CANADA PENSION PLAN

STATUTORY ACTUARIAL REPORT NO. 6

AS AT DECEMBER 31, 1977

DEPARTMENT OF INSURANCE
OTTAWA K1A 0H2, CANADA

CANADA PENSION PLAN

ACTUARIAL REPORT AS AT DECEMBER 31, 1977

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CANADA PENSION PLAN

STATUTORY ACTUARIAL REPORT NO. 6

(as at December 31, 1977)

I. INTRODUCTION

This is the sixth actuarial report since the inception of the plan and was prepared pursuant to subsection 116(1) of the Canada Pension Plan, which provides that at least once in every five years a report shall be prepared based on an actuarial examination of the operation of this Act and the state of the Canada Pension Plan Account. The last report pursuant to subsection 116(1) was Statutory Actuarial Report No. 5, as at December 31, 1973, which was tabled in the House of Commons on April 17, 1974.

This report is divided into three sections. Section II presents the main tables of financial projections for the plan, and Section III contains certain observations and conclusions. The report is followed by four appendices. The tables includedin the body of the report are based on a single set of assumptions, which differ slightly from those used for purposes of the preceding report. Auxiliary tables to test the sensitivity of the projections to some of the major assumptions are given in Appendix A. The main provisions of the Canada Pension Plan are summarized in Appendix B, and the principal assumptions and procedures underlying the main tables of financial projections are given in Appendix C. Estimates of contribution rates applicable to a "fully funded" system and the development of the accompanying "unfunded liability" are contained in Appendix D.

Projections are shown for each year from 1978 to 1987, inclusive, and for the years 1990, 1995, 2000, 2005, 2010, 2025, 2030 and 2050. The

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three types of tables presented in Section II are:

(a) fund projections (including benefits and expenses, amounts of contributions at stipulated rates and net cash flow to the provinces),

(b) amounts of benefits (classified by type of benefit) and expenses, and

(c) benefits and expenses expressed as percentages of contributory earnings ("pay-as-you-go" or "current cost" contribution rates).

The fund projections are dependent not only on the various economic and demographic assumptions but also on the contribution rates assumed to be in effect from time to time. The contribution rate has been maintained at 3.6% of contributory earnings (split equally between employers and employees) since the inception of the Plan in 1966. It was expected from the beginning that this rate would be more than sufficient to meet current benefits and expenses for about fifteen years, that eventually it would have to be increased, and that the size of the required increases in contribution rates would depend on the experience of the Plan, the funding objectives and, of course, any amendments made to the provisions of the Plan.

The projections contained in this report largely confirm the conclusions of the preceding report. However, as a result of experience and some changes in assumptions, the projected fund accumulations and required contribution rates are somewhat higher in this report. The new projections indicate that the contribution rate would have to rise slowly to reach a level of about 9% by the year 2030. Theoretically, an almost infinite number of scenarios involving increased contribution rates is conceivable, and the issues involved and the implications of a number of practical alternatives are being studied by a sub-committee of the federal-provincial Continuing Committee of Officials on Fiscal and Economic Matters.

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As in the preceding report, the fund projections herein are developed on three relatively simple assumptions regarding funding objectives and levels of contribution rates, in order to demonstrate the likely progression of the fund and the contribution rates under those circumstances.

FUND A

This fund is based on the somewhat unlikely assumption that contributions continue as long as possible at the present statutory rate of 3.6% of contributory earnings, which results in three phases in the development of the fund.

During the initial phase, contributions are greater than the amounts required for payment of benefits and expenses. The resulting excess funds constitute the net cash flow to the provinces which gradually decreases to zero. The fund increases by this excess as well as by investment earnings; however, since investment earnings are funds flowing from the provinces which are returnable to them in the form of new loans, they do not affect the net cash flow. The first phase ends when current benefits and expenses become greater than current contributions.

During the second phase, in addition to contributions, an increasing part of the interest earnings of the fund would be required to meet the payment of benefits and expenses. While the fund would continue to grow from the accumulation of any interest not required for current expenditures, the funds available to the provinces in the form of new loans would now be less than the interest payments required from them, so that the net cash flow to the provinces would be negative.

The third phase in the progress of the fund begins when current expenditures would become greater than the sum of current interest

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and current contributions. During this phase, an increasing proportion of the loans would have to be repaid by the provinces in order to meet current expenditures, and the fund would decrease until it became exhausted.

At the end of the third phase, either the contribution rate would have to be raised to the level of a current cost (pay-as-you-go) contribution rate or new sources of funds would have to be introduced.

FUND B

This fund is identical with Fund A during the initial phase. However, at the end of this period the net cash flow to the provinces would not be permitted to become negative; instead, the contribution rate would begin to be increased to a level sufficient to meet current expenditures.

Under this assumption, interest payments by the provinces would never be used for purposes of expenditures and thus would be continually returnable to the provinces in the form of new loans and would result in an ever increasing fund.

FUND C

This fund is identical with Fund A during the first two phases. However, at the end of the second phase the fund would not be permitted to decrease; instead, the contribution rate would begin to be increased to levels such that contributions plus interest earnings would continue to be equal to expenditures on a current basis.

Under this assumption, the loans made to the provinces up to the end of the second phase would be renewable in perpetuity. In contrast to Fund B, interest payments by the provinces would be required for purposes of paying benefits and expenses. However, in real terms the fund and

interest payments would gradually become less and less significant.

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It should be recognized that Fund A shows the expected progress of the fund if, as is theoretically possible, there were to be no changes in benefits or contribution rates until the fund became exhausted. It is difficult to visualize circumstances under which such a course would be followed as a matter of policy. Even if it were considered desirable to operate the Plan on a current cost (pay-as-you-go) basis, little would be accomplished by having the loans to the provinces repaid. And even if it were decided to have the loans repaid, it is unlikely that it would be desirable to have them repaid at a pace which would seriously distort provincial borrowing requirements. Also, delaying an increase in the contribution rate until the fund became exhausted would necessitate a rather substantial sudden initial increase, i.e., from 3.6% to about 5.4% of contributory earnings, twenty-five years hence.

Clearly, the question to be resolved is how soon and at what pace the contribution rate should begin to rise to its ultimate level. As noted earlier, funding alternatives are presently being studied by a federal-provincial committee and some alternative other than those presented here for illustrative purposes as Fund B and Fund C may commend itself.

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II MAIN TABLES OF FINANCIAL PROJECTIONS

This section contains the following tables:

	Table	Page
(a) Fund projections (showing also contributions, expenditures and the difference between these two which constitutes the net cash flow to the provinces)	1	7
(b) Benefits and expenses, showing each type of benefit	2	8
(c) Benefits and expenses, showing each type of benefit, expressed as percentages of contributory earnings ("pay-as-you-go" or "current cost" contribution rates)	3	9
(d) Benefits and expenses, (split by major category) in absolute amounts and expressed as percentages of contributory earnings	4	10

The principal assumptions underlying these projections are described in Appendix C (page 35).

A number of auxiliary fund projections based on variations in one or more of the assumptions are given in Appendix A (page 17).

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TABLE 1

FUND PROJECTIONS

(FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS,
CONTRIBUTION RATE AS PERCENT OF CONTRIBUTORY EARNINGS)

		FUND A			FUND B				FUND C			
		3.6% CONTRIBUTION RATE			CASH FLOW TO PROVINCES DECREASES UNTIL ZERO				CASH FLOW TO PROVINCES DECREASES UNTIL NEGATIVE AND EQUAL TO INTEREST ON FUND			
CALENDAR YEAR	BENEFITS AND EXPENSES	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$	$	$	$	%	$	$	$	%	$	$	$
1978	1386	2096	710	14.3	3.60	2096	710	14.3	3.60	2096	710	14.3
1979	1752	2376	625	16.1	3.60	2376	625	16.1	3.60	2376	625	16.1
1980	2152	2674	522	17.9	3.60	2674	522	17.9	3.60	2674	522	17.9
1981	2553	2992	439	19.8	3.60	2992	439	19.8	3.60	2992	439	19.8
1982	2993	3323	330	21.7	3.60	3323	330	21.7	3.60	3323	330	21.7
1983	3427	3666	238	23.7	3.60	3666	238	23.7	3.60	3666	238	23.7
1984	3901	4016	116	25.6	3.60	4016	116	25.6	3.60	4016	116	25.6
1985	4415	4372	-43	27.5	3.64	4415	0	27.6	3.60	4372	-43	27.5
1986	5000	4702	-299	29.3	3.83	5000	0	29.7	3.60	4702	-299	29.3
1987	5630	5038	-591	30.9	4.02	5630	0	31.9	3.60	5038	-591	30.9
1990	7794	6142	-1652	34.2	4.57	7794	0	39.5	3.60	6142	-1652	34.2
1995	12297	8579	-3718	32.1	5.16	12297	0	55.5	4.13	9847	-2451	34.7
2000	18416	11997	-6418	14.5	5.53	18416	0	76.7	4.84	16146	-2270	34.7
2005	26766				5.74	26766	0	105.1	5.26	24512	-2255	34.7
2010	39850	FUND WOULD BECOME EXHAUSTED IN 2003, AND CONTRIBUTION RATE WOULD HAVE TO RISE TO "FUND B" LEVEL OR OTHER REVENUE FOUND.			6.20	39850	0	144.0	5.85	37596	-2255	34.7
2025	135629				8.62	135629	0	379.5	8.48	133374	-2255	34.7
2030	193314				9.09	193314	0	507.6	8.98	191060	-2255	34.7
2050	636210				8.76	636210	0	1788.5	8.73	633955	-2255	34.7

TABLE 2

BENEFITS AND EXPENSES OF ADMINISTRATION

(IN MILLIONS OF DOLLARS)

CALENDAR YEAR	RETIREMENT PENSIONS	DISABILITY PENSIONS			SURVIVING SPOUSES' PENSIONS		ORPHANS' BENEFITS	DEATH BENEFITS	EXPENSES OF ADMINIS-TRATION	TOTAL
		FLAT RATE	EARNINGS RELATED	CHILDREN'S BENEFITS	FLAT RATE	EARNINGS RELATED				
	(1)	(2A)	(2B)	(2C)	(3A)	(3B)	(4)	(5)	(6)	(7)
1978	815.1	50.0	103.2	24.2	101.8	130.5	67.1	36.3	58.2	1386.5
1979	1043.7	59.0	128.0	29.3	119.0	179.3	81.2	46.0	66.0	1751.6
1980	1291.8	68.0	154.7	34.4	136.7	239.3	95.5	57.5	74.3	2152.1
1981	1528.8	76.9	183.7	37.9	152.8	309.9	109.3	70.9	83.1	2553.4
1982	1786.4	85.7	215.0	40.8	169.4	394.5	122.6	86.3	92.3	2993.0
1983	2068.6	94.3	249.6	43.4	185.4	457.3	128.2	98.7	101.8	3427.3
1984	2379.5	102.8	287.3	45.7	201.9	526.8	133.2	111.8	111.6	3900.7
1985	2723.0	110.6	325.5	48.0	219.0	603.8	138.2	125.6	121.5	4415.1
1986	3124.2	118.2	364.8	50.6	238.1	690.7	144.2	139.1	130.6	5000.5
1987	3560.8	125.3	402.6	53.4	257.8	785.6	150.5	153.4	140.0	5629.5
1990	5071.7	148.7	525.7	62.6	319.4	1120.4	172.1	202.7	170.6	7794.0
1995	8187.1	198.0	782.6	81.4	422.9	1851.4	219.4	316.2	238.3	12297.4
2000	12258.5	270.3	1171.9	101.8	577.7	2954.7	268.4	479.4	333.3	18415.8
2005	17766.8	383.1	1816.3	122.1	755.2	4422.6	321.4	712.5	466.4	26766.4
2010	26922.7	528.7	2739.2	146.2	988.8	6453.9	381.4	1046.3	643.1	39850.3
2025	101591.4	1007.8	6821.8	279.4	1971.9	18539.9	726.1	3117.2	1573.6	135628.7
2030	147497.0	1156.9	8578.0	343.1	2359.5	25944.5	891.8	4416.3	2137.7	193314.1
2050	486917.1	2831.7	30923.1	787.6	5081.7	85095.1	2039.1	15276.2	7258.5	636210.0

FOR ASSUMPTIONS SEE APPENDIX C (PAGE 35)

TABLE 3

BENEFITS AND EXPENSES OF ADMINISTRATION
EXPRESSED AS
PERCENTAGES OF CONTRIBUTORY EARNINGS

CALENDAR YEAR	RETIREMENT PENSIONS	DISABILITY PENSIONS			SURVIVING SPOUSES' PENSIONS		ORPHANS' BENEFITS	DEATH BENEFITS	EXPENSES OF ADMINIS-TRATION	TOTAL
		FLAT RATE	EARNINGS RELATED	CHILDREN'S BENEFITS	FLAT RATE	EARNINGS RELATED				
	(1)	(2A)	(2B)	(2C)	(3A)	(3B)	(4)	(5)	(6)	(7)
1978	1.40	0.09	0.18	0.04	0.18	0.22	0.12	0.06	0.10	2.38
1979	1.58	0.09	0.19	0.04	0.18	0.27	0.12	0.07	0.10	2.65
1980	1.74	0.09	0.21	0.05	0.18	0.32	0.13	0.08	0.10	2.90
1981	1.84	0.09	0.22	0.05	0.19	0.37	0.13	0.09	0.10	3.07
1982	1.94	0.09	0.23	0.04	0.18	0.43	0.13	0.09	0.10	3.24
1983	2.03	0.09	0.25	0.04	0.18	0.45	0.13	0.10	0.10	3.37
1984	2.13	0.09	0.26	0.04	0.18	0.47	0.12	0.10	0.10	3.50
1985	2.24	0.09	0.27	0.04	0.18	0.50	0.11	0.10	0.10	3.64
1986	2.39	0.09	0.28	0.04	0.18	0.53	0.11	0.11	0.10	3.83
1987	2.54	0.09	0.29	0.04	0.18	0.56	0.11	0.11	0.10	4.02
1990	2.97	0.09	0.31	0.04	0.18	0.66	0.10	0.12	0.10	4.57
1995	3.41	0.08	0.33	0.03	0.18	0.78	0.09	0.13	0.10	5.16
2000	3.68	0.08	0.35	0.03	0.17	0.89	0.08	0.14	0.10	5.53
2005	3.81	0.08	0.39	0.03	0.16	0.95	0.07	0.15	0.10	5.74
2010	4.10	0.08	0.43	0.02	0.15	1.00	0.06	0.16	0.10	6.20
2025	6.43	0.06	0.43	0.02	0.12	1.17	0.05	0.20	0.10	8.62
2030	6.93	0.05	0.40	0.02	0.11	1.22	0.04	0.21	0.10	9.09
2050	6.71	0.04	0.43	0.01	0.07	1.17	0.03	0.21	0.10	8.76

[illegible] APPENDIX [illegible]

TABLE 4

BENEFITS AND EXPENSES OF ADMINISTRATION

(BY MAJOR BENEFIT CATEGORY)

CALENDAR YEAR	EXPRESSED IN MILLIONS OF DOLLARS				EXPRESSED AS PERCENTAGES OF CONTRIBUTORY EARNINGS			
	RETIREMENT PENSIONS	DISABILITY PENSIONS*	SURVIVORS' AND DEATH BENEFITS	TOTAL**	RETIREMENT PENSIONS	DISABILITY PENSIONS*	SURVIVORS' AND DEATH BENEFITS	TOTAL**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1978	815.1	177.4	335.7	1386.5	1.40	0.31	0.58	2.38
1979	1043.7	216.3	425.5	1751.6	1.58	0.32	0.64	2.65
1980	1291.8	257.1	529.0	2152.1	1.74	0.35	0.71	2.90
1981	1528.8	298.5	642.9	2553.4	1.84	0.36	0.78	3.07
1982	1786.4	341.5	772.8	2993.0	1.94	0.36	0.83	3.24
1983	2068.6	387.3	869.6	3427.3	2.03	0.38	0.86	3.37
1984	2379.5	435.8	973.7	3900.7	2.13	0.39	0.87	3.50
1985	2723.0	484.1	1086.6	4415.1	2.24	0.40	0.89	3.64
1986	3124.2	533.6	1212.1	5000.5	2.39	0.41	0.93	3.83
1987	3560.8	581.3	1347.3	5629.5	2.54	0.42	0.96	4.02
1990	5071.7	737.0	1814.6	7794.0	2.97	0.44	1.06	4.57
1995	8187.1	1062.0	2809.9	12297.4	3.44	0.44	1.18	5.16
2000	12258.5	1544.0	4280.2	18415.8	3.68	0.46	1.28	5.53
2005	17765.8	2321.5	6211.7	26766.4	3.81	0.50	1.33	5.74
2010	26922.7	3414.1	8870.4	39850.3	4.19	0.53	1.37	6.20
2025	101591.4	8109.0	24355.1	135628.7	6.46	0.51	1.54	8.52
2030	147497.0	10078.0	33612.1	193314.1	6.93	0.47	1.58	9.08
2050	486917.4	34542.4	107492.1	636210.0	6.71	0.48	1.48	8.76

* INCLUDES PENSIONS FOR CHILDREN OF DISABLED CONTRIBUTORS

**INCLUDES EXPENSES OF ADMINISTRATION

FOR ASSUMPTIONS SEE APPENDIX C (PAGE 35)

III. OBSERVATIONS AND CONCLUSIONS

1. Notwithstanding occasional comments reported in the news media to the contrary, there appears to be no reason why the Canada Pension Plan could not be operated in the indefinite future in the manner contemplated at its inception, which would involve a gradual increase in the contribution rate, beginning within the next decade or so. As noted in the introduction, the timing and size of the increases will depend on the experience of the plan and the funding objectives, as well as on future amendments to benefit provisions, and these matters are currently being studied by a sub-committee of the federal-provincial Continuing Committee of Officials on Fiscal and Economic Matters.

2. Our projections indicate that the Plan could probably operate without an increase in the contribution rate until about the year 2003. However, this rather unlikely scenario would require the provinces to repay total accumulated loans of $34.7 billion, beginning in 1993, at a rate that would be equivalent to about 0.6% of contributory earnings by 1995 and about 1.9% by 2002. Delaying an increase in the contribution rate in this way until the last possible moment would render impossible the introduction of a series of relatively smooth gradual increases in the contribution rate. The first projected required increase would be from 3.6% in 2002 to 5.4% in 2003.

3. If it were considered desirable to prevent the accumulated fund from decreasing and thus avoid having the provinces repay the borrowed funds, Table 1 (page 7) indicates that as a minimum the contribution rate would have to increase as shown for Fund C; the rate for selected years would be as follows:

Year	Percentage of Contributory Earnings Required to Prevent Decline in Fund
1993	3.75
1994	3.95
1995	4.13
1996	4.30
2000	4.84
2010	5.85
2015	6.72
2025	8.48
2030	8.98
2035	8.90
2050	8.73

Differences between actual experience and the underlying assumptions would, of course, result in deviations from the above table. Some of these are highlighted below. However, it is important to note that the values in the table are practically independent of the level of inflation, provided the gap between increases in earnings and increases in the Consumer Price Index (a measure of the real rate of increase in earnings) remains as assumed; a comparison of Table 1 and Table 7 (page 20) reveals that under such circumstances a somewhat higher level of inflation results in slightly lower contribution rates.

4. As detailed in Appendix C, the economic assumptions underlying the main tables imply a gap of two percentage points between increases in earnings and increases in the Consumer Price Index. A comparison of Table 1 and Table 5 (page 18) indicates the relative effect of a gap of 1.5% instead of 2%; for example, increases in the contribution rate would tend to be required slightly earlier and the required level of contribution rate would have to be slightly higher (about 0.5% of contributory earnings higher by the year 2035). On the other hand, the reverse would

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be true, if the gap were to average above 2%, as it did over the last fifty years.

5. A comparison of Table 1 and Table 6 (page 19) confirms the otherwise obvious fact that the rate of interest affects the contribution rate only to the extent that interest earnings are applied to the provision of benefits. The lower interest rate applicable to Table 6, of course, results in somewhat lower fund accumulations and smaller interest payments from the provinces. However, by definition, the interest rate cannot affect the contribution rate in the case of Fund B; it affects the contribution rate slightly in the case of Fund C, where it also affects the net cash flow from the provinces, since in this case interest earnings do not flow back to the provinces in the form of new loans. Appendix D shows the effect of the interest rate on the contribution rate in an actuarially funded system.

6. The immigration assumptions underlying the main tables, as discussed in Appendix C, imply a nearly constant ratio of net immigrants to current population of about 0.465%. A comparison of Table 1 and Table 8 (page 21) indicates the effect of a constant level of net immigrants of 100,000 p.a. instead of the said constant ratio. A constant number of net immigrants, of course, results not only in a smaller total population but in a ratio of net immigrants to current population which declines to about 0.23% by the year 2050. This would result in slightly more rapid increases in the required contribution rates, leading to a rate for the year 2050 of 9.45% instead of the 8.73% shown in the table on page 12. (The contribution rate for the year 2050 would be 9.58% for a constant level of net immigration of 80,000, but only to 8.93% for a level of net immigration of 80% of that assumed for purposes of the main tables).

7. As noted in Appendix C, the population projections underlying the main tables are based on a total ultimate (after 1985) fertility rate of 2.112. In order to test the effect of a more pessimistic assumption, Table 1 may be compared with Table 9 (page 22) which is based on a total ultimate fertility rate of 1.8, i.e. a continuation of the rather low rates experienced over the last few years. Fertility rates at the lower level would result in required contribution rates higher than indicated in the table on page 12, beginning gradually in about twenty years and reaching 10.05% rather than 8.73% by the year 2050.

8. Table 10 was included in Appendix A in an attempt to show what might be considered a high cost estimate and is based on the combination of the variations in assumptions discussed in the three preceding paragraphs. In other words, Table 10 assumes (I) a gap between increases in earnings and increases in the Consumer Price Index of 1.5% rather than 2%, (II) a constant level of net immigration of 100,000 instead of increasing in line with current population and (III) an ultimate fertility rate of 1.8 rather than 2.112. A comparison of Table 10 (Page 23) with Table 1 indicates that if experience in the three areas were to be less favourable than assumed for purposes of the main tables, to the extent indicated here, the required increases in contribution rates would be greater and the rate for the year 2050 would be 11.76% instead of the 8.73% shown in the table on page 12.

9. Table 10, discussed in the preceding paragraph presents the situation under conditions substantially less favourable than we would expect. (Among other things, the demographic assumptions underlying Table 10 result in a total population which actually begins to decrease about 2043). However, it seems rather unlikely that the results will turn out as unfavourable as indicated in Table 10. Not only may one or more of the three factors combining to produce the results in Table 10 emerge as even more favourable than assumed for the main tables, but the experience in some other area

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may do so. For example, for purposes of this report it was deemed prudent to use mortality rates based on the assumption of continuous improvement, whereas the rates used for purposes of the preceding report assumed no improvement after the year 2000; there are some other differences between the two sets of assumed mortality rates; however, the effect of adopting the new basis was an increase in the contribution rate of about 0.5% by the year 2050. It is quite conceivable that the improvement in mortality rates for significant age ranges will not be as great as assumed, which would tend to reduce costs.

10. Summary of Projections

	Year	Contribution Rate (% of contributory earnings)	Fund at Year End ($ billions)	Ratio of Fund to Expenditures
Fund C				
(Contribution rate increased as required to prevent fund from decreasing)	1980	3.60	17.9	8.3
	1990	3.60	34.2	4.4
	2000	4.84	34.7	1.9
	2015	6.72	34.7	0.57
	2030	8.98	34.7	0.18
	2050	8.73	34.7	0.05
Fund B				
(Contribution rate increased as required to meet expenditures without recourse to interest earnings)	1980	3.60	17.9	8.3
	1990	4.57	39.5	5.1
	2000	5.53	76.7	4.2
	2015	6.98	197.4	3.2
	2030	9.09	507.6	2.6
	2050	8.76	1788.5	2.8

11. The gradually increasing rates exhibited in the projections of costs, expressed as percentages of contributory earnings, suggest that the most orderly way of guiding the Canada Pension Plan Investment Fund

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toward an agreed level would be to raise contribution rates gradually in a series of steps. If it were desired simply to prevent the fund from declining, the first increase in the contribution rate would likely not be required until sometime after the year 1990. The size of the contribution rate has important implications for the borrowing requirements of the provinces and, as noted earlier, the matter is currently being studied by a sub-committee of the federal-provincial Continuing Committee of Officials on Fiscal and Economic Matters.

Respectfully submitted,

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K1A 0H2

December 14, 1978

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Appendix A

AUXILIARY FUND PROJECTIONS

This appendix contains six tables based on assumptions that differ in one or several respects from those underlying the main tables (1 to 4).

The auxiliary tables may be compared with Table 1 in order to examine the effect of the following:

Table		Page
5	Reduction in gap between annual increases in earnings and prices from 2% to 1.5%	18
6	Decrease in yield on new investments from 3.5 to 3%	19
7	Economic assumptions 1% above those underlying Table 1	20
8	Net immigration of a constant 100,000 p.a. instead of approximately .465% of current population p.a.	21
9	Total fertility rate of 1.8 instead of 2.112	22
10	Combined modifications of Tables 5,8 and 9 ("high cost")	23

LONG-TERM ASSUMPTIONS

EARNINGS INCREASE 5.5% P.A.

PRICES INCREASE 4.0% P.A.

NEW INVESTMENTS YIELD 6.5% P.A.

'TABLE '5 '

AUXILIARY FUND PROJECTIONS *

(FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATE AS PERCENT OF CONTRIBUTORY EARNINGS)

		FUND A			FUND B				FUND C			
		3.6% CONTRIBUTION RATE			CASH FLOW TO PROVINCES DECREASES UNTIL ZERO				CASH FLOW TO PROVINCES DECREASES UNTIL NEGATIVE AND EQUAL TO INTEREST ON FUND			
CALENDAR YEAR	BENEFITS AND EXPENSES	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$	$	$	$	%	$	$	$	%	$	$	$
1978	1385	2096	712	14.3	3.60	2096	712	14.3	3.60	2096	712	14.3
1979	1751	2376	625	16.1	3.60	2376	625	16.1	3.60	2376	625	16.1
1980	2156	2674	519	17.9	3.60	2674	519	17.9	3.60	2674	519	17.9
1981	2565	2992	427	19.8	3.60	2992	427	19.8	3.60	2992	427	19.8
1982	3015	3323	308	21.7	3.60	3323	308	21.7	3.60	3323	308	21.7
1983	3462	3666	203	23.6	3.60	3666	203	23.6	3.60	3666	203	23.6
1984	3952	4016	64	25.5	3.60	4016	64	25.5	3.60	4016	64	25.5
1985	4486	4372	-113	27.3	3.69	4486	0	27.5	3.60	4372	-113	27.3
1986	5093	4702	-392	29.0	3.90	5093	0	29.5	3.60	4702	-392	29.0
1987	5747	5038	-709	30.5	4.11	5747	0	31.7	3.60	5038	-709	30.5
1990	8007	6142	-1865	33.0	4.69	8007	0	39.3	3.60	6142	-1865	33.0
1995	12742	8579	-4162	28.6	5.35	12742	0	55.3	4.36	10390	-2351	33.2
2000	19202	11997	-7205	6.0	5.76	19202	0	76.4	5.11	17032	-2170	33.2
2005	28033	FUND WOULD BECOME EXHAUSTED IN 2003, AND CONTRIBUTION RATE WOULD HAVE TO RISE TO "FUND B" LEVEL OR OTHER REVENUE FOUND.			6.01	28033	0	104.6	5.55	25878	-2155	33.2
2010	41795				6.50	41795	0	143.4	6.16	39640	-2155	33.2
2025	142288				9.04	142288	0	368.7	8.91	140133	-2155	33.2
2030	203169				9.55	203169	0	505.2	9.45	201014	-2155	33.2
2050	671952				9.26	671952	0	1780.1	9.23	669797	-2155	33.2

* ALL ASSUMPTIONS AS FOR TABLE [illegible] IN THIS REPORT

LONG-TERM ECONOMIC ASSUMPTIONS

EARNINGS INCREASE 5.5% P.A.

PRICES INCREASE 3.5% P.A.

NEW INVESTMENTS YIELD 6.0% P.A.

TABLE 6

AUXILIARY FUND PROJECTIONS *

(FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATE AS PERCENT OF CONTRIBUTORY EARNINGS)

		FUND A			FUND B				FUND C			
		3.6% CONTRIBUTION RATE			CASH FLOW TO PROVINCES DECREASES UNTIL ZERO				CASH FLOW TO PROVINCES DECREASES UNTIL NEGATIVE AND EQUAL TO INTEREST ON FUND			
CALENDAR YEAR	BENEFITS AND EXPENSES	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$	$	$	$	%	$	$	$	%	$	$	$
1978	1386	2096	710	14.3	3.60	2096	710	14.3	3.60	2096	710	14.3
1979	1752	2376	625	16.1	3.60	2376	625	16.1	3.60	2376	625	16.1
1980	2152	2674	522	17.9	3.60	2674	522	17.9	3.60	2674	522	17.9
1981	2553	2992	439	19.8	3.60	2992	439	19.8	3.60	2992	439	19.8
1982	2993	3323	330	21.7	3.60	3323	330	21.7	3.60	3323	330	21.7
1983	3427	3666	238	23.6	3.60	3666	238	23.6	3.60	3666	238	23.6
1984	3901	4016	116	25.5	3.60	4016	116	25.5	3.60	4016	116	25.5
1985	4415	4372	-43	27.4	3.64	4415	0	27.4	3.60	4372	-43	27.4
1986	5000	4702	-299	29.1	3.83	5000	0	29.4	3.60	4702	-299	29.1
1987	5630	5038	-591	30.6	4.02	5630	0	31.6	3.60	5038	-591	30.6
1990	7794	6142	-1652	33.5	4.57	7794	0	38.7	3.60	6142	-1652	33.5
1995	12297	8579	-3718	30.5	5.16	12297	0	53.6	4.21	10041	-2257	33.8
2000	18416	11997	-6418	11.8	5.53	18416	0	72.4	4.91	16372	-2044	33.8
2005	26766	FUND WOULD BECOME EXHAUSTED IN 2002, AND CONTRIBUTION RATE WOULD HAVE TO RISE TO "FUND B" LEVEL OR OTHER REVENUE FOUND.			5.74	26766	0	96.9	5.30	24739	-2027	33.8
2010	39850				6.20	39850	0	129.7	5.88	37823	-2027	33.8
2025	135629				8.62	135629	0	313.9	8.49	133601	-2027	33.8
2030	193314				9.09	193314	0	416.1	8.99	191287	-2027	33.8
2050	636210				8.76	636210	0	1334.4	8.74	634183	-2027	33.8

* SEE NOTES FOR TABLE 1, EXCEPT YIELD

LONG-TERM ECONOMIC ASSUMPTIONS

EARNINGS INCREASE 6.5% P.A.

PRICES INCREASE 4.5% P.A.

NEW INVESTMENTS YIELD 7.5% P.A.

TABLE 7 *

AUXILLARY FUND PROJECTIONS *

(FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATE AS PERCENT OF CONTRIBUTORY EARNINGS)

		FUND A			FUND B				FUND C			
		3.6% CONTRIBUTION RATE			CASH FLOW TO PROVINCES DECREASES UNTIL ZERO				CASH FLOW TO PROVINCES DECREASES UNTIL NEGATIVE AND EQUAL TO INTEREST ON FUND			
CALENDAR YEAR	BENEFITS AND EXPENSES	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBU-TION RATE	CONTRI-BUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$	$	$	$	%	$	$	$	%	$	$	$
1978	1382	2087	705	14.3	3.60	2087	705	14.3	3.60	2087	705	14.3
1979	1750	2370	620	16.1	3.60	2370	620	16.1	3.60	2370	620	16.1
1980	2158	2677	519	17.9	3.60	2677	519	17.9	3.60	2677	519	17.9
1981	2570	3012	442	19.9	3.60	3012	442	19.9	3.60	3012	442	19.9
1982	3028	3368	340	21.8	3.60	3368	340	21.8	3.60	3368	340	21.8
1983	3490	3743	253	23.8	3.60	3743	253	23.8	3.60	3743	253	23.8
1984	4002	4136	134	25.9	3.60	4136	134	25.9	3.60	4136	134	25.9
1985	4567	4544	-23	27.9	3.62	4567	0	27.9	3.60	4544	-23	27.9
1986	5220	4939	-281	29.8	3.80	5220	0	30.2	3.60	4939	-281	29.8
1987	5932	5353	-580	31.6	3.99	5932	0	32.6	3.60	5353	-580	31.6
1990	8454	6744	-1710	35.5	4.51	8454	0	40.9	3.60	6744	-1710	35.5
1995	13998	9839	-4159	33.9	5.12	13998	0	59.6	4.08	11146	-2852	36.4
2000	21987	14434	-7554	13.5	5.48	21987	0	86.0	4.80	19249	-2739	36.4
2005	33505	FUND WOULD BECOME EXHAUSTED IN 2002, AND CONTRIBUTION RATE WOULD HAVE TO RISE TO "FUND B" LEVEL OR OTHER REVENUE FOUND.			5.71	33505	0	123.5	5.24	30776	-2729	36.4
2010	52299				6.16	52299	0	177.2	5.84	49569	-2729	36.4
2025	205074				8.57	205074	0	526.4	8.46	202345	-2729	36.4
2030	306414				9.03	306414	0	752.9	8.95	303685	-2729	36.4
2050	1217285				8.71	1217285	0	3198.2	8.69	1214556	-2729	36.4

* ALL ASSUMPTIONS AS FOR TABLE 1, EXCEPT ECONOMIC ASSUMPTIONS REFLECT EXPLICITLY OR IMPLICITLY LEVEL OF INFLATION OF [illegible]

LONG-TERM ECONOMIC ASSUMPTIONS

EARNINGS INCREASE 5.5% P.A.

PRICES INCREASE 3.5% P.A.

NEW INVESTMENTS YIELD 9.5% P.A.

TABLE 8

AUXILIARY FUND PROJECTIONS *

(FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATE AS PERCENT OF CONTRIBUTORY EARNINGS)

		FUND A			FUND B				FUND C			
		3.6% CONTRIBUTION RATE			CASH FLOW TO PROVINCES DECREASES UNTIL ZERO				CASH FLOW TO PROVINCES DECREASES UNTIL NEGATIVE AND EQUAL TO INTEREST ON FUND			
CALENDAR YEAR	BENEFITS AND EXPENSES	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBUTION RATE	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBUTION RATE	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR
	(1) $	(2) $	(3) $	(4) $	(5) %	(6) $	(7) $	(8) $	(9) %	(10) $	(11) $	(12) $
1978	1386	2090	705	14.3	3.60	2090	705	14.3	3.60	2090	705	14.3
1979	1750	2367	617	16.1	3.60	2367	617	16.1	3.60	2367	617	16.1
1980	2150	2662	512	17.9	3.60	2662	512	17.9	3.60	2662	512	17.9
1981	2551	2975	425	19.8	3.60	2975	425	19.8	3.60	2975	425	19.8
1982	2989	3302	313	21.7	3.60	3302	313	21.7	3.60	3302	313	21.7
1983	3422	3638	216	23.6	3.60	3638	216	23.6	3.60	3638	216	23.6
1984	3893	3981	88	25.5	3.60	3981	88	25.5	3.60	3981	88	25.5
1985	4405	4329	-76	27.4	3.66	4405	0	27.5	3.60	4329	-76	27.4
1986	4988	4649	-339	29.1	3.86	4988	0	29.5	3.60	4649	-339	29.1
1987	5613	4975	-638	30.6	4.06	5613	0	31.7	3.60	4975	-638	30.6
1990	7763	6037	-1725	33.6	4.63	7763	0	39.3	3.60	6037	-1725	33.6
1995	12220	8359	-3861	30.7	5.26	12220	0	55.3	4.23	9815	-2402	34.0
2000	18244	11581	-6662	11.4	5.67	18244	0	76.4	4.98	16022	-2222	34.0
2005	26413	FUND WOULD BECOME EXHAUSTED IN 2002, AND CONTRIBUTION RATE WOULD HAVE TO RISE TO "FUND B" LEVEL OR OTHER REVENUE FOUND.			5.92	26413	0	104.7	5.43	24207	-2207	34.0
2010	39144				6.44	39144	0	143.4	6.03	36937	-2207	34.0
2025	130636				9.16	130636	0	363.8	9.01	128429	-2207	34.0
2030	184528				9.72	184528	0	505.2	9.61	182321	-2207	34.0
2050	575122				9.48	575122	0	1780.2	9.45	572916	-2207	34.0

* ALL ASSUMPTIONS AS FOR TABLE 1, EXCEPT AS INDICATED

LONG-TERM ECONOMIC ASSUMPTIONS

EARNINGS INCREASE 5.5% P.A.

PRICES INCREASE 3.5% P.A.

NEW INVESTMENTS YIELD 6.5% P.A.

TABLE 9*

AUXILLIARY FUND PROJECTIONS *

(FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATE AS PERCENT OF CONTRIBUTORY EARNINGS)

		FUND A			FUND B				FUND C			
		3.6% CONTRIBUTION RATE			CASH FLOW TO PROVINCES DECREASES UNTIL ZERO				CASH FLOW TO PROVINCES DECREASES UNTIL NEGATIVE AND EQUAL TO INTEREST ON FUND			
CALENDAR YEAR	BENEFITS AND EXPENSES	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBUTION RATE	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBUTION RATE	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR
	(1) $	(2) $	(3) $	(4) $	(5) %	(6) $	(7) $	(8) $	(9) %	(10) $	(11) $	(12) $
1978	1386	2096	710	14.3	3.60	2096	710	14.3	3.60	2096	710	14.3
1979	1751	2376	625	16.1	3.60	2376	625	16.1	3.60	2376	625	16.1
1980	2152	2674	523	17.9	3.60	2674	523	17.9	3.60	2674	523	17.9
1981	2553	2992	439	19.8	3.60	2992	439	19.8	3.60	2992	439	19.8
1982	2992	3323	331	21.8	3.60	3323	331	21.8	3.60	3323	331	21.8
1983	3425	3666	240	23.7	3.60	3666	240	23.7	3.60	3666	240	23.7
1984	3898	4016	118	25.6	3.60	4016	118	25.6	3.60	4016	118	25.6
1985	4412	4372	-39	27.6	3.63	4412	0	27.6	3.60	4372	-39	27.6
1986	4996	4702	-294	29.3	3.82	4996	0	29.7	3.60	4702	-294	29.3
1987	5623	5039	-584	30.9	4.02	5623	0	31.9	3.60	5039	-584	30.9
1990	7782	6142	-1640	34.2	4.56	7782	0	39.5	3.60	6142	-1640	34.2
1995	12268	8565	-3703	32.3	5.16	12268	0	55.6	4.12	9810	-2458	34.6
2000	18363	11884	-6480	14.7	5.56	18363	0	76.7	4.87	16087	-2277	34.8
2005	26686	FUND WOULD BECOME EXHAUSTED IN 2002, AND CONTRIBUTION RATE WOULD HAVE TO RISE TO "FUND B" LEVEL OR OTHER REVENUE FOUND.			5.86	26686	0	105.2	5.36	24424	-2262	34.8
2010	39720				6.43	39720	0	144.1	6.06	37458	-2262	34.8
2025	134887				9.39	134887	0	370.6	9.23	132625	-2262	34.8
2030	191984				10.10	191984	0	507.7	9.98	189722	-2262	34.8
2050	604741				10.07	604741	0	1789.0	10.03	602479	-2262	34.8

* ALL ASSUMPTIONS AS FOR TABLE 1, EXCEPT TOTAL FERTILITY RATE 1.8 INSTEAD OF 2.1

LONG-TERM ECONOMIC ASSUMPTIONS

EARNINGS INCREASE 5.5% P.A.

PRICES INCREASE 4.0% P.A.

REAL INVESTMENTS YIELD 6.5% P.A.

TABLE 10

AUXILIARY FUND PROJECTIONS*

(FUND IN BILLIONS OF DOLLARS, OTHER DOLLAR FIGURES IN MILLIONS, CONTRIBUTION RATE AS PERCENT OF CONTRIBUTORY EARNINGS)

		FUND A			FUND B				FUND C			
		3.6% CONTRIBUTION RATE			CASH FLOW TO PROVINCES DECREASES UNTIL ZERO				CASH FLOW TO PROVINCES DECREASES UNTIL NEGATIVE AND EQUAL TO INTEREST ON FUND			
CALENDAR YEAR	BENEFITS AND EXPENSES	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBUTION RATE	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR	CONTRIBUTION RATE	CONTRIBUTIONS	CASH FLOW TO PROVINCES	FUND AT END OF YEAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$	$	$	$	%	$	$	$	%	$	$	$
1978	1384	2090	706	14.3	3.60	2090	706	14.3	3.60	2090	706	14.3
1979	1750	2367	617	16.1	3.60	2367	617	16.1	3.60	2367	617	16.1
1980	2153	2662	509	17.9	3.60	2662	509	17.9	3.60	2662	509	17.9
1981	2561	2975	414	19.8	3.60	2975	414	19.8	3.60	2975	414	19.8
1982	3010	3302	292	21.7	3.60	3302	292	21.7	3.60	3302	292	21.7
1983	3455	3638	183	23.5	3.60	3638	183	23.5	3.60	3638	183	23.5
1984	3942	3981	39	25.4	3.60	3981	39	25.4	3.60	3981	39	25.4
1985	4472	4329	-143	27.2	3.72	4472	0	27.3	3.60	4329	-143	27.2
1986	5075	4649	-426	28.8	3.93	5075	0	29.4	3.60	4649	-426	28.8
1987	5724	4976	-748	30.2	4.14	5724	0	31.6	3.60	4976	-748	30.2
1990	7962	6037	-1925	32.6	4.75	7962	0	39.1	3.60	6037	-1925	32.6
1995	12631	8345	-4285	27.4	5.45	12631	0	55.0	4.45	10317	-2313	32.6
2000	18968	11468	-7500	3.2	5.95	18968	0	76.0	5.23	15836	-2132	32.6
2005	27580	FUND WOULD BECOME EXHAUSTED IN 2001, AND CONTRIBUTION RATE WOULD HAVE TO RISE TO "FUND B" LEVEL OR OTHER REVENUE FOUND.			6.34	27580	0	104.2	5.86	25462	-2118	32.6
2010	40921				7.02	40921	0	142.7	6.66	38804	-2118	32.6
2025	136296				10.55	136296	0	367.1	10.38	134178	-2118	32.6
2030	192592				11.48	192592	0	503.0	11.36	190474	-2118	32.6
2050	575806				11.80	575806	0	1772.3	11.76	573688	-2118	32.6

* ALL ASSUMPTIONS AS FOR TABLE 1, EXCEPT PRICES INCREASE [illegible] OF [illegible] 5.5%, NET IMMIGRATION 100,000 INSTEAD OF [illegible] OF [illegible] IN PROVINCES, [illegible]

Appendix B

MAIN PROVISIONS OF THE EXISTING PLAN

1. Coverage and Contributions

In general, the Canada Pension Plan which came into force on January 1, 1966, applies to 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. The main exceptions are:

(a) persons with earnings less than the "Year's Basic Exception",

(b) persons to whom a retirement or disability pension is payable pursuant to the Act, and

(c) members of certain religious sects.

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

The rate of contribution as respects earnings subject to contributions which has been in effect since the inception of the Plan is 1.8% of salary and wages for each of employees and their employers and 3.6% of self-employed earnings.

2. Definition of Terms Relating to Earnings

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

Year's Maximum Pensionable Earnings (YMPE)

"Year's Maximum Pensionable Earnings" for any year means the upper limit above which annual earnings are not subject to contributions in that year.

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 and $7,400 for 1974 and 1975, respectively. For each year after 1975 it is determined as equal to 112.5% of the YMPE for the preceding year but not more than the quantity $52(I_{z-1})(I_{z-3} + I_{z-2} + I_{z-1}) \div (I_{z-4\ 1/2} + I_{z-3\ 1/2} + I_{z-2\ 1/2})$ where I_{z-1} is the average of the Industrial Composite (Statistics Canada: average weekly wages and salaries)

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for the twelve months ending June 30 in the preceding year. Once the YMPE is linked to average industrial earnings in this manner, the latter formula is to be continued and the former increase of 12.5% per annum is to be abandoned. If the amount calculated by formula is not a multiple of $100 the next lower multiple of $100 is used, but any reduction in the YMPE because of the operation of the formula is ruled out.

Year's Basic Exemption (YBE)

"Year's Basic Exemption" for any year means the amount of annual earnings below which earnings are not subject to contributions. It is calculated as 12% of the YMPE for each year from 1966 to 1974 inclusive and 10% thereafter (rounded if necessary to the nearest lower multiple of $100). The basic exemption is prorated in individual cases to allow for periods below age 18, above age 70, and while on retirement or disability pension and to allow for death.

A person with earnings in any year greater than the YBE is required to contribute under the Plan on all earnings between the YBE and the YMPE.

Contributory Earnings

"Contributory earnings" for any year means the earnings of a contributor on which contributions are payable, i.e., earnings between the YBE and the YMPE for that year.

Pensionable Earnings

"Pensionable earnings" for any year means all earnings of a contributor up to the YMPE provided that required contributions have been made in that year, multiplied by the ratio that the average YMPE for the year when a retirement pension or other earnings-related benefit becomes payable under the Act and for the two preceding years bears to the YMPE for the year in which the contributions were made.

3. 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 and the upper limit on the amount of death benefit,

(b) the Year's Basic Exemption,

(c) the flat-rate component of a disability pension,

(d) the flat-rate component of a survivor's pension (payable to a surviving spouse),

(e) the flat-rate benefit for orphans and children of disabled contributors,

(f) all monthly benefits in payment.

Annual adjustment of all elements subject to automatic adjustment depend on changes in the Pension Index constructed as described in the next following paragraph, with two exceptions. First, annual adjustments of the contributory earnings limits (YMPE and YBE) after 1973 are as described on the first page of this appendix. Secondly, 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 twelve months ending with June of the year preceding the year of emergence.

For 1967, the Pension Index was computed as the average of the CPI's for Canada for the twelve months ending with June 1966. For each year from 1968 through 1973, it was computed as the average of the CPI's for the twelve months 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 equals the average of the CPI's for the twelve months ending with June 1972, multiplied by the average of the CPI's for the sixteen months ending with October 1973, and divided by the corresponding average for the sixteen months ending with June 1972*. The Pension Index for 1975 and later years equals the average of the CPI's for the twelve months ending with October of the preceding year in each case, except that the Pension Index for the preceding year will be retained if a reduction in its value would otherwise occur.

4. Retirement Pension

Upon application, a contributor aged 65 or over becomes entitled to a retirement pension. (A contributor in receipt of a disability pension becomes entitled to a retirement pension on attainment of 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,

* The Pension Index for 1974 is defined differently in the Act, but it is used in such a way as to produce the same benefit amounts as the procedure described here.

except for adjustment 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.

In general, the initial amount of retirement pension payable to a contributor is based on the whole history of his Pensionable Earnings from January 1, 1966, or from attainment of age 18, if later, until the year in which the pension commences.

Retirement pensions in payment are subject to automatic adjustment in accordance with changes in the Pension Index.

A convenient formula for determining the initial amount of retirement pension involves the use of an "average earnings ratio", as follows:

Formula for Retirement Pension

Initial Amount of Annual Pension

This amount is equal to 25% of the average of the YMPE for the three years ending with the year in which pension commences, multiplied by the "average earnings ratio" which is determined as follows:

Years in Contributory Period	Formula for Average Earnings Ratio
	Average of a number of the highest "annual earnings ratios", such number being the greater of
less than 10	(a) the number of years in the contributory period or (b) 10 less the number of years when disability pension payable
10 or more	(a) 10 or (b) 85% of the years in the contributory period

The "annual earnings ratio" referred to above is the ratio of "unescalated pensionable earnings" to the YMPE in a calendar year. Unescalated pensionable earnings for a year are the actual earnings of a contributor up to the YMPE, provided that required contributions have been made. It should be noted that if no contributions are made

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during a calendar year, the "annual earnings ratio" for that year is zero; and for any year in which a contributor's earnings exceed the YMPE, the ratio is one).

The "contributory period" for purposes of retirement pensions is the number of years from January 1, 1966, (or from attainment of age 18, if later), to age 65, less the number of years, if any, during which a disability pension is payable.

Examination of the above formula will make it clear that, in addition to the exclusion from the benefit calculations of the whole period during which a disability pension is payable, certain lowest recorded annual earnings ratios will normally be excluded from the benefit calculations by reason of contributions made after age 65 and by reason of the 15% "drop-out" provision; however, the drop-out must not reduce the total number of years to less than ten.

5. Disability Pension

A contributor aged less than 65, who becomes disabled within the meaning of the disability provisions of the Plan, is entitled to a disability pension, under the following conditions:

Number of calendar years in contributory period	Number of calendar years for which contributions must have been made
Less than 10	5
10 to 30	5 of last 10, and in total at least 1/3 of the number of calendar years in the contributory period
30 or more	5 of last 10, and in total at least 10

The "contributory period" for purposes of disability pensions is the number of years from January 1, 1966, (or from attainment of age 18, if later) to the date of commencement of the disability pension, less the number of years during which a disability pension was previously payable.

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

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Disability pensions in payment like retirement pensions are subject to automatic adjustment in accordance with changes in the Pension Index.

The amount of pension payable is composed of two parts, namely, 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 to the date of commencement of the disability pension. The initial flat-rate part is determined as $25 per month adjusted in accordance with the increase in the Pension Index from 1967 to the year in which the disability pension commences (for example, $48.19 for pensions payable in 1978). The initial earnings-related part is equal to 75% of an earnings-related pension calculated in the manner described earlier for retirement pensions, except that the contributory period ends at the date of commencement of the disability pension and that, both before and after December 31, 1975, the number of years to be taken into account in determining the "average earnings ratio" is as follows:

Years in Contributory Period	Number of highest "annual earnings ratios" used in calculating average earnings ratio
Less than 10	years in contributory period
10 or more	greater of 10 or 85% of the number of years in contributory period

In addition to the normal disability pension described above, benefits may be payable to the children of disabled contributors.

6. Disabled Contributor's Child's Benefit

An unmarried 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 age 25 and has been attending school full-time and substantially without interruption since attainment of age 18 or the time of the contributor's disability, whichever occurred later.

The initial amount of pension payable in respect of each child is equal to the initial flat-rate benefit payable to the disabled contributor (i.e., $25 per month adjusted in accordance with changes in

the Pension Index from 1967 to the year in which the disability pension commences). However, only one child's benefit is payable in respect of each child, even if both parents are entitled to a disability pension; furthermore, a child may not simultaneously receive a disabled contributor's child's benefit and an orphan's benefit (see 8(c) below).

7. Survivor's Pension and Orphan's Benefit

(a) General

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

(i) ten calendar years, or

(ii) one-third of the number of calendar years in which contributions could have been made, but not less than three years.

By the expression "calendar years in which contributions could have been made" is meant all calendar years after 1965 or from age 18, if that age was attained after 1965, to the attainment of age 65 or cessation of contributions, if later, but not beyond the month of death, and including any calendar months during which a disability pension was payable.

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 she or he is entitled for any one of such reasons.

A surviving spouse may become entitled to both a survivor's pension and either a disability pension or a retirement pension. However, the total annual amount of the two pensions 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).

A survivor's pension is suspended during any period of remarriage.

Survivors' Pensions and Orphans' Benefits in payment like retirement and disability pensions are subject to automatic adjustment in accordance with changes in the Pension Index.

(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 an unmarried 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 attainment of age 18 or the time of the contributor's death, whichever occurred later, or

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

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

A surviving spouse aged between 45 and 65 at widowhood (widowerhood) is entitled to a survivor's pension.

The amount of pension payable is composed of two parts, namely 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 determined as $25 per month adjusted in accordance with the increase in the Pension Index from 1967 to the year in which the death of the contributor occurs. The initial earnings-related part is equal to 37.5% of an earnings-related pension based on the contributor's pensionable earnings record calculated as at the date of the contributor's death or commencement of his age retirement pension, whichever is the 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 age retirement pension became payable to the year of his death. In general, the amount of the contributor's earnings-related pension is

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calculated in the manner described earlier for retirement pensions, except that the "contributory period" ends at the date of death or at age 65, whichever is the earlier, and that the number of years to be taken into account in determining the "average earnings ratio" is,

A. the number of years in the contributory period, if the number of years in the contributory period is less than ten, or

B. the greater of ten or 85% of the number of years in the contributory period, if the number of years in the contributory period is ten or more.

(iii) Surviving spouses aged less than 45 at widowhood (widowerhood) without dependent children and not disabled

A surviving spouse without dependent children and not disabled, age 35 or less at widowhood (widowerhood), is not entitled to a survivor's pension.

A surviving spouse without dependent children and not disabled, aged more than 35 but less than 45 at widowhood (widowerhood) 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 widowhood (widowerhood) is less than 45.

(iv) Surviving spouses aged less than 45 at widowhood (widowerhood) with dependent children

A surviving spouse aged less than 45 at widowhood (widowerhood), with dependent children, is entitled to a survivor's pension calculated as described in (ii) above.

If a surviving spouse in receipt of a survivor's pension is aged less than 45 and not disabled at the time she or he ceases to be a "surviving spouse with dependent children", 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 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.

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The surviving (disabled) 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 is disabled, whichever is later. 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. The calculated initial amount of pension is subject to the limitation on the maximum initial amount payable in respect of dual pensions, as explained in (a) above.

(vi) Surviving spouses aged 65 or over

At age 65, or upon widowhood (widowerhood) at a later age, a surviving spouse who is not then in receipt of an age retirement pension or to whom such a pension does not become payable immediately, is entitled to an amount of pension equal to 60% of an earnings-related pension* based on the pensionable earnings record of the deceased spouse.

At the time a surviving spouse becomes entitled to both a survivor's pension and a retirement pension or to either one while in receipt of the other, the total amount of pension is equal to the greater of

A. 60% of the surviving spouse's own retirement pension plus 60% of an earnings-related pension* based on the pensionable earnings record of the deceased spouse, or

B. 100% of the surviving spouse's own retirement pension plus 37.5% of an earnings-related pension* based on the pensionable earnings record of the deceased spouse,

subject to the limitation on the maximum initial amount payable in respect of dual pensions, as explained in (a) above.

(c) Orphan's Benefit

The provisions for orphans are analogous to those described earlier for children of disabled contributors.

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* An earnings-related pension, calculated as described in (ii) above, 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 (him) while in receipt of a survivor's pension.

For purposes of orphans' benefits, an "orphan" means an unmarried 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 attainment of age 18 or the time of the contributor's death, whichever occurred later.

The amount of pension payable in respect of each orphan is $25 per month adjusted in accordance with changes in the Pension Index from 1967 to the year in which the benefit is payable. However, only one orphan's benefit is payable in respect of each child, even if both deceased parents were contributors; furthermore as noted in (7) above, a child may not simultaneously receive both an orphan's benefit and a disabled contributor's child's benefit.

8. 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 any reduction that may have arisen by reason of commencement of pension within the ten-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 in the manner described for retirement pensions, except that the deceased contributor's contributory period ends at the date of death or at age 65, whichever is the earlier,

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

9. 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 and requires the consent of two-thirds of the provinces having in aggregate at least two-thirds of the population of Canada.

Appendix C

Principal Assumptions and Procedures

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Appendix C

PRINCIPAL ASSUMPTIONS AND PROCEDURES

1. General

We have continued the practice adopted for Statutory Actuarial Report No. 3 (December 31, 1973) of basing the main tables on one set of what we regard as reasonably realistic demographic assumptions and long-term relationships between the various economic factors.

As noted below, a number of relatively minor changes were made in the assumptions, and the number of auxiliary fund projections (Appendix A) was increased to allow greater appreciation of the sensitivity of the projections to the various assumptions.

2. Economic Assumptions

The economic assumptions used for the main tables differ slightly from those used for purposes of the preceding report, a key feature of which was the assumption that (except for a short transition period) the gap between the annual increase in average earnings and the increase in the Consumer Price Index would remain constant at 2.5%.

In the light of past experience in Canada, this assumption appeared appropriate. For the twenty-five years ending in 1977, the compound average annual rate of real increase in earnings(measured as a function of average industrial earnings and the Consumer Price Index) was 2.67%, and the corresponding figure for the ten years ending in 1977 was 2.71%. However, the figure for the five years ending in 1977 was only 1.77%, and there appears to be a growing body of opinion holding that real increases in average earnings in the foreseeable future will be lower than in the past. Recent actuarial projections made for the Quebec Pension Plan and the United States social security system (OASDI) have been based on assumptions for real increases in earnings in the long term of 2% and 1.75% respectively. For purposes of the main estimates in this report, it was assumed that beginning in 1982-83 average earnings would increase at a real rate of 2% per annum (actually approximately 1.932%). However, as for the preceding report, we have prepared auxiliary fund projections, on an assumption of a 1.5% real rate of increase in earnings, which may be found in Appendix A.

The narrowing of the gap between the assumed increases in earnings and prices could be accomplished either by raising the assumed rate of increase in prices or lowering the corresponding rate for earnings. Although there was no intention to make an upward revision in the assumed level of long-term inflation it seemed more acceptable in the current economic climate to adopt the former alternative. Accordingly, the assumed ultimate rate of increase in prices was raised from 3% to 3.5%, while the assumed ultimate rate of increase in earnings was left at 5.5% per annum.

As noted in Section III of the Report, the assumed level of inflation is of relatively slight practical significance in determining the level of costs expressed as a percentage of contributory earnings. The use of substantially higher assumed rates of inflation, while doing very little to enhance the value of the projections, could do substantial harm by adding weight to expectations of higher levels of inflation and thereby helping to frustrate efforts to control inflation.

It was decided to keep the annual rate of interest on new investments in the long term at 6.5%. This assumption, coupled with an assumption of 3.5% for increases in the Consumer Price Index, implies an assumed rate of real investment earnings of 3% per annum. This is a lower real rate of earnings than was assumed for the preceding report but a somewhat higher rate than might well be experienced in the future by a fund invested entirely at rates reflecting long term Government of Canada bond rates. However, it must be recognized that neither actual nor assumed rates of interest have a significant effect on contribution rates, unless a relatively significant fund is maintained. The assumed rate of interest is highly significant in the calculation of the contribution rate on a full "actuarially funded" basis and of the related unfunded liability (see Appendix D); 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 of 3% p.a. appears quite appropriate for this purpose as well.

The three key economic assumptions used are as follows:

	1978	1983 and later
Annual increase in average earnings	6.7%	5.5%
Annual increase in Consumer Price Index	9.0%	3.5%
Annual rate of interest on new investments	9.4%	6.5%

The assumptions for 1978 (based upon each experience as was available in September 1978) were graded smoothly into the ultimate rates.

3. Population Projections

(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 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 resident in Quebec. However, provision for this group was made implicitly in the development of the participation rates given in section 4 of this appendix.

Populations were projected from the 1971 census, after first applying adjustment factors to compensate for the 1971 census undercount. The projections carry forward to the year 2050, which provides a period of seventy-three years from the effective date of this examination.

Detailed figures for selected years by sex and age-group are given in Schedules 5, 6 and 7 of this appendix following the description of the underlying fertility, mortality and immigration assumptions. Schedule 1 below shows census and projected total populations for selected years for Canada, excluding Quebec, as well as some of the noteworthy projected demographic relationships.

Schedule 1

Middle of Year	Census and Projected Populations for Canada Excluding Quebec (in thousands) Male	Female	Total	Ratio of Population Aged 65 and over to Population Aged 20 to 64 (%)	Birth Rate per 1000	Rates of Net Immigration to Population (all Canada) (%)
1951	5,067	4,887	9,954	15.5	26.1	1.046
1961	6,587	6,392	12,979	16.4	26.1	-0.010
1971	7,801	7,740	15,541	16.4	17.6	0.310
1971*	7,975	7,863	15,838	16.2	17.2	0.455
1980	9,128	9,103	18,231	16.0	17.6	0.451
1990	10,660	10,704	21,364	17.0	16.9	0.462
2000	12,052	12,156	24,208	17.7	14.7	0.465
2025	15,464	15,794	31,258	26.9	13.9	0.464
2050	18,743	19,251	37,994	29.1	13.8	0.466

(b) Fertility

The fertility assumptions used for the projections of the population for Canada as well as those for Quebec provide that the age-specific fertility rates for 1985 and later produce a total fertility rate of 2.112.** This value corresponds approximately to a net reproduction rate of 1; i.e., every female born alive is assumed to bear one female child. For the years 1975 to 1984, the total fertility rates were obtained by employing a linear interpolation between the 1974 actual values (1.875 for Canada and 1.657 for Quebec) and the assumed 1985 value of 2.112. For the years 1971 to 1974, the actual total fertility rates were available and, accordingly, were used directly in the population projections. In all cases, the distribution of the age-specific fertility rates was that of the three-year average for 1970 to 1972, with the level of such rates adjusted to produce the required total fertility rate.

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* 1971 starting populations adjusted for undercount of 1971 census.

**See footnote on page 39.

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Experience fertility rates for the years 1966, 1970 and 1974, as well as the rates used for 1985 and later are shown below.

Schedule 2

Selected Fertility Rates

(Number of live births per 1000 females in age group)

Female Age Group	Recently Experienced Fertility Rates						Fertility Rates Assumed for 1985 and later**	
	1966		1970		1974			
	Canada*	Province of Quebec	Canada*	Province of Quebec	Canada*	Province of Quebec	Canada	Province of Quebec
15-19	48.2	25.4	43.4	21.0	35.3	16.6	39.2	22.2
20-24	169.1	150.2	142.1	112.0	113.1	91.1	128.3	119.5
25-29	163.5	161.2	145.6	130.3	131.1	126.6	137.6	145.2
30-34	103.3	105.6	80.7	77.1	66.6	67.5	74.7	84.2
35-39	57.5	62.3	38.5	38.8	23.0	23.6	32.7	38.8
40-44	19.1	22.2	11.0	11.6	5.5	5.6	9.2	11.6
45-49	1.7	2.4	.9	1.0	.4	.4	.7	.9
Total	2812.0	2646.5	2311.0	1959.0	1875.0	1657.0	2112.0	2112.0

It may be seen from Schedule 2 that, although recent years have shown a steady decline in the level of total fertility, it is assumed that by 1985 fertility will return to a level somewhat higher than that for 1974 (the most recent year for which published data were available). The ultimate level of fertility assumed is approximately equal to the level experienced in Canada outside the province of Quebec in 1972.

Of course, it is possible that fertility rates may become stabilized at some level equivalent to a net reproduction rate of less than one. Under such conditions, however, it seems reasonable to expect that the relative size of the productive population will be maintained either through increased immigration or later retirements or a combination of both. (It is also possible, of course, that the relative size of the productive population will not be maintained but that this will be compensated by new technological developments or that a lower level of production will become acceptable).

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* Newfoundland is excluded because of unavailability of data

** The total fertility rate for 1985 and later of 2.112 is slightly below 2.3, the medium fertility assumption used by Statistics Canada for "Population projections for Canada and the provinces 1972-2001" and is the basis for all tables in this report except tables 9 and 10. The latter are based on a total fertility rate of 1.8 (the low fertility assumption used by Statistics Canada).

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(c) Mortality

Mortality is projected to improve from Life Table 1970-72, Canada,* assumed applicable for 1971, to an ultimate mortality table for year 2050, which is assumed to apply to Canada as well as to Quebec only. For the intermediate years mortality rates were obtained by a geometric interpolation; i.e., a constant percentage decrease in mortality from one year to the next was assumed.

The ultimate mortality table used in our population projections is in part based on work done by the Office of the Actuary of the U.S. Social Security Administration. "Actuarial Study No. 77 - United States Population Projections for OASDHI Cost Estimates" derives mortality rates for the year 2050 by considering death rates by age-group and sex, in 10 broad groups of causes of death, and by combining the assumed percentage reductions for each cause of death to obtain average reductions** in mortality by age and sex for all causes combined. For the current Canada Pension Plan projections, the same relative improvements in mortality from 1970-72 levels implied by Actuarial Study No. 77 were assumed to be applicable to the 1970-72 Canada Life Table. The resulting ultimate table (assumed applicable to the year 2050) produces an expectation of life at birth of 73.1 for males and 81.2 for females, compared to 69.3 and 76.4, respectively, for the 1970-72 Canada Life Table. For age 65 the expectation of life according to the ultimate table is 16.0 for males and 20.7 for females, compared to 13.7 and 17.5, respectively, for the 1970-72 Canada Life Table. Sample values of the ultimate mortality rates are given in Schedule 3, along with a comparison of mortality rates for Canada as well as Quebec alone on the basis of the Canada Life Tables 1960-62 and 1970-72. (See page 41)

The 1970-72 Canada Life Table for Canada, the corresponding table for Quebec, and the ultimate mortality table constructed as above consist of one-year probabilities of mortality for individual ages 0 to 109. The 1971 census population data for Canada and Quebec, available by individual ages up to 89, were adjusted to spread to 90+ age-group by individual ages to 109. Survivors of the population for a particular year were then obtained by simply applying the probabilities of survival for that year to the given population.

(d) Migration

Migration is generally recognized to be a rather uncertain parameter of future population growth, since it is subject to a variety of demographic, economic, social and political factors. During the period from 1961 to 1972, for example, immigration to Canada varied from 70,000 to 214,000 and, although relatively more stable, emigration from Canada is estimated to have fluctuated between 47,000 and 81,000 (Statistics Canada: "Technical Report on Population Projections for Canada and the Provinces, 1972-2001").

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* Published by Statistics Canada and referred to herein as "1970-72 Canada Life Table".

** The relatively low death rates for ages 15 to 30 are projected to increase slightly, as a result of some gradual increase in violent deaths.

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Schedule 3

Comparison of Mortality Rates for the Province of Quebec and for Canada

(Annual deaths per 1,000 persons)

Age	Life Tables 1960-62		Life Tables 1970-72		Rates Assumed For Year 2000		Rates Assumed for Year 2050
	Province of Quebec	Canada	Province of Quebec	Canada	Province of Quebec	Canada	
Males							
0	34.90	30.58	20.97	20.02	16.01	15.54	10.05
1	2.11	1.85	1.31	1.28	1.09	1.08	.80
5	.93	.73	.66	.61	.55	.55	.41
10	.59	.50	.48	.39	.38	.34	.26
20	1.50	1.53	1.87	1.78	1.88	1.82	1.89
30	1.50	1.50	1.61	1.52	1.58	1.52	1.53
40	3.15	2.82	2.99	2.91	2.76	2.71	2.40
50	8.29	7.72	8.19	7.61	7.16	6.84	5.69
60	21.56	19.99	21.41	19.18	18.60	17.35	14.59
70	47.06	44.67	47.84	44.36	41.51	39.58	32.51
80	104.95	100.91	105.77	97.01	94.79	89.74	78.47
90	244.10	227.12	233.54	209.77	197.36	184.40	147.65
Females							
0	27.19	23.87	16.73	15.44	12.62	11.99	7.76
1	1.86	1.64	1.09	1.15	.90	.93	.64
5	.67	.53	.62	.50	.47	.41	.29
10	.34	.29	.31	.28	.25	.23	.17
20	.55	.55	.64	.57	.56	.52	.44
30	.82	.79	.77	.77	.67	.67	.52
40	1.93	1.74	1.76	1.73	1.53	1.51	1.19
50	4.63	4.36	4.17	4.03	3.58	3.50	2.75
60	12.27	10.64	10.42	9.31	9.06	8.44	7.12
70	31.60	27.74	25.85	23.37	21.47	20.14	15.58
80	86.35	73.41	73.19	65.14	61.35	56.01	43.16
90	234.59	207.08	181.83	171.37	154.89	149.19	117.48

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For purposes of this report,* a level of immigration of 160,000 and emigration of 60,000 was assumed for 1971, and both these figures were increased with time at the rate of 1.5% per annum to 1995, 1.0% per annum from 1995 to 2025 and .8% per annum thereafter, so that net immigration to Canada would, in effect, remain constant at approximately .465% of population. For purposes of projecting the population of Quebec it was assumed that the percentage of immigrants and emigrants attributable to the Province of Quebec of 17.33% and 29.84%, respectively, for 1968-71 were applicable to 1971 and that the average number of net interprovincial migrants from Quebec of 22,017 for 1966-71 was also applicable to the year 1971. The combination of these assumptions imply an initial outflow from Quebec of 12,193. In order not to assume such a net outflow to continue indefinitely, the following bases were adopted:

	1971	2000 and later
% immigration destined for Quebec	17.33%	25%
% emigration attributable to Quebec	29.84%	25%
net interprovincial migration from Quebec	22,017	0

For the intervening years, values were obtained by linear interpolation. The figure of 25% was chosen in order to maintain the proportion of the population assumed to be attributable to Quebec after 2000 at about 25%. The distribution of immigrants by individual age and sex was obtained from "Analytical and Technical Memorandum No. 6: Migration Projections for Canada" by K.S. Gnanasekaran (Statistics Canada).

The distribution of emigrants by age and sex is not readily available, because no statistics on emigrants are maintained and even the level of emigration is obtained only from estimates of population and data on total immigration and natural growth. The assumed age-sex distribution of emigrants is based on the distribution of immigrants to the United States from Canada obtained on a continuous basis by Statistics Canada from the United States Department of Justice (Analytical and Technical Memorandum No. 6). Emigrants from Canada to the United States have constituted about two-thirds of the estimated total emigration in past years and their distribution is assumed to be applicable to all emigrants.

Net immigration over age 65 was excluded from the population in order to avoid a substantial overstatement of benefits in respect of immigrants.

Sample age distribution figures, for both immigrants and emigrants, are shown on page 43.

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* This is the basis of all tables except Tables 9 and 11. The latter are based on the assumption of a constant level of net immigration of 100,000 which is medium-high assumption used by Statistics Canada in its range of 20,000 to 140,000.

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Schedule 4

Distribution of Immigrants and Emigrants by Age Group

Age Group	Immigrants		Emigrants	
	Males	Females	Males	Females
	%	%	%	%
0-4	4.879	4.607	6.365	5.985
5-9	4.176	3.903	5.053	5.069
10-14	2.948	2.808	3.532	3.447
15-19	3.758	4.096	2.689	3.596
20-24	8.969	10.470	3.601	8.881
25-29	9.147	8.049	6.436	7.240
30-34	5.728	4.838	6.097	5.105
35-39	3.699	3.123	4.861	3.826
40-44	2.189	1.931	3.199	2.755
45-49	1.316	1.371	2.143	1.846
50-54	.927	1.226	1.397	1.480
55-59	.694	1.157	.939	1.072
60-64	.530	1.012	.539	.721
65-69	.471	.755	.429	.523
70+	.427	.796	.499	.675
All ages	49.858	50.142	47.779	52.221

(e) Populations

In Schedules 5, 6 and 7 are shown for Canada, the Province of Quebec and Canada excluding Quebec, respectively, the 1971 starting population* and the projected populations for 1980, 1990, 2000, 2025 and 2050. The populations are shown distributed by sex and broad age groups. These populations were used for all projections except Tables 8, 9 and 10.

* 1971 census adjusted for undercount.

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SCHEDULE 5

POPULATIONS FOR ALL CANADA *
(IN THOUSANDS)

MIDDLE OF YEAR		TOTAL	14 AND UNDER		15 - 19		20 - 39		40-59		60 - 64		65 - 69		70 AND OVER	
			NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL
1971	MALES	11038	3301	29.9	1104	10.0	3166	28.7	2288	20.7	387	3.5	300	2.7	492	4.5
	FEMALES	10944	3156	28.8	1066	9.7	3065	28.0	2283	20.9	400	3.7	327	3.0	647	5.9
	TOTAL	21982	6457	29.4	2170	9.9	6231	28.3	4571	20.8	787	3.6	627	2.9	1139	5.2
1980	MALES	12382	2946	23.8	1216	9.8	4273	34.5	2528	20.4	449	3.6	380	3.1	590	4.8
	FEMALES	12391	2807	22.7	1163	9.4	4151	33.5	2509	20.2	495	4.0	435	3.5	831	6.7
	TOTAL	24773	5753	23.2	2379	9.6	8424	34.0	5037	20.3	944	3.8	815	3.3	1421	5.7
1990	MALES	14302	3525	24.6	954	6.7	4921	34.4	3155	22.1	544	3.8	459	3.2	744	5.2
	FEMALES	14391	3341	23.2	909	6.3	4754	33.0	3126	21.7	593	4.1	555	3.9	1113	7.7
	TOTAL	28693	6866	23.9	1863	6.5	9675	33.7	6281	21.9	1137	4.0	1014	3.5	1857	6.5
2000	MALES	16078	3724	23.2	1247	7.8	4779	29.7	4328	26.9	580	3.6	493	3.1	927	5.8
	FEMALES	16229	3527	21.7	1185	7.3	4586	28.3	4312	26.6	623	3.8	565	3.5	1431	8.8
	TOTAL	32307	7251	22.4	2432	7.5	9365	29.0	8640	26.7	1203	3.7	1058	3.3	2358	7.3
2025	MALES	20541	4396	21.4	1403	6.8	5841	28.4	4987	24.3	1180	5.7	1022	5.0	1712	8.3
	FEMALES	20970	4161	19.8	1332	6.4	5579	26.6	4903	23.4	1262	6.0	1169	5.6	2564	12.2
	TOTAL	41511	8557	20.6	2735	6.6	11420	27.5	9890	23.8	2442	5.9	2191	5.3	4276	10.3
2050	MALES	24876	5243	21.1	1671	6.7	7010	28.2	6168	24.8	1344	5.4	1153	4.6	2287	9.2
	FEMALES	25520	4960	19.4	1585	6.2	6695	26.2	6044	23.7	1421	5.6	1297	5.1	3518	13.8
	TOTAL	50396	10203	20.2	3256	6.5	13705	27.2	12212	24.2	2765	5.5	2450	4.9	5805	11.5

* THESE POPULATIONS WERE USED FOR ALL TABLES OF FINANCIAL PROJECTIONS EXCEPT TABLES 8, 9 AND 10.

SCHEDULE 6

POPULATIONS FOR QUEBEC *
(IN THOUSANDS)

MIDDLE OF YEAR		TOTAL	14 AND UNDER		15 - 19		20 - 39		40 - 59		60 - 64		65 - 69		70 AND OVER	
			NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL
1971	MALES	3063	923	30.1	324	10.6	918	30.0	614	20.0	101	3.3	75	2.4	108	3.5
	FEMALES	3081	883	28.7	314	10.2	906	29.4	633	20.5	110	3.6	87	2.8	148	4.8
	TOTAL	6144	1806	29.4	638	10.4	1824	29.7	1247	20.3	211	3.4	162	2.6	256	4.2
1980	MALES	3254	728	22.4	332	10.2	1175	36.1	669	20.6	115	3.5	95	2.9	140	4.3
	FEMALES	3288	692	21.0	317	9.6	1140	34.7	689	21.0	130	4.0	114	3.5	206	6.3
	TOTAL	6542	1420	21.7	649	9.9	2315	35.4	1358	20.8	245	3.7	209	3.2	346	5.3
1990	MALES	3642	889	24.4	216	5.9	1281	35.2	819	22.5	141	3.9	117	3.2	179	4.9
	FEMALES	3687	840	22.8	205	5.6	1219	33.1	837	22.7	162	4.4	144	3.9	280	7.6
	TOTAL	7329	1729	23.6	421	5.7	2500	34.1	1656	22.6	303	4.1	261	3.6	459	6.3
2000	MALES	4026	928	23.1	314	7.8	1159	28.8	1125	27.9	147	3.7	126	3.1	227	5.6
	FEMALES	4073	875	21.5	298	7.3	1096	26.9	1123	27.6	164	4.0	153	3.8	364	8.9
	TOTAL	8099	1803	22.3	612	7.6	2255	27.8	2248	27.8	311	3.8	279	3.4	591	7.3
2025	MALES	5077	1095	21.6	342	6.7	1441	28.4	1204	23.7	301	5.9	265	5.2	429	8.4
	FEMALES	5176	1033	20.0	324	6.3	1372	26.5	1174	22.7	318	6.1	301	5.8	654	12.6
	TOTAL	10253	2128	20.8	666	6.5	2813	27.4	2378	23.2	619	6.0	566	5.5	1083	10.6
2050	MALES	6133	1301	21.2	409	6.7	1740	28.4	1507	24.6	342	5.6	289	4.7	545	8.9
	FEMALES	6269	1226	19.6	386	6.2	1657	26.4	1473	23.5	362	5.8	325	5.2	840	13.4
	TOTAL	12402	2527	20.4	795	6.4	3397	27.4	2980	24.0	704	5.7	614	5.0	1385	11.2

* THESE POPULATIONS WERE USED FOR ALL TABLES OF FINANCIAL PROJECTIONS EXCEPT TABLES 8, 9 AND 10.

SCHEDULE 7

POPULATIONS FOR CANADA EXCLUDING QUEBEC *
(IN THOUSANDS)

MIDDLE OF YEAR		TOTAL	14 AND UNDER		15 - 19		20 - 39		40 - 59		60 - 64		65 - 69		70 AND OVER	
			NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL	NUMBER	PROP'N OF TOTAL
1971	MALES	7975	2378	29.8	780	9.8	2248	28.2	1674	21.0	286	3.6	225	2.8	384	4.8
	FEMALES	7863	2273	28.9	752	9.6	2159	27.5	1650	21.0	290	3.7	240	3.1	499	6.3
	TOTAL	15838	4651	29.4	1532	9.7	4407	27.8	3324	21.0	576	3.6	465	2.9	883	5.6
1980	MALES	9128	2218	24.3	884	9.7	3098	33.9	1859	20.4	334	3.7	285	3.1	450	4.9
	FEMALES	9103	2115	23.2	846	9.3	3011	33.1	1820	20.0	365	4.0	321	3.5	625	6.9
	TOTAL	18231	4333	23.8	1730	9.5	6109	33.5	3679	20.2	699	3.8	606	3.3	1075	5.9
1990	MALES	10660	2636	24.7	738	6.9	3640	34.1	2336	21.9	403	3.8	342	3.2	565	5.3
	FEMALES	10704	2501	23.4	704	6.6	3535	33.0	2289	21.4	431	4.0	411	3.8	833	7.8
	TOTAL	21364	5137	24.0	1442	6.7	7175	33.6	4625	21.6	834	3.9	753	3.5	1398	6.5
2000	MALES	12052	2796	23.2	933	7.7	3620	30.0	3203	26.6	433	3.6	367	3.0	700	5.8
	FEMALES	12156	2652	21.8	887	7.3	3490	28.7	3189	26.2	459	3.8	412	3.4	1067	8.8
	TOTAL	24208	5448	22.5	1820	7.5	7110	29.4	6392	26.4	892	3.7	779	3.2	1767	7.3
2025	MALES	15464	3301	21.3	1061	6.9	4400	28.5	3783	24.5	879	5.7	757	4.9	1283	8.3
	FEMALES	15794	3128	19.8	1008	6.4	4207	26.6	3729	23.6	944	6.0	868	5.5	1910	12.1
	TOTAL	31258	6429	20.6	2069	6.6	8607	27.5	7512	24.0	1823	5.8	1625	5.2	3193	10.2
2050	MALES	18743	3942	21.0	1262	6.7	5270	28.1	4661	24.9	1002	5.3	864	4.6	1742	9.3
	FEMALES	19251	3734	19.4	1199	6.2	5038	26.2	4571	23.7	1059	5.5	972	5.0	2678	13.9
	TOTAL	37994	7676	20.2	2461	6.5	10308	27.1	9232	24.3	2061	5.4	1836	4.8	4420	11.6

* THESE POPULATIONS WERE USED FOR ALL TABLES OF FINANCIAL PROJECTIONS EXCEPT TABLES 8, 9 AND 10.

4. Participation Rates and Modified Average Earnings

(a) For each of the years 1971-75, the CPP Division of the Department of Supply and Services provided us with a cumulative distribution of contributors and of earnings (for each of eleven age-groups subdivided by sex) over some 80 earnings ranges, expressed as percentages of the average earnings for the "age-group sex cell" involved. We took the averages of the 5 years of experience, for each cell separately, and assumed that these would represent cumulative distributions of contributors (C-distribution) and of earnings (E-distribution) applicable to that cell indefinitely in the future. For illustrative purposes, the data might indicate that 70% of contributors for a particular cell earn less than 120% of average earnings for the cell (C-distribution) and account for 40% of total earnings for the cell (E-distribution). We assumed that such percentages would be applicable to that cell indefinitely in the future. By interpolation between the various points of the distributions, we could then determine for any percentage of average earnings of any cell what percentage of contributors earn less than such percentage of average earnings, and what percentage of total earnings for the cell are earned by such contributors.

(b) Superficially, one might expect that there would be few, if any, contributors earning less than the Year's Basic Exemption (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. Surprisingly perhaps, 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 1/12 of the YBE. Employer and employee contributions must be deducted at source for any month during which earnings exceed 1/12 of the YBE (unless the year's maximum has already been deducted), and 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, and therefore have a record of their earnings for that year maintained on the CPP Record of Earnings, even though such earnings are not countable for pensionable earnings purposes. For this reason, it appeared reasonable to consider the cumulative distributions of contributors (C) and of their earnings (E), developed in (a) above as being cumulative distributions of earners and of their earnings, for purposes of subsequent analysis.

(c) For 1971 to 1975, we obtained participation rates assuming no YBE for each "year age-group sex cell", by dividing the total number of contributors (assumed to be the total number of earners) by the projected populations. From other data available we extended these backward to 1966. We also projected them forward to 2050 taking into account the trend in such rates during the 1971-75 period, our guesses as to likely changes in the future, and projections that had been made by various experts in the field. The result was a complete set of participation rates assuming no YBE for each "year age-group sex cell" running from 1966 to 2050.

(d) We obtained average earnings assuming no YBE, for 1971 to 1975, for each "year age-group sex cell", by dividing total earnings by total number of contributors (assumed to be total number of earners). From other data available, these were extended backward to 1966.

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For years subsequent to 1975 it was assumed that total average earnings (for all age-groups and both sexes combined) would increase at the same annual rate as the Industrial Composite (average wages and salaries) for Canada. For 1975-76 and 1976-77, we used the known rate of increase in the Industrial Composite, and for subsequent years, the rates postulated in the economic assumptions (see 2 above).

However, we did not apply such aggregate rates of increase to each "age-group sex cell" because we felt that the gap between earnings for males and females would gradually narrow. Hence, we developed rates of increase in average earnings for each "age-group sex cell" that would (i) produce an aggregate rate of increase equal to the rate postulated in the economic assumptions, (ii) produce rates of increase for each age-group, both sexes combined, that would be the same for all age-groups, and (iii) produce separate rates of increase for male and female average earnings for each age-group 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 for each "year age-group sex cell" from the year of inception, 1966, to 2050.

(e) On the basis of the formula for the calculation of the Year's Maximum Pensionable Earnings (YMPE) described earlier in this Report, and the assumed increases in average earnings taken to apply to the Industrial Composite of Wages and Salaries, we were able to project the YMPE for each year in the future.

Future YBE's were taken as 10% of the projected YMPE's rounded down to the next lowest multiple of $100 if not a multiple of $100.

(f) For any "year age-group sex cell", the YBE could then be expressed as a percentage of average earnings and, using the C-distribution described in (a), we could calculate the proportion of earners earning less than the YBE. Applying the complements of such proportions to the participation rates assuming no YBE yielded participation rates excluding earners earning less than the YBE, which are the participation rates used in subsequent calculations. Sample values of such participation rates are shown in Schedule 8 below.

Schedule 8

Participation Rates
(used for all financial projections except Table 7)

	Age Group	1980 %	1990 %	2000 %	2025 %	2050 %
Males	18-19	84.5	81.8	81.4	81.1	80.8
	20-24	94.9	93.4	93.2	93.0	92.8
	25-29	99.8	99.0	99.0	98.7	98.5
	30-34	96.9	96.3	96.2	96.1	96.0
	35-39	97.1	96.6	96.5	96.4	96.3
	40-44	94.2	93.8	93.7	93.6	93.5
	45-49	94.1	93.6	93.6	93.4	93.3
	50-54	90.5	90.0	90.0	89.8	89.7
	55-59	86.7	86.2	86.1	86.0	85.9
	60-64	76.0	75.2	75.1	75.0	74.9
	65-69	35.3	25.8	21.5	21.4	21.3
Females	18-19	71.1	69.4	70.4	70.9	71.3
	20-24	72.9	72.4	74.2	74.6	74.9
	25-29	66.9	67.6	68.3	68.8	69.2
	30-34	60.2	61.6	62.4	63.2	63.7
	35-39	61.2	62.9	63.7	64.4	64.9
	40-44	62.0	63.8	64.6	65.3	65.7
	45-49	57.3	58.8	59.6	60.2	60.5
	50-54	49.2	50.8	52.0	52.5	52.8
	55-59	43.8	45.4	46.5	46.9	47.1
	60-64	27.7	27.2	27.3	27.6	27.8
	65-69	10.5	10.3	10.3	10.5	10.6

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(g) The next step was to calculate for each "year age-group sex" combination Modified Average Earnings, which are average pensionable earnings of contributors earning more than the YBE based on average earnings excluding portions of earnings above the YMPE. The formula used is

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

where

MAE = Modified Average 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 earned by earners earning less than the YBE (calculated from E-distribution in (a) above

EU = Proportion of total earnings earned by earners earning less than the YMPE (calculated similarly to EL)

YMPE = Year's Maximum Pensionable Earnings, developed in (e) above

Sample values of Modified Average Earnings, which are the earnings used in the rest of the calculations for purposes of the main tables, are shown below.

Schedule 9

Modified Average Earnings
(used for all financial projections except Table 7)

		1980	1990	2000	2025	2050
	Y.M.P.E.	$ 13,100	$ 27,200	$ 46,500	$177,500	$676,800
	Age Group					
Males	18-19	7,407	13,346	22,392	84,513	318,129
	20-24	9,145	16,685	28,011	105,622	397,434
	25-29	11,141	21,528	36,307	136,863	515,417
	30-34	11,738	23,177	39,204	147,820	557,375
	35-39	11,843	23,486	39,730	149,846	564,790
	40-44	11,870	23,572	39,856	150,265	566,456
	45-49	11,780	23,284	39,431	148,567	560,192
	50-54	11,622	22,802	38,607	145,497	548,285
	55-59	11,330	21,980	37,176	140,285	528,559
	60-64	10,649	20,294	34,250	129,686	489,844
	65-69	8,416	15,755	26,641	100,595	378,607
Females	18-19	6,169	11,130	19,059	75,210	292,338
	20-24	7,719	13,856	23,780	94,225	367,299
	25-29	8,956	16,924	29,253	116,493	455,014
	30-34	8,757	16,928	29,556	118,668	465,190
	35-39	8,737	16,963	29,730	120,242	472,951
	40-44	8,891	17,267	30,266	122,608	482,583
	45-49	8,929	17,242	30,353	123,156	485,467
	50-54	8,868	17,001	29,957	121,573	479,714
	55-59	8,807	16,714	29,310	118,813	468,185
	60-64	8,476	15,907	27,729	112,364	443,373
	65-69	6,783	12,799	22,358	90,097	354,571

(h) The element of unemployment was not introduced explicitly into the calculations, because it was felt that to do so would not measurably enhance the projections.

5. Contributions and Expenses of Administration

(a) Contributory earnings were calculated as the product of (i) Modified Average Earnings less the Year's Basic Exemption, (ii) participation rates, and (iii) projected populations.

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, e.g., (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 employees 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) employees or employers entitled to refunds do not always claim such refunds and under such circumstances they are not made. However, while in the past contributions estimated in accordance with the above method have always been less than contributions actually collected, the difference has been narrowing and by 1977 was reduced to nil. In view of this trend, no special adjustment was made.

(b) The contribution rates assumed in the fund accumulations were applied to contributory earnings to estimate contributions.

(c) Costs of administration were assumed to be at the level of 0.1% of contributory earnings.

6. Retirement Benefits

(a) For persons at sample individual ages on January 1, 1966, average pensionable earnings histories that would be applicable to the population projections were developed by multiplying modified average earnings by participation rates for each year of the person's primary contribution period, running from January 1, 1966, or attainment of age 18, whichever is later, to attainment of age 65.

(b) The average pensionable earnings for each year of the history were divided by the Year's Maximum Pensionable Earnings (YMPE) for the year of the earnings and multiplied by the average of the three consecutive YMPE's ending with the year of attainment of age 65 to obtain average adjusted pensionable earnings histories.

(c) Average benefit factors are calculated as equal to 25% of (i) the sum of the adjusted pensionable earnings of the individual less such earnings during a period equal to 15% of his primary contribution period when such earnings were lowest divided by (ii) 85% of his primary contribution period. By summing the average adjusted pensionable earnings in (b) for a person belonging to a cohort, we obtain the average sum of all the adjusted pensionable earnings of persons belonging to that cohort, but there is no automatic way of determining the average lowest 15% to be dropped out of this sum from the numerator of the benefit formula. However, it is possible to determine both the maximum and the minimum value of the earnings to be dropped for an average individual (the minimum value being 0, provided participation rates do not average more than 85%). For males it was assumed that the earnings to be dropped would equal half of the maximum value. For females it was assumed that each female would have at least 15% years of nil earnings, so that no earnings were dropped from the numerator.

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(d) The average benefit factors for sample individual ages developed pursuant to (c) above were increased slightly to allow for the disability drop-out provisions of the plan. Then, interpolation techniques were used to convert the factors applicable to individual ages into factors applicable to age-group 65-69 in quinquennial attained years.

(e) The benefit factors for age-group 65-69 were increased by Pension Index escalation to obtain benefit factors applicable to age-group 70-74 five years later, age-group 75-79 ten years later, etc.

(f) The benefit factors for age-group 65-69 were then reduced by 10% in the case of males and 5% in the case of females, on the assumption that the average pension age would be 65.5 for the former and 65.25 for the latter.

(g) A somewhat different approach from that outlined above had to be used to determine benefit factors applicable to persons qualifying for benefits in the first 10 years of the Plan's operations because (i) earnings for at least 10 years have to be taken into account in determining the average benefits, and (ii) it was not appropriate to assume that contributors would elect their retirement pensions shortly after age 65, partly because it would not have been in their interest to do so, partly because the earnings test and retirement requirement during the early years of the Plan would have prevented them from so electing.

(h) The benefit factors, when applied to the projected populations, yielded estimated benefits payable in quinquennial years. The estimates for 1975, although not greatly different from the actual amounts of benefits paid in that year, were replaced by actual amounts of benefits paid in that year. Lagrange interpolation was then used to obtain benefits payable in non-quinquennial years.

7. Disability Benefits

(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 1975 using suitable disability termination rates and augmenting benefits payable to such survivors according to Pension Index increases;
(ii) estimate flat-rate benefits emerging in years subsequent to 1975 by application of disability incidence rates, probabilities of being insured for disability, and flat-rate benefit factors, to the projected populations developed as described in 3 above;
(iii) estimate earnings-related benefits emerging in years subsequent to 1975 by application of disability incidence rates, proportions of earnings insured for disability benefits, and earnings-related benefit factors, to the same projected populations; and
(iv) project flat-rate and earnings-related benefits emerging in years subsequent to 1975 to future years in a manner similar to that used in projecting benefits in pay at the end of 1975, as described in (i) above.

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

(b) Benefits in Pay at the end of 1975

These were available from special tabulations prepared for us by the CPP Division of the Department of Supply and Services subdivided by age, sex and duration. Since the totals were somewhat out of line with known amounts of disability benefits paid in 1975 available from other sources, the data were adjusted to ensure consistency with such amounts.

(c) Probabilities of being insured for disability benefits

Since the main requirement to be insured for disability benefits is to have made contributions in at least five of the last ten years, such probabilities are heavily dependent upon the levels of participation rates in such recent years and, since such probabilities may be higher or lower than such levels depending upon working patterns, it was decided to assume that an individual's probability of being insured for disability benefits in any given year would be equal to the average of the most recent ten participation rates for his age-sex cohort. Sample probabilities are shown below.

Schedule 10

Probability of Being Insured for Disability Benefits

Age:	22	25	30	35	40	50	55	60
Males								
1980:	0.155	0.621	0.970	0.979	0.964	0.936	0.915	0.868
2050:	0.154	0.616	0.957	0.970	0.959	0.931	0.909	0.863
Females								
1980:	0.114	0.455	0.638	0.558	0.530	0.503	0.470	0.408
2050:	0.121	0.483	0.702	0.660	0.647	0.615	0.556	0.471

(d) Proportions of earnings insured for disability benefits

Since insured contributors will generally have higher aggregate earnings than uninsured contributors, such proportions should be higher than the probabilities of being insured for disability benefits. Sample values of proportions assumed are shown below.

Schedule 11

Proportion of Earnings Insured for Disability Benefits

Age:	22	25	30	40	50	60
Males						
1980:	0.831	0.924	0.993	0.991	0.984	0.967
2050:	0.831	0.923	0.990	0.988	0.972	0.931
Females						
1980:	0.823	0.891	0.919	0.883	0.876	0.852
2050:	0.824	0.897	0.933	0.894	0.846	0.736

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(e) Disability Incidence Rates

Disability Incidence Rates varying by age and sex were calculated by dividing 1975 emerging disability beneficiaries by the products of the 1975 projected populations and the assumed 1975 probabilities of being insured for disability benefits. Sample values are as follows:

Schedule 12

Disability Incidence Rates per 1000

Age	Males	Females
25	0.340	0.202
30	0.454	0.302
35	0.736	0.479
40	1.337	0.891
45	2.188	1.701
50	4.512	3.318
55	8.960	6.759
60	17.195	13.400

(f) Disability Termination Rates

Since CPP experience to date has not been sufficiently extensive to yield reliable termination rates, at least at the longer durations, it was decided to use rates derived from graduated OASDI rates as published in Actuarial Study No. 74 of the U.S. Social Security Administration pertaining to 1968-74 experience under the United States plan; preliminary investigation showed that these rates would not be inappropriate for application to CPP beneficiaries. Sample values are listed below.

Schedule 13

Disability Termination Rates per 1000

		Year of Disability						Attained
	Age	1	2	3	4	5	Ultimate	Age
Males	25	115.9	176.0	105.1	61.3	40.3	29.2	30
	30	116.8	164.3	97.4	58.1	41.1	28.7	35
	35	118.9	158.6	95.5	59.0	43.8	31.0	40
	40	117.4	144.0	88.0	58.1	46.2	35.2	45
	45	120.8	126.6	78.9	57.6	49.4	41.5	50
	50	118.6	109.4	72.8	60.5	56.0	52.6	55
	55	113.3	97.4	71.9	66.3	65.7	64.7	60
	60	102.8	89.6	75.7	74.1	74.5	---	65
Females	25	70.8	98.8	65.3	39.3	26.5	19.2	30
	30	63.1	87.3	58.5	38.3	28.5	22.3	35
	35	68.4	87.7	58.6	39.4	29.6	22.8	40
	40	74.4	90.5	59.4	38.1	29.2	22.6	45
	45	78.9	85.7	55.3	37.2	30.1	25.8	50
	50	75.3	72.7	47.4	35.5	31.7	30.0	55
	55	68.9	61.2	43.9	37.0	35.2	34.4	60
	60	60.6	54.7	43.2	39.0	37.8	---	65

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(g) Earnings-related benefit factors

Such factors were developed in a manner similar to that used in the development of retirement benefit factors described in 6 above, multiplied by .75, of course, to allow for the difference in the benefit formula.

8. Children of Disabled Contributors' Benefits

(a) General Procedure

(i) It was 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 over age 18 would be entitled; it was further assumed that parents would not be disabled at the time of a child's birth. (ii) For quinquennial years and quinary age-groups and each sex separately, adult disability beneficiaries who had become disabled within the last 'n' years (n = 5, 10, 15 or 20), were estimated using techniques similar to those described in 7 above for the estimation of flat-rate disability benefits. (iii) The beneficiaries in (ii) were divided by estimates of the general 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. (iv) A percentage age distribution of fathers for male contributors, or mothers for female contributors, was applied to the above probabilities, to yield probabilities that an 'n' year old child will have a father or a mother, as the case may be, of a given age, who became a disability beneficiary after the birth of the child and who survived as such to the attained year. (v) Summing such probabilities over all ages of the parent yielded the probability that the child would have a parent who was a disability beneficiary, and therefore the probability that the child would be entitled to a child-of-disabled-contributor benefit in respect of that parent. (vi) Interpolation between the pivotal probabilities for age 'n' of the child developed in (v) yielded probabilities that a 0-4, 5-9, 10-14 or 15-17 year old child in the attained year would be entitled to a child-of-disabled-contributor benefit in respect of a parent of a given sex. (vii) Applying such probabilities to the projected children's populations yielded child-of-disabled-contributor beneficiaries; the beneficiaries in respect of disabled mothers were then reduced by 5% to allow for the fact that children may not receive benefits in respect of both parents; Lagrange interpolation was used to determine beneficiaries for non-quinquennial years, and beneficiaries were multiplied by the applicable amount of flat-rate benefits to yield benefits. (viii) Before projecting adult beneficiaries in (ii) above, based on the distribution of existing adult beneficiaries at December 31, 1975, and estimates of future emerging beneficiaries, it was determined that the existing adult beneficiaries at December 31, 1975 were inconsistently high relative to the known child beneficiaries at that time, and that the use of such figures would significantly overstate the number of child beneficiaries in the early years of the projection. Therefore, the existing adult beneficiaries at December 31, 1975 were reduced for consistency with the known number of child beneficiaries at that time.

(b) Age distribution of parents of new-born children

The distribution of fathers and mothers of new-born children by age was based on data from Vital Statistics for 1965 to 1969 and 1970 to 1974 respectively.

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9. Surviving Spouses' Benefits

(a) For sample years of first spouse's death, male deaths (for widows' benefits) and female deaths (for widowers' benefits) were derived as a by-product of our population projections and multiplied by proportions married to obtain married deaths. The proportions married were derived from 1961 Census data with some allowance for expected improvement in mortality. Sample values are shown below.

Schedule 14

Proportions Married (%)

	Males			Females		
Age	1975	2000	2025	1975	2000	2025
20-24	30	30	30	59	59	59
25-29	70	70	70	84	84	84
30-34	82	82	82	88	88	88
35-39	86	86	86	89	89	89
40-44	88	88	88	87	88	88
45-49	88	88	89	85	86	86
50-54	87	88	88	81	82	82
55-59	85	86	86	75	77	77
60-64	83	85	85	68	71	72
65-69	81	83	84	59	63	64
70-74	76	80	81	48	52	54
75-79	70	74	76	38	42	44
80-84	58	62	64	25	28	29
85-89	46	50	52	15	17	18
90+	34	38	40	8	9	9

(b) For earnings-related benefit purposes, married deaths were multiplied by earnings-related benefit factors, developed by a procedure similar to that used for retirement benefit factors described in 6 above.

(c) The surviving spouses and their earnings-related benefits were then redistributed by age of surviving spouse using relative age distributions of husbands and wives derived from 1961 Census data.

(d) The surviving spouses and their earnings-related benefits were then projected to quinquennial years using mortality and remarriage as causes of decrement.

For widows, rates of remarriage were assumed in accordance with the rates described in the paper "Remarriage Experience under the Pension Act of Canada" (Transactions of the Society of Actuaries, Volume XII), rates that were based on the 1940-1957 experience and that are somewhat lower than those which have been experienced across Canada in more recent periods and consequently may result in some overstatement of widows' benefits.

For widowers, rates of remarriage were developed from some rather scanty data available in the Vital Statistics publications and were adjusted so as to produce approximately the same proportionate overstatement in benefits as the rates used in the valuation of widows' benefits.

(e) The earnings-related benefits for surviving spouses were increased by the required Pension Index escalation.

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To estimate flat-rate benefits, survivors under 65 of the surviving spouses were multiplied by probabilities of qualifying for flat-rate benefits (i.e., representing probabilities of the deceased spouse having been insured for the spouse's benefit) and by a flat-rate benefit factor.

(f) For widows and widowers over age 65 entitled to a retirement benefit, there are limits on the combined surviving spouses' and retirement pensions available, inferior to the sum of the two pensions. Since the full retirement pension is assumed to be payable in our estimates of retirement pensions, estimates of surviving spouses' pensions had to be reduced to take into account these limits. The required reductions were estimated on the basis of rough hypothetical distributions of surviving spouses' and retirement pensions around their mean value.

Surviving spouses under age 65 who are also entitled to disability pensions are subject to similar limits on their combined pensions, but this was ignored.

(g) The foregoing steps produce earnings-related benefits and flat-rate benefits for quinquennial attained years for sample years of widowhood. By interpolation between the figures for sample years of widowhood and summation of the results, benefits were obtained for quinquennial attained years for all years of widowhood combined. Lagrange interpolation between these results yielded benefit estimates for the remaining attained years.

(h) In addition to several assumptions noted above, certain others would tend to overstate projected survivors' pensions (e.g., reduction or suspension of pensions to spouses below age 45 and the characteristic of mortality to be lighter among married than unmarried males were ignored). To compensate, the final estimates were reduced by ten percent. Nevertheless, it was found that estimates for the first few years following the date of this report significantly exceeded benefits that could be expected to be paid on the basis of recent experience, and these short-run estimates were further reduced to bring them into line with what might be reasonably expected.

10. Orphans' Benefits

(a) General Procedure

(i) It was 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. (ii) Age distributions of fathers and mothers of newborn children 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. Such probabilities were reduced for early years of the Plan to exclude the probability of dying before January 1, 1968 since such deaths would not have been insured. (iii) The probabilities developed in (ii) were multiplied by the proportions of parents insured for orphans' benefits at date of death, taken as a uniform .98 for fathers but varying according to year and age at death for mothers (the year and age at death were assumed to be at the mid-point of the period of exposure to death inherent in the probabilities developed in (ii) above). (iv) The probabilities as adjusted in (iii) above, summed over all ages of the parent, yield the probability that a child age 'n' in a particular year would be entitled to orphan's benefits. Interpolation between these pivotal values yielded probabilities that children aged 0-4, 5-9, 10-14, or 15-17 in that year would be entitled to orphans' benefits in respect of a parent of a given sex. Such probabilities, when applied to the projected children's population, yielded orphan beneficiaries. The orphan beneficiaries in

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respect of female contributors were reduced by five percent to allow for the fact that a child cannot simultaneously receive benefits in respect of both of his parents. Since the calculations had been carried out for quinquennial attained years only, Lagrange interpolation was used to obtain beneficiaries for other years. Benefits were determined by multiplying beneficiaries by the flat-rate amount of benefit. (v) Benefits projected for the early years following the valuation date by the above procedures turned out to be unreasonably high in comparison to benefits that have been paid in recent years and were arbitrarily reduced to allow for recent experience.

(b) Age distribution of fathers and mothers of new-born children

The distributions of fathers and mothers of new-born children by age were based on data from Vital Statistics for 1958 to 1962 and 1966 to 1970, respectively.

(c) Proportions of Mothers insured for Orphans' Benefits (%)

Age Group	1975	2000	2025	2050
20-24	72	77	77	77
25-29	68	82	82	82
30-34	61	80	81	81
40-44	45	78	80	80
50-54	45	73	78	78
60-64	36	63	75	75

11. Death Benefits

Estimated deaths were multiplied by earnings-related benefit factors developed by a procedure similar to that used for retirement benefit factors described in 6 above, but representing the value of half a year's instead of a full year's pension payment. 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. In addition, since it was found that estimates for years shortly following the date of this report exceeded benefits that could be expected to be paid on the basis of recent experience, short-run estimates were further reduced to bring them into line with what might be reasonably expected.

12. Modifications for "Divorce and Divide" Provision

The assumptions described above were used for making estimates without taking into account the plan provision that pensionable earnings of spouses earned during the marriage may be split equally between the spouses if the marriage should end in divorce or annulment.

A second set of estimates was made assuming that pensionable earnings of spouses earned during the marriage would be split equally between them on a year-by-year basis in all cases.

The final projections of benefits and expenditures used in this report were taken as 9/10 (14/15 for spouses' benefits) of the figures generated by the first set of estimates, plus 1/10 (1/15 for spouses' benefits) of the figures generated by the second set of estimates.

While the "divorce and divide" provision has some effect on the subdivision of benefits by various categories, particularly on subdivisions by sex of the contributor, it has very little effect on the aggregate level of benefits, and for such purposes might well have been ignored (as it was, for the sake of convenience, in estimating the entry-age normal costs and the related unfunded liability in Appendix D).

13. Fund Accumulations

(a) The Fund, for the purpose of this report, is assumed to be the amount to the credit of the Canada Pension Plan Account.

(b) Annual investments in provincial bonds prior to 1978 are known, but for various reasons are less in total than the amount to the credit of the Canada Pension Plan Account at December 31, 1977. They were adjusted proportionately so as to match the said credit.

(c) The annual amounts of interest earned on each year of investments made prior to 1978 are also known, and were adjusted in proportion to the adjustments in the investments.

(d) Amounts invested in each future year were taken as equal to contributions for the year minus benefits for the year plus one year's interest on outstanding investments plus prior investments matured during the year.

(e) Each future year's investments are assumed to earn interest until maturity at the annual rate of interest on new investments postulated in the economic assumptions for the year of investment.

(f) Normally, investments are assumed to mature after 20 years. However, if the amount to be invested in any year, calculated by the formula in (d), and assuming 20-year maturities, should turn out to be negative, it is necessary to assume additional maturities in that year sufficient to provide a positive investment. Otherwise, there would not be sufficient funds released in that year to pay benefits. Such additional maturities were assumed to be on a last-in, first-out basis.

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

14. Entry-Age-Normal Cost and Related Unfunded Liability (discussed in Appendix D)

(a) Entry-Age-Normal Cost

This was determined by estimating contributory earnings and benefits and expenses in respect of the quinary age-group cohort centered around age 18 on December 31, 1977, and determining, by an iteration process, and using our usual fund accumulation methods, the contribution rate that would be exactly sufficient to accumulate a nil fund in respect of that cohort at the expiration of all contributions and expenditures in respect of that cohort. The entry-age-normal cost was taken as the contribution rate so determined.

(b) Unfunded Liability

An amount A, hypothetically invested in 1978, was determined by an iteration process so that together with (i) the fund at December 31, 1977, (ii) future (post-1977) contributions at the entry-age-normal cost contribution rate collected in respect of the population aged 18

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and over on December 31, 1977 and (iii) investment earnings, it would be just sufficient, to pay all future benefits and administrative expenses in respect of that population. The unfunded liability at December 31, 1977, was taken as the amount A discounted for one-half year's interest.

(c) An accumulation process was used to determine both the entry-age - normal cost and the unfunded liability, rather than the more usual discounting process, because the interest assumptions (annual rates of interest on new investments), together with the maturity assumptions used in the Fund accumulation, are readily conducive to the accumulation of funds, but not to their discounting.

Appendix D

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

Application of the principles of "actuarial funding" (which are the cornerstone of security for private pension plans) is usually considered inappropriate in the field of social insurance for a number of reasons: (A) It does not seem possible to provide greater security of benefits through funding in the usual sense, because a country cannot divest itself of its pension obligations, unless it were to export the required capital and, if necessary, secure it through successful use of arms. (B) The actuarial funding of national pensions would tend to concentrate overwhelming control of capital in the hands of governments or their agencies. (C) It does not seem possible to determine (outside of a controlled economy) to what extent actuarial funding would result in higher total savings and greater intergenerational equity than would otherwise exist. (D) There appears to be no way to level out the impact of benefit payments on the economy, although it may be possible and desirable to complement the benefit load (reflecting the entire non-productive population) with a varying level of investment designed to enhance future productivity. (E) Since social insurance benefits are normally payable in a manner approximating maintenance of real benefit levels, accumulated funds would need to be maintained in real terms.

Notwithstanding the above, it is interesting 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 that information based on principles of "actuarial funding" be made public, and it was agreed to include such information with this report.

The rates of contribution quoted in this appendix were developed by a method approximating what is referred to by actuaries as the entry-age-normal method of funding,which aims at a level percentage of pensionable earnings to be contributed during the active lifetime of a normal cohort of entrants, sufficient to support all benefits payable to them or their beneficiaries. For the purpose of this study, the cohort of entrants was taken to be the age-group comprising ages 16 to 20 at December 31, 1977, including future immigrants belonging to that generation.

Entry-age-normal cost contribution rates for several reasons exhibit characteristics quite different from those of the current cost (pay-as-you-go) rates presented in the body of this report (see Table 3 and "Fund B" rates). The former are highly sensitive to the assumed rate of interest while the latter are totally independent of it. On the other hand, the latter are markedly affected by the fertility rates which affect the former only to the extent that children's benefits are provided. The level of immigration affects both sets of rates, but in opposite directions (e.g. high immigration would tend to increase entry-age-normal cost rates but decrease pay-as-you-go rates).

The concept of an entry-age-normal cost contribution rate engenders the concept of an unfunded actuarial liability arising out of the lack of contributions prior to the inception of the plan, the collection of contributions at a rate inferior to the entry-age-normal cost rate since the inception of the plan, and several other less significant sources.

The unfunded liability estimated in the study is equal to the amount that would have to be credited to the Canada Pension Plan Account in 1978 and invested at the rates assumed applicable to new investments at that time (9.4% for 20 years and the ultimate rate thereafter), so that the amount in the fund together with future contributions to be received from and in respect of the population aged 18 and older, at the hypothetical entry-age-normal contribution rate, would be sufficient to provide for all expenditures in respect of contributors and former contributors aged 18 and older at that time. The unfunded liability may be expected to grow substantially (i) by the amount of interest not earned thereon and (ii) by the difference between contributions at the hypothetical entry-age-normal contribution rate and contributions actually collected and by interest not earned on this difference.

The results of our calculations are as follows:

	Economic Assumptions *					
			Interest on New Investments			
	Increase in CPI (%)	Increase in Earnings (%)	1978 (%)	1983 & later (%)	Entry-Age-Normal Contribution Rate (%)	1977 Unfunded Liability ($ billions)
A	3.5	5.5	9.4	6.5	8.04	81.3
B	4.0	5.5	9.4	6.5	8.48	85.4
C	3.5	5.5	9.4	6.0	9.38	84.4

* The assumptions shown for A, B and C are the basis of Tables 1, 5 and 6 respectively. All other relevant assumptions are those used for purposes of the main tables and described in Appendix C.

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It might be added that the liquidation of the unfunded liability is unlikely to be advocated, because it would enhance neither the security of benefit payments nor intergenerational equity.