Office of the Superintendent
of Financial Institutions

Bureau du surintendant
des institutions financières

Canada Pension Plan

Eleventh

Statutory Actuarial Report

as at December 31, 1988

Canada

CANADA PENSION PLAN

ELEVENTH STATUTORY ACTUARIAL REPORT AS AT DECEMBER 31, 1988

TABLE OF CONTENTS

		Page
I.	Introduction	1
II.	Rationale for the Choice of the Key Assumptions	2
III.	Main Tables of Financial Projections	6
IV.	Auxiliary Account Projections (Sensitivity Studies)	11
V.	Observations, Conclusions and Actuarial Opinion	16

Appendices

A.	Main Provisions of the Plan	22
B.	Assumptions and Procedures	35
C.	Estimates of Contribution Rates Based on Actuarial Funding and Development of the Related Unfunded Actuarial Liability	73

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AS AT DECEMBER 31, 1988

I. INTRODUCTION

This is the Eleventh Statutory Actuarial Report since the inception of the Canada Pension Plan in 1966. It has been prepared in compliance with subsections 115(1) and 115(3) of the Canada Pension Plan Act. Subsection 115(1) provides that a periodic report shall be prepared at least every three years; the most recent report was the Tenth Actuarial Report, as at December 31, 1985, which was tabled in the House of Commons on October 3, 1986. Subsection 115(3) provides that a report shall be prepared every five years for purposes of the contribution rates review by the Minister of Finance and the Ministers of the Crown from the included provinces.

The Canada Pension Plan was subject to a series of amendments as of January 1, 1987 pursuant to the adoption of Bill C-116. The effect of these amendments was covered in the Tenth Actuarial Report. No amendments additional to those covered in that report have been made.

The remainder of this report is divided into four sections:

Section II summarizes the rationale for the choice of the Key Economic and Demographic Assumptions used for financial projections. Some key economic and demographic assumptions differ from those used for the previous report.

Section III presents four Main Tables of Financial Projections based on a single set of assumptions.

Section IV provides four Auxiliary Tables designed to test the sensitivity of the projections to some variations in key assumptions. Included in the Auxiliary Tables are projections on the basis of the key assumptions used in the previous report. This will enable the reader to gauge the effect of changes made to the key assumptions upon which the Main Projections of this report are based.

Section V contains Observations and Conclusions, as well as the Actuarial Opinion recommended by the Canadian Institute of Actuaries.

The report contains three appendices. The main provisions of the Plan are summarized in Appendix A, and the assumptions and procedures underlying the tables in Section III are described in Appendix B. Finally, the contribution rate that would be applicable in a fully funded system and the accompanying unfunded actuarial liability are the subject of Appendix C.

II. RATIONALE FOR THE CHOICE OF KEY ECONOMIC AND DEMOGRAPHIC ASSUMPTIONS

Certain economic and demographic assumptions that must be used in projecting the financial position of the Canada Pension Plan Account into the future (to the year 2100) are of critical importance. These key assumptions are the rate of productivity increase, which is represented by the real increases in wages and salaries (earnings), the fertility rate and the level of net immigration. To predict what these rates are likely to be from now to 2100 is not an easy task.

Because of the importance of these assumptions on the future financing requirements of the Canada Pension Plan, we reviewed a number of studies and learned papers produced by various organizations and individuals in the public and private sectors. We also held discussions with experts in economics and demography.

As a result of this concentrated review of current evidence of what the future is likely to hold, we decided that significant changes in the key economic and demographic assumptions, as compared to those used in previous reports, would be appropriate at this time.

Because the future cannot be predicted with a high degree of probability, and because it is inadvisable to make abrupt changes in assumptions from one periodic review of the Canada Pension Plan to the next, a decision was made that, for the review of the Plan as at December 31, 1988, the key assumptions in respect of the ultimate period in the projection span will be changed only part way to the level at which, the current evidence indicates, they should be. (The ultimate period in the projection span is from approximately the year 2000 to 2100. However, for certain of the key assumptions, the beginning of the ultimate period may be earlier than the year 2000. In respect of the period between January 1, 1989 and the beginning of the ultimate period, the key economic assumptions for new money interest rates, inflation and earnings increases are based on the projections contained in the April 1989 budget, modified to reflect the likely effect of the replacement of the current federal sales tax by the Goods and Services Tax assumed to be introduced on January 1, 1991 at 9 per cent. These rates are then blended into the assumptions for the ultimate period.)

If current trends in economic and demographic developments are continuing at the next periodic review of the Canada Pension Plan, a further adjustment to the assumptions may well have to be made. Should the then current trends, or any of them, indicate a likely long-term reversal in direction, this also can be reflected in the choice of assumptions at that time.

In summary, we decided it would be irresponsible not to begin to reflect in the current statutory review of the Canada Pension Plan the long-term changes in economic and demographic developments taking place in the Canadian society. Not to do so would have severe and unwelcome effects on the financing requirements of the Plan in the future.

Key Economic Assumptions: The Present View of the Future

The assumptions described in this and the next subsection are those that, but for the comments in the preceding three paragraphs, would be adopted for purposes of this report.

On the basis of the best evidence currently available, the key long-term economic assumptions for the ultimate period should be such as to produce a real increase in earnings of approximately 1 per cent per year from 1996.

Although less important in the context of the Canada Pension Plan, the long-term real rate of return to be realized from investments made in the future is assumed to decrease from the current levels to reach approximately 2.5 per cent per year in 1998.

The annual nominal ultimate rates in this report to produce the above approximate relationships are interest at 6 per cent, increases in earnings at 4.5 per cent and inflation at 3.5 per cent.

Key Demographic Assumptions: The Present View of the Future

After a review of the varied opinions held by population experts, we decided that it may well be appropriate to assume for the ultimate period a fertility rate of 1.750 for Canada and 1.700 for Quebec. The corresponding rates used in the previous report were 2.0 for both Canada and Quebec. The fertility rates that we now consider would be appropriate for the ultimate period, viz, 1.750 for Canada and 1.700 for Quebec, correspond approximately to the rates observed in 1980. These rates are somewhat higher than the 1987 rates of 1.656 for Canada and 1.424 for Quebec. The latter rates reflect the continuous decrease in fertility rates that has been observed since the early 1960s. There is a considerable divergence of views on whether the decrease will continue, the rate will stabilize at the current level, or whether the rate will rebound. To maintain a stable population requires a fertility rate of approximately 2.1.

Although the number of immigrants admitted to Canada in any one year varies with prevailing conditions as well as government policy, we decided that, on the basis of current government plans for intake of immigrants (and taking into account emigration from Canada), it would be appropriate to assume, for the projection period, that net annual immigration to Canada in any year will be 0.4 per cent of the Canadian population in that year. At present, this assumption would produce net immigration of approximately 105,000 per year.

Key Economic and Demographic Assumptions Adopted for this Report

We have just described the key economic and demographic assumptions that current evidence suggests should be adopted for purposes of this report. For the reasons described earlier, we decided not to adopt all of them for the Main Projections. Instead, we decided to start making adjustments in the ultimate assumptions used in the previous report so as to bring them, over time, to a level that best reflects the future.

In line with this approach, the assumptions with respect to the real rate of increase in earnings adopted for this report will be such that the current real rates will rise gradually to reach a rate of 1.3 per cent in 1996. This represents a reduction of 0.2 per cent from the ultimate rate of 1.5 per cent used in the Tenth Report.

The annual nominal economic assumptions in this report for the ultimate period are, therefore, interest at 6 per cent, increase in earnings at 4.8 per cent, and inflation at 3.5 per cent.

With respect to the rate of fertility for the ultimate period, it was decided for the purpose of this report to increase gradually the current rates to reach 1.85 for Canada and 1.80 for Quebec in 2010. These rates represent a reduction from the ultimate rates used in the preceding report (2.0 for both Canada and Quebec).

With respect to net immigration, we decided to adopt the assumption set out above. This means that beginning with the year 1989, net immigration in any year is assumed to be 0.4 per cent of the Canadian population in that year. In the previous report, the assumption for net annual immigration was 0.302 per cent of the Canadian population.

All the economic and demographic assumptions, including these key assumptions, are detailed in Appendix B.

Auxiliary Tables

To enable the reader to gauge the sensitivity of the various economic and demographic assumptions on the projections, we are presenting some Auxiliary Tables.

Auxiliary Table 1 is based on the key economic and demographic assumptions of the previous report. A comparison between Main Table 1B and Auxiliary Table 1 will enable the reader to see the impact of the changes in assumptions.

Auxiliary Table 2 is based on the key economic and demographic assumptions described in "The Present View of the Future." The projection in Auxiliary Table 2 shows the results that would be obtained if we were certain that that view of the future would materialize.

The projection shown in Auxiliary Table 3 is based on the same economic and demographic assumptions as the Main Projection except that the rate of decrease in future mortality is half of that assumed in the Main Projection.

Auxiliary Table 4, which could be characterized as a least favourable scenario, uses the same economic and demographic assumptions as Auxiliary Table 2 except that the rate of fertility is assumed to remain at the 1987 level for the balance of the projection period. We did not make projections assuming fertility rates would decrease further from that level.

As the projections show, with all other things being equal, lower fertility would eventually result in higher costs. Lower rates of increase in real earnings would have the same effect.

In the text and tables that follow, references to "contribution rates" mean combined employer and employee contribution rates. These combined contribution rates are divided equally between the employer and the employee. Self-employed persons pay the combined rate.

III. MAIN TABLES OF FINANCIAL PROJECTIONS

This section contains four Main Tables:

Table 1A: Account Projection using contribution rates scheduled until 2011 and those resulting from the 15-year formula thereafter (see Appendix A, section 1, last paragraph).

Table 1B: Account Projection using contribution rates scheduled until 1991 and those resulting from the 15-year formula thereafter (see Appendix A, section 1, last paragraph).

Table 2: Expenditures by type (in millions of dollars).

Table 3: Expenditures by type (as a percentage of contributory earnings); that is, pay-as-you-go-rates.

The assumptions underlying these projections are described in Appendix B. Some of the key ultimate assumptions are as follows:

	Previous Report	This Report
Rate of increase in earnings:	5%	4.8%
Rate of increase in prices:	3.5%	3.5%
Rate of interest:	6%	6%
Mortality:	1980-82 Canada Life Tables adjusted for future mortality reductions	1985-87 Canada Life Tables adjusted for future mortality reductions
Net annual immigration to Canada (percentage of population):	0.302%	0.400%
Total fertility rate:	2.00 for Canada 2.00 for Quebec	1.85 for Canada 1.80 for Quebec

MAIN TABLE 1A
ACCOUNT PROJECTION IN MILLIONS OF DOLLARS

The contribution rate for 1988 was 4.0%.
Future contribution rates are determined as follows:
1. From 1989 to 1991: 0.20% constant annual increase;
2. From 1992 to 2011: 0.15% constant annual increase;
3. After 2011: "15-year formula"; that is a constant annual rate of change (+ or -) in the contribution rate is determined so as to produce an account/expenditure ratio equal to 2.00 after 15 years; the constant rate of change is revised every 5 years.

Year	Pay-as-you-go Rate %	Contribution Rate %	Contributions $	Expenditures $	Cash Flow $	Investment Earnings $	Change in Account $	Year-End Account $	Account/Expenditures Ratio
1989	5.82	4.20	6770	9374	-2604	4054	1450	38837	3.72
1990	6.14	4.40	7491	10448	-2957	4208	1251	40088	3.48
1991	6.46	4.60	8188	11504	-3316	4319	1003	41091	3.24
1992	6.80	4.75	8850	12663	-3813	4390	577	41668	3.07
1993	6.97	4.90	9552	13580	-4028	4423	394	42062	2.91
1994	7.07	5.05	10318	14450	-4132	4432	300	42363	2.76
1995	7.15	5.20	11149	15328	-4179	4418	238	42601	2.61
1996	7.24	5.35	12060	16313	-4253	4385	132	42733	2.45
1997	7.27	5.50	13183	17428	-4245	4336	90	42823	2.30
1998	7.33	5.65	14346	18618	-4272	4285	12	42836	2.15
1999	7.38	5.80	15633	19884	-4251	4224	-27	42809	2.01
2000	7.43	5.95	17003	21246	-4243	4136	-107	42702	1.88
2001	7.50	6.10	18455	22699	-4244	3996	-248	42454	1.75
2002	7.58	6.25	20018	24264	-4246	3773	-473	41981	1.62
2003	7.64	6.40	21729	25956	-4227	3488	-739	41242	1.48
2004	7.73	6.55	23534	27790	-4256	3309	-948	40295	1.35
2005	7.84	6.70	25437	29770	-4333	3060	-1274	39021	1.22
2006	7.95	6.85	27503	31914	-4411	2854	-1557	37464	1.09
2007	8.10	7.00	29650	34293	-4643	2634	-2009	35455	0.96
2008	8.27	7.15	31931	36913	-4982	2410	-2571	32883	0.83
2009	8.43	7.30	34398	39743	-5345	2130	-3215	29668	0.69
2010	8.61	7.45	37019	42794	-5775	1771	-4004	25665	0.56
2011	8.80	7.60	39802	46084	-6282	1398	-4884	20780	0.42
2012	9.01	8.17	44998	49650	-4652	1081	-3570	17210	0.32
2013	9.22	8.74	50738	53533	-2795	886	-1909	15301	0.27
2014	9.45	9.31	56804	57671	-867	793	-73	15227	0.25
2015	9.68	9.88	63362	62097	1265	816	2081	17308	0.26
2016	9.91	10.45	70441	66831	3610	973	4583	21891	0.30
2017	10.15	10.82	76646	71900	4746	1261	6006	27898	0.36
2018	10.41	11.19	83144	77329	5815	1633	7448	35346	0.43
2019	10.65	11.56	90228	83120	7108	2097	9204	44551	0.50
2020	10.91	11.93	97635	89289	8346	2665	11012	55562	0.58
2025	12.20	13.10	135649	126380	9269	6683	15952	127553	0.94
2030	13.04	13.62	180265	172529	7736	11853	19590	218212	1.19
2035	13.25	13.70	234187	226509	7678	18401	26079	334174	1.40
2040	13.15	13.58	300924	291404	9520	27432	36952	495053	1.62
2045	13.02	13.39	383404	372882	10522	40193	50715	720843	1.84
2050	13.04	13.23	486589	479646	6943	57015	63959	1015001	2.01
2055	13.16	13.08	616558	620120	-3562	77261	73699	1365158	2.09
2060	13.22	13.01	787692	800422	-12730	100611	87881	1771850	2.10
2065	13.21	13.00	1013632	1030374	-16742	129539	112797	2281132	2.10
2070	13.22	13.04	1309515	1327345	-17830	167442	149612	2951186	2.11
2075	13.30	13.09	1689031	1716514	-27483	216847	189364	3818864	2.11
2100	13.75	13.58	6123589	6201907	-78318	741706	663388	13087743	2.01

MAIN TABLE 1B

ACCOUNT PROJECTION IN MILLIONS OF DOLLARS

The contribution rate for 1988 was 4.0%.
Future contribution rates are determined as follows:
1. From 1989 to 1991: 0.20% constant annual increase;
2. After 1991: "15-year formula"; that is a constant annual rate of change (+ or -) in the contribution rate is determined so as to produce an account/expenditure ratio equal to 2.00 after 15 years; the constant rate of change is revised every 5 years.

Year	Pay-as-You-Go Rate %	Contribution Rate %	Contributions $	Expenditures $	Cash Flow $	Investment Earnings $	Change in Account $	Year-End Account $	Account/Expenditures Ratio
1989	5.82	4.20	6770	9374	-2604	4054	1450	38837	3.72
1990	6.14	4.40	7491	10448	-2957	4208	1251	40088	3.48
1991	6.46	4.60	8188	11504	-3316	4319	1003	41091	3.24
1992	6.80	4.82	8980	12663	-3683	4393	710	41802	3.08
1993	6.97	5.04	9824	13580	-3756	4441	685	42487	2.94
1994	7.07	5.26	10747	14450	-3703	4477	774	43261	2.82
1995	7.15	5.48	11749	15328	-3579	4500	921	44182	2.71
1996	7.24	5.70	12849	16313	-3464	4518	1054	45236	2.60
1997	7.27	5.92	14189	17428	-3239	4518	1280	46516	2.50
1998	7.33	6.14	15590	18618	-3028	4545	1517	48032	2.42
1999	7.38	6.36	17143	19884	-2741	4581	1840	49872	2.35
2000	7.43	6.58	18803	21246	-2443	4612	2170	52042	2.29
2001	7.50	6.80	20572	22699	-2127	4617	2491	54533	2.25
2002	7.58	7.02	22484	24264	-1780	4568	2788	57321	2.21
2003	7.64	7.24	24581	25956	-1375	4489	3114	60435	2.17
2004	7.73	7.46	26803	27790	-987	4552	3565	64000	2.15
2005	7.84	7.68	29157	29770	-613	4587	3974	67975	2.13
2006	7.95	7.90	31718	31914	-196	4711	4515	72490	2.11
2007	8.10	8.13	34436	34293	143	4872	5015	77505	2.10
2008	8.27	8.36	37335	36913	422	5088	5511	83016	2.09
2009	8.43	8.59	40476	39743	733	5332	6065	89081	2.08
2010	8.61	8.82	43827	42794	1033	5613	6646	95727	2.08
2011	8.80	9.05	47395	46084	1311	5937	7248	102975	2.07
2012	9.01	9.29	51167	49650	1517	6317	7834	110809	2.07
2013	9.22	9.53	55324	53533	1791	6754	8545	119354	2.07
2014	9.45	9.77	59611	57671	1940	7239	9179	128533	2.07
2015	9.68	10.01	64195	62097	2098	7767	9866	138399	2.07
2016	9.91	10.25	69093	66831	2262	8344	10606	149004	2.07
2017	10.15	10.47	74166	71900	2266	8970	11236	160240	2.07
2018	10.41	10.69	79429	77329	2100	9636	11737	171977	2.07
2019	10.65	10.91	85155	83120	2035	10337	12372	184349	2.06
2020	10.91	11.13	91088	89289	1799	11073	12872	197221	2.06
2025	12.20	12.03	124569	126380	-1811	14946	13135	263504	1.95
2030	13.04	12.64	167295	172529	-5234	18773	13539	329492	1.80
2035	13.25	12.99	222050	226509	-4459	23266	18808	410349	1.72
2040	13.15	13.13	290952	291404	-452	30089	29637	534399	1.75
2045	13.02	13.15	376532	372882	3650	40767	44417	726180	1.85
2050	13.04	13.11	482176	479646	2530	55829	58359	991506	1.96
2055	13.16	13.06	615615	620120	-4505	74613	70108	1318710	2.02
2060	13.22	13.05	790114	800422	-10308	97257	86949	1715517	2.04
2065	13.21	13.05	1017531	1030374	-12843	126164	113321	2225475	2.05
2070	13.22	13.09	1314536	1327345	-12809	164409	151600	2902257	2.08
2075	13.30	13.14	1695483	1716514	-21031	214706	193675	3786431	2.09
2100	13.75	13.49	6083005	6201907	-118902	743144	624242	13084310	2.00

MAIN TABLE 2
TOTAL EXPENDITURES (IN MILLIONS OF DOLLARS)

		DISABILITY				SURVIVING SPOUSES						
YEAR	RETIREMENT	Flat-Rate	Earnings-Related	Children	SUB-TOTAL	Flat-Rate	Earnings-Related	SUB-TOTAL	ORPHANS	DEATH	EXPENSES	GRAND TOTAL
1989	6117	695	747	96	1537	255	1038	1293	129	136	161	9374
1990	6917	728	797	104	1630	270	1164	1434	136	161	170	10448
1991	7712	759	843	106	1709	286	1301	1587	141	177	178	11504
1992	8563	798	896	108	1802	305	1464	1769	149	194	186	12663
1993	9243	819	926	106	1850	319	1608	1928	153	211	195	13580
1994	9899	831	945	103	1879	333	1750	2083	157	227	204	14450
1995	10556	843	965	99	1907	346	1898	2244	158	249	214	15328
1996	11280	863	992	100	1955	361	2061	2422	163	268	225	16313
1997	12085	893	1032	102	2027	378	2242	2621	169	286	240	17428
1998	12933	930	1082	105	2117	397	2434	2830	176	309	254	18618
1999	13822	976	1143	108	2228	417	2634	3050	182	332	270	19884
2000	14766	1030	1215	111	2357	437	2846	3283	189	366	286	21246
2001	15780	1089	1296	113	2498	459	3069	3528	197	393	303	22699
2002	16871	1157	1389	115	2661	481	3305	3786	205	421	320	24264
2003	18053	1232	1492	116	2841	505	3552	4057	213	452	340	25956
2004	19347	1313	1606	118	3037	530	3812	4342	221	484	359	27790
2005	20748	1402	1731	120	3253	556	4085	4641	230	517	380	29770
2006	22280	1495	1866	124	3484	584	4373	4957	238	554	401	31914
2007	24008	1595	2011	128	3733	613	4677	5290	245	593	424	34293
2008	25950	1695	2160	132	3987	643	4997	5640	253	636	447	36913
2009	28064	1801	2319	137	4257	674	5334	6009	261	681	471	39743
2010	30348	1915	2493	143	4550	708	5690	6398	271	731	497	42794
2011	32843	2029	2671	147	4847	743	6066	6809	279	781	524	46084
2012	35632	2123	2824	152	5099	779	6464	7243	288	837	551	49650
2013	38683	2226	2994	158	5378	816	6883	7699	298	895	581	53533
2014	41931	2339	3181	163	5684	855	7326	8181	308	958	610	57671
2015	45412	2458	3381	169	6008	894	7797	8692	319	1025	641	62097
2016	49152	2582	3591	175	6347	936	8297	9232	330	1095	674	66831
2017	53183	2705	3802	182	6689	978	8827	9805	343	1172	708	71900
2018	57538	2826	4016	189	7031	1021	9389	10410	356	1252	743	77329
2019	62212	2946	4232	196	7374	1065	9984	11049	370	1336	781	83120
2020	67214	3064	4450	204	7718	1109	10618	11726	384	1429	818	89289
2025	97523	3647	5615	252	9513	1339	14499	15838	472	1999	1035	126380
2030	135319	4077	6666	308	11052	1578	19901	21479	577	2779	1324	172529
2035	177653	4824	8408	372	13604	1833	27204	29037	696	3810	1709	226509
2040	227259	5857	10882	446	17185	2134	36666	38800	832	5113	2216	291404
2045	289171	7275	14425	536	22236	2516	48405	50921	998	6693	2863	372882
2050	372089	8944	18923	649	28516	2998	62577	65575	1207	8582	3678	479646
2055	484214	10714	24153	788	35656	3573	79638	83211	1466	10859	4714	620120
2060	629653	12750	30594	955	44299	4238	100695	104932	1775	13707	6055	800422
2065	814710	15364	39243	1150	55757	5015	127550	132565	2138	17407	7797	1030374
2070	1052923	18749	50999	1382	71130	5953	162447	168399	2568	22285	10042	1327345
2075	1366169	22861	66247	1665	90774	7091	207813	214904	3092	28676	12903	1716514
2100	5022852	58160	230394	4268	292822	16763	717103	733865	7917	99362	45093	6201907

MAIN TABLE 3: PAY-AS-YOU-GO RATES
TOTAL EXPENDITURES (AS PERCENTAGES OF CONTRIBUTORY EARNINGS)

		DISABILITY				SURVIVING SPOUSES						TOTAL PAY-AS-YOU-GO
YEAR	RETIREMENT	Flat-Rate	Earnings-Related	Children	SUB-TOTAL	Flat-Rate	Earnings-Related	SUB-TOTAL	ORPHANS	DEATH	EXPENSES	RATES
1989	3.79	0.43	0.46	0.06	0.95	0.16	0.64	0.80	0.08	0.08	0.10	5.82
1990	4.06	0.43	0.47	0.06	0.96	0.16	0.68	0.84	0.08	0.09	0.10	6.14
1991	4.33	0.43	0.47	0.06	0.96	0.16	0.73	0.89	0.08	0.10	0.10	6.46
1992	4.60	0.43	0.48	0.06	0.97	0.16	0.79	0.95	0.08	0.10	0.10	6.80
1993	4.74	0.42	0.47	0.05	0.95	0.16	0.83	0.99	0.08	0.11	0.10	6.97
1994	4.84	0.41	0.46	0.05	0.92	0.16	0.86	1.02	0.08	0.11	0.10	7.07
1995	4.92	0.39	0.45	0.05	0.89	0.16	0.89	1.05	0.07	0.12	0.10	7.15
1996	5.00	0.38	0.44	0.04	0.87	0.16	0.91	1.07	0.07	0.12	0.10	7.24
1997	5.04	0.37	0.43	0.04	0.85	0.16	0.94	1.09	0.07	0.12	0.10	7.27
1998	5.09	0.37	0.43	0.04	0.83	0.16	0.96	1.11	0.07	0.12	0.10	7.33
1999	5.13	0.36	0.42	0.04	0.83	0.15	0.98	1.13	0.07	0.12	0.10	7.38
2000	5.17	0.36	0.43	0.04	0.82	0.15	1.00	1.15	0.07	0.13	0.10	7.43
2001	5.22	0.36	0.43	0.04	0.83	0.15	1.01	1.17	0.07	0.13	0.10	7.50
2002	5.27	0.36	0.43	0.04	0.83	0.15	1.03	1.18	0.06	0.13	0.10	7.58
2003	5.32	0.36	0.44	0.03	0.84	0.15	1.05	1.20	0.06	0.13	0.10	7.64
2004	5.38	0.37	0.45	0.03	0.85	0.15	1.06	1.21	0.06	0.13	0.10	7.73
2005	5.47	0.37	0.46	0.03	0.86	0.15	1.08	1.22	0.06	0.14	0.10	7.84
2006	5.55	0.37	0.46	0.03	0.87	0.15	1.09	1.23	0.06	0.14	0.10	7.95
2007	5.67	0.38	0.47	0.03	0.88	0.14	1.10	1.25	0.06	0.14	0.10	8.10
2008	5.81	0.38	0.48	0.03	0.89	0.14	1.12	1.26	0.06	0.14	0.10	8.27
2009	5.96	0.38	0.49	0.03	0.90	0.14	1.13	1.28	0.06	0.14	0.10	8.43
2010	6.11	0.39	0.50	0.03	0.92	0.14	1.15	1.29	0.05	0.15	0.10	8.61
2011	6.27	0.39	0.51	0.03	0.93	0.14	1.16	1.30	0.05	0.15	0.10	8.80
2012	6.47	0.39	0.51	0.03	0.93	0.14	1.17	1.32	0.05	0.15	0.10	9.01
2013	6.66	0.38	0.52	0.03	0.93	0.14	1.19	1.33	0.05	0.15	0.10	9.22
2014	6.87	0.38	0.52	0.03	0.93	0.14	1.20	1.34	0.05	0.16	0.10	9.45
2015	7.08	0.38	0.53	0.03	0.94	0.14	1.22	1.36	0.05	0.16	0.10	9.68
2016	7.29	0.38	0.53	0.03	0.94	0.14	1.23	1.37	0.05	0.16	0.10	9.91
2017	7.51	0.38	0.54	0.03	0.94	0.14	1.25	1.38	0.05	0.17	0.10	10.15
2018	7.74	0.38	0.54	0.03	0.95	0.14	1.26	1.40	0.05	0.17	0.10	10.41
2019	7.97	0.38	0.54	0.03	0.94	0.14	1.28	1.42	0.05	0.17	0.10	10.65
2020	8.21	0.37	0.54	0.02	0.94	0.14	1.30	1.43	0.05	0.17	0.10	10.91
2025	9.42	0.35	0.54	0.02	0.92	0.13	1.40	1.53	0.05	0.19	0.10	12.20
2030	10.22	0.31	0.50	0.02	0.84	0.12	1.50	1.62	0.04	0.21	0.10	13.04
2035	10.39	0.28	0.49	0.02	0.80	0.11	1.59	1.70	0.04	0.22	0.10	13.25
2040	10.26	0.26	0.49	0.02	0.78	0.10	1.65	1.75	0.04	0.23	0.10	13.15
2045	10.10	0.25	0.50	0.02	0.78	0.09	1.69	1.78	0.03	0.23	0.10	13.02
2050	10.12	0.24	0.51	0.02	0.78	0.08	1.70	1.78	0.03	0.23	0.10	13.04
2055	10.27	0.23	0.51	0.02	0.76	0.08	1.69	1.77	0.03	0.23	0.10	13.16
2060	10.40	0.21	0.51	0.02	0.73	0.07	1.66	1.73	0.03	0.23	0.10	13.22
2065	10.45	0.20	0.50	0.01	0.72	0.06	1.64	1.70	0.03	0.22	0.10	13.21
2070	10.48	0.19	0.51	0.01	0.71	0.06	1.62	1.68	0.03	0.22	0.10	13.22
2075	10.59	0.18	0.51	0.01	0.70	0.05	1.61	1.67	0.02	0.22	0.10	13.30
2100	11.14	0.13	0.51	0.01	0.65	0.04	1.59	1.63	0.02	0.22	0.10	13.75

IV. AUXILIARY ACCOUNT PROJECTIONS

The following four Auxiliary Tables of Account Projections are presented for purposes of measuring the effect of certain variations in assumptions. Each of these four Auxiliary Account Projections was developed using contribution rates of the schedule until 1991 and the rates produced by the 15-year formula thereafter (see Appendix A, section 1, last paragraph). The Auxiliary Projections are based on assumptions that differ from those used for purposes of Main Table 1B in the following respects:

Table 1. Using ultimate key economic and demographic assumptions of the previous report:
- (a) earnings increases: 5.0% instead of 4.8%;
- (b) fertility rates: 2.0 for both Canada and Quebec, instead of 1.85 for Canada and 1.80 for Quebec;
- (c) net immigration: 0.302%, instead of 0.400%, of total Canadian population.

Table 2. Using ultimate key economic and demographic assumptions according to "The Present View of the Future":
- (a) earnings increases: 4.5% instead of 4.8%;
- (b) fertility rates: 1.75 for Canada and 1.70 for Quebec, instead of 1.85 and 1.80, respectively.

Table 3. Using the same economic and demographic assumptions as in Main Table 1B except that the assumed rates of decrease in future mortality are cut in half.

Table 4. Least favourable scenario:
- (a) earnings increases: 4.5% instead of 4.8%;
- (b) fertility rates: kept constant at their 1987 levels of 1.656 for Canada and 1.424 for Quebec.

AUXILIARY TABLE 1
(Key ultimate assumptions of the previous report)
ACCOUNT PROJECTION IN MILLIONS OF DOLLARS

The contribution rate for 1988 was 4.0%.
Future contribution rates are determined as follows:
1. From 1989 to 1991: 0.20% constant annual increase;
2. After 1991: "15-year formula"; that is a constant annual rate of change (+ or -) in the contribution rate is determined so as to produce an account/expenditure ratio equal to 2.00 after 15 years; the constant rate of change is revised every 5 years.

Year	Pay-As-You-Go Rate %	Contribution Rate %	Contributions $	Expenditures $	Cash Flow $	Investment Earnings $	Change in Account $	Year-End Account $	Account/Expenditures Ratio
1989	5.83	4.20	6745	9371	-2626	4053	1428	38814	3.72
1990	6.16	4.40	7454	10441	-2987	4205	1218	40032	3.48
1991	6.50	4.60	8138	11493	-3355	4312	957	40989	3.24
1992	6.84	4.82	8914	12647	-3733	4382	648	41637	3.07
1993	7.02	5.04	9739	13557	-3818	4424	606	42243	2.93
1994	7.13	5.26	10641	14420	-3779	4453	674	42917	2.81
1995	7.21	5.48	11618	15290	-3672	4469	797	43714	2.69
1996	7.30	5.70	12702	16266	-3564	4478	914	44628	2.57
1997	7.33	5.93	14046	17370	-3324	4470	1146	45773	2.47
1998	7.38	6.16	15478	18547	-3069	4489	1420	47193	2.38
1999	7.41	6.39	17065	19802	-2737	4520	1783	48977	2.32
2000	7.46	6.62	18764	21153	-2389	4549	2160	51137	2.26
2001	7.52	6.85	20574	22596	-2022	4554	2533	53669	2.22
2002	7.59	7.07	22499	24152	-1653	4507	2855	56524	2.19
2003	7.68	7.29	24527	25836	-1309	4432	3123	59647	2.16
2004	7.76	7.51	26758	27666	-908	4496	3588	63235	2.13
2005	7.87	7.73	29121	29642	-521	4533	4011	67246	2.12
2006	7.97	7.95	31725	31786	-61	4659	4598	71844	2.10
2007	8.10	8.18	34488	34170	318	4826	5144	76988	2.09
2008	8.27	8.41	37434	36801	633	5051	5684	82672	2.09
2009	8.44	8.64	40582	39648	934	5305	6239	88911	2.08
2010	8.64	8.87	43879	42720	1159	5596	6755	95666	2.08
2011	8.81	9.10	47539	46038	1501	5929	7430	103096	2.08
2012	9.03	9.34	51362	49640	1722	6323	8045	111140	2.07
2013	9.25	9.58	55457	53568	1889	6772	8661	119801	2.07
2014	9.47	9.82	59892	57759	2133	7266	9399	129200	2.08
2015	9.70	10.06	64581	62247	2334	7810	10144	139345	2.08
2016	9.92	10.30	69588	67054	2534	8405	10940	150285	2.08
2017	10.18	10.51	74580	72207	2373	9049	11422	161707	2.08
2018	10.42	10.72	79936	77731	2205	9727	11932	173638	2.08
2019	10.68	10.93	85620	83627	1993	10437	12430	186068	2.07
2020	10.92	11.14	91697	89918	1779	11176	12955	199023	2.06
2025	12.20	12.03	126042	127817	-1776	15070	13295	265739	1.94
2030	12.96	12.56	169663	175019	-5356	18925	13568	332142	1.79
2035	13.06	12.81	225729	230129	-4400	23446	19046	413651	1.71
2040	12.83	12.81	296012	296430	-418	30370	29952	539514	1.73
2045	12.57	12.72	384391	379975	4416	41241	45657	735252	1.84
2050	12.47	12.58	494612	490314	4298	56882	61179	1011480	1.96
2055	12.49	12.47	636275	637290	-1015	76833	75818	1360450	2.03
2060	12.48	12.37	821429	828630	-7201	101488	94287	1792376	2.05
2065	12.42	12.31	1066709	1076132	-9423	132859	123436	2346091	2.07
2070	12.39	12.30	1390411	1400873	-10462	174455	163993	3081503	2.09
2075	12.47	12.38	1820746	1833858	-13112	229405	216293	4052256	2.09
2100	12.86	12.83	7036047	7053772	-17725	873517	855792	15455999	2.08

AUXILIARY TABLE 2
(Key ultimate assumptions as described in "The Present View of the Future")
ACCOUNT PROJECTION IN MILLIONS OF DOLLARS

The contribution rate for 1988 was 4.0%.
Future contribution rates are determined as follows:
1. From 1989 to 1991: 0.20% constant annual increase;
2. After 1991: "15-year formula"; that is a constant annual rate of change (+ or -) in the contribution rate is determined so as to produce an account/expenditure ratio equal to 2.00 after 15 years; the constant rate of change is revised every 5 years.

Year	Pay-As-You-Go Rate %	Contribution Rate %	Contributions $	Expenditures $	Cash Flow $	Investment Earnings $	Change in Account $	Year-End Account $	Account/ Expenditures Ratio
1989	5.82	4.20	6770	9374	-2604	4054	1450	38837	3.72
1990	6.14	4.40	7491	10447	-2956	4208	1252	40089	3.49
1991	6.46	4.60	8188	11503	-3315	4319	1004	41094	3.25
1992	6.80	4.82	8980	12661	-3681	4394	713	41806	3.08
1993	6.97	5.04	9824	13577	-3753	4442	689	42495	2.94
1994	7.07	5.26	10747	14447	-3700	4477	777	43273	2.82
1995	7.15	5.48	11749	15324	-3575	4501	926	44198	2.71
1996	7.24	5.70	12830	16307	-3477	4519	1042	45241	2.60
1997	7.30	5.94	14170	17420	-3250	4519	1269	46510	2.50
1998	7.38	6.18	15569	18604	-3035	4545	1510	48020	2.42
1999	7.45	6.42	17119	19863	-2744	4581	1837	49857	2.35
2000	7.50	6.66	18848	21215	-2367	4613	2246	52103	2.30
2001	7.58	6.90	20615	22652	-2037	4623	2586	54690	2.26
2002	7.68	7.13	22459	24197	-1738	4578	2840	57530	2.22
2003	7.78	7.36	24480	25861	-1381	4502	3121	60651	2.19
2004	7.89	7.59	26618	27659	-1041	4565	3524	64175	2.17
2005	8.01	7.82	28877	29592	-715	4597	3882	68057	2.15
2006	8.14	8.05	31335	31679	-344	4714	4370	72428	2.13
2007	8.28	8.30	34073	33989	84	4868	4952	77380	2.12
2008	8.47	8.55	36850	36523	327	5080	5407	82787	2.11
2009	8.67	8.80	39858	39251	607	5317	5925	88712	2.10
2010	8.84	9.05	43169	42184	985	5592	6577	95289	2.10
2011	9.05	9.30	46582	45334	1248	5911	7159	102447	2.10
2012	9.26	9.55	50239	48738	1501	6287	7788	110236	2.10
2013	9.52	9.80	53987	52431	1556	6718	8274	118509	2.10
2014	9.75	10.05	58071	56356	1715	7187	8902	127411	2.10
2015	9.99	10.30	62431	60543	1888	7699	9587	136998	2.11
2016	10.25	10.55	66903	65004	1899	8257	10156	147154	2.11
2017	10.51	10.79	71593	69765	1828	8854	10682	157836	2.11
2018	10.78	11.03	76574	74849	1725	9489	11214	169050	2.11
2019	11.05	11.27	81862	80253	1609	10158	11767	180817	2.10
2020	11.32	11.51	87406	85994	1412	10859	12271	193088	2.10
2025	12.74	12.51	117997	120162	-2166	14531	12365	255777	2.00
2030	13.71	13.22	156188	161937	-5749	18064	12315	316366	1.85
2035	14.06	13.67	204117	209945	-5828	22051	16223	387581	1.76
2040	14.06	13.91	263696	266575	-2879	27883	25004	493327	1.77
2045	14.04	14.03	336223	336356	-133	36793	36660	652967	1.85
2050	14.16	14.13	425239	426113	-874	49207	48333	871825	1.95
2055	14.37	14.19	534715	541610	-6896	64733	57837	1142107	2.01
2060	14.50	14.20	671759	686154	-14395	83118	68723	1462235	2.03
2065	14.54	14.20	845697	865946	-20249	105397	85148	1852633	2.04
2070	14.56	14.24	1068296	1092406	-24110	133575	109465	2348849	2.05
2075	14.66	14.33	1350769	1381962	-31193	169592	138399	2981602	2.06
2100	15.19	14.88	4378905	4470244	-91339	542222	450883	9541189	2.04

AUXILIARY TABLE 3
(The same key ultimate assumptions as in Main Table 1B
except that the rates of decrease in future mortality are cut in half)
ACCOUNT PROJECTION IN MILLIONS OF DOLLARS

The contribution rate for 1988 was 4.0%.
Future contribution rates are determined as follows:
1. From 1989 to 1991: 0.20% constant annual increase;
2. After 1991: "15-year formula"; that is a constant annual rate of change (+ or -) in the contribution rate is determined so as to produce an account/expenditure ratio equal to 2.00 after 15 years; the constant rate of change is revised every 5 years.

Year	Pay-As-You-Go Rate %	Contribution Rate %	Contributions $	Expenditures $	Cash Flow $	Investment Earnings $	Change in Account $	Year-End Account $	Account/Expenditures Ratio
1989	5.82	4.20	6769	9377	-2608	4054	1446	38833	3.72
1990	6.14	4.40	7489	10449	-2960	4208	1248	40081	3.48
1991	6.46	4.60	8185	11501	-3316	4318	1002	41083	3.25
1992	6.80	4.81	8957	12654	-3697	4392	695	41778	3.08
1993	6.96	5.02	9779	13564	-3785	4438	653	42431	2.94
1994	7.07	5.23	10677	14424	-3747	4471	724	43155	2.82
1995	7.14	5.44	11652	15290	-3638	4491	852	44008	2.71
1996	7.22	5.65	12722	16260	-3538	4503	965	44973	2.59
1997	7.25	5.87	14051	17356	-3305	4499	1193	46166	2.49
1998	7.31	6.09	15439	18523	-3084	4520	1436	47603	2.41
1999	7.35	6.31	16978	19764	-2786	4552	1766	49369	2.34
2000	7.40	6.53	18624	21097	-2473	4579	2106	51475	2.29
2001	7.46	6.75	20377	22515	-2138	4580	2443	53917	2.24
2002	7.52	6.96	22239	24041	-1802	4527	2726	56643	2.20
2003	7.59	7.17	24280	25689	-1409	4445	3036	59679	2.17
2004	7.67	7.38	26441	27473	-1032	4503	3471	63151	2.15
2005	7.77	7.59	28728	29398	-670	4533	3862	67013	2.13
2006	7.87	7.80	31214	31481	-267	4649	4382	71395	2.11
2007	8.01	8.02	33851	33791	60	4802	4862	76257	2.10
2008	8.17	8.24	36662	36334	328	5009	5337	81594	2.09
2009	8.33	8.46	39706	39079	627	5242	5869	87463	2.08
2010	8.50	8.68	42950	42037	913	5512	6425	93888	2.08
2011	8.67	8.90	46404	45224	1180	5822	7002	100889	2.07
2012	8.88	9.13	50052	48676	1376	6188	7564	108453	2.07
2013	9.08	9.36	54073	52432	1641	6608	8249	116702	2.07
2014	9.30	9.59	58215	56432	1783	7076	8859	125560	2.07
2015	9.52	9.82	62643	60708	1935	7585	9520	135080	2.07
2016	9.74	10.05	67370	65277	2093	8142	10235	145316	2.07
2017	9.96	10.26	72261	70166	2095	8746	10841	156157	2.07
2018	10.21	10.47	77331	75397	1934	9389	11323	167479	2.07
2019	10.44	10.68	82845	80971	1874	10065	11939	179418	2.06
2020	10.69	10.89	88555	86903	1652	10775	12427	191845	2.06
2025	11.91	11.74	120665	122421	-1757	14524	12767	256034	1.96
2030	12.66	12.26	160893	166173	-5280	18231	12951	319777	1.82
2035	12.80	12.51	211789	216707	-4918	22478	17560	395922	1.74
2040	12.63	12.55	275064	276811	-1747	28775	27028	510049	1.76
2045	12.44	12.51	353788	351860	1928	38482	40410	684398	1.85
2050	12.41	12.46	451949	450153	1796	52281	54077	928112	1.96
2055	12.48	12.41	576068	579539	-3471	69871	66400	1235373	2.03
2060	12.52	12.36	735864	745320	-9456	91342	81886	1611055	2.06
2065	12.49	12.31	942406	955874	-13468	118354	104886	2086259	2.08
2070	12.46	12.30	1210875	1226276	-15401	153475	138074	2706268	2.10
2075	12.50	12.30	1553328	1578598	-25270	198950	173680	3503984	2.11
2100	12.74	12.54	5487313	5575238	-87925	668629	580704	11785590	2.01

AUXILIARY TABLE 4
(Least favourable scenario)
ACCOUNT PROJECTION IN MILLIONS OF DOLLARS

The contribution rate for 1988 was 4.0%.
Future contribution rates are determined as follows:
1. From 1989 to 1991: 0.20% constant annual increase;
2. After 1991: "15-year formula"; that is a constant annual rate of change (+ or -) in the contribution rate is determined so as to produce an account/expenditure ratio equal to 2.00 after 15 years; the constant rate of change is revised every 5 years.

Year	Pay-As-You-Go Rate	Contribution Rate	Contributions	Expenditures	Cash Flow	Investment Earnings	Change in Account	Year-End Account	Account/Expenditures Ratio
	%	%	$	$	$	$	$	$	
1989	5.82	4.20	6770	9374	-2604	4054	1450	38837	3.72
1990	6.14	4.40	7491	10447	-2956	4208	1252	40089	3.49
1991	6.46	4.60	8188	11503	-3315	4319	1004	41094	3.25
1992	6.80	4.82	8980	12661	-3681	4394	713	41806	3.08
1993	6.96	5.04	9824	13576	-3752	4442	690	42496	2.94
1994	7.07	5.26	10747	14445	-3698	4478	779	43276	2.82
1995	7.15	5.48	11749	15322	-3573	4501	928	44204	2.71
1996	7.24	5.70	12830	16305	-3475	4519	1044	45248	2.60
1997	7.30	5.93	14146	17417	-3271	4519	1248	46496	2.50
1998	7.38	6.16	15518	18601	-3083	4543	1461	47956	2.41
1999	7.45	6.39	17039	19860	-2821	4576	1754	49710	2.34
2000	7.50	6.62	18734	21211	-2477	4602	2125	51836	2.29
2001	7.58	6.85	20464	22648	-2184	4604	2420	54256	2.24
2002	7.68	7.09	22331	24191	-1860	4550	2690	56946	2.20
2003	7.77	7.33	24378	25855	-1477	4465	2988	59934	2.17
2004	7.89	7.57	26545	27652	-1107	4520	3413	63347	2.14
2005	8.01	7.81	28836	29585	-749	4546	3797	67144	2.12
2006	8.14	8.05	31330	31671	-341	4658	4317	71461	2.10
2007	8.28	8.30	34066	33980	86	4809	4895	76356	2.09
2008	8.47	8.55	36840	36513	327	5018	5345	81701	2.08
2009	8.67	8.80	39845	39240	605	5251	5856	87557	2.08
2010	8.84	9.05	43151	42171	980	5521	6501	94058	2.08
2011	9.05	9.30	46557	45320	1237	5836	7072	101130	2.08
2012	9.27	9.55	50205	48721	1484	6207	7691	108821	2.08
2013	9.52	9.80	53943	52412	1531	6631	8162	116983	2.08
2014	9.76	10.05	58014	56335	1679	7093	8772	125755	2.08
2015	10.00	10.30	62358	60519	1839	7597	9436	135191	2.08
2016	10.26	10.55	66810	64978	1832	8145	9977	145167	2.08
2017	10.53	10.79	71476	69736	1740	8731	10471	155638	2.08
2018	10.80	11.03	76429	74816	1613	9353	10966	166604	2.08
2019	11.07	11.27	81684	80216	1468	10006	11474	178078	2.07
2020	11.35	11.51	87189	85953	1236	10688	11925	190002	2.06
2025	12.79	12.55	117853	120088	-2235	14246	12011	250786	1.96
2030	13.79	13.35	156618	161805	-5187	17734	12547	311021	1.82
2035	14.19	13.82	204261	209714	-5453	21814	16361	383717	1.74
2040	14.24	14.10	263629	266173	-2544	27667	25123	489802	1.76
2045	14.26	14.27	335899	335662	237	36628	36865	650323	1.85
2050	14.44	14.38	423104	424910	-1806	48971	47165	867030	1.95
2055	14.71	14.48	530785	539393	-8608	63935	55327	1126967	1.99
2060	14.90	14.54	665628	681941	-16313	81419	65106	1431189	2.00
2065	14.97	14.63	838656	858218	-19562	102737	83175	1806587	2.01
2070	15.02	14.73	1057844	1078867	-21023	130659	109636	2299810	2.04
2075	15.15	14.83	1330673	1359141	-28468	166819	138351	2934402	2.06
2100	15.80	15.38	4175288	4288304	-113016	515415	402399	9052633	2.02

V. OBSERVATIONS, CONCLUSIONS AND ACTUARIAL OPINION

1. Highlights of Main Tables

The following table shows samples of pay-as-you-go rates and, for comparison, the contribution rates taken from Main Tables 1A and 1B.

In Main Table 1A the contribution rates shown from 1989 to 2011 are those included in the Schedule to the Act which provides annual constant increases of 0.20% until 1991 and of 0.15% from 1992 to 2011; however, the rates for the years 1992 to 2011 as well as for later years are subject to quinquennial federal-provincial reviews. For purposes of determining the contribution rates for years after 2011, it is assumed that the Schedule will be extended in accordance with the 15-year formula (see Appendix A, section 1, last paragraph) prescribed by regulation that would come into operation in the absence of agreement or recommendation at subsequent quinquennial federal-provincial reviews.

Main Table 1B, required by the Act to serve as a basis for the review process mentioned in the above paragraph, shows the contribution rates included in the Schedule to the Act from 1989 to 1991; the rates shown for 1992 and after were determined in accordance with the 15-year formula (see Appendix A, section 1, last paragraph).

Year	Pay-as-you-go rates	Contribution rates	
		Table 1A	Table 1B
	%	%	%
1989	5.82	4.20	4.20
1990	6.14	4.40	4.40
1991	6.46	4.60	4.60
1992	6.80	4.75	4.82
1993	6.97	4.90	5.04
1994	7.07	5.05	5.26
1995	7.15	5.20	5.48
1996	7.24	5.35	5.70
2001	7.50	6.10	6.80
2006	7.95	6.85	7.90
2011	8.80	7.60	9.05
2016	9.91	10.45	10.25
2020	10.91	11.93	11.13
2025	12.20	13.10	12.03
2030	13.04	13.62	12.64
2035	13.25	13.70	12.99
2040	13.15	13.58	13.13
2045	13.02	13.39	13.15
2050	13.04	13.23	13.11
2075	13.30	13.09	13.14
2100	13.75	13.58	13.49

A reference to Main Table 1A will show that the retention to 2011 of the contribution rates included in the Schedule would result in the ratio of Account to Expenditures falling to a low of 0.25 in 2014. This is much below the ratio of 2 which is the aim of the Act.

2. Comparison with Previous Report

Main Table 3 shows projected pay-as-you-go rates reaching 7.43%, 13.04% and 13.75% of contributory earnings for the years 2000, 2030 and 2100, respectively. They exceed those projected in the previous report for these years by 0.68%, 1.01% and 2.25%, respectively. The following chart gives insight into the various reasons for the changes in the pay-as-you-go rates shown in this report over those shown in the previous report:

	1990	2000	2010	2020	2030	2050	2100
	%	%	%	%	%	%	%
Tenth Report rates:	5.63	6.75	7.88	10.09	12.03	11.49	11.50
I. Improvement in valuation methods and actuarial techniques(1)	-0.14	0.12	0.12	0.01	-0.07	-0.12	-0.21
II. Experience update							
A. Demographic(2)	0.04	0.08	0.13	0.22	0.33	0.13	0.06
B. Economic(3)	-0.10	-0.19	-0.19	-0.18	-0.16	-0.10	-0.09
C. Benefits in pay(4)	0.59	0.20	0.20	0.16	-0.05	-0.02	-0.09
Sub-Total II	0.53	0.09	0.14	0.20	0.12	0.01	-0.12
III. Changes in assumptions							
A. Demographic							
i) mortality(5)	-0.02	0.03	0.16	0.27	0.38	0.49	1.04
ii) fertility(6)	0.00	0.00	0.00	0.07	0.25	0.71	1.05
iii) migration(7)	-0.04	-0.11	-0.16	-0.21	-0.17	-0.02	0.01
Sub-Total A	-0.06	-0.08	0.00	0.13	0.46	1.18	2.10
B. Economic	0.18	0.55	0.47	0.48	0.50	0.48	0.48
Sub-Total III	0.12	0.47	0.47	0.61	0.96	1.66	2.58
Total I + II + III	0.51	0.68	0.73	0.82	1.01	1.55	2.25
Eleventh Report rates:	6.14	7.43	8.61	10.91	13.04	13.04	13.75

(1) Age by age basis, 15% and child-rearing drop-out provisions, credit-splitting on marriage or union breakdown.
(2) Population characteristics (update from 1981 Census to 1986 Census).
(3) Actual participation rates, average earnings and rates of increase in prices and earnings for 1986, 1987 and 1988.
(4) The effect of higher than expected early retirement rates is 0.27%, 0.09%, 0.16% and 0.12% for 1990, 2000, 2010 and 2020, respectively.
(5) Mortality reductions and effect of AIDS.
(6) 1.85/1.80 versus 2.0/2.0 for Canada/Quebec.
(7) 0.4% versus 0.302%.

3. Term of Securities and Quinquennial Review of Contribution Rates

The Canada Pension Plan provides that the Fund (i.e., the portion of the Account in excess of the Operating Balance of estimated expenditures for the ensuing three months) shall be available for the purchase of securities of the provinces. The term to maturity of the securities is 20 years or such lesser term as may be fixed by the Minister of Finance on the recommendation of the Chief Actuary when he deems it necessary to meet any payments that will be required.

Main Table 1B indicates that the Account would continuously increase into the foreseeable future, so that there should be no need to shorten the terms of the securities. However, this would not be the case in the situation to which Main Table 1A applies. In this case, the Account would start decreasing in 1999. Main Table 1A corresponds to the situation where Ministers of Finance would, at least until 2011, recommend no change, or would not reach an agreement for a change, in the Schedule of contribution rates. Although this scenario is not impossible, it is more likely that an agreement would be reached before the period (about 2010 to 2020) during which the Fund, as illustrated in Main Table 1A, would be almost exhausted.

If the Ministers of Finance do not recommend a change, or do not reach an agreement for a change, before 1992, the Schedule would then automatically be extended for the period 2012 to 2016 as shown in Main Table 1A; that is, the combined employer and employee contribution rates, shared equally by the employer and the employee, would be subject to a 0.57 per cent constant annual increase for that period (0.285 per cent for the employer and 0.285 per cent for the employee). The self-employed persons pay the combined rate and would be subject to the full 0.57 per cent increase.

If the projected financial situation underlying Main Table 1A still prevails at the time of the next actuarial report, it will then be necessary to consider the shortening of the term of securities in accordance with the conditions prevailing at that time.

4. Sensitivity Tests

Divergence of future experience from the assumptions underlying the Main Tables would produce different results. Examples of such different results are shown in Auxiliary Tables 1, 2, 3 and 4. Because the contribution rates are nearly independent of the absolute level of inflation, provided the differential between increases in earnings and in the Consumer Price Index (a measure of the real rate of increase in earnings) remains constant, we did not include Auxiliary Tables that are based on different assumptions as to the absolute rate of inflation.

It can be seen in section 2 above that the pay-as-you-go rate for 2050 is increased by:

(a) 0.71 per cent if the ultimate fertility rate is reduced from 2.0, for both Canada and Quebec, to 1.85 for Canada and 1.80 for Quebec, and by

(b) 0.48 per cent if the ultimate differential between the rates of increase in earnings and prices is reduced from 1.5 per cent to 1.3 per cent.

It can be seen from a comparison between Main Table 1B and Auxiliary Table 2 that a further decrease in the ultimate fertility rate to 1.75 for Canada and 1.70 for Quebec, in combination with a further decrease in the differential between the rates of increase in earnings and prices to 1 per cent, entails a further increase of 1.12 per cent in the pay-as-you-go rate for 2050.

Comparing Auxiliary Table 4 with Auxiliary Table 2 shows that a further decrease in the ultimate fertility rates to their 1987 levels (1.656 for Canada and 1.424 for Quebec) would entail a further increase of 0.28 per cent in the pay-as-you-go rate for 2050.

While the rates of decrease in future mortality are not expected to fall below the rates assumed for the Main Tables of Projections, a comparison between Main Table 1B and Auxiliary Table 3 indicates that the pay-as-you-go rate for 2050 would be decreased by 0.63 per cent if these assumed rates of decrease were cut in half.

It is possible that two or more adverse factors could operate together to increase costs. On the other hand, the opposite is also possible. Most likely, there may be some offsetting factors. For example, a continuing low birth rate may be offset by relatively higher immigration.

Auxiliary Table 4 was included in an attempt to show what might be considered a least favourable scenario. Although the scenario underlying Auxiliary Table 4 is believed to be less probable than the one underlying Auxiliary Table 2 (The Present View of the Future), it illustrates that under unfavourable conditions, the combined employer-employee contribution rate could reach 14.38 per cent in year 2050. This compares with a combined employer-employee contribution rate in 2050 of 13.23 per cent in the situation illustrated by Main Table 1A and a combined contribution rate of 13.11 per cent in the situation illustrated by Main Table 1B. In the scenario to which Auxiliary Table 2 applies, the combined contribution rate in 2050 would be 14.13 per cent.

It can be easily observed from the Main and Auxiliary Tables that pay-as-you-go rates invariably increase over the years. Indeed, from the level of 5.41 per cent experienced in 1988, they reach in all cases levels not less than 12.41 per cent (shown in Auxiliary Table 3) for 2050. These increases in costs are due mainly to the

maturation of the plan (lasting until about year 2010 when all persons then over age 65 would potentially be eligible to full retirement benefits), the sustained low levels of assumed fertility rates and the assumed decreases in future mortality. Higher differentials between increases in earnings and prices could partially offset these anticipated increases. For example, if the differential in the ultimate period were 2 per cent instead of 1.3 per cent, there would be a reduction in the pay-as-you-go rates but it would be less than that produced by a 50 per cent cut in the rate of decrease in future mortality.

As mentioned earlier, the financial projections in this report are based on assumptions that include a provision for the likely effect of the Goods and Services Tax expected to be introduced on January 1, 1991 at 9 per cent to replace the current federal sales tax. The Standing Committee on Finance recently recommended certain changes to the government's proposed Goods and Services Tax, including a reduction in the rate of the tax from 9 per cent to 7 per cent. We decided, therefore, to make some additional sensitivity studies to see the effect of a Goods and Services Tax at 9 per cent and 7 per cent as compared to the situation where the current federal sales tax is retained and no Goods and Services Tax is introduced.

The effect of a Goods and Services Tax, replacing the current federal sales tax, on the pay-as-you-go rates and on the contribution rates is very small in the early years and, as expected, disappears in the long term.

Type of rates	Year	9% GST Main Table 1B %	7% GST %	No GST (current federal sales tax retained) %
Pay-as-you-go rates	1993	6.97	6.90	6.84
	2000	7.43	7.44	7.49
	2020	10.91	10.91	10.93
	2050	13.04	13.04	13.04
Contribution rates*	1993	5.04	5.02	5.02
	2000	6.58	6.57	6.53
	2020	11.13	11.13	11.13
	2050	13.11	13.11	13.10

* Rates in the Schedule to 1991 and those produced by the 15-year formula after 1991.

5. Actuarial Opinion

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

(a) the assumptions which have been used are adequate and appropriate; and

(b) the methods employed are consistent with sound actuarial principles.

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

Respectfully submitted,

G. W. Poznanski, F.S.A., F.C.I.A.
Chief Actuary

Ottawa, Canada

December 8, 1989

APPENDIX A

MAIN PROVISIONS OF THE CANADA PENSION PLAN

1. COVERAGE AND CONTRIBUTIONS

The Canada Pension Plan, which came into force on January 1, 1966, includes as contributors virtually all paid members of the labour force in Canada (both employees and self-employed persons) between the ages of 18 and 70, other than persons in the province of Quebec who are covered by the Quebec Pension Plan. However, the Canada Pension Plan covers all members of the Canadian Forces and the Royal Canadian Mounted Police, including those residing in the province of Quebec. The main exceptions are:

(a) persons with earnings less than the "Year's Basic Exemption",
(b) persons to whom a retirement or disability pension is payable pursuant to the Act, and
(c) members of certain religious groups.

For those who are eligible, contributions in any year are required in respect of contributory earnings; i.e., all earnings between the "Year's Basic Exemption" and the "Year's Maximum Pensionable Earnings".

From the inception of the Plan until 1986, the rate of contribution as respects these contributory earnings has been 1.8% for employees (and a like amount for their employers) and 3.6% in respect of self-employed earnings.

This combined employer-employee contribution rate of 3.6% is subject to an annual increase of 0.2% from 1987 to 1991, and of 0.15% from 1992 to 2011. However, the rates beyond 1991 will depend on the conclusions of the quinquennial federal-provincial reviews by the Ministers of Finance. The first of these reviews is scheduled to take place prior to 1992 and, if possible, to be completed early enough to permit the Minister of Finance to make appropriate recommendations before January 1, 1991.

At the conclusion of each quinquennial federal-provincial review, the rates for the last 20 years in the Schedule (see Main Table 1A) must be confirmed or revised and the Schedule extended by five years. In addition to the Schedule, a formula (the 15-year formula described below) prescribed by regulation would come into operation in the absence of agreement or recommendation at subsequent quinquennial federal-provincial reviews. The formula is designed to extend the schedule for five years by means of the smallest constant annual increase, expressed as a multiple of 0.01% of contributory earnings, such that if an increase of that size were in effect for a total of 15 years, the Account at the end of 15 years would be at least equal to twice the expenditure in the following year.

2. ACCOUNT, INVESTMENT FUND AND OPERATING BALANCE

Charges and credits with respect to the plan are made to the Canada Pension Plan Account in the Consolidated Revenue Fund.

At the end of each quarter, the excess of the balance to the credit of the Account over the Operating Balance (the estimated amount required in the ensuing three months to pay benefits and administration costs) constitutes an increase in the Investment Fund and is available for loans to the provinces in proportion to contributions made by the residents of the respective provinces. Any part of this excess not borrowed by the provinces is invested in federal securities.

The securities are non-negotiable obligations payable to the Canada Pension Plan Investment Fund. The term to maturity is 20 years, unless the Minister of Finance, on the recommendation of the Chief Actuary of the Office of the Superintendent of Financial Institutions, deems it appropriate to fix a lesser period to meet the projected payments. The interest applicable to the securities is payable semi-annually and is based on the average yield to maturity on all outstanding Government of Canada bonds maturing in 20 years or more.

3. DEFINITION OF TERMS RELATING TO EARNINGS

Six terms relating to the earnings of contributors that are used in this report are defined and described below.

Year's Maximum Pensionable Earnings

Year's Maximum Pensionable Earnings (YMPE) for any calendar year means the upper limit above which that year's earnings are not subject to contributions and do not affect benefits. The YMPE for a particular calendar year is prorated in individual cases to allow for the portion of the year before age 18 or after age 70, death, retirement or disablement.

For 1966 and 1967, the YMPE was $5,000. Beginning in 1968 it was adjusted upward in steps of integral hundreds of dollars in accordance with increases in the "Pension Index", reaching $5,600 in 1973. It was fixed at $6,600 for 1974 and $7,400 for 1975. For each year from 1976 to 1985, it was determined as being equal to 112.5% of the YMPE for the preceding year. For 1986 (and similarly for 1987), the YMPE was set equal to

$$\text{YMPE} = 52 \times J_{1985} \times \frac{J_{1983} + J_{1984} + J_{1985}}{D_{1981} + D_{1982} + D_{1983}}$$

where J and D are the average of the Industrial Composite (Statistics Canada: average weekly wages and salaries) for the 12-month period ending June 30 and December 31, respectively, in the given year. For 1988 and after, the YMPE increases in accordance with the ratio of the average of the Industrial Aggregate (the new measure of average wages and salaries adopted by Statistics Canada) during the 12-month period ending June 30 of the preceding year over the average during the corresponding period one year earlier. If the amount calculated by formula is not a multiple of $100, the next lower multiple of $100 is used. However, the YMPE is not allowed to decrease from one year to the next.

Year's Basic Exemption

Year's Basic Exemption (YBE) for any calendar year means the lower limit below which that year's earnings are not subject to contributions. It was calculated as 12% of the YMPE for each year from 1966 to 1974 inclusive and 10% thereafter (rounded if necessary to the next lower multiple of $100) and is subject to adjustment in individual cases similar to the YMPE.

Contributory Earnings

Contributory Earnings for any calendar year means the earnings of a contributor on which contributions are payable; that is, earnings between the YBE and the YMPE for that year.

Contributory Period

Contributory Period corresponds to the number of months from attainment of age 18 or from January 1, 1966, if later, to the earliest of

(a) the month in which the contributor dies;

(b) the month preceding the month in which the retirement pension commences; and

(c) the month preceding the month in which the contributor reaches 70 years of age,

less the number of months during which the contributor was disabled, or during which the contributor had at least one child under the age of 7 years and had earnings less than one-twelfth of the YBE.

Unadjusted Pensionable Earnings

Unadjusted Pensionable Earnings for any calendar month means all earnings of a contributor in the calendar month up to one-twelfth of the YMPE applicable to the corresponding calendar year, provided that required contributions have been made for that month. The unadjusted pensionable earnings are zero for any month during which contributions are not required or not made. Earnings in a month in excess of one twelfth of the YMPE are applied to the extent required to maximize the unadjusted pensionable earnings in other months in the same calendar year.

Unadjusted Pensionable Earnings are split equally between two married or common law spouses in respect of their cohabitation period in the event of divorce or separation occurring after 1977. In case of divorce, splitting is automatic provided the Minister receives the prescribed information; in case of separation for at least one year or until the death of one of the former spouses during this year, splitting is mandatory, upon valid application by one spouse, provided the former spouses did cohabit for at least one year.

Pensionable Earnings

Pensionable Earnings for a given month means Unadjusted Pensionable Earnings of that month multiplied by the ratio that the average of the YMPE for the year when a retirement pension or other earnings-related benefit becomes payable under the Act, and of the YMPE for the two preceding years bears to the YMPE for the year to which the given month belongs.

4. AUTOMATIC ADJUSTMENT FEATURES

Several elements of the Plan are subject to automatic adjustment in accordance with changes in specified indices. These elements include:

(a) the YMPE and, dependent thereon, Pensionable Earnings (upon which all earnings-related benefits going into payment are based), the limit on the amount of death benefit, and the YBE,

(b) all monthly benefits payable.

Annual adjustments of all elements subject to automatic adjustment depend, with two exceptions, on changes in the Pension Index constructed as described in the next paragraph. First, annual adjustments of the contributory earnings limits (YMPE and YBE) after 1973 and of unadjusted pensionable earnings to obtain pensionable earnings are as described above. Second, the monthly amount of any earnings-related benefit that emerged prior to 1974 equals the initial monthly amount multiplied by the Pension Index for the year of payment and divided by the average of the Consumer Price Indices (CPI) for the 12-month period ending with June of the year preceding the year of emergence.

For 1967, the Pension Index was computed as the average of the CPIs for Canada for the 12-month period ending with June 1966. For each year from 1968 through 1973, it was computed as the average of the CPIs for the 12-month period ending with June of the preceding year, or 1.02 times the Pension Index for the preceding year, whichever was the lesser. (In practice, the latter formula was always applicable). The Pension Index for 1974 equalled the average of the CPIs for the 12-month period ending with June 1972, multiplied by the average of the CPIs for the 16-month period ending with October 1973, and divided by the corresponding average for the 16 months ending with June 1972. The Pension Index for 1975 and later years equals the average of the CPIs for the 12-month period ending with October of the preceding year in each case, except that the Pension Index for the preceding year is retained if a reduction in its value would otherwise occur.

5. RETIREMENT PENSION

A contributor aged 60 or over becomes entitled to a retirement pension upon application. Disability pensions payable to contributors before they attain age 65 are automatically replaced by retirement pensions at age 65. After a retirement pension becomes payable or, in any event after age 70, a contributor is not eligible to contribute under the Plan. Thus, except for annual adjustments of the amount of pension in payment in accordance with changes in the Pension Index, the amount of pension is fixed at the time the pension first becomes payable.

The initial amount of retirement pension payable to a contributor is based on the whole history of his or her pensionable earnings from January 1, 1966, or from attainment of age 18, if later, until the month preceding the one in respect of which the first pension payment is due.

The initial amount of annual retirement pension is equal to 25% of the average YMPE for the three years ending with the year in which the pension commences, multiplied by the Average Earnings Ratio which is the average of a number of the highest Monthly Earnings Ratios. These numbers are determined as follows:

For pensions commencing	Number of highest Monthly Earnings Ratios used in calculating the Average Earnings Ratio
before 1976	120 less the number of months of disability;
after 1975	the number of months in the contributory period less (i) the number of months during which the contributor had at least one child less than 7 years of age and had earnings greater than one-twelfth of the YBE which, if dropped out, would increase his or her "average earnings ratio", provided the remaining number of months is not thereby reduced to less than 120 months minus the months of disability, less (ii) the number of months, if any, between age 65 of the contributor and the commencement of the retirement pension, if later, provided the remaining number of months is not thereby reduced to less than 120 months minus the months of disability, less (iii) 15% of the number of months remaining in the contributory period, provided the remaining number of months is not thereby reduced to less than 120 months.

For any calendar month, the Monthly Earnings Ratio is the ratio of Unadjusted Pensionable Earnings to one-twelfth of the YMPE for that calendar year. If no contributions are made during a calendar year, each Monthly Earnings Ratio for that year is zero; for any year in which a contributor's earnings exceed the YMPE each ratio is one.

In other words, this formula works in such a way that, in addition to the whole period during which a disability pension is payable, a certain number of months associated with the lowest recorded "monthly earnings ratios" will normally be excluded in the benefit calculations by reason of pensions commencing after age 65 and by reason of the 15% and the child-rearing drop-out provisions.

The resulting amount of pension is subject to an actuarial adjustment that depends on the contributor's age at commencement of the pension. The initial rate of pension is decreased or increased, depending on whether the pension begins before or after age 65, by 0.5% for each month between age 65 and the age when the pension commences. An applicant for a retirement pension payable before age 65 must provide proof that he or she has ceased to be wholly or substantially engaged in paid employment or self-employment.

6. DISABILITY PENSION

A person is considered disabled if he or she is determined in a prescribed manner to be suffering from a severe and prolonged mental or physical disability. A disability is considered severe if by reason of it the person is incapable of pursuing regularly any substantially gainful occupation; a disability is considered prolonged if it is likely to be long continuing and of indefinite duration or likely to result in death.

A contributor who becomes disabled while aged less than 65 and while not receiving a CPP retirement pension is entitled to a disability pension, provided that contributions have been made for at least either

(i) 5 of the last 10 calendar years, or
(ii) 2 of the last 3 calendar years,

irrespective of whether any of these years are included wholly or partly in the contributory period.

Disability pensions commence with the fourth month following the month of disablement and are payable until age 65 or until death or recovery from disability at an earlier age.

The amount of pension payable is composed of two parts: a flat-rate part depending only on the year in which the disability pension is payable and an earnings-related part depending initially only on the pensionable earnings record of the contributor as of the date of commencement of the disability pension. The initial flat-rate part is $264.04 for pensions payable in 1989. The initial earnings-related part is equal to 75% of a pension calculated in the manner described earlier for retirement pensions, except that no actuarial adjustment applies and that the number of months to be taken into account in determining the Average Earnings Ratio is subject to a minimum of 24 (instead of 120) less months of disability, in respect of the months of child-rearing.

7. DISABLED CONTRIBUTOR'S CHILD'S BENEFIT

A child of a contributor who is entitled to a disability pension is entitled to a benefit provided the child

(i) is under age 18, or

(ii) is aged 18 or over but under 25 and has been attending school full-time and substantially without interruption since attaining age 18 or the time of the contributor's disability, whichever occurred later.

The amount of the monthly pension payable in respect of each child is $103.02 for 1989. Two child's benefits are payable in respect of each child if both parents are entitled to a disability pension; furthermore, a child may simultaneously receive a disabled contributor's child's benefit and an orphan's benefit (see 8(c) below).

8. SURVIVOR'S PENSION AND ORPHAN'S BENEFIT

(a) General

A surviving spouse and an orphan may become entitled to a "survivor's pension" and an "orphan's benefit", respectively. For entitlement to such a pension, the deceased contributor must have made contributions during the lesser of

(i) 10 calendar years, or

(ii) one-third of the number of years included wholly or partly in his or her contributory period, but not less than three years.

A surviving spouse may become entitled to a survivor's pension by reason of having dependent children, being disabled or simply being over age 35 at the date of the contributor's death. The amount of pension payable to a surviving spouse who becomes entitled to a survivor's pension for more than one reason is the largest to which the survivor is entitled for any one of these reasons.

(b) Survivor's Pension

(i) Definition of Surviving spouse with dependent children

A surviving spouse with dependent children means a widow or widower who wholly or substantially maintains a child of the deceased contributor where the child is

A. under age 18,

B. aged 18 or over but under age 25 and has been attending school full-time and substantially without interruption since attaining age 18 or the time of the contributor's death, whichever occurred later, or

C. aged 18 or over and disabled, having been disabled without interruption since attaining age 18 or the time of the contributor's death, whichever occurred later.

(ii) Surviving spouse aged between 45 and 65 at date of contributor's death

A spouse who becomes widowed while aged between 45 and 65 is entitled to a survivor's pension.

The amount of pension payable until the surviving spouse attains age 65 is composed of two parts: a flat-rate part depending only on the year in which the survivor's pension is payable and an earnings-related part depending initially only on the pensionable earnings record of the contributor to the date of his or her death. The initial flat-rate part is $103.02 per month for 1989. The initial earnings-related part is equal to 37.5% of an earnings-related pension based on the contributor's pensionable earnings record. This is calculated as at the date of the contributor's death or commencement of his or her pension, whichever is earlier, except that in the latter case the calculated pension is adjusted in accordance with the increase in the Pension Index from the year in which the contributor's retirement pension became payable to the year of his or her death.

The amount of the contributor's earnings-related pension is calculated in the manner described earlier for retirement pensions (see 5 above) except that no actuarial adjustment applies and that the number of months to be taken into account in determining the Average Earnings Ratio is subject to a minimum of 36 (instead of 120) minus the months of disability, in respect of the months of child-rearing.

(iii) Surviving spouse aged less than 45 at date of contributor's death without dependent children and not disabled

A spouse without dependent children and not disabled who becomes widowed while aged less than 35 years is not entitled to a survivor's pension.

A surviving spouse without dependent children and not disabled who becomes widowed while aged 35 years or more, but less than 45, is entitled to an amount of pension, calculated as described in (ii) above, reduced by 1/120th of such amount for each month that the surviving spouse's age at the beginning of widowhood or widowerhood is less than 45.

(iv) Surviving spouse aged less than 45 at date of contributor's death with dependent children

A spouse with dependent children who becomes widowed while aged less than 45 is entitled to a survivor's pension calculated as described in (ii) above. If a surviving spouse in receipt of a survivor's pension ceases to be a "surviving spouse with dependent children" before attaining age 45 and is not disabled at that time, the amount of the survivor's pension is discontinued or reduced in the manner described in (iii) above in accordance with the surviving spouse's age at the time she or he ceased to be a "surviving spouse with dependent children".

(v) Disabled surviving spouses aged less than 65

A surviving spouse aged less than 65 years is entitled to a survivor's pension if she or he either is disabled at the date of death of the contributor or becomes disabled at a later date.

The disabled surviving spouse's pension is payable from the month following the month in which the contributor dies or from the month following the month in which the surviving spouse becomes disabled, whichever is later. If the disabled surviving spouse recovers from disability before age 45, the amount of the survivor's pension is discontinued or reduced in the manner described in (iii) above in accordance with the surviving spouse's age at the time of recovery.

The initial amount of pension is calculated as described in (ii) above, except that, in the case where the surviving spouse becomes disabled subsequent to the death of the contributor, the pension so calculated is adjusted in accordance with changes in the Pension Index from the year in which the contributor died to the year in which disability occurs.

(vi) Surviving spouses aged 65 or over

At age 65, or upon widowhood or widowerhood at a later age, a surviving spouse is entitled to a pension equal to 60% of an earnings-related pension based on the pensionable earnings record of the deceased spouse. This earnings-related pension is calculated as described in (ii) above and is adjusted, where applicable, in accordance with changes in the Pension Index from the year in which the contributor died to the year in which the surviving spouse attains age 65 or the year in which a retirement pension becomes payable to her or him while in receipt of a survivor's pension.

(c) Orphan's Benefit

The provisions for orphans are analogous to those described earlier for children of disabled contributors. For purposes of the orphan's benefit, an orphan means a child of a deceased contributor, where the child is

(i) under age 18, or

(ii) aged 18 or over but under age 25 and has been attending school full-time and substantially without interruption since attaining age 18 or the time of the contributor's death, whichever occurred later.

The amount of the monthly pension payable in respect of each orphan is $103.02 for 1989. Two orphan's benefits are payable in respect of each child if both deceased parents were contributors; furthermore, a child may simultaneously receive both an orphan's benefit and a disabled contributor's child's benefit.

9. DUAL PENSIONS

Benefits payable to persons who become entitled to both a survivor pension and either a disability or a retirement pensions are subject to a limit.

(a) Survivor pension combined with a disability pension

(i) the flat-rate portion of the combined pension is equal to the flat-rate portion of the disability pension;

(ii) the earnings-related portion of the combined pension is equal to the sum of the earnings-related portion of the survivor and the disability annual pensions but cannot initially exceed an amount equal to 25% of the average of the YMPE for the three years ending with the year in which the later of the two pensions commences (that is, an amount equal to the maximum retirement pension applicable for that year).

(b) Survivor pension combined with a retirement pension

(i) the flat-rate portion of the combined pension is equal to the flat-rate portion of the survivor pension;

(ii) the earnings-related portion of the combined pension is equal to the sum of the earnings-related portion of the survivor pension and of the survivor's actuarially adjusted retirement pension; however, the sum of the earnings-related portion of the survivor pension and of the survivor's retirement pension before application of the actuarial adjustment cannot initially exceed the maximum retirement pension applicable for the year in which the later of the two pensions commences; in such case, the earnings-related portion of the survivor pension is reduced accordingly.

10. DEATH BENEFIT

A lump-sum benefit is payable to the estate of a deceased contributor who made contributions in at least the minimum number of calendar years required for entitlement to a survivor's pension.

The amount of benefit is equal to

(a) in respect of a contributor to whom a retirement pension was payable at the time of death, one-half of the annual amount of pension payable in the year of death, adjusted to exclude

  (i) any actuarial adjustment applicable by reason of commencement of pension at an age other than 65, and/or

  (ii) any reduction that may have arisen by reason of commencement of pension within the 10-year transitional period ending December 31, 1975, or

(b) in respect of any other contributor, one-half of the annual amount of an earnings-related pension calculated, exclusive of the actuarial adjustment, in the manner described for retirement pensions,

subject to the limitation that the amount of benefit cannot exceed 10% of the YMPE applicable in the year of the contributor's death.

11. SPLITTING OF RETIREMENT PENSIONS

If one of the spouses requests it, retirement pensions earned during cohabitation may be divided, in respect of the proportionate number of years during which the spouses cohabited, during the joint lifetime of the spouses. This applies provided both spouses are at least 60 years old and have ceased contributing. On the death of the first spouse, or in the event of divorce or separation, any pension splitting previously applied is reversed.

12. AMENDMENTS

Any major amendment providing for changes in benefits or contributions cannot become effective until the first day of the third year following the year in which notice of intention to introduce such a measure was laid before Parliament. An amendment requires the consent of at least two-thirds of the provinces having in aggregate at least two-thirds of the population of Canada, excluding the Yukon and the Northwest Territories.

APPENDIX B

ASSUMPTIONS AND PROCEDURES

INDEX

		Page
1.	General	36
2.	Economic Assumptions: Interest, Prices, Earnings	36
3.	Population Projections	38
	(a) General	38
	(b) Fertility	39
	(c) Mortality	40
	(d) Migration	43
	(e) Population Tables	44
4.	Participation Rates and Average Pensionable Earnings	49
5.	Contributions and Expenses of Administration	56
6.	Retirement Pension	57
7.	Disability Pension	61
8.	Disabled Contributor's Child's Benefit	65
9.	Surviving Spouse's Pension	67
10.	Orphan's Benefit	70
11.	Death Benefit	70
12.	Account Projections	71
13.	Entry-Age Normal Actuarial Cost and Related Unfunded Actuarial Liability	72

APPENDIX B

ASSUMPTIONS AND PROCEDURES

1. GENERAL

In accordance with the practice first adopted for the Third Statutory Actuarial Report as of December 31, 1973, the Main Tables are based on one set of what we regard as reasonably realistic demographic assumptions and long-term relationships between the various economic factors.

As in preceding reports, certain auxiliary Account projections are presented (Section IV) to allow an appreciation of the sensitivity of the projections to certain variations in key assumptions.

2. ECONOMIC ASSUMPTIONS

The new economic assumptions used for the Main Tables differ somewhat from those used for purposes of the Tenth Report. For the years 1989 to 1994, they are based on the assumptions of the April 1989 budget, modified to reflect recent developments, and were linked to the ultimate assumptions over the following two to four years.

The most significant feature of the ultimate level of the economic assumptions adopted for the Main Tables of this Report is that the differential between increases in earnings (4.8%) and increases in prices (3.5%) has been reduced from 1.5% used in the Tenth Report to 1.3%.

The assumed absolute level of inflation is of relatively slight practical significance in determining the level of costs expressed as a percentage of contributory earnings, as long as the real increases in earnings remain unchanged.

We decided to maintain the assumed ultimate annual rate of interest on new investments at 6%. This assumption, coupled with an assumption of 3.5% for increases in the Consumer Price Index, implies an assumed real rate of investment earnings of 2.415%. For a fund invested entirely at rates reflecting long-term Government of Canada bond rates, this real rate is deemed to be close to the rate that might be expected to be earned over long periods on the basis of past experience. In any event, it must be recognized that although rates of interest may have a significant effect on the ratio of the Account to expenditures, they do not have a significant effect on contribution rates, unless a relatively high degree of funding is contemplated.

By contrast, the assumed rate of interest is highly significant in calculating the contribution rate on an actuarially funded basis and the related unfunded actuarial liability (see Appendix C). However, since the primary purpose of such calculation is to compare the cost of CPP benefits with costs of private pension plans, an assumed real rate of investment earnings closer to 3% is probably more appropriate for this purpose.

The three key economic assumptions used for the Main Tables are as follows:

Year	Annual increase in CPI (%)	Annual increase in average earnings (%)	Annual rate of interest on new bonds (%)
1983*	5.8	7.4	11.6
1984*	4.4	4.3	13.3
1985*	4.0	3.5	11.6
1986*	4.1	2.8	9.8
1987*	4.4	2.7	9.7
1988*	4.1	4.8	10.0
1989	4.8	4.4	10.9
1990	4.4	3.3	10.2
1991	5.7	3.2	9.4
1992	3.0	3.0	8.5
1993	2.7	3.0	7.9
1994	2.5	3.0	7.3
1995	3.0	4.0	6.8
1996	3.5	4.8	6.4
1997	3.5	4.8	6.1
1998 and after	3.5	4.8	6.0

The effect of the proposed Goods and Services Tax (assumed at 9%) was taken into account by an additional increase (included above) of 2.3% in the assumed CPI for 1991 and by additional increases (included above), in the assumed earnings for 1992 to 1995, which would cumulatively offset most of the 2.3% additional increase in CPI for 1991.

* Rates for these years are actual experience rates.

3. POPULATION PROJECTION

(a) General

The populations required for the Canada Pension Plan pertain to Canada excluding Quebec, but including all members of the Canadian Forces and the Royal Canadian Mounted Police. The population projections used for purposes of the financial estimates were obtained by simple subtraction of the projected populations for Quebec from the projected populations for Canada. Consequently, the projected populations do not make allowance for members of the Canadian Forces and Royal Canadian Mounted Police that reside in Quebec. However, provision for this group was made implicitly in developing the participation rates described in Section 4 of this appendix.

Populations were projected from the 1986 census, after first applying adjustment factors to compensate for the 1986 census undercount. The projections carry forward to 2100, providing a period of 112 years from the effective date of this examination.

Detailed figures for selected years by sex and age group are given in Schedules 5, 6A, 6B and 7 of this appendix following the description of the underlying fertility, mortality and migration assumptions. Schedule 1 below summarizes these figures (all ages combined) in addition to demographic statistics in respect of selected past years.

Schedule 1(*)

Middle of Year	Census and Projected Populations (in thousands) Male	Female	Total	Population Aged 65 and over as a percentage of Population Aged 20 to 64
1961	6,587	6,392	12,979	16.4
1971	7,801	7,740	15,541	16.4
1981	9,104	9,155	18,259	17.1
1986(**)	9,667	9,781	19,448	17.8
2000	11,253	11,486	22,739	20.8
2025	13,566	13,979	27,545	33.8
2050	14,916	15,558	30,474	39.5
2100	17,815	18,489	36,304	43.0

(*) All figures shown are for Canada excluding Quebec.
(**) 1986 starting population adjusted for undercount of 1986 census.

(b) Fertility

The age-fertility rate corresponds to the number of live births per female at a given age of the female. 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 Schedule 2 below). The ultimate total fertility rate of 2.0 used for the preceding report was reduced to 1.85 for Canada and 1.80 for Quebec. However, we have retained 2010 as the year from which these ultimate rates are assumed to apply. For the years from 1988 to 2009 the rates were obtained by linear interpolation between the actual 1987 values of 1.656 for Canada and 1.424 for Quebec and the assumed values of 1.85 for Canada and 1.80 for Quebec for 2010. For purposes of distributing the ultimate total fertility rate into age-specific rates, the postulated rates for Canada and for Quebec were distributed in the same proportion as the 1987 experience for Canada and Quebec, respectively.

Schedule 2

Fertility Rates

Canada

Age Group	Recently Experienced Fertility Rates					Fertility rates assumed for 2010 and after
	1970	1975	1980	1985	1987	
15-19	42.8	35.3	27.6	23.7	23.2	25.9
20-24	143.3	112.7	100.1	85.3	81.5	91.0
25-29	147.2	131.2	129.4	125.3	123.0	137.4
30-34	81.8	64.4	69.3	74.6	76.3	85.2
35-39	39.0	21.6	19.4	21.8	23.7	26.5
40-44	11.3	4.8	3.1	3.0	3.4	3.8
45-49	0.9	0.4	0.2	0.1	0.2	0.2
Total	2,331.5	1,852.0	1,745.5	1,669.0	1,656.5	1,850.0

Province of Quebec

Age Group	Recently Experienced Fertility Rates 1970	1975	1980	1985	1987	Fertility rates assumed for 2010 and later
15-19	20.7	19.5	16.1	14.5	15.8	20.0
20-24	113.9	96.4	92.7	73.5	72.3	91.4
25-29	131.0	136.2	137.2	116.7	114.6	144.8
30-34	77.4	69.4	70.6	62.0	62.1	78.4
35-39	39.0	23.4	19.8	17.1	17.3	21.9
40-44	11.8	5.2	3.0	2.2	2.6	3.3
45-49	1.0	0.6	0.2	0.1	0.1	0.2
Total	1,974.0	1,753.5	1,698.0	1,430.5	1,424.0	1,800.0

(c) Mortality

Mortality rates shown in Life Tables, Canada and the Provinces, 1985-1987 (published by Statistics Canada and referred to here in as 1985-87 Canada Life Tables) are assumed to be applicable for 1986. To reflect anticipated sustained improvements in life expectancy, these 1986 mortality rates were projected to the year 2100 using the following annual rates of decrease:

(a) for 1987 to 2010, the annual rates of decrease (varying by age, sex and calendar year) were determined by interpretation between
   (i) the average reduction rates experienced in Canada between 1976 and 1986, and
   (ii) the constant rates of decrease, described in b) below, in respect of the period 2011 to 2100;

(b) 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 (Social Security Area Population Projection) prepared by the Office of the Actuary of the U.S. Social Security Administration. These rates of decrease were determined by analyzing the current trends in mortality decrease separately for each of 10 broad causes of death.

To account for AIDS, ignored in all the phases of the above projections, male mortality for both Canada and Quebec was increased for the years 1989 to 2018 by the increments estimated by the Canadian Institute of Actuaries' Task Force on AIDS in its November 1988 Report of the Subcommittee on Modeling. 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. 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 per cent of the above increments for males.

The resulting ultimate tables (assumed applicable to the year 2100) produce an expectation of life at birth of 80.3 for males and 86.9 for females (Quebec: 79.3 and 86.5), compared to 73.0 and 79.7, respectively, for the 1985-87 Canada Life Tables (Quebec: 72.0 and 79.4). At age 65 the expectation of life according to the ultimate table is 19.3 for males and 24.5 for females (Quebec: 18.6 and 24.1), compared to 14.9 and 19.1, (Quebec: 14.1 and 18.7) respectively, for the 1985-87 Canada Life Tables. Schedule 3 sets out sample values of the ultimate mortality rates as well as the values of mortality rates on the basis of the 1940-42 and 1985-87 Canada Life Tables and the rates assumed for 1986 in the Tenth Report.

1986: 73.0

2100: 80.3

Schedule 3

Comparison of Mortality Rates for the Province of Quebec and for Canada
(annual deaths per 1,000 persons)

Age	1940-42 Canada Life Tables	1985-87 Canada Life Tables		Rates Assumed for 1986 in Report #10		Rates Assumed for Year 2100		
		Province of Quebec	Canada	Province of Quebec	Canada	Tenth Report both Canada & Quebec	This Report Quebec	This Report Canada
Males								
0	62.50	8.02	8.58	9.40	10.40	5.59	2.10	2.24
1	7.21	0.62	0.67	0.75	0.78	0.53	0.25	0.27
5	1.98	0.27	0.30	0.38	0.38	0.25	0.11	0.12
10	1.22	0.22	0.18	0.24	0.21	0.12	0.10	0.08
20	2.41	1.36	1.30	1.46	1.50	1.17	0.67	0.64
30	2.60	1.39	1.30	1.38	1.30	1.05	0.89	0.83
40	4.28	2.12	1.97	2.30	2.15	1.38	1.02	0.95
50	8.95	5.81	5.32	6.65	6.09	4.17	2.73	2.50
60	20.29	16.59	14.68	17.47	15.77	10.57	8.75	7.75
70	47.59	42.05	36.73	41.74	38.13	27.96	24.28	21.21
80	117.38	94.08	86.65	92.06	87.31	64.61	57.10	52.59
90	250.48	198.73	191.97	188.79	185.77	136.21	118.52	114.49
Females								
0	49.31	6.22	6.78	7.67	8.03	4.29	1.48	1.61
1	6.34	0.58	0.62	0.59	0.63	0.40	0.22	0.24
5	1.57	0.26	0.22	0.28	0.26	0.16	0.09	0.07
10	0.90	0.16	0.14	0.20	0.18	0.10	0.06	0.05
20	1.80	0.37	0.42	0.43	0.46	0.38	0.18	0.20
30	2.60	0.54	0.51	0.55	0.56	0.37	0.28	0.26
40	3.86	1.09	1.12	1.24	1.27	0.76	0.52	0.53
50	7.01	3.21	3.12	3.29	3.28	2.21	1.73	1.68
60	15.28	7.67	7.51	8.12	7.84	5.71	4.32	4.23
70	38.12	19.49	18.67	20.10	19.35	14.08	10.68	10.23
80	101.96	55.09	51.73	54.58	52.04	33.30	28.96	27.19
90	233.91	150.37	144.15	141.05	142.87	92.33	75.74	72.61

The 1985-87 Canada Life Tables for Canada, the corresponding tables for Quebec, and the ultimate mortality tables consist of one-year probabilities of mortality for individual ages 0 to 109. The 1986 census population data for Canada and Quebec, available by individual ages up to 89, were adjusted to spread the age group 90 and over by individual ages to 109. Survivors of the population for a particular year were then obtained simply by applying the probabilities of survival for that year to the given population.

(d) 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 June 1, 1973 to May 31, 1989, for example, annual immigration varied from 83,000 to 214,000, and annual emigration is estimated to have fluctuated between 41,000 and 84,000. Net annual immigration during the most recent 10-year period averaged 76,752.

For purposes of this report we decided to assume 155,000 immigrants and 50,000 emigrants for 1986. Both these figures were increased with time so as to maintain a constant ratio of net immigration to total current Canadian population of 0.400%.

For purposes of projecting the population of Quebec it was assumed that 17% of immigrants and 14% of emigrants would be attributable to that province; Statistics Canada data for the last 10 years showed 17.1% of immigrants and 14.2% of emigrants attributable to Quebec. In addition it was assumed that Quebec would experience net interprovincial emigration of 10,000 in 1986, decreasing uniformly to zero by the year 2010, based on the trends of the 1979 to 1989 experience.

The distributions of immigrants and emigrants by age group and sex used for purposes of the projections in the Tenth Report were based on Statistics Canada data for 1977-1980. The distributions for 1983-1988, used for purposes of this report, indicate average ages somewhat higher for immigrants and somewhat lower for emigrants. These distributions are shown in Schedule 4.

Schedule 4

Distributions of Immigrants and Emigrants by Age Group and Sex

Age Group	Immigrants		Emigrants	
	Males (%)	Females (%)	Males (%)	Females (%)
0- 4	3.334	3.172	3.780	3.597
5- 9	3.547	3.307	4.387	4.299
10-14	3.695	3.450	4.197	3.947
15-19	4.656	4.733	3.638	3.522
20-24	6.580	7.543	4.327	5.501
25-29	7.668	7.414	7.212	7.553
30-34	5.697	5.391	6.687	6.525
35-39	3.572	3.478	6.194	4.985
40-44	2.073	2.053	4.011	3.208
45-49	1.427	1.729	2.190	1.845
50-54	1.257	1.967	1.412	1.212
55-59	1.453	2.142	0.987	0.873
60-64	1.556	1.906	0.595	0.711
65-69	1.042	1.248	0.560	0.710
70+	1.150	1.760	0.516	0.819
Total:	48.707	51.293	50.693	49.307

(e) Population Tables

Schedules 5, 6A and 6B below show, for Canada excluding Quebec, the 1986 starting population (1986 census adjusted for undercount) and the projected mid-year populations for 1990, 2000, 2025, 2050, 2075 and 2100. The populations shown are distributed by sex and broad age groups. Schedule 7 shows corresponding dependency ratios.

Schedule 5

Population in thousands
Canada excluding Quebec
Both Sexes

	Age Group	1986	1990	2000	2025	2050	2075	2100
	0- 4	1416	1504	1469	1604	1730	1860	2006
	5- 9	1353	1425	1544	1626	1734	1863	2014
	10-14	1378	1373	1561	1617	1727	1869	2027
	15-19	1512	1444	1492	1592	1737	1894	2055
Total	0-19	5659	5746	6066	6439	6928	7486	8102
	20-24	1843	1586	1473	1627	1805	1966	2127
	25-29	1804	1925	1577	1732	1900	2048	2204
	30-34	1686	1825	1709	1838	1958	2090	2251
	35-39	1526	1664	2003	1850	1948	2084	2256
	40-44	1190	1480	1857	1746	1888	2056	2241
	45-49	982	1144	1666	1656	1844	2040	2223
	50-54	917	956	1468	1674	1853	2032	2196
	55-59	900	907	1127	1724	1871	2002	2148
	60-64	855	871	928	1926	1811	1922	2070
Total	20-64	11703	12358	13808	15773	16878	18240	19716
	65-69	697	791	833	1683	1618	1768	1945
	70-74	569	594	731	1374	1402	1586	1783
	75-79	394	459	590	1037	1220	1394	1573
	80-84	242	280	374	627	1003	1146	1286
	85-89	121	144	221	353	799	816	935
	90+	63	70	116	259	626	737	964
Total	65-90+	2086	2338	2865	5333	6668	7447	8486
Grand Total		19448	20442	22739	27545	30474	33173	36304

Schedule 6A

Population in thousands
Canada excluding Quebec
Males

	Age Group	1986	1990	2000	2025	2050	2075	2100
	0- 4	723	772	751	823	889	956	1031
	5- 9	693	728	790	836	892	958	1035
	10-14	707	704	801	833	889	961	1042
	15-19	778	741	762	820	892	973	1056
Total	0-19	2901	2945	3104	3312	3562	3848	4164
	20-24	941	812	751	831	922	1005	1088
	25-29	907	977	802	879	967	1044	1124
	30-34	844	916	870	933	998	1066	1148
	35-39	770	832	1012	939	992	1061	1148
	40-44	605	746	926	880	959	1043	1137
	45-49	496	579	827	833	931	1030	1124
	50-54	465	480	732	838	928	1021	1105
	55-59	448	454	559	857	929	999	1073
	60-64	405	423	452	942	890	949	1023
Total	20-64	5881	6219	6931	7932	8516	9218	9970
	65-69	319	363	400	798	777	858	945
	70-74	253	261	333	628	653	745	842
	75-79	165	191	244	452	539	622	710
	80-84	92	106	139	251	409	473	542
	85-89	39	48	72	123	287	301	355
	90+	17	18	30	70	173	212	287
Total	65-90+	885	987	1218	2322	2838	3211	3681
Grand Total		9667	10151	11253	13566	14916	16277	17815

Schedule 6B

Population in thousands
Canada excluding Quebec
Females

	Age Group	1986	1990	2000	2025	2050	2075	2100
	0- 4	693	732	718	781	841	904	975
	5- 9	660	697	754	790	842	905	979
	10-14	671	669	760	784	838	908	985
	15-19	734	703	730	772	845	921	999
Total	0-19	2758	2801	2962	3127	3366	3638	3938
	20-24	902	774	722	796	883	961	1039
	25-29	897	948	775	853	933	1004	1080
	30-34	842	909	839	905	960	1024	1103
	35-39	756	832	991	911	956	1023	1108
	40-44	585	734	931	866	929	1013	1104
	45-49	486	565	839	823	913	1010	1099
	50-54	452	476	736	836	925	1011	1091
	55-59	452	453	568	867	942	1003	1075
	60-64	450	448	476	984	921	973	1047
Total	20-64	5822	6139	6877	7841	8362	9022	9746
	65-69	378	428	433	885	841	910	1000
	70-74	316	333	398	746	749	841	941
	75-79	229	268	346	585	681	772	863
	80-84	150	174	235	376	594	673	744
	85-89	82	96	149	230	512	515	580
	90+	46	52	86	189	453	525	677
Total	65-90+	1201	1351	1647	3011	3830	4236	4805
Grand Total		9781	10291	11486	13979	15558	16896	18489

Schedule 7

Dependency Ratios (%)
Canada excluding Quebec

Year	Both Sexes		
	Young1	Old2	Total3
1986	48.4	17.8	66.2
1990	46.5	18.9	65.4
2000	43.9	20.8	64.7
2025	40.8	33.8	74.6
2050	41.0	39.5	80.6
2075	41.0	40.8	81.9
2100	41.1	43.0	84.1

Year	Males		
	Young1	Old2	Total3
1986	49.3	15.1	64.4
1990	47.4	15.9	63.2
2000	44.8	17.6	62.4
2025	41.7	29.3	71.0
2050	41.8	33.3	75.1
2075	41.7	34.8	76.6
2100	41.8	36.9	78.7

Year	Females		
	Young1	Old2	Total3
1986	47.4	20.6	68.0
1990	45.7	22.0	67.7
2000	43.1	24.0	67.0
2025	39.9	38.4	78.3
2050	40.3	45.8	86.1
2075	40.3	46.9	87.3
2100	40.4	49.3	89.7

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.

4. PARTICIPATION RATES AND AVERAGE PENSIONABLE EARNINGS

(a) For each of the years 1982-1986, inclusive, the Department of Supply and Services provided a cumulative distribution of contributors and of earnings (for each of 11 age groups subdivided by sex) over 79 earnings ranges, expressed as percentages of the average earnings by age and by sex. The averages of the five years of experience were calculated for each subdivision separately, and it was assumed that these would represent cumulative distributions of contributors (C-distribution) and of earnings (E-distribution) applicable to that cell indefinitely in the future. To illustrate: the data might indicate that 60% of contributors for a particular subdivision earn less than 120% of average earnings for the subdivision (C-distribution) and account for 40% of total earnings for the subdivision (E-distribution). By interpolation between the various points of the distributions, we could then determine for any percentage of average earnings of any subdivision what percentage of contributors earn less than such percentage of average earnings, and what percentage of total earnings for the subdivision are earned by such contributors.

(b) Superficially, one might expect that there would be few, if any, contributors earning less than the YBE, since, except in unusual circumstances, the contributions of such contributors are refundable and their earnings are not counted for purposes of calculating pensionable earnings. However, the data revealed a very large number of contributors earning less than the YBE, as large or almost as large as one might expect if there were no YBE. The likely reason for this is that most contributors who earn less than the YBE during a year have low yearly earnings because they work for only a small fraction of the year, but during that fraction they have monthly earnings in excess of one-twelfth of the YBE. Employer and employee contributions must be deducted at source for any month during which earnings exceed one-twelfth of the YBE (unless the year's maximum has already been deducted). While the employee contributions may be refundable if the employee earns less than the YBE during the year, the employer contributions are not. Hence, the bulk of earners earning less than the YBE in any year would seem to have employer contributions to their credit. They would therefore have a record of their earnings for that year maintained on the CPP Record of Earnings, even though those earnings are not counted for pensionable earnings purposes. For this reason, it appeared reasonable to consider the cumulative distributions of contributors (C) and of their earnings (E) (described in the above paragraph) as being cumulative distributions of earners and of their earnings.

(c) For 1966 to 1986, experience participation rates assuming no YBE were obtained by sex for each age from 18 to 69 by dividing the total number of contributors (assumed to be the total number of earners) by the estimated populations (Census populations, adjusted for undercount, and estimated intercensal values). We projected these participation rates from 1987 to 2100, taking into account the trend in such rates during the 1970-1980 period, the continued increase in participation by females, and our expectation of likely changes in the future. The result was a complete set of participation rates by sex and by age assuming no YBE for each year running from 1966 to 2100.

(d) Annual average earnings assuming no YBE were obtained by sex and by age for each year from 1971 to 1986 by dividing total earnings by total number of contributors (assumed to be total number of earners). Average earnings for 1966 to 1970 were obtained from T4 slips.

For years subsequent to 1986 we assumed that total average earnings (for all ages and both sexes combined) would increase at the same annual rate as the Industrial Aggregate of average weekly earnings for Canada. For 1986-87 and 1987-88 we used the known rate of increase in the Industrial Aggregate and, for subsequent years, the rates of increase in average earnings postulated in the economic assumptions (see 2 above).

However, we did not apply those aggregate rates of increase uniformly by age and sex because we assumed a gradual narrowing of the gap between earnings for males and females. Hence, we developed rates of increase in average earnings by age and by sex that would produce

(i) an aggregate rate of increase equal to the rate postulated in the economic assumptions,

(ii) rates of increase for each age, both sexes combined, that would be the same for all ages, and

(iii) 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.

In this manner average earnings, assuming no YBE, were calculated by age and by sex for each year from 1966 to 2100.

(e) We projected the unrounded 1990 YMPE of $28,962.79 for each year in the future in accordance with the formula described in section 3 of Appendix A and with the assumed increases in average earnings. The result, if not a multiple of $100, was rounded down to the next multiple of $100.

Future YBEs were taken as 10% of the projected YMPEs rounded down to the next multiple of $100 if not a multiple of $100.

(f) The YBE could then be expressed as a percentage of average earnings by year, by sex and by age and, using the C-distribution described in 4a above, the proportion of earners earning less than the YBE could be calculated. The application of the complements of such proportions to the participation rates that assume no YBE yielded participation rates excluding earners earning less than the YBE. These rates were adjusted (see 5b below) to reflect the flexible retirement age provision for ages 60 and over and are participation rates used for the calculation of contributory earnings. Sample values of these participation rates are shown in Schedule 8A.

Schedule 8A

Participation Rates
(before splitting on marriage or union breakdown)

		Year				
	Age	1990	2000	2020	2050	2100
Males	18	0.675	0.706	0.704	0.698	0.693
	20	0.669	0.697	0.697	0.692	0.687
	25	0.881	0.909	0.908	0.906	0.903
	30	0.919	0.953	0.953	0.951	0.949
	35	0.917	0.956	0.955	0.953	0.952
	40	0.938	0.944	0.943	0.941	0.940
	45	0.922	0.931	0.930	0.928	0.927
	50	0.874	0.884	0.883	0.882	0.880
	55	0.826	0.850	0.850	0.848	0.846
	60	0.685	0.673	0.673	0.670	0.668
	65	0.158	0.105	0.105	0.104	0.103
Females	18	0.649	0.653	0.679	0.690	0.696
	20	0.663	0.678	0.732	0.739	0.744
	25	0.716	0.715	0.722	0.735	0.738
	30	0.678	0.685	0.708	0.730	0.734
	35	0.683	0.699	0.738	0.768	0.772
	40	0.726	0.729	0.752	0.788	0.792
	45	0.700	0.706	0.736	0.782	0.785
	50	0.624	0.658	0.686	0.732	0.739
	55	0.524	0.602	0.661	0.714	0.733
	60	0.343	0.357	0.384	0.403	0.413
	65	0.041	0.018	0.016	0.015	0.015

These rates vary slightly from those developed for purposes of the Tenth Report.

Participation rates from this schedule were then adjusted to reflect the effect (for pensionable, but not contributory, earnings purposes) of splitting on marriage or union breakdown. This was done on the basis of the following assumptions:

(i) Divorce rate: 1% (on the basis of recent data compiled by Statistics Canada)

(ii) Male participation rates do not vary by marital status;

(iii) Participation rates of single females are the same as for males;

(iv) Distribution of earnings of each spouse of a couple is the same as that under the "C" and "E" distribution described above for the appropriate sex. This means, for example, that the distribution of earnings of an "average" female married to a "given" male is always in accordance with the female "C" and "E" distributions, irrespective of the level of earnings of this male, and vice versa "average" male/"given" female.

The resulting participation rates, further adjusted to remove the effect of retirement below age 65, are the participation rates used for the calculation of benefit factors. Sample values are shown in schedule 8B.

Schedule 8B

Participation Rates
(after splitting on marriage or union breakdown)

		Year				
	Age	1990	2000	2020	2050	2100
Males	18	0.676	0.707	0.705	0.699	0.694
	20	0.686	0.712	0.713	0.708	0.704
	25	0.897	0.921	0.920	0.918	0.916
	30	0.931	0.960	0.960	0.959	0.957
	35	0.929	0.962	0.962	0.961	0.960
	40	0.946	0.951	0.951	0.950	0.949
	45	0.930	0.938	0.938	0.937	0.935
	50	0.882	0.893	0.893	0.892	0.891
	55	0.832	0.857	0.858	0.857	0.855
	60	0.705	0.694	0.694	0.693	0.691
	65	0.336	0.303	0.302	0.301	0.300
Females	18	0.654	0.658	0.684	0.694	0.701
	20	0.696	0.712	0.757	0.763	0.768
	25	0.789	0.793	0.797	0.807	0.808
	30	0.762	0.771	0.788	0.803	0.806
	35	0.756	0.772	0.801	0.823	0.826
	40	0.781	0.784	0.802	0.830	0.834
	45	0.749	0.754	0.779	0.817	0.819
	50	0.668	0.698	0.723	0.763	0.768
	55	0.558	0.632	0.686	0.735	0.752
	60	0.380	0.395	0.421	0.439	0.447
	65	0.144	0.111	0.099	0.090	0.087

(g) The element of unemployment was not introduced explicitly into the calculations because we believed that to do so would not measurably enhance the projections in the long run. Variations in unemployment, however, would affect the derived participation rates and average earnings.

(h) The next step was to calculate Average Pensionable Earnings by age, by sex and by calendar year; these are average unadjusted pensionable earnings of contributors earning more than the YBE based on earnings excluding portions of earnings above the YMPE. The formula used is

$$APE = \frac{AE(EU - EL) + YMPE(1 - CU)}{1 - CL}$$

where

APE = Average Pensionable Earnings

AE = Average earnings (developed in (d) above)

CL = Proportion of earners earning less than the YBE (calculated from C-distribution in (a) above)

CU = Proportion of earners earning less than the YMPE (calculated similarly to CL)

EL = Proportion of total earnings attributable to persons earning less than the YBE (calculated from E-distribution in (a) above)

EU = Proportion of total earnings attributable to persons earning less than the YMPE (calculated similarly to EL)

YMPE = Year's Maximum Pensionable Earnings, as described in (e) above.

Sample values of Average Pensionable Earnings, which are the earnings used for calculating contributory earnings, and which are further adjusted to reflect retirements below age 65 (see 5b below), are shown in Schedule 9A.

Schedule 9A

Average Pensionable Earnings
(before splitting on marriage or union breakdown)

		Year				
		1990	2000	2020	2050	2100
		$	$	$	$	$
	YMPE:	28,900	42,200	107,800	440,300	4,590,600
	Age					
Males	18	13,911	19,931	50,417	202,264	2,066,707
	20	12,190	17,527	44,657	180,134	1,851,312
	25	20,248	29,137	74,016	298,619	3,069,802
	30	23,298	33,602	85,409	345,006	3,550,321
	35	24,505	35,394	89,954	363,402	3,740,380
	40	25,025	36,210	91,877	371,205	3,819,688
	45	24,953	36,125	91,645	370,147	3,805,192
	50	24,714	35,794	90,746	366,565	3,765,409
	55	24,213	35,112	89,227	360,091	3,694,748
	60	20,870	30,244	76,898	310,503	3,193,472
	65	15,636	23,924	60,650	244,748	2,525,246
Females	18	11,076	16,261	42,872	179,760	1,923,131
	20	10,547	15,390	40,177	166,522	1,762,081
	25	17,282	25,277	66,393	277,229	2,952,429
	30	19,055	28,006	73,869	309,121	3,290,875
	35	19,450	28,683	75,885	318,147	3,390,825
	40	19,738	29,277	77,544	325,820	3,477,939
	45	19,522	29,102	77,367	326,020	3,485,324
	50	19,204	28,692	76,419	322,725	3,453,357
	55	18,615	27,958	74,870	316,292	3,386,059
	60	15,323	22,882	61,107	257,722	2,763,096
	65	13,419	21,125	56,451	240,103	2,608,601

Average Pensionable Earnings were then adjusted to reflect the effect (for pensionable, but not contributory, earnings purposes) of splitting on marriage or union breakdown. This was done on the basis of the same assumptions used in developing the participation rates of Schedule 8B. Resulting Average Pensionable Earnings were further adjusted to remove the effect of retirements below age 65.

Sample values of Average Pensionable Earnings, which are the earnings used for purposes of benefits calculations, are shown in Schedule 9B.

Schedule 9B

Average Pensionable Earnings
(after splitting on marriage or union breakdown)

		Year				
		1990	2000	2020	2050	2100
		$	$	$	$	$
	YMPE:	28,900	42,200	107,800	440,300	4,590,600
	Age					
Males	18	13,880	19,890	50,321	201,898	2,063,151
	20	11,823	17,052	43,555	175,825	1,808,654
	25	19,148	27,639	70,422	285,213	2,940,234
	30	21,774	31,550	80,628	327,459	3,380,265
	35	22,981	33,388	85,448	347,268	3,585,385
	40	23,785	34,492	87,927	357,379	3,688,198
	45	23,864	34,629	88,241	358,443	3,693,905
	50	23,738	34,490	87,721	355,840	3,662,914
	55	23,435	34,110	86,958	352,030	3,619,121
	60	22,746	32,964	83,876	338,911	3,487,575
	65	19,894	28,480	72,203	291,367	3,006,243
Females	18	11,022	16,183	42,659	178,778	1,911,633
	20	10,178	14,879	38,990	161,327	1,704,007
	25	16,673	24,339	63,682	265,288	2,812,456
	30	18,475	27,141	71,449	298,541	3,162,975
	35	19,039	28,111	74,389	311,635	3,306,629
	40	19,536	28,898	76,328	320,685	3,409,583
	45	19,303	28,703	76,171	321,228	3,421,795
	50	18,878	28,226	75,055	317,184	3,385,507
	55	18,252	27,527	73,799	312,099	3,338,103
	60	17,951	26,791	71,528	301,556	3,230,218
	65	15,626	22,962	61,360	260,981	2,835,434

5. CONTRIBUTIONS AND EXPENSES OF ADMINISTRATION

(a) Contributory earnings were calculated as the product of

(i) Average Pensionable Earnings (before splitting; see Schedule 9A) less the Year's Basic Exemption,
(ii) participation rates (before splitting; see Schedule 8A), and
(iii) projected populations.

(b) Most recent experience data on participation rates and contributory earnings do not yet reflect the effect of the new flexible retirement age provision implemented on January 1, 1987. For this reason, participation rates and average pensionable earnings (as shown in Schedules 8A and 9A) include a downward adjustment at ages 60 to 69.

Participation rates had accordingly been multiplied by the complement of the retirement prevalence rates which were computed using the age retirement election percentages shown in Schedule 10. Average Pensionable Earnings had been multiplied by the complement of 40% of the age election rates to reflect the effect of retirement, assumed to take place mid-year on the average, on average earnings. This is to say that average earnings should, on average, be cut in half for those retiring during the year but to a lesser extent for those earning more than the YMPE.

(c) Logic would seem to indicate that contributory earnings calculated in this fashion, to be used for the purpose of estimating contributions, should be increased somewhat to allow for the fact that contributions may be collected from other sources; for example

(i) contributions made by an employer in respect of an employee earning less than the YBE are not refundable,
(ii) excess contributions made by an employer in respect of an employee earning more than the YMPE are refundable only to the extent that the employee had earnings with that particular employer in excess of the YMPE, and
(iii) in cases where employees or employers entitled to refunds do not claim such refunds, they are not made.

Although in the early years of the Plan contributions estimated in accordance with this method were always less than contributions actually collected, from 1977 to 1981 there was virtually no difference. In 1982 actual contributions jumped to 108% of expected only to fall to 91% in 1983, but this seems to be attributable to the fact that nearly all contributions related to 1982 earnings were made in 1982, while 1983 was subject to the customary delay of receipts to the early months of the following calendar year. The actual contributions were very close to the expected between 1984 and 1986.

However, contributions estimated for 1988, computed using known rates of increase in scales of average earnings, show a deficiency of about 6% in comparison to actual contributions for 1988. This is due to a normal deviation between the rate of increase in scales of average earnings and the rate of increase in CPP average earnings which, for example, reflect the effect of variations in part-time work and unemployment from one year to the next. Contributory earnings computed for 1988, and contributions thereon, were adjusted accordingly.

(d) The contribution rates assumed in the Account accumulations were applied to total yearly contributory earnings to estimate total yearly contributions.

(e) Costs of administration continued to be assumed as 0.1% of contributory earnings.

6. RETIREMENT PENSION

(a) For the cohorts of contributors reaching a given retirement age from 60 to 65 in each of the calendar years from 1989 to 2100, the average unadjusted pensionable earnings history of an "average male" and an "average female" was determined by multiplying average pensionable earnings of Schedule 9B by participation rates of Schedule 8B for each year of the contributory period for purposes of retirement pension (i.e., the period running from January 1, 1966, or attainment of age 18, whichever is later, to attainment of the given retirement age). This approach of multiplying participation rates by average pensionable earnings implicitly assumes that the average pensionable earnings of people who die before retirement is the same as that of all people for each year before the underlying date of death.

(b) To obtain the average adjusted pensionable earnings history we divided the average unadjusted pensionable earnings for each year of the history by the YMPE for the year involved and multiplied by the average of the three consecutive YMPEs ending with the year of attainment of the given retirement age.

(c) Average benefit factors for each sex, each retirement age (60 to 65) and each calendar year were calculated as equal to 25% of

(i) the sum of the average adjusted pensionable earnings of the particular cohort less earnings that have to be dropped out in accordance with the child-rearing and the 15% drop-out provisions, divided by

(ii) the contributory period less the number of years that have to be dropped in accordance with the two drop-out provisions mentioned above.

It was assumed that no males would benefit from the child-rearing drop-out provision so that, for this sex, the number of years to be dropped from the denominator was taken as 15% of the contributory period. For females, the number of years to be dropped on account of the child-rearing drop-out provision was expressed by age as a function of the estimated average number of children born so far to an average female of the underlying cohort; that is up to seven years for the first child and up to two years for each additional child. This number was then increased by 15% of the remaining number of years of the contributory period to determine the total number of years to be dropped from the denominator.

By summing the average adjusted pensionable earnings for a cohort, we obtain the average sum of all the pensionable earnings of individuals belonging to the cohort, which is what is desired. Unfortunately, there is no automatic way of determining what earnings have to be dropped out from this sum. The earnings that have to be dropped out for an individual belonging to a cohort are the lowest earnings of that individual for a number of years equal to a portion of the child-rearing period plus 15% of the residual contributory period. On the basis of a model taking into account relevant factors (among them mobility in participation and earnings), the following formula was developed for determining percentages, varying according to the total drop-out proportion and the average participation rate over the contributory period, which, when multiplied by the sum (for a period of years equal to the total drop-out period) of the products of lowest participation rates and lowest average earnings, would give the amount of earnings to be dropped:

Drop-out proportion = d
Average participation rate = AVRPAR
Average participation factor = PARFAC = d/(1-AVRPAR)
Maximum average participation factor = MAXFAC = 1/(1-AVRPAR)

Range of PARFAC	Value of drop-out multiplying factor
0.0 to 0.5	PARFAC /10.
0.5 to 1.0	PARFAC - 0.45
1.0 to MAXFAC	$0.55 + 0.45 \times \frac{(PARFAC-1)}{(MAXFAC-1)}$

The amount of earnings dropped is the product of the lowest average adjusted pensionable earnings value and the lowest participation rate over the contributory period, plus the product of the next lowest adjusted pensionable earnings value and the next lowest participation rate, and so on for a number of years equal to the number of years of child-rearing plus 15% of the residual contributory period.

(d) For the cohorts of contributors reaching a given retirement age from 66 to 70 in each of the calendar years from 1989 to 2100, the retirement benefit factors were determined as above but ignoring the earnings history after age 64. This approach implies that the provision for the replacement of earnings under age 65 by any higher ones for ages over 65 has a nil effect on retirement benefits.

(e) The average benefit factors for ages 60 to 70, developed pursuant to (c) and (d) above, were then slightly increased to allow for the disability drop-out provision of the plan.

(f) Retirement benefit factors so developed by sex, calendar year and age at retirement (60 to 70) were then multiplied by the appropriate actuarial adjustment factor (corresponding to a change of 0.5% for each month between the age when the pension commences and age 65) and by the appropriate proportion (by age, sex and calendar year) of contributors electing to retire at a given age. For that purpose, it was assumed that males and females would elect to start receiving CPP retirement benefits according to percentages shown in Schedule 10 below that were developed from Quebec Pension Plan experience for 1984 to 1987 and CPP experience for 1987 and 1988. These percentages correspond to the proportion of contributors electing to retire at a given age plus 6 months (i.e. "age last birthday" basis).

Schedule 10

Retirement Election Percentages

	Year	Age at Retirement 60 %	61 %	62 %	63 %	64 %	65 %
Males	1987	25.9	20.6	23.5	24.8	30.4	100.0
	1988	24.1	9.2	10.3	10.0	17.1	69.6
	1989	25	8	8	8	13	58.1
	1990	25	8	8	8	11	53.5
	1991	25	8	8	8	11	50.1
	1992	25	8	8	8	11	37.9
	1993	25	8	8	8	11	40.9
	1994+	25	8	8	8	11	40.0
Females	1987	43.1	30.2	32.2	32.1	42.2	100.0
	1988	39.6	12.5	12.9	12.5	25.4	57.8
	1989	40	10	10	10	20	42.5
	1990	40	9	9	9	15	35.3
	1991	40	9	8	8	15	31.9
	1992	40	9	8	8	15	10.4
	1993	40	9	8	8	15	18.4
	1994+	40	9	8	8	15	20.0

For 1988 and later, the election percentage for age 65 was taken as 100% minus the sum of percentages experienced by, or assumed for, the underlying cohort (of contributors reaching age 65 in the given year) from age 60 (or age in 1987 if higher) to age 64.

(g) These techniques were used to develop benefit factors for benefits that would emerge each year after 1988. For benefits already in pay at the end of 1988, we developed benefits factors for individual ages 60 to 92 by dividing benefits paid in that year by the projected populations for that year.

(h) These benefit factors, when applied to the projected populations aged 60 and over, yielded estimated benefits payable in all future years. For example, the population projected for a given year at age 75 is multiplied by the sum of benefit factors in respect of age 60 reached 15 years earlier, of age 61 reached 14 years earlier, and so on up to age 70 reached 5 years earlier plus, if applicable, the benefit in pay factor in respect of the age of the underlying cohort in 1988.

(i) The benefits were thereafter escalated in accordance with the Pension Index.

7. DISABILITY PENSION

(a) General procedure

The general procedure used to estimate disability benefits was to

(i) project flat-rate and earnings-related benefits in pay at the end of 1988 (see (b) below) using the disability termination rates shown in (f) below and augment benefits payable to these beneficiaries according to Pension Index increases;

(ii) estimate initial flat-rate benefits emerging in years subsequent to 1988 by application of disability incidence rates (see (e) below), probabilities of being insured for disability benefit (see (c) below), and flat-rate benefit amounts, to the projected populations developed as described in 3 above;

(iii) estimate initial earnings-related benefits emerging in years subsequent to 1988 by applying the same disability incidence rates, proportions of earnings insured for disability benefits (see (d) below), and earnings-related benefit factors (see (g) below), to the same projected populations; and

(iv) project initial flat-rate and earnings-related benefits described in (ii) and (iii) above to future years in a manner similar to that used in projecting benefits in pay at the end of 1988, as described in (i) above.

The estimate of benefits paid in any particular future year are equal to the sum of the benefits projected to that year.

(b) Benefits in pay at the end of 1988

These were derived from experience data subdivided by age, sex and duration, using data prepared for us by the Department of Supply and Services. The data were adjusted to match with final results shown in the statement of the Canada Pension Plan Account.

(c) Probabilities of being insured for disability benefits

Since the main requirement to be insured for disability benefits is to have made contributions for at least five of the last ten years or at least two of the last three years, such probabilities depend heavily on the levels of participation rates for those few years preceding disability. And, since such probabilities may be higher or lower than such levels depending on working patterns, we decided to assume that an individual's probability of being insured for disability benefits in any given year would be equal to the larger of the following two values:

(i) Probability of having participated in at least five of the last ten years: the average of the most recent ten participation rates for the cohort, and

(ii) Probability of having participated in at least two of the last three years:

$$\frac{P^2(3-2P)(10+9P)+P}{20}$$

where "P" corresponds to the participation rate. This formula was obtained by assuming that

(i) the proportion of individuals who never participated in the plan equals (1-P)/2

(ii) the proportion of individuals who participated without interruption since the beginning of the contributory period equals P/20

(iii) the proportion of individuals who participated randomly since the beginning of the contributory period equals the complement of the sum of (i) and (ii) above, that is (9P+10)/20

and by setting the probability of having participated in at least two of the last three years, for individuals covered in (iii), equal to $3P^2 - 2P^3$ and for those covered in (i) and (ii), equal to 0 and 1, respectively.

Sample probabilities are shown below.

Schedule 11

Probability of Being Insured for Disability Benefits

		Age at Disablement							
	Year	20	25	30	35	40	50	55	60
Males	1990	0.654	0.922	0.953	0.951	0.965	0.907	0.859	0.760
	2050	0.686	0.942	0.975	0.976	0.968	0.917	0.879	0.751
	2100	0.680	0.940	0.973	0.975	0.967	0.915	0.877	0.750
Females	1990	0.668	0.797	0.760	0.756	0.786	0.687	0.594	0.458
	2050	0.762	0.819	0.815	0.840	0.848	0.788	0.732	0.568
	2100	0.768	0.821	0.818	0.843	0.852	0.797	0.749	0.586

(d) Proportions of earnings insured for disability benefits

Since insured contributors will generally have higher aggregate earnings than uninsured contributors, these proportions should be higher than the probabilities of being insured for disability benefits. They were set equal to probabilities of being insured for disability benefits divided by the probability of being insured for a retirement pension, plus one-third of the difference between unity and the resulting probabilities (this last adjustment is meant to reflect the difference in average earnings as between those who ever participated and those who are eligible for the disability benefit). Probabilities of being insured for a retirement pension correspond to the probability of having ever contributed. They were determined as the arithmetic average between unity and the highest participation rate experienced by, or assumed for, the underlying age-cohort over its contributory period elapsed at time of disablement. Sample values are shown below.

Schedule 12

Proportion of Earnings Insured for Disability Benefits

		Age at disablement							
	Year	20	25	30	35	40	50	55	60
Males	1990	0.942	0.989	0.995	0.985	0.989	0.944	0.918	0.853
	2050	0.947	0.992	0.999	0.999	0.993	0.958	0.932	0.845
	2100	0.946	0.992	0.998	0.999	0.993	0.958	0.932	0.845
Females	1990	0.960	0.977	0.937	0.930	0.963	0.913	0.862	0.774
	2050	0.983	0.967	0.964	0.979	0.975	0.932	0.893	0.771
	2100	0.985	0.966	0.964	0.980	0.976	0.935	0.899	0.776

(e) Disability incidence rates

Disability incidence rates used in the Tenth Report were retained for this report. They were based on the CPP experience of 1976 to 1984 giving weights of 7 to the years 1976 to 1981 inclusive and of 1 to the years 1982 to 1984 inclusive. They were calculated by dividing the number of emerging disability beneficiaries by the product of the populations and the assumed probabilities of being insured for disability benefits. Sample values are as follows:

Schedule 13

Disability incidence rates per 1000

Age	Males	Females
25	0.459	0.257
30	0.555	0.350
35	0.882	0.617
40	1.517	1.277
45	2.513	2.163
50	4.746	4.185
55	10.029	8.131
60	22.138	18.647

An examination of the disability cases that have actually emerged from 1984 to 1988 indicates that the incidence rates do not seem to have reduced, as anticipated, to their pre-1982 levels (1982 to 1984 were years of abnormally high disability incidence deemed to be associated with the prevailing economic downturn). Because a return to pre-1982 levels has actually been experienced under the Quebec Pension Plan, we decided to increase the incidence rates of Schedule 13 by 25% for 1989, 20% for 1990, 15% for 1991, 10% for 1992 and 5% for 1993, and to use the table without adjustment for years after 1993.

Disability incidence rates so determined were then reduced, for ages 60 to 64, in accordance with the proportions of contributors assumed to be already in receipt of the retirement pension at these ages (see retirement election percentages in Schedule 10 above).

(f) Disability termination rates

We decided to retain the termination rates used for the Tenth Report. These termination rates were derived from CPP experience from 1976 to 1984, giving weights of 7 and 1 to the 1976-1981 and 1982-1984 periods, respectively.

Schedule 14

Disability termination rates per 1,000

	Age	Year of Disability 1	2	3	4	5	Ultimate	Attained Age
Males	20	159.127	259.097	198.892	136.995	116.666	74.186	25
	25	165.739	220.505	163.220	109.592	91.429	55.114	30
	30	162.422	183.128	128.509	92.378	74.248	42.859	35
	35	153.050	154.046	107.713	78.870	65.100	45.221	40
	40	149.565	136.153	89.401	73.095	61.626	48.910	45
	45	156.299	123.501	73.150	61.200	55.278	48.823	50
	50	160.574	106.975	66.607	57.333	55.339	54.705	55
	55	137.068	89.167	62.309	59.214	58.254	58.750	60
	60	106.517	74.890	59.131	58.582	59.135	-	65
Females	20	168.004	174.145	141.477	118.224	94.203	72.333	25
	25	132.162	136.804	108.318	90.355	71.904	50.146	30
	30	124.300	119.583	88.169	69.713	51.722	35.305	35
	35	140.362	117.220	77.266	64.565	53.183	43.154	40
	40	139.110	106.243	67.362	58.701	50.815	43.437	45
	45	126.520	86.942	53.963	47.616	41.928	36.753	50
	50	110.660	78.263	45.411	41.244	37.283	33.768	55
	55	81.800	59.568	37.581	34.767	32.574	30.928	60
	60	57.353	41.410	31.680	30.984	29.929	-	65

(g) Earnings-related benefit factors

These factors were developed by year and by sex for each age from 18 to 64 in a manner similar to that used in developing retirement benefit factors described in 6 above, and were multiplied by 0.75, to allow for the specific disability benefit percentage, but not by actuarial adjustments (in respect of the flexible retirement age) or by retirement election rates for ages 60 to 64.

8. DISABLED CONTRIBUTOR'S CHILD'S BENEFIT

(a) We assumed that all children under age 18 would be entitled to benefits if a parent was in receipt of a disability pension, but that no children age 18 or over would be entitled. We further assumed that no parent would be disabled at the time of a child's birth.

(b) For quinquennial years and quinary age groups and each sex separately, we estimated adult disability beneficiaries who had become disabled within the last "n" years (n=5, 10, 15 or 20) using techniques similar to those described in 7 above to estimate flat-rate disability benefits. Therefore, our projection of adult beneficiaries was based on the existing adult beneficiaries at December 31, 1988, and on estimates of future emerging beneficiaries.

(c) We divided the beneficiaries in (b) by estimates of the population "n" years earlier to obtain probabilities that an individual of given sex and age-group in a given year would become a disability beneficiary within the next "n" years and survive as such to the end of the "n" years.

(d) A distribution of fathers and mothers of new-born children by age had been developed earlier from published Vital Statistics data for 1965-1969 and 1970-1974, respectively. This distribution (of fathers and mothers of new-born children for male and female contributors, respectively) was applied to the above probabilities, to yield probabilities that an n-year-old child in a given year will have a father or a mother who became a disability beneficiary after the birth of the child and who survived as such to the given year.

(e) Summing such probabilities over all ages of the parent yielded the probability that the child would have a parent who is a disability beneficiary in a given year and, therefore, the probability that the child would be entitled to a disabled contributor's child's benefit in respect of that parent in that given year.

(f) Interpolation between the probabilities (developed in (e) above) for age "n" of the child yielded probabilities that a child aged 0-4, 5-9, 10-14 or 15-17 years in the given year would be entitled to a disabled contributor's child's benefit in respect of a parent of a given sex.

(g) Applying such probabilities to the projected children's populations yielded disabled contributor's child beneficiaries. To yield benefits, beneficiaries were then multiplied by the applicable amount of flat-rate benefits.

(h) Using these procedures, benefits estimated for the recent years preceding the valuation date turned out to be about 10% higher than actual corresponding benefits paid in these years. Accordingly, we reduced benefits projected for all years after 1988 using a factor of 0.889.

9. SURVIVING SPOUSE'S PENSION

(a) For individual years after 1988, male deaths (for widows' benefits) and female deaths (for widowers' benefits), derived for each individual age over 20 years consistent with the population projections described in 3 above, were multiplied by proportions married at death to obtain married deaths. The proportions married at death were derived from actual experience as shown in Vital Statistics for the calendar years 1960, 1965, 1970, 1975 and 1980. For the years after 1980, proportions were extrapolated on the basis of these five series of actual values. Sample values are shown below for 1990:

Schedule 15

Proportions Married at Death
(%)

AGE	Males	Females
20-24	14	20
25-29	32	48
30-34	55	57
35-39	63	64
40-44	64	69
45-49	68	76
50-54	69	74
55-59	74	71
60-64	76	62
65-69	76	51
70-74	74	41
75-79	69	27
80-84	62	16
85-89	56	10
90+	32	3

(b) To determine numbers of emerging widows and widowers eligible for flat-rate benefits, we multiplied married deaths by an estimated probability of the deceased spouse being insured for the spouse's benefit, based on participation rates during his or her contributory period.

(c) For earnings-related benefits purposes, we multiplied married deaths by earnings-related benefit factors, developed by a procedure similar to that used for retirement benefit factors described in 6 above but ignoring the actuarial adjustment in respect of the flexible retirement age and the retirement election rates for ages 60 to 65. They were also multiplied by proportions of earnings insured for survivor

benefits. We set these proportions equal to probabilities of being insured for survivor benefits (see "b" above) divided by the probability of being insured for a retirement benefit (see 7d above), plus one-third of the difference between unity and the resulting probabilities (this last adjustment is meant to reflect the difference in average earnings as between those who ever participated and those who are eligible for the survivor benefit). Sample values are shown below:

Schedule 16

Proportions of Earnings Insured for Survivor Benefits

	Males		Females	
AGE	1990	2050	1990	2050
20-24	0.949	0.950	0.922	0.907
25-29	0.966	0.980	0.977	0.975
30-34	0.974	0.983	0.978	0.985
35-39	0.980	0.992	0.990	0.984
40-44	0.999	0.992	0.973	0.984
45-49	0.991	0.992	0.961	0.984
50-54	0.993	0.992	0.977	0.983
55-59	0.983	0.992	0.968	0.983
60-64	0.983	0.992	0.981	0.984
65-69	0.969	0.992	1.000	0.984
70-74	0.963	0.992	1.000	0.984
75-79	0.938	0.992	1.000	0.985
80-84	0.935	0.991	1.000	0.985
85-89	0.923	0.987	1.000	0.984
90 +	0.422	0.988	0.387	0.983

(d) We then distributed numbers of insured married deaths and emerging earnings-related benefits by age of surviving spouse using relative age distributions of husbands and wives as derived from the 1976-80 experience under the Plan.

(e) Comparisons of actual benefits that actually emerged during the 1986-1988 period with those estimated to emerge, using the above techniques, indicated significant differences. Consequently, we decided to adjust estimates of all survivor benefits emerging after the valuation date, determined by these methods, by applying the following factors varying by sex and by type of benefit:

Schedule 17

Experience adjustment factors for survivor benefits

Widows		Widowers	
Flat-Rate	Earnings-Related	Flat-Rate	Earnings-Related
0.917	1.068	0.682	0.570

(f) We projected these emerging surviving spouses and their earnings-related benefits to each subsequent calendar year using mortality rates described in 3(c) above.

(g) The number of survivors under age 65 was multiplied by the flat-rate benefit amounts, and both earnings-related benefits and flat-rate benefits were escalated in accordance with the Pension Index. Reductions to benefits in respect of survivors under age 45 who are without dependent children and not disabled were assumed to apply to 25% of all cases emerging at these ages.

(h) For surviving spouses entitled to a retirement pension, there is a limit on the combined survivor and retirement pensions available. Since the retirement pension is assumed to be payable in full in our estimates of retirement pensions, estimates of survivor pensions had to be reduced to take this limit into account. The required reductions were estimated on the basis of hypothetical distributions of surviving spouses' and retirement pensions around their mean value.

Surviving spouses under age 65 who are also entitled to a disability pension are subject to a similar limit on their combined earnings-related pensions, but this was ignored.

(i) The foregoing steps produced earnings-related benefits and flat-rate benefits for each individual calendar year following each individual year of widowhood or widowerhood after 1988. Benefits actually in pay at the end of 1988, derived from tabulations subdivided by age, sex and duration, were adjusted to match with the final results shown in the Statement of the CPP Account and were projected to subsequent years using the mortality factors mentioned in (f) and making allowance for Pension Index escalation and the change in benefit formula at age 65. These were then added to benefits emerging after the valuation date to obtain total benefits payable in each future year.

10. ORPHAN'S BENEFIT

(a) We assumed that all children under age 18 of deceased insured parents would be entitled to benefits, but that no children over age 18 would be entitled.

(b) Age distributions of fathers and mothers of new-born children (see 8(d) above) were projected "n" years (n=5, 10, 15 or 20) to determine probabilities that a child has a deceased father or mother who would have belonged to a certain age group if he or she had survived. These probabilities were reduced for early years of the Plan to exclude the probability of dying before January 1, 1968 since those deaths would not have been insured.

(c) The probabilities developed in (b) were multiplied by the proportions described in 9(b) for surviving spouse benefits.

(d) The probabilities as adjusted in (c), summed over all ages of the parent, produced the probability that a child age "n" in a particular year would be entitled to an orphan's benefit. Interpolation between those pivotal values yielded probabilities that children aged 0-4, 5-9, 10-14, or 15-17 in that year would be entitled to orphan benefits in respect of a parent of a given sex. These probabilities, when applied to the projected children's population, yielded orphan beneficiaries. Benefits were determined by multiplying the number of beneficiaries by the flat-rate amount of benefit adjusted in accordance with the Pension Index.

(e) Using the above procedures, benefits projected for the recent years preceding the valuation date turned out to be too high compared to benefits that have been paid in these years. Benefits projected for all years after the valuation date were accordingly reduced to allow for this recent experience.

11. DEATH BENEFIT

Estimated deaths, derived consistent with population projections described in 3 above, were multiplied by earnings-related benefit factors developed by the procedure used (before applying actuarial adjustments and retirement election rates) for retirement benefit factors described in 6 above, but representing the value of half a year's pension payment instead of a full year's. The resultant death benefit estimates were reduced to allow for the fact that the death benefit cannot exceed 10% of the YMPE for the year of death. Projections were finally multiplied by 1.032 to account for the difference between actual results of recent years and those computed as above.

12. ACCOUNT PROJECTIONS

(a) We used data on annual investments in provincial bonds, on the annual amounts of interest earned on those bonds and on the Operating Balance prior to 1989 to reproduce the actual amount of the Account at the end of each year from 1966 to 1988 and to compute all future investment earnings and maturities (20 years) resulting from these 1988 outstanding investments.

(b) Contribution rate increases were determined using an iteration process so as to find the target increase in accordance with the 15-year formula (see Appendix A, Section 1, last paragraph).

(c) Amounts invested in each future year were taken as equal to contributions for the year minus expenditures for the year, plus 30% of one year's interest thereon, plus one year's interest on outstanding investments, plus prior investments maturing during the year. The 30% factor reflects the experienced effect of the uneven distribution of investments made during each calendar year. If investments were spread evenly during the year, the factor would be 25%, i.e. investments made during a given year would produce one-fourth of a full year's investments during that year because of the semi-annual interest payments.

(d) The investments in the Fund in any future year are assumed to earn interest until maturity (20 years) at the annual rate of interest on new investments postulated in the economic assumptions for the year of investment. On the other hand, the investments in the Operating Balance are assumed to be reinvested yearly and to earn the rate of interest on new investments less 1%.

(e) Normally investments in the Fund are assumed to mature after 20 years. However, if the amount to be invested in any year, assuming 20-year maturities, should turn out to be negative, additional maturities are assumed in that year, sufficient to provide a positive investment, and to release sufficient cash in that year to meet all expected payments. These additional maturities are assumed to be on a first-in, first-out basis as stated in the Act.

(f) The Account at the end of any year was taken as the sum of the outstanding investments.

13. ENTRY-AGE NORMAL ACTUARIAL COST AND RELATED UNFUNDED ACTUARIAL LIABILITY

Estimates of the entry age normal cost and of the unfunded liability are shown in Appendix C. They were determine as follows:

(a) Entry-age normal actuarial cost (current service contribution rate)

The entry-age normal cost was determined as the ratio, in respect of the cohort of people aged 18 on December 31, 1988, of

(i) the present value (interest discount only) of all future annual expenditures

to

(ii) the present value (interest discount only) of all future annual contributory earnings.

(b) Unfunded actuarial liability

An amount, hypothetically invested in mid-1989, was determined by an iteration process such that together with

(i) the Account at December 31, 1988,

(ii) future (post-1988) contributions at the entry-age normal actuarial cost rate collected in respect of the population aged 18 and over on December 31, 1988 and

(iii) investment earnings,

it would be just sufficient to pay all future benefits and administrative expenses in respect of those aged 18 and over on December 31, 1988. The unfunded actuarial liability at December 31, 1988 was taken as the amount so obtained but further discounted for one-half year's interest.

(c) Economic assumptions

For reasons explained in Appendix C, only the ultimate economic assumptions are used for purposes of (a) and (b) above.

APPENDIX C

ESTIMATES OF CONTRIBUTION RATES BASED ON ACTUARIAL FUNDING AND DEVELOPMENT OF RELATED UNFUNDED ACTUARIAL LIABILITY

Details on methodology are shown in section 13 of Appendix B.

In the field of private pensions, normal actuarial funding serves three main purposes:

1. It recognizes and aims to meet the estimated real cost of pension obligations at the time the benefits are deemed to be earned. Thus it prevents inappropriate deferment of costs.

2. The plan sponsor transfers the accrued pension obligations to trustees or an insurance company. Thus the security of the pensions is not tied to the fortunes of the sponsor (normally the employer).

3. Costs tend to be stable and are conducive to the orderly conduct of the sponsor's business.

Although in social insurance it is possible to calculate a normal actuarial cost (current service contribution rate), there appear to be great difficulties not only in applying the technique of actuarial funding but in applying the objectives or even some of the basic concepts.

On a national basis, it is not clear to what extent pensions can be prefunded and thus a deferment of costs avoided. Moreover, if actuarially calculated contributions are collected, it is often feared that the colossal investment funds that are generated would lead either to unwarranted government projects or to indirect government control over the private sector through the investment of social insurance funds. In any case, it is not easy to demonstrate how the payment of pensions in the distant future would be facilitated or savings increased, although the direct link between concurrent contributions and benefit payments would be eliminated and future productivity might well be enhanced by prudent investments.

Because of these reasons and imponderables, the application of the principles of actuarial funding is usually considered inappropriate in the field of social insurance. Nevertheless, it is interesting and informative to calculate the level of the contribution rate that might be considered appropriate, if the benefits provided by the Canada Pension Plan were to be funded by means of a normal pension trust. Moreover, the Auditor General of Canada suggested in 1977 that information based on principles of "actuarial funding" be made public. Accordingly, this

information was included for the first time with the Sixth Statutory Actuarial Report.

The rates of contribution quoted in this appendix were developed by the entry-age normal actuarial cost method. This method aims at a level percentage of contributory earnings to be contributed during the active lifetime of a normal cohort of entrants sufficient to support all benefits payable to them and their beneficiaries.

Certain assumptions do not affect entry-age normal contribution rates in the same way as they affect the pay-as-you-go rates.

Assumption changed		Effect on CPP rate	
		Pay-as-you-go	Entry-age normal
(i)	Interest rate	independent	varies inversely, other things being equal.
(ii)	Rate of increase in earnings	varies inversely	varies directly.
(iii)	Rate of increase in prices	varies directly	varies directly.
(iv)	Real rate of increase in earnings (i.e., differential between earnings and price increases)	varies inversely	may vary directly or inversely depending on the net effect of change in both - the real interest rate (interest rate less rate of price increases), and in - the difference between the rate of interest and the rate of earnings increases.
(v)	Fertility	varies inversely	negligible (affects only volume of children's benefits).
(vi)	Immigration	varies inversely	varies directly.

The concept of an entry-age normal actuarial cost (contribution rate) carries with it the concept of an unfunded actuarial liability arising from the lack of contributions prior to the inception of the Plan and the collection of contributions since the inception of the Plan at a rate below the entry-age normal rate.

As described in section 13.b) of Appendix B, the unfunded actuarial liability is calculated as the amount that theoretically would be required to be invested on the valuation date. It is therefore extremely sensitive to the rate of interest assumed applicable at that date. For example, if there is a drop in interest rates, all other things being equal, the unfunded liability would appear to have increased very substantially in the following year, merely because the amount of the unfunded liability was not invested during a year of high interest rates. To avoid these somewhat artificial fluctuations, the calculations for purposes of this Appendix (as in the case of the Eighth and the Tenth Reports) were based only on the ultimate economic assumptions.

The unfunded actuarial liability may be expected to grow

(i) by the amount of interest not earned thereon at the assumed rate; and

(ii) by the difference between contributions at the hypothetical entry-age normal actuarial cost rate and contributions actually collected and by interest not earned on this difference. These increases in the unfunded actuarial liability are offset to some extent by the difference between interest at the actual and assumed rates (and there may be other sources of gains and losses).

The results of our calculations are as follows:

	Economic Assumptions			Entry Age Normal Actuarial Cost	1988 Year-End Unfunded Actuarial Liability
Basis	Increase in CPI (%)	Increase in Earnings (%)	Interest on New Bonds (%)	(%)	(billions)
A	3.5	4.8	6.0	10.22	337.9
B	3.5	5.0	6.0	10.61	342.0
C	3.5	4.5	6.0	9.64	331.5
D	3.5	4.8	6.5	8.71	306.7