 4	3.640	3.448	3.500	3.512
5- 9	4.043	3.774	4.355	4.209
10-14	3.936	3.648	3.982	3.618
15-19	4.509	4.432	3.783	3.689
20-24	5.965	6.688	4.426	5.714
25-29	7.536	7.302	7.186	7.557
30-34	6.226	5.904	6.725	6.504
35-39	4.160	3.919	6.162	4.993
40-44	2.378	2.201	4.247	3.509
45-49	1.509	1.632	2.164	1.845
50-54	1.200	1.658	1.394	1.188
55-59	1.254	1.749	0.980	0.852
60-64	1.284	1.613	0.536	0.705
65-69	0.890	1.069	0.555	0.696
70+	0.984	1.449	0.543	0.872
TOTAL	49.514	50.486	50.537	49.463

3. Methodology

In 1991, for the first time, the census of population included both permanent and non-permanent residents of Canada. Using this new definition of population for demographic projections purposes, without introducing appropriate methodological adjustments, would introduce non-negligible structural inconsistencies into the OAS actuarial valuation methodology. Unfortunately, the timing for the release of the 1991 census population data precluded the implementation of such methodological adjustments within the time frame for the preparation of this report. Consequently, this report uses the 1986 census as the starting point for its demographic projections.

More specifically, the starting point for demographic projections purposes is 1 July 1986. The projections carry forward to 2100.

The 1986 census data for Canada are available by individual ages up to 89, but the data for ages 90 and over are grouped. Therefore, the latter data were desegregated for individual ages 90 to 106 by surviving the population data at age 89, using the 1985-1987 Life Tables, up to age 106. A constant proportional adjustment was made to the population so survived for each age from 90 to 106 to match its total with the census aggregate value for this age group.

To compensate for the census undercount, adjustment factors developed by Statistics Canada were applied to the 1986 census population data. These factors vary by age and sex.

The population, by age and sex, was then projected from one year to the next, by age and sex, by adding births and immigrants, subtracting deaths and emigrants. The annual numbers of births, deaths, immigrants and emigrants were developed by applying the fertility, mortality and migration assumptions to the mid-year population.

4. Population Tables

The first two tables below show the projected Canada mid-year populations for 1991, 1995, 2000, 2025, 2050, 2075 and 2100. The populations shown are distributed by sex and broad age groups. The third table shows corresponding dependency ratios.

POPULATION (in thousands)
CANADA
BOTH SEXES

Age Group	1991	1995	2000	2025	2050	2075	2100
0- 4	2036	2094	1989	2121	2240	2381	2553
5- 9	1887	2022	2134	2142	2246	2397	2580
10-14	1871	1920	2064	2114	2249	2424	2615
15-19	1864	1897	1965	2092	2277	2468	2657
TOTAL 0-19	7658	7933	8152	8469	9012	9670	10405
20-24	2059	1959	1963	2152	2371	2549	2730
25-29	2542	2165	2035	2306	2485	2634	2811
30-34	2517	2635	2231	2487	2548	2688	2879
35-39	2327	2511	2669	2416	2523	2693	2909
40-44	2084	2274	2521	2281	2463	2682	2911
45-49	1649	2012	2267	2198	2438	2684	2894
50-54	1328	1568	1995	2167	2478	2678	2852
55-59	1229	1276	1544	2246	2531	2613	2773
60-64	1188	1194	1242	2542	2351	2477	2663
TOTAL 20-64	16923	17594	18467	20795	22188	23698	25422
65-69	1068	1100	1119	2253	2087	2281	2511
70-74	821	937	980	1836	1829	2066	2314
75-79	618	655	782	1380	1552	1833	2041
80-84	382	449	493	838	1281	1522	1652
85-89	194	230	288	461	1031	1041	1185
90+	91	114	149	339	816	933	1229
TOTAL 65+	3174	3485	3811	7107	8596	9676	10932
GRAND TOTAL	27755	29012	30430	36371	39796	43044	46759

POPULATION (in thousands)
CANADA
BY SEX

Age Group	1991	1995	2000	2025	2050	2075	2100
				males			
0- 4	1054	1070	1016	1089	1152	1225	1313
5- 9	967	1047	1091	1103	1156	1233	1327
10-14	959	984	1069	1090	1158	1247	1345
15-19	955	972	1006	1077	1170	1268	1366
0-19	3935	4073	4182	4359	4636	4973	5351
20-24	1054	1001	1002	1100	1213	1306	1400
25-29	1296	1105	1036	1172	1269	1347	1438
30-34	1265	1337	1136	1264	1303	1375	1472
35-39	1164	1257	1349	1238	1289	1374	1484
40-44	1048	1135	1258	1156	1254	1364	1481
45-49	834	1010	1128	1110	1235	1361	1470
50-54	663	787	996	1088	1246	1353	1444
55-59	610	630	767	1119	1263	1313	1394
60-64	574	582	603	1246	1171	1231	1324
20-64	8508	8844	9275	10493	11243	12024	12907
65-69	488	515	532	1070	1009	1112	1226
70-74	355	408	440	839	854	973	1097
75-79	252	264	318	598	684	818	924
80-84	141	165	179	332	518	627	697
85-89	62	73	91	157	366	387	449
90+	23	29	37	89	223	268	365
65+	1321	1454	1597	3085	3654	4185	4758
Total males	13764	14371	15054	17937	19533	21182	23016
				females			
0- 4	982	1024	973	1032	1088	1156	1240
5- 9	920	975	1043	1039	1090	1164	1253
10-14	912	936	995	1024	1091	1177	1270
15-19	909	925	959	1015	1107	1200	1291
0-19	3723	3860	3970	4110	4376	4697	5054
20-24	1005	958	961	1052	1158	1243	1330
25-29	1246	1060	999	1134	1216	1287	1373
30-34	1252	1298	1095	1223	1245	1313	1407
35-39	1163	1254	1320	1178	1234	1319	1425
40-44	1036	1139	1263	1125	1209	1318	1430
45-49	815	1002	1139	1088	1203	1323	1424
50-54	665	781	999	1079	1232	1325	1408
55-59	619	646	777	1127	1268	1300	1379
60-64	614	612	639	1296	1180	1246	1339
20-64	8415	8750	9192	10302	10945	11674	12515
65-69	580	585	587	1183	1078	1169	1285
70-74	466	529	540	997	975	1093	1217
75-79	366	391	464	782	868	1015	1117
80-84	241	284	314	506	763	895	955
85-89	132	157	197	304	665	654	736
90+	68	85	112	250	593	665	864
65+	1853	2031	2214	4022	4942	5491	6174
Total females	13991	14641	15376	18434	20263	21862	23743

DEPENDENCY RATIOS (%)
Canada

Year	Both Sexes		
	Children[1]	Seniors[2]	Total[3]
1991	45.3	18.8	64.0
2000	44.1	20.6	64.8
2025	40.7	34.2	74.9
2050	40.6	38.7	79.4
2075	40.8	40.8	81.6
2100	40.9	43.0	83.9

Year	Males		
	Children[1]	Seniors[2]	Total[3]
1991	46.2	15.5	61.8
2000	45.1	17.2	62.3
2025	41.5	29.4	70.9
2050	41.2	32.5	73.7
2075	41.4	34.8	76.2
2100	42.5	36.9	78.3

Year	Females		
	Children[1]	Seniors[2]	Total[3]
1991	44.2	22.0	66.3
2000	43.2	24.1	67.3
2025	39.9	39.0	78.9
2050	40.0	45.2	85.1
2075	40.2	47.0	87.3
2100	40.4	49.3	89.7

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1 Population aged 19 years and under as a percentage of population aged 20 to 64 years.

2 Population aged 65 years and over as a percentage of population aged 20 to 64 years.

3 Population aged 19 years and under, plus population aged 65 years and over, as a percentage of population aged 20 to 64 years.

-II- EMPLOYMENT EARNINGS AND BENEFITS

1. Data

(a) Demographic

Historical and projected populations, the output of section I above, are used for various computational purposes in the economic projections. For example,

- ratios of the actual number of earners to the population correspond to the proportions of earners;
- the relevant population times the benefit eligibility rate, and times the average annual rate of OAS benefit produces the amount of projected benefits;

(b) Economic indices

The Consumer Price Index (CPI) and the Average Industrial Aggregate Wages statistic (AIAW, the current measure of the average rate of weekly wages and salaries) are produced by Statistics Canada (catalogues 11-010 and 72-002, respectively). The observed (1966 to 1992) annual increases in the CPI and the AIAW replace, for methodology validation purposes, values assumed in the previous actuarial report; they are also used as a basis for the determination of corresponding assumptions for the future. Rates of interest are not required for purposes of this report.

(c) Earnings statistics

Statistics on the average employment earnings, by sex and quinquennial age-group, of all workers covered by the CPP (i.e., Canada less Quebec basis) are prepared annually and transmitted as machine readable files, via magnetic tapes, by officials of Health and Welfare Canada (HWC) and Supply and Services Canada (SSC) involved in the administration of the CPP. These data originate from Revenue Canada, which is responsible for the processing of CPP contributions through salary deductions. The employment earnings data pertaining to a given calendar year normally become available in the second year (about mid-year) following that given year. This normal delay is due to the contribution adjustments resulting from tax returns filed after the given year. In summary, these earnings statistics include the number of earners and the average annual employment earnings of these earners.

(d) Aggregate Employment Earnings for Canada

The amount of employment earnings for all of Canada is made available each year by the Chief Actuary for the Canada Employment and Immigration Commission. This amount actually originates from Revenue Canada.

(e) Administrative reports

The annual accounting reports and the Reference Guide on Income Security Programs, flowing from the administration of the OAS by HWC, provide aggregate financial data on the OAS like the number of beneficiaries, the amount of benefits and the administrative expenses.

Such aggregate data are also compiled over each calendar year after the preparation of an actuarial report and compared with corresponding aggregate projected values of that report for methodology validation purposes until the next report comes due.

2. Economic Assumptions

The main table of financial projections shown in the main body of this report is based on a single set of realistic economic and demographic assumptions. The economic assumptions described below relate to this main table, but not to the auxiliary tables.

(a) Key assumptions

The key economic assumptions involved in the projection of employment earnings and benefits are the annual rates of increase in average employment earnings and in the CPI. Rates of interest are not required for projections covered in this report.

The assumptions used in the 25 February 1992 federal budget constitute the main reference used for the selection of short-term assumptions. Consequently, for the years 1993 to 1997 for prices and earnings, the key economic assumptions are those included in this budget. For 1998 and 1999, the assumptions were derived to fall between the budget projections and the ultimate (2000 and later years) assumptions described below.

Since the financial projections of this report cover a long period, long-term key economic assumptions were chosen on the basis of:

i)   The average long-term (about 50 years) past experience and the observed trends over the past short (about 15 years) and medium (about 25 years) terms.

ii) Judgmental opinion as to the outlook of the overall economy over the future long term.

It was accordingly decided to maintain the ultimate assumption for the annual increase in prices at 3.5% as for the previous report. However, the ultimate annual rate of increase in average employment earnings is assumed to be 4.5%, as compared to 4.8% for the previous report. This corresponds to a reduction from 1.3% to 1% in the productivity rate, i.e., the assumed ultimate gap between the annual rates of increase in earnings and prices. The possibility and appropriateness

of such a reduction was discussed in the previous report. It was decided to apply it for this report considering, among other things, that:

i) The actual gap between the annual rates of increase in average employment earnings and prices, each measured by the ratio of the relevant year-end index over that of the previous year, is equal on average over the last 5, 10, 15, 25 and 50 years, to 0.38%, 0.22%, –0.16%, +1.11% and +1.70%, respectively.

ii) It is generally believed that, in this post-industrialized era where the economy is more and more service-oriented, the productivity rate should not, in the long-term, be as high as during the industrialized era.

The table below shows the short-term and ultimate assumptions adopted for this report regarding the annual increases in earnings and prices.

ANNUAL RATE OF INCREASE IN PRICES AND AVERAGE EMPLOYMENT EARNINGS

YEAR	PRICES (%)	EARNINGS (%)	GAP (***) (%)
1985 (*)	3.9	3.5	(0.4)
1986 (*)	4.2	3.0	(1.2)
1987 (*)	4.4	3.8	(0.6)
1988 (*)	4.0	4.4	0.4
1989 (*)	5.0	5.2	0.2
1990 (*)	4.8	4.5	(0.3)
1991 (*)	5.6	4.6	(1.0)
1992 (*)	1.5	3.4	1.9
1993	2.2 (**)	2.8 (**)	0.6
1994	2.1 (**)	2.9 (**)	0.8
1995	2.0 (**)	2.8 (**)	0.8
1996	1.9 (**)	2.9 (**)	1.0
1997	1.8 (**)	2.8 (**)	1.0
1998	2.5	3.5	1.0
1999	3.0	4.0	1.0
2000 (ultimate)	3.5	4.5	1.0

(*)   Rates for these years are actual experience rates.
(**)   Rates for these years are taken from the February 1992 budget.
(***) Absolute difference between earnings and prices annual rates of increase;
       brackets mean that these rates are negative.

(b) Secondary (other than key) economic assumptions

i) Proportions of earners

The assumed proportions of earners were determined, on a Canada less Quebec basis, exactly as under the CPP fourteenth statutory actuarial report as at 31 December 1991.

In respect of each past year since 1966, proportions of earners are computed, by age and sex, as the ratio of the number of earners (from earnings statistics) to the corresponding population (from demographic computations). In addition to being used for the computation of the past and future employment earnings, these historical values constitute an important reference for the selection of assumed future proportions of earners.

These proportions for the future were accordingly determined taking partly into account the trends in their counterpart actual, adjusted (see section 3(b) below) values for 1966 to 1990. These trends reveal quite stable proportions for males and significant year to year increases for females.

Male proportions of earners are assumed to reach by year 2000 the levels at which they were on average from 1975 to 1980, before the 1982-1984 recession. However, such proportions assumed for males were multiplied, on the basis of past experience, by 0.975 for 1991, 1992 and 1993, and by 0.98 and 0.99 for 1994 and 1995, respectively, to account for the effects of the early 1990's recession on earnings.

Since 1985, female proportions have increased much more rapidly than anticipated, and in 1990 have already, on average, reached the levels assumed in previous actuarial reports for 2050. It was nonetheless decided for the projection period (1992 to 2100) to maintain the previous assumptions for females. This approach implicitly produces, for the 1991 to 1994 period, female proportions geometrically decreasing by about 5% on average, in line with the expected effect of the early 1990s recession on earnings.

Selected values of the adjusted past actual and future assumed proportions of earners is shown by age, sex and calendar year in section 3(b) below.

ii) Average employment earnings

The assumed average employment earnings were determined, on a Canada less Quebec basis, exactly as under the CPP fourteenth statutory actuarial report as at 31 December 1991.

In respect of a cohort of earners of a given age and sex, the average employment earnings for a given calendar year correspond to the ratio of the sum of individual employment earnings earned during the year to the number of earners in the cohort. Average employment earnings for each such age-sex cohort are assumed to increase from one year to the next at the same rate as the AIAW. The AIAW, compiled by Statistics Canada, corresponds to the weekly rate of pay, at a particular point in time, averaged over all industries. However, this rate of earnings increase assumption is subject to the following two adjustments:

. The preceding statement of the above assumption implies that the effect, on average employment earnings, of unemployment levels prevailing on average during the base year (1990) of earnings projections, will remain constant each year in the future. Whenever the actual level of average unemployment during the base year of earnings projections is not deemed representative of the expected future average level of unemployment, average earnings of the base year are adjusted over the next 5 to 10 years to bring them in line with the expected average unemployment level. On the basis of the average level of unemployment prevailing during 1990, it was decided, for this report, that no such adjustment was required. On the other hand, the anticipated temporary reduction effect of the early 1990s recession on average employment earnings was taken into account by multiplying male and female assumed average employment earnings by 0.945 (determined on the basis of past experience) for 1991, 1992 and 1993, and by 0.955 and 0.975 for 1994 and 1995, respectively.

. The assumed annual rate of increase in the AIAW was not implemented uniformly by sex since it was further assumed that an annual geometrical narrowing of 1% in the gap between male and female average employment earnings would apply. Hence, rates of increase in average employment earnings were developed by age and by sex so as to produce:
  - an aggregate rate of increase equal to that assumed for the AIAW;
  - rates of increase for each age, both sexes combined, that would be the same for all ages; and
  - separate rates of increase for male and female average earnings for each age such that the ratio of female to male average earnings would move 1% of the way to unity each year.

3. Methodology

(a) General Approach

The projections carry forward to year 2100. The actuarial approach used for projections is macro-simulated as opposed to micro-simulated. One of the important characteristics of such macro-simulation is that projections are made relying on grouped, as opposed to individual, data (mainly numbers of persons and earnings). This results in the need for a considerably smaller volume of data to be processed. Using micro-simulation, individual benefits can be easily determined via calculations involving individual data. Using macro-simulation, only aggregate benefits (i.e., combined by age and sex separately for each year of benefit payment) can be obtained directly, since the data used in the computational processes are aggregate values.

(b) Proportions of Earners and Average Employment Earnings

As mentioned in section 1(c) above, earnings statistics are combined into quinquennial age groups. Since the valuation process works on an individual age basis, actual past Proportions of Earners and Average Employment Earnings are desegregated to an individual age basis using appropriate interpolation formulae.

They are also adjusted so that the age corresponds to 1 July instead of 31 December of the relevant calendar year. This is required because the valuation methodology is designed on an average mid-year basis. For this purpose, specific 4-pivotal point actuarial interpolation formulae were developed.

A sample of past actual and future assumed proportions of earners and average employment earnings is shown in the tables below on a Canada less Quebec basis.

PROPORTIONS OF EARNERS
(past actual adjusted and future assumed)
Canada Less Quebec basis

				calendar year			
	Age	1980	1990	2000	2025	2050	2100
males							
	20	0.9057	0.7719	0.8839	0.8839	0.8839	0.8839
	25	0.9390	0.9653	0.9819	0.9819	0.9819	0.9819
	30	0.9839	0.9591	1.0056•	1.0056•	1.0056•	1.0056•
	35	0.9823	0.9632	0.9952	0.9952	0.9952	0.9952
	40	0.9691	0.9856	0.9774	0.9774	0.9774	0.9774
	45	0.9509	0.9797	0.9632	0.9632	0.9632	0.9632
	50	0.9143	0.9391	0.9167	0.9167	0.9167	0.9167
	55	0.8833	0.8765	0.8904	0.8904	0.8904	0.8904
	60	0.7683	0.7003	0.7345	0.7345	0.7345	0.7345
	65	0.4763	0.3178	0.3636	0.3636	0.3636	0.3636
females							
	20	0.8123	0.7429	0.8539	0.8945	0.8934	0.8934
	25	0.7564	0.8888	0.8242	0.8422	0.8464	0.8464
	30	0.7008	0.8216	0.7736	0.7999	0.8128	0.8128
	35	0.6838	0.8303	0.7823	0.8277	0.8485	0.8485
	40	0.6904	0.8752	0.8022	0.8274	0.8560	0.8562
	45	0.6550	0.8583	0.7710	0.8058	0.8434	0.8426
	50	0.5752	0.7619	0.7204	0.7534	0.7913	0.7946
	55	0.4926	0.6295	0.6670	0.7351	0.7800	0.7965
	60	0.3569	0.4215	0.4250	0.4541	0.4691	0.4758
	65	0.1879	0.1645	0.1400	0.1206	0.1106	0.1061

* Rates higher than one in the above table may be explained as follows:
1. Earners include all persons who ever had earnings during the year, whereas the population count is taken as at mid-year and does not record the number of all persons who ever lived in Canada during the year.
2. The undercount adjustments made to the census populations may be underestimated for certain ages.
3. The possession of more than one Social Insurance number by some individuals and the consequent overcount of earners.
4. The presence of individuals who have employment earnings, but are not included in the population count, such as students with working permits but no landed immigrant status, and persons with business visas.
5. The presence of dual earners, who would be included both as CPP contributors and Quebec Pension Plan contributors.
6. The fact that the Armed Forces personnel and the members of the RCMP who are employed in Quebec or outside Canada, contribute to the Canada Pension Plan. They are therefore included in the numerator (numbers of earners) of the proportions

AVERAGE EMPLOYMENT EARNINGS
(past actual adjusted and future assumed)
Canada Less Quebec basis

	Age	calendar year					
		1980	1990	2000	2025	2050	2100
	20	8283	9977	13505	40477	119528	1057832
	25	13866	20637	27679	82509	242704	2137051
	30	17601	27863	36857	108942	317841	2767191
	35	20189	32505	42880	125930	366633	3173819
Males	40	21041	36213	47951	140060	406724	3512372
	45	21020	38104	50520	147245	427172	3676207
	50	20685	37477	49801	145225	420757	3611601
	55	19549	33916	45450	133431	386930	3317593
	60	17452	30359	40523	119390	347145	3010779
	65	10044	17194	22271	65472	191537	1686632
	20	5831	8228	11364	35485	108063	996442
	25	9009	15754	21756	68776	211282	1969663
	30	9701	18058	25128	81975	256645	2444852
	35	9782	19721	27628	91091	287738	2760620
Females	40	9909	21466	30292	99939	316100	3038892
	45	9889	21654	30795	102528	326267	3150830
	50	9837	20536	29442	99046	316691	3071172
	55	9485	18343	26577	90335	289723	2813342
	60	9277	16909	24286	82181	262991	2569208
	65	6046	9993	13835	46183	147644	1452790

(c) Total Employment Earnings

Aggregate employment earnings for all of Canada for a given calendar year corresponds to the sum, over each age and sex, of the products of the Canada population by the appropriate "Canada less Quebec" proportion of earners and by the appropriate "Canada less Quebec" average employment earnings. Actual total Canada employment earnings reported by the Canada Employment and Immigration Commission correspond on average to 93.66% of the employment earnings computed as above for 1986 to 1990. Aggregate employment earnings projected for each year of the valuation period were accordingly multiplied by 93.66%.

(d) OAS Benefits

- General approach

    Total OAS benefits projected for a given calendar year are equal to the average number of OAS beneficiaries projected for that year times the average annual rate of OAS benefit projected for that year.

- Average number of beneficiaries

    The projected average number of OAS beneficiaries for any given year after 1991 is equal to the product of the OAS assumed eligibility rate and the total Canadian population, at ages 65 and over, projected for that year.

    The eligibility rate to OAS benefits for a given year is defined as the ratio of the average number of OAS beneficiaries for the year to the total Canadian population at ages 65 and over as of July 1 of the year. The OAS eligibility rate was very close to 98% for a good number of years before 1988; it was 97.95%, 98.08%, 98.26% and 98.53% for 1988, 1989, 1990 and 1991, respectively. For purposes of OAS benefit projections, it was therefore assumed that the OAS eligibility rate would reach 98.75% in 1992 and remain constant thereafter.

- Average annual rate of OAS benefit

    For 1991, the actual average annual rate of OAS benefit was $4,331.64, calculated as total benefits paid during the year divided by total average number of beneficiaries for the year. For any given year after 1991, the average annual rate of OAS benefit was set equal to the previous year's average annual rate of OAS benefit times the following indexation factor:

$$\text{indexation factor} = (1+c_{N-1})^{1/3} + (1+c_N)^{2/3}$$

where c_N = assumed rate of increase in CPI from year "N-1" to year "N"

- Income taxes

  The Old Age Security pension is subject to federal and provincial income taxes. Moreover, for purposes of federal income taxes, the OAS is reimbursable at the rate of 15% of the individual income exceeding a threshold which is increased annually in accordance with the increase in the consumer price index minus 3 percentage points; this threshold was $50,000 for 1989. The government has stated that it would review the threshold periodically and adjust it as appropriate. Since the reimbursement, generally referred to as "claw-back", is required under the Income Tax Act and not under the OAS Act, it has not been taken into account for purposes of financial projections in this report. It is not believed at this time that the effect of the "claw-back" on take-up rates of OAS pensions is likely to be significant.

(e) Administrative Expenses

On the basis of past financial experience of the Program, OAS administrative expenses were assumed to be equal to 0.35% of total OAS benefits projected for each future calendar year.

4. Costs Expressed as a Percentage of Total Employment Earnings

Absolute current dollar amounts of expenditures projected for each calendar year were divided by the year's projected total employment earnings to give a simple relative measure of the pattern of OAS costs over the years. It was well recognized that the Gross Domestic Product (GDP) would have been a more suitable basis since OAS benefits are financed through general revenues and not on the basis of total employment earnings. However, total employment earnings were retained as the comparative measure of cost because:

(i) they can be projected with more accuracy than the GDP;

(ii) they generally represent a simpler notion than the GDP and would therefore be more easily understood, and

(iii) they are generally deemed to change at a rate similar to that at which the GDP changes.

-III- INDEX TO KEYWORDS AND ACRONYMS