Office of the Superintendent
of Financial Institutions

Bureau du surintendant
des institutions financières

CANADA PENSION PLAN

Seventeenth Actuarial Report

as at 31 December 1997

Canada

15 December 1998

The Honourable Paul Martin, P.C., M.P.
Minister of Finance
House of Commons
Ottawa, Ontario
K1A 0G5

Dear Minister:

Subject: Seventeenth Actuarial Report on the Canada Pension Plan

In accordance with subsection 115(3) of the Canada Pension Plan, which
provides that an actuarial report shall be prepared every three years for purposes
of the contribution rates review by the Minister of Finance and the ministers of
the Crown of the provinces, I am pleased to submit the Seventeenth Actuarial
Report on the Canada Pension Plan, prepared as at 31 December 1997.

Yours sincerely,

Michael Hafeman
Acting Chief Actuary

CANADA PENSION PLAN

Seventeenth Actuarial Report
As At 31 December 1997

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CANADA PENSION PLAN
Seventeenth Actuarial Report
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I.   Introduction

This is the Seventeenth Actuarial Report since the inception of the Canada
Pension Plan (CPP) in 1966. It presents the results of an actuarial examination
of the status of the CPP as at 31 December 1997, and includes projections of
future experience through the year 2100. The Sixteenth Actuarial Report, dated
September 1997, was a special report prepared in connection with the
introduction in the House of Commons of Bill C-2 to amend the CPP and was
based on the methods and assumptions of the most recent comprehensive CPP
report, the Fifteenth Actuarial Report as at 31 December 1993.

A.   Purposes of the Report

Section 113.1 of the Canada Pension Plan provides that once every three years,
the Minister of Finance and ministers of the Crown of the provinces shall
review the state of the CPP and may make recommendations as to whether the
benefits or contribution rates or both should be changed. It identifies factors
they are to consider in their review, including information to be provided by the
Chief Actuary.

Section 115 requires the Chief Actuary to prepare a report during the first year
of each such three-year period setting out the results of an actuarial examination
of the CPP as at a date not earlier than the preceding 31 December. It also
specifies certain information that must be included in the report. This report has
been prepared in compliance with both the timing and information requirements
of the CPP.

Another important purpose of the report is to inform CPP contributors and
beneficiaries of the current and projected future financial status of the CPP.
Such information should facilitate a better understanding of the financing basis
of the CPP and the factors that influence its cost, contributing to an informed
public discussion of issues related to the CPP.

Introduction

B.   Overview of the Report

The actuarial status of the CPP is traditionally evaluated over a very long period of time. The actuarial estimates in this report are based on the current provisions of the CPP, data regarding the starting point for the projections, assumptions regarding future demographic and economic experience, and a methodology for translating this information into estimates of future CPP revenues and expenditures. The information required by statute has been derived using assumptions which reflect my best judgement regarding future experience. Section II presents the results of these actuarial projections. It includes information on trends in key demographic and financial indicators, highlights of the projections of the income, expenditures and assets of the CPP, and the steady-state contribution rate determined on the basis of these projections.

Section III describes the key "best-estimate" assumptions that underlie the results presented in Section II.

A wide variety of factors influence both the current and the projected financial positions of the CPP. Accordingly, the results shown in this report differ from those shown in previous reports. Section IV provides an analysis of the changes between the results shown in this report and those presented in the Fifteenth and Sixteenth Actuarial Reports.

Likewise, future actuarial examinations will reveal actual results that differ from the projections included in this report. Section V summarises the results of tests of the sensitivity of projected results to changes in key actuarial assumptions, both individually and under combined "low-cost" and "high-cost" scenarios.

Section VI consists of my formal opinion regarding this actuarial examination.

The appendices in Section VII provide a summary of the main provisions of the CPP and detailed descriptions of the data, assumptions and methods employed in the actuarial examination. They also include detailed tables setting out the results of projections under both the best-estimate and sensitivity-test assumptions. Supplementary information, such as the actuarial position of the CPP if a private pension plan valuation method were to be applied, and the expected internal rate of return to various generations of CPP participants, is contained in the final appendix.

II.   Results Based on Best-Estimate Assumptions

A.   Overview

The results of the actuarial projections of the financial position of the CPP presented in this report are generally consistent with the trends revealed in the Sixteenth Actuarial Report. For example:

*   demographic changes will have a major impact on the ratio of retirees to workers; the ratio of the number of people ages 65 and over to the number ages 20 to 64 is expected to grow from about 20% in 1997 to 40% in 2050;

*   the pay-as-you-go rate is expected to increase steadily from its 1997 level of 8.67% to a high of 11.21% in 2034, driven largely by the retirement of the baby boom generation;

*   under the current schedule of contribution rates, the funding level is expected to increase significantly over the next 25 years, with the ratio of assets to the following year's expenditures growing from 2.0 in 1997 to 5.0 or more in 2017 and thereafter;

*   the steady-state contribution rate for 2003 and thereafter determined by this actuarial review is 9.8% of contributory earnings, slightly lower than the 9.9% rate currently scheduled.

These trends are evident from the graphs below.

Results Based on Best-Estimate Assumptions

Graph II.1   Distribution of Historical and Projected Population by Age
             Group
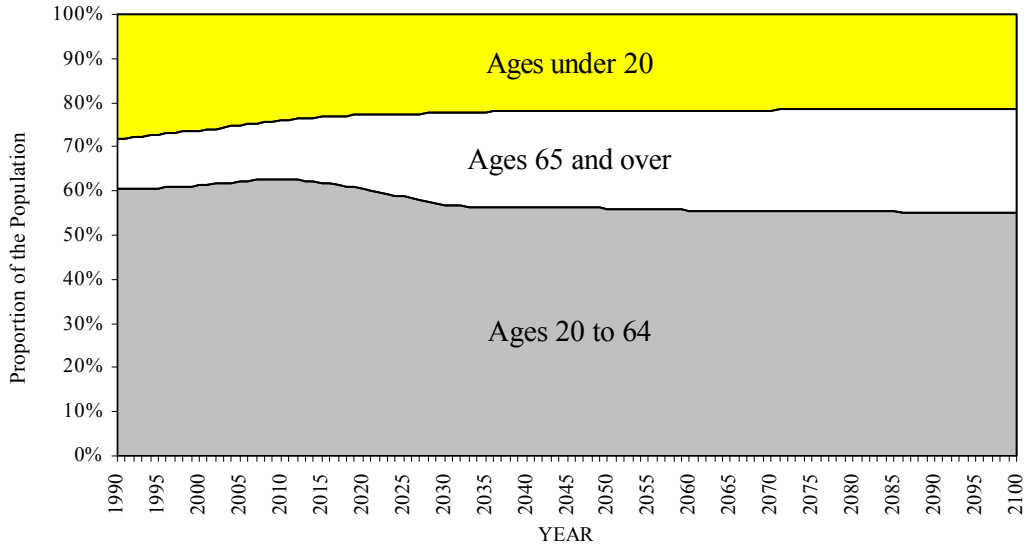
Graph II.2   Historical and Projected Pay-As-You-Go Rates
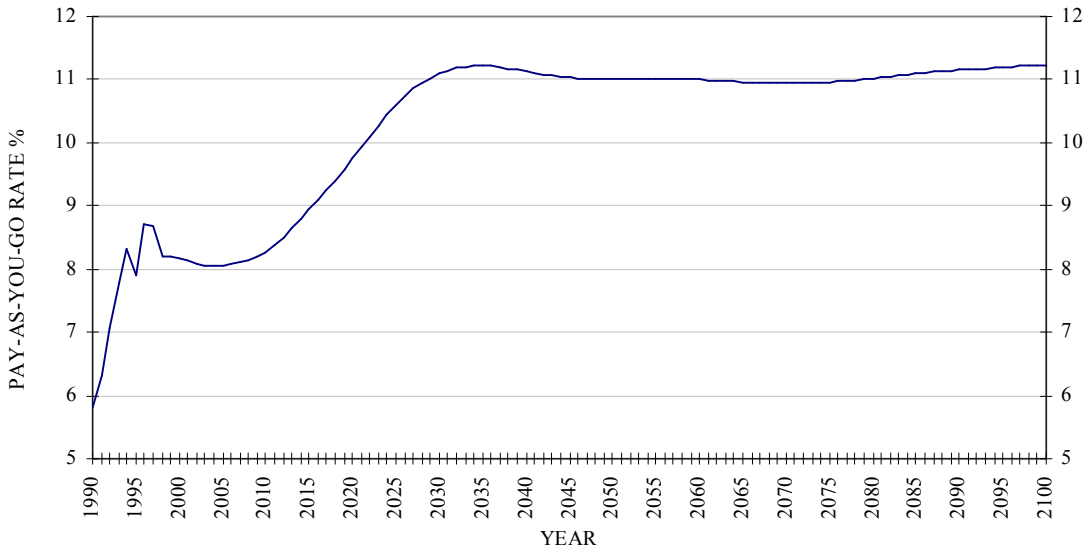
Graph II.3   Historical and Projected Ratios of Assets to Expenditures
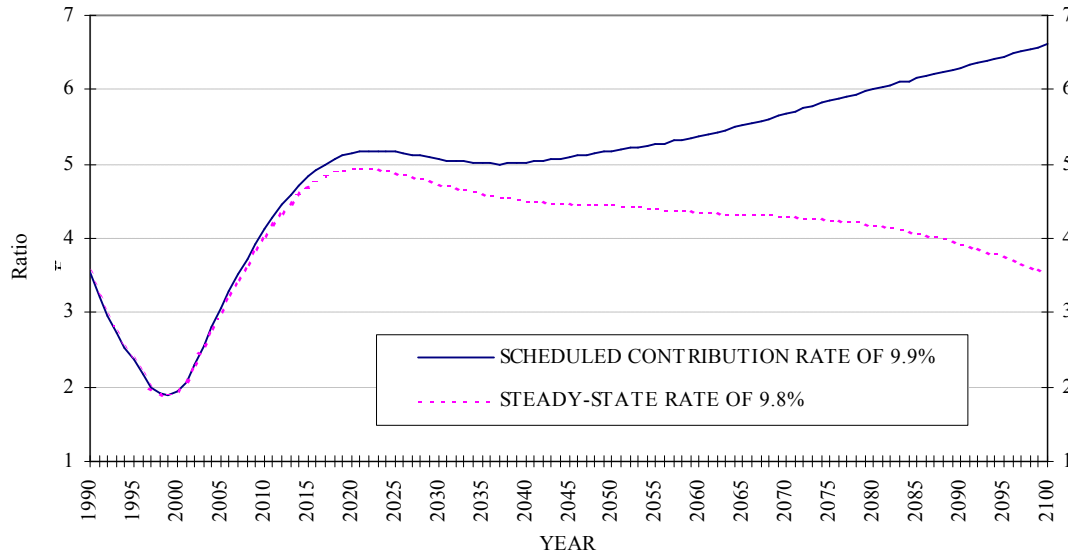
B.   Financial Projections

Table II.1 provides a summary of the historical financial development of the
CPP, which forms the basis for the projections. The tables that follow present
the results of projections using the best-estimate assumptions described in
Section III:

•   Table II.2 shows the projected financial development of the CPP,
        assuming the current schedule of contribution rates is maintained; the
        impact of adopting the steady-state contribution rate of 9.8% determined
        by this actuarial review is discussed in subsection II.C;

•   Table II.3 provides additional information regarding projected
        expenditures, showing expenses and the various components of benefits
        separately; and

•   Table II.4 shows the same components of expenditures as the previous
        table, but expresses them as percentages of projected contributory
        earnings, i.e., as pay-as-you-go rates.

Results Based on Best-Estimate Assumptions

Table II.1 Historical Results (millions of dollars)

Year	Paygo Rate %	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets at 31 Dec.	Yield %	Assets / Expenditures Ratio
1966	0.05	3.60	14,744	531	8	523	5	525	525	1.76	52.47
1967	0.06	3.60	17,316	623	10	614	37	651	1,175	4.14	48.98
1968	0.13	3.60	19,056	686	24	662	79	741	1,916	5.04	35.49
1969	0.26	3.60	20,485	737	54	683	128	811	2,727	5.49	28.12
1970	0.45	3.60	21,475	773	97	676	193	869	3,596	6.17	24.14
1971	0.66	3.60	22,663	816	149	666	260	927	4,523	6.51	21.33
1972	0.88	3.60	24,148	869	212	657	333	990	5,513	6.78	19.83
1973	1.07	3.60	26,072	939	278	661	406	1,065	6,578	6.87	16.78
1974	1.17	3.60	33,429	1,203	392	812	497	1,308	7,887	7.03	14.06
1975	1.42	3.60	39,617	1,426	561	865	608	1,472	9,359	7.23	11.47
1976	1.80	3.60	45,288	1,630	816	815	746	1,561	10,920	7.58	10.48
1977	2.05	3.60	50,782	1,828	1,042	786	889	1,675	12,596	7.81	9.72
1978	2.31	3.60	56,176	2,022	1,296	727	1,043	1,770	14,365	8.01	9.03
1979	2.47	3.60	64,374	2,317	1,590	727	1,235	1,962	16,328	8.34	8.31
1980	2.72	3.60	72,325	2,604	1,965	638	1,467	2,105	18,433	8.78	7.64
1981	2.89	3.60	83,566	3,008	2,413	595	1,785	2,379	20,812	9.50	7.03
1982	2.91	3.60	101,810	3,665	2,958	707	2,160	2,867	23,679	10.17	6.58
1983	3.73	3.60	96,507	3,474	3,598	-124	2,494	2,369	26,049	10.53	6.22
1984	3.66	3.60	114,386	4,118	4,185	-67	2,829	2,763	28,811	10.84	5.97
1985	4.31	3.60	111,993	4,032	4,826	-795	3,114	2,319	31,130	10.79	5.66
1986	4.20	3.60	131,131	4,721	5,503	-782	3,395	2,613	33,743	10.91	4.73
1987	5.02	3.80	141,927	5,393	7,130	-1,736	3,653	1,917	35,660	10.82	4.31
1988	5.41	4.00	152,832	6,113	8,272	-2,159	3,885	1,727	37,387	10.90	3.98
1989	5.89	4.20	159,373	6,694	9,391	-2,698	4,162	1,465	38,852	11.13	3.72
1990	5.82	4.40	179,290	7,889	10,438	-2,549	4,387	1,838	40,689	11.30	3.53
1991	6.31	4.60	182,518	8,396	11,518	-3,122	4,476	1,353	42,043	11.02	3.22
1992	7.07	4.80	185,062	8,883	13,076	-4,193	4,498	305	42,347	10.75	2.97
1993	7.79	5.00	183,329	9,166	14,273	-5,106	4,479	-627	41,720	10.59	2.72
1994	8.33	5.20	184,324	9,585	15,362	-5,778	4,404	-1,374	40,346	10.56	2.52
1995	7.91	5.40	202,061	10,911	15,986	-5,075	4,411	-664	39,683	10.95	2.37
1996	8.71	5.60	192,084	10,757	16,723	-5,966	4,178	-1,788	37,894	10.55	2.16
1997	8.67	6.00	202,756	12,165	17,570	-5,405	3,971	-1,434	36,460	10.45	2.00

Table II.2   Projected Financial Development (millions of dollars)

Year	Paygo Rate %	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expenditures Ratio
1998	8.21	6.40	222,386	14,233	18,252	-4,019	3,850	-169	36,291	10.51	1.91
1999	8.19	7.00	231,677	16,217	18,967	-2,750	3,795	1,045	37,336	10.39	1.89
2000	8.16	7.80	242,196	18,891	19,770	-879	3,763	2,884	40,220	10.03	1.94
2001	8.13	8.60	254,455	21,883	20,684	1,199	3,822	5,021	45,241	9.34	2.08
2002	8.09	9.40	268,567	25,245	21,738	3,507	3,997	7,504	52,745	8.44	2.30
2003	8.06	9.90	284,703	28,186	22,956	5,230	4,313	9,543	62,288	7.72	2.56
2004	8.05	9.90	302,690	29,966	24,365	5,601	4,872	10,473	72,760	7.42	2.81
2005	8.05	9.90	321,666	31,845	25,904	5,941	5,440	11,381	84,142	7.13	3.05
2006	8.07	9.90	341,621	33,820	27,560	6,260	6,131	12,392	96,534	6.98	3.29
2007	8.10	9.90	362,505	35,888	29,364	6,524	6,905	13,429	109,963	6.88	3.51
2008	8.15	9.90	384,160	38,032	31,328	6,704	7,770	14,474	124,437	6.82	3.72
2009	8.21	9.90	407,388	40,331	33,437	6,894	8,703	15,598	140,035	6.77	3.92
2010	8.27	9.90	431,278	42,697	35,682	7,015	9,724	16,738	156,773	6.74	4.12
2011	8.39	9.90	453,439	44,890	38,062	6,828	10,784	17,613	174,386	6.70	4.29
2012	8.51	9.90	476,918	47,215	40,603	6,612	11,932	18,544	192,930	6.69	4.45
2013	8.65	9.90	501,275	49,626	43,337	6,289	13,170	19,459	212,389	6.70	4.59
2014	8.79	9.90	525,894	52,064	46,244	5,820	14,512	20,332	232,721	6.72	4.72
2015	8.94	9.90	551,896	54,638	49,326	5,312	15,906	21,218	253,938	6.74	4.83
2016	9.09	9.90	578,372	57,259	52,592	4,667	17,355	22,022	275,961	6.76	4.92
2017	9.25	9.90	606,195	60,013	56,053	3,960	18,861	22,821	298,782	6.78	5.00
2018	9.41	9.90	634,884	62,854	59,726	3,128	20,419	23,547	322,329	6.79	5.07
2019	9.57	9.90	664,512	65,787	63,621	2,166	22,037	24,203	346,532	6.81	5.11
2020	9.75	9.90	695,029	68,808	67,751	1,057	23,721	24,778	371,310	6.83	5.15
2021	9.93	9.90	726,538	71,927	72,119	-192	25,464	25,273	396,582	6.85	5.17
2022	10.10	9.90	759,648	75,205	76,710	-1,505	27,260	25,756	422,338	6.87	5.18
2023	10.27	9.90	793,840	78,590	81,534	-2,944	29,073	26,129	448,467	6.88	5.18
2024	10.44	9.90	829,314	82,102	86,582	-4,480	30,871	26,391	474,858	6.88	5.17
2025	10.59	9.90	866,768	85,810	91,825	-6,015	32,686	26,671	501,528	6.88	5.16
2026	10.73	9.90	906,004	89,694	97,233	-7,539	34,519	26,980	528,508	6.88	5.14
2027	10.85	9.90	947,597	93,812	102,771	-8,959	36,372	27,413	555,922	6.88	5.13
2028	10.94	9.90	991,448	98,153	108,447	-10,294	38,256	27,962	583,884	6.88	5.11
2029	11.02	9.90	1,037,117	102,675	114,300	-11,625	40,176	28,551	612,435	6.88	5.09
2030	11.09	9.90	1,085,137	107,429	120,341	-12,912	42,137	29,225	641,659	6.88	5.07
2035	11.21	9.90	1,365,842	135,218	153,096	-17,878	52,845	34,967	803,301	6.88	5.01
2040	11.12	9.90	1,723,263	170,603	191,704	-21,101	66,105	45,004	1,006,199	6.88	5.02
2045	11.03	9.90	2,166,730	214,506	238,980	-24,474	83,418	58,944	1,271,612	6.88	5.09
2050	11.00	9.90	2,713,442	268,631	298,525	-29,894	105,997	76,102	1,616,534	6.88	5.18
2055	11.02	9.90	3,391,204	335,729	373,672	-37,943	134,927	96,984	2,057,305	6.88	5.26
2060	11.00	9.90	4,243,739	420,130	466,852	-46,722	172,011	125,290	2,623,590	6.89	5.38
2065	10.96	9.90	5,316,259	526,310	582,715	-56,405	220,246	163,840	3,361,366	6.89	5.52
2070	10.94	9.90	6,657,443	659,087	728,245	-69,158	283,399	214,241	4,326,712	6.89	5.68
2075	10.96	9.90	8,323,300	824,007	912,216	-88,209	365,740	277,531	5,582,395	6.89	5.85
2080	11.02	9.90	10,389,314	1,028,542	1,145,019	-116,477	471,898	355,421	7,197,207	6.90	6.01
2085	11.09	9.90	12,961,032	1,283,142	1,437,567	-154,425	607,517	453,092	9,257,954	6.90	6.15
2090	11.15	9.90	16,175,266	1,601,351	1,803,028	-201,677	780,544	578,867	11,887,633	6.90	6.30
2095	11.19	9.90	20,192,664	1,999,074	2,259,486	-260,412	1,001,958	741,546	15,253,444	6.90	6.45
2100	11.23	9.90	25,206,020	2,495,396	2,831,335	-335,939	1,285,755	949,816	19,566,096	6.91	6.61

Results Based on Best-Estimate Assumptions

Table II.3   Projection of Total Expenditures (millions of dollars)

		Disability				Survivor						
Year	Retirement	Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total	Orphans	Death	Expenses	Grand Total
1998	12,217	1,262	1,285	235	2,782	339	2,223	2,563	212	238	240	18,252
1999	12,763	1,267	1,290	235	2,792	351	2,325	2,675	222	245	269	18,967
2000	13,359	1,286	1,310	239	2,835	357	2,431	2,788	232	254	303	19,770
2001	14,029	1,323	1,352	245	2,920	365	2,547	2,911	243	263	318	20,684
2002	14,780	1,378	1,415	255	3,048	374	2,672	3,046	255	272	336	21,738
2003	15,635	1,453	1,499	268	3,221	385	2,809	3,194	268	282	356	22,956
2004	16,614	1,550	1,606	285	3,440	398	2,959	3,357	282	293	378	24,365
2005	17,679	1,663	1,730	304	3,698	412	3,114	3,525	296	304	402	25,904
2006	18,834	1,786	1,865	324	3,976	427	3,271	3,698	310	315	427	27,560
2007	20,120	1,915	2,006	344	4,265	442	3,433	3,874	324	326	453	29,364
2008	21,558	2,045	2,151	363	4,559	457	3,598	4,055	338	338	480	31,328
2009	23,122	2,181	2,301	382	4,865	474	3,768	4,241	352	349	509	33,437
2010	24,803	2,323	2,460	401	5,184	491	3,941	4,431	365	360	539	35,682
2011	26,617	2,462	2,618	420	5,499	509	4,120	4,629	379	371	567	38,062
2012	28,612	2,584	2,764	438	5,787	527	4,307	4,834	394	380	596	40,603
2013	30,788	2,714	2,913	457	6,084	544	4,497	5,042	407	390	627	43,337
2014	33,110	2,853	3,073	476	6,402	563	4,694	5,256	420	399	657	46,244
2015	35,584	2,996	3,242	494	6,733	582	4,897	5,478	433	408	690	49,326
2016	38,222	3,144	3,419	513	7,076	601	5,107	5,709	445	418	723	52,592
2017	41,033	3,296	3,602	532	7,431	621	5,327	5,948	457	427	758	56,053
2018	44,043	3,448	3,787	551	7,787	642	5,556	6,198	468	437	794	59,726
2019	47,265	3,597	3,972	571	8,140	662	5,796	6,459	480	447	831	63,621
2020	50,711	3,744	4,155	591	8,490	683	6,049	6,732	492	457	869	67,751
2021	54,375	3,892	4,341	612	8,844	704	6,316	7,020	505	467	908	72,119
2022	58,251	4,033	4,524	633	9,190	726	6,599	7,324	518	478	950	76,710
2023	62,345	4,170	4,705	654	9,530	746	6,899	7,646	531	489	992	81,534
2024	66,644	4,304	4,887	677	9,868	768	7,220	7,987	546	500	1,037	86,582
2025	71,126	4,429	5,064	700	10,193	788	7,562	8,350	561	512	1,083	91,825
2026	75,755	4,547	5,238	725	10,510	809	7,926	8,735	576	524	1,133	97,233
2027	80,481	4,665	5,416	751	10,832	829	8,316	9,145	593	536	1,184	102,771
2028	85,316	4,779	5,594	778	11,151	850	8,732	9,582	610	549	1,239	108,447
2029	90,279	4,898	5,784	806	11,488	871	9,176	10,046	629	562	1,296	114,300
2030	95,361	5,031	5,994	836	11,861	892	9,648	10,540	648	574	1,356	120,341
2035	122,153	5,932	7,437	1,001	14,370	1,012	12,461	13,473	753	640	1,707	153,096
2040	153,121	7,082	9,378	1,191	17,651	1,164	16,041	17,205	873	699	2,154	191,704
2045	190,899	8,556	11,949	1,411	21,916	1,354	20,351	21,706	1,007	745	2,708	238,980
2050	239,361	10,214	15,001	1,671	26,887	1,582	25,369	26,951	1,161	774	3,392	298,525
2055	301,608	12,060	18,592	1,986	32,637	1,838	31,216	33,055	1,342	791	4,239	373,672
2060	379,317	14,189	22,943	2,369	39,500	2,126	38,245	40,371	1,557	802	5,305	466,852
2065	475,622	16,888	28,657	2,827	48,372	2,460	46,994	49,455	1,806	816	6,645	582,715
2070	596,532	20,199	35,981	3,364	59,544	2,859	58,064	60,923	2,090	834	8,322	728,245
2075	749,819	24,175	45,212	3,995	73,382	3,332	72,009	75,341	2,413	856	10,404	912,216
2080	945,110	28,782	56,496	4,741	90,019	3,882	89,358	93,240	2,785	878	12,987	1,145,019
2085	1,191,978	34,106	70,241	5,632	109,978	4,510	110,783	115,294	3,217	899	16,201	1,437,567
2090	1,501,200	40,421	87,341	6,697	134,459	5,230	137,282	142,512	3,719	919	20,219	1,803,028
2095	1,887,808	48,031	108,913	7,965	164,909	6,064	170,224	176,288	4,299	941	25,241	2,259,486
2100	2,372,808	57,191	136,117	9,465	202,773	7,039	211,278	218,316	4,966	964	31,508	2,831,335

Table II.4   Projection of Pay-As-You-Go Rates (percentages of contributory earnings)

Year	Retirement	Disability				Survivor			Orphans	Death	Expenses	Grand Total
		Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total				
1998	5.49	0.57	0.58	0.11	1.25	0.15	1.00	1.15	0.10	0.11	0.11	8.21
1999	5.51	0.55	0.56	0.10	1.21	0.15	1.00	1.16	0.10	0.11	0.12	8.19
2000	5.52	0.53	0.54	0.10	1.17	0.15	1.00	1.15	0.10	0.10	0.13	8.16
2001	5.51	0.52	0.53	0.10	1.15	0.14	1.00	1.14	0.10	0.10	0.12	8.13
2002	5.50	0.51	0.53	0.09	1.13	0.14	0.99	1.13	0.09	0.10	0.13	8.09
2003	5.49	0.51	0.53	0.09	1.13	0.14	0.99	1.12	0.09	0.10	0.13	8.06
2004	5.49	0.51	0.53	0.09	1.14	0.13	0.98	1.11	0.09	0.10	0.12	8.05
2005	5.50	0.52	0.54	0.09	1.15	0.13	0.97	1.10	0.09	0.09	0.12	8.05
2006	5.51	0.52	0.55	0.09	1.16	0.12	0.96	1.08	0.09	0.09	0.12	8.07
2007	5.55	0.53	0.55	0.09	1.18	0.12	0.95	1.07	0.09	0.09	0.12	8.10
2008	5.61	0.53	0.56	0.09	1.19	0.12	0.94	1.06	0.09	0.09	0.12	8.15
2009	5.68	0.54	0.56	0.09	1.19	0.12	0.92	1.04	0.09	0.09	0.12	8.21
2010	5.75	0.54	0.57	0.09	1.20	0.11	0.91	1.03	0.08	0.08	0.12	8.27
2011	5.87	0.54	0.58	0.09	1.21	0.11	0.91	1.02	0.08	0.08	0.13	8.39
2012	6.00	0.54	0.58	0.09	1.21	0.11	0.90	1.01	0.08	0.08	0.12	8.51
2013	6.14	0.54	0.58	0.09	1.21	0.11	0.90	1.01	0.08	0.08	0.13	8.65
2014	6.30	0.54	0.58	0.09	1.22	0.11	0.89	1.00	0.08	0.08	0.12	8.79
2015	6.45	0.54	0.59	0.09	1.22	0.11	0.89	0.99	0.08	0.07	0.13	8.94
2016	6.61	0.54	0.59	0.09	1.22	0.10	0.88	0.99	0.08	0.07	0.13	9.09
2017	6.77	0.54	0.59	0.09	1.23	0.10	0.88	0.98	0.08	0.07	0.13	9.25
2018	6.94	0.54	0.60	0.09	1.23	0.10	0.88	0.98	0.07	0.07	0.13	9.41
2019	7.11	0.54	0.60	0.09	1.22	0.10	0.87	0.97	0.07	0.07	0.13	9.57
2020	7.30	0.54	0.60	0.09	1.22	0.10	0.87	0.97	0.07	0.07	0.13	9.75
2021	7.48	0.54	0.60	0.08	1.22	0.10	0.87	0.97	0.07	0.06	0.12	9.93
2022	7.67	0.53	0.60	0.08	1.21	0.10	0.87	0.96	0.07	0.06	0.13	10.10
2023	7.85	0.53	0.59	0.08	1.20	0.09	0.87	0.96	0.07	0.06	0.12	10.27
2024	8.04	0.52	0.59	0.08	1.19	0.09	0.87	0.96	0.07	0.06	0.13	10.44
2025	8.21	0.51	0.58	0.08	1.18	0.09	0.87	0.96	0.06	0.06	0.12	10.59
2026	8.36	0.50	0.58	0.08	1.16	0.09	0.87	0.96	0.06	0.06	0.13	10.73
2027	8.49	0.49	0.57	0.08	1.14	0.09	0.88	0.97	0.06	0.06	0.12	10.85
2028	8.61	0.48	0.56	0.08	1.12	0.09	0.88	0.97	0.06	0.06	0.12	10.94
2029	8.70	0.47	0.56	0.08	1.11	0.08	0.88	0.97	0.06	0.05	0.12	11.02
2030	8.79	0.46	0.55	0.08	1.09	0.08	0.89	0.97	0.06	0.05	0.12	11.09
2035	8.94	0.43	0.54	0.07	1.05	0.07	0.91	0.99	0.06	0.05	0.12	11.21
2040	8.89	0.41	0.54	0.07	1.02	0.07	0.93	1.00	0.05	0.04	0.12	11.12
2045	8.81	0.39	0.55	0.07	1.01	0.06	0.94	1.00	0.05	0.03	0.12	11.03
2050	8.82	0.38	0.55	0.06	0.99	0.06	0.93	0.99	0.04	0.03	0.13	11.00
2055	8.89	0.36	0.55	0.06	0.96	0.05	0.92	0.97	0.04	0.02	0.12	11.02
2060	8.94	0.33	0.54	0.06	0.93	0.05	0.90	0.95	0.04	0.02	0.13	11.00
2065	8.95	0.32	0.54	0.05	0.91	0.05	0.88	0.93	0.03	0.02	0.12	10.96
2070	8.96	0.30	0.54	0.05	0.89	0.04	0.87	0.92	0.03	0.01	0.13	10.94
2075	9.01	0.29	0.54	0.05	0.88	0.04	0.87	0.91	0.03	0.01	0.12	10.96
2080	9.10	0.28	0.54	0.05	0.87	0.04	0.86	0.90	0.03	0.01	0.13	11.02
2085	9.20	0.26	0.54	0.04	0.85	0.03	0.85	0.89	0.02	0.01	0.12	11.09
2090	9.28	0.25	0.54	0.04	0.83	0.03	0.85	0.88	0.02	0.01	0.12	11.15
2095	9.35	0.24	0.54	0.04	0.82	0.03	0.84	0.87	0.02	0.00	0.13	11.19
2100	9.41	0.23	0.54	0.04	0.80	0.03	0.84	0.87	0.02	0.00	0.13	11.23

Results Based on Best-Estimate Assumptions

C.   Contribution Rate

Subsection 113.1 of the Canada Pension Plan describes a financing objective of
having a contribution rate in years 2003 and thereafter that is no lower than the
lowest rate that can be maintained over the foreseeable future and that will
result in the ratios of the assets to the following year's expenditures remaining
generally constant. The lowest such contribution rate that will meet this
objective is referred to as the steady-state contribution rate in this report.

The meaning of the above phrase "remaining generally constant" is not defined
in the CPP. For purposes of the Sixteenth Actuarial Report, the preliminary
methodology used in this respect was to determine a steady-state contribution
rate that would result in the assets-to-expenditures ratios in 2030 and 2100
being equal. The exact rate was rounded to the nearest 0.1%, resulting in the
currently-scheduled ultimate contribution rate of 9.9%.

Bill C-2 provided that a regulation be made to establish the methodology for
determining the steady-state contribution rate. The regulation setting out such
methodology has recently been approved by the federal Cabinet and is awaiting
formal approval by the provinces. The regulation requires a comparison of the
assets-to-expenditures ratios 10 and 60 years following the end of the applicable
review period; e.g., for this review, years 2010 and 2060. This methodology has
therefore been incorporated into the determination of the steady-state
contribution rate.

I have determined the steady-state contribution rate for years 2003 and
thereafter to be 9.8%.

The steady-state contribution rate, required under subsection 115(1.1)(c) of the
CPP, is referred to by the default provisions in subsections 113.1(11) to
113.1(11.15). These default provisions may result in adjustments being made to
the contribution rate and, perhaps, benefits in payment if no agreement is
reached by the federal and provincial governments in response to the actuarial
determination of a steady-state contribution rate which is higher than 9.9%.

In respect of the current triennial review, since the steady-state contribution rate
is less than 9.9%, the default provisions would not apply. Therefore, in the
absence of specific action by the federal and provincial governments, the
contribution rates will remain as currently scheduled, e.g., 9.9% for years 2003
and thereafter.

Table II.5 compares the projected funding levels of the CPP, depending on whether the 9.9% contribution rate is either retained or replaced by 9.8%. Note that only the numerator of the assets-to-expenditures ratio is affected by the contribution rate; expenditures are the same in either case. A detailed financial projection of the CPP based on a contribution rate of 9.8% in 2003 and thereafter is shown in Table VII.C.7 of Appendix C.

Table II.5   Projected Ratios of Assets to Expenditures
                    - Contribution Rates of 9.9% or 9.8%

	2000	2025	2050	2075	2100
Retain 9.9%	1.94	5.16	5.18	5.85	6.61
Adopt 9.8%	1.94	4.90	4.45	4.26	3.54

The steady-state contribution rate will be redetermined in connection with the next triennial actuarial report, to be prepared as at 31 December 2000. It may also be redetermined, at an earlier date, to reflect the cost impact of any changes to the CPP that may be adopted in connection with the current federal and provincial review.

III. Key Assumptions

A. Overview

An actuarial examination of the CPP involves the projection of its income and expenditures over a long period of time. This is necessary in order to properly assess the future impact of historical and projected trends in demographic and economic factors. For this report, the projection period continues until 2100.

The income of the CPP includes both contributions and investment earnings. The projection of contributions begins with a projection of the working-age population. This requires assumptions regarding demographic factors, such as fertility, migration and mortality. Contributory earnings are derived by applying economic and demographic assumptions, including wage increase and CPP participation rates. Contributions are then derived simply by applying the contribution rates to contributory earnings.

Newly-emerging benefits are projected by applying demographic assumptions regarding retirement, disability and death to the eligible population, together with CPP benefit provisions and the earnings histories of the participants. The projection of total benefits, which includes the continuation of benefits already in payment, requires further demographic assumptions, along with an assumption regarding the rate of increases in prices. Administrative expenses, a relatively small component of CPP expenditures, are projected based on historical experience, increased to take account of the expense of the new CPP Investment Board.

Investment earnings are projected considering the existing portfolio of bonds and the Operating Balance, projected net cash flows and the assumed rates of return on new investments.

B. Best-Estimate Assumptions

The information required by statute, which is presented in Section II, has been derived using assumptions which reflect my best judgement regarding future demographic and economic trends. They are referred to in the report as the "best-estimate" assumptions. Most of the assumptions are graded from recent experience levels to their ultimate values during the first 5 to 18 years of the projection period. The exception is mortality, which is assumed to continue to improve throughout the projection period (although the relative annual rates of improvement remain constant after 2011). The most important of these

Key Assumptions

demographic and economic assumptions, and the corresponding assumptions used in the most recent reports, are summarised in the table below and discussed briefly thereafter. The assumptions are described more fully in Appendix B.

Table III.1   Best-Estimate Demographic and Economic Assumptions - Ultimate Years

		Report 17		Reports 15 & 16	
1.	Total fertility rate	Canada Québec	1.70 1.60	Canada Québec	1.85 1.80
2.	Net annual migration	External	0.60% of population	External	0.40% of population
		From Québec	10,000	From Québec	nil after 2010
3.	Mortality	1990-92 Canada Life Tables with future improvements.		1985-87 Canada Life Tables with future improvements.	
		Life expectancy at birth in 2100 of:		Life expectancy at birth in 2100 of:	
		males females	82.0 years 87.7 years	males females	80.5 years 87.4 years
4.	Aggregate rate of disability incidence per 1,000 eligible workers	3.5 overall	4.0 males 3.0 females	Report 16 Report 15	5.0 both sexes 5.5 both sexes
5.	Employment - estimated unemployment rate		7.0%		7.5%
6.	Real-wage differential		1.0%		1.0%
7.	Rate of increase in prices		3.0%		3.5%
8.	Real rate of return on new Fund investments		4.0%	Report 16 Report 15	4.0% 2.5%

Best-Estimate Assumptions

1.   Fertility

The total fertility rate for a year represents the average number of children that would be born to a woman in her lifetime if she were to experience the age-specific fertility rates observed in, or assumed for, that year. The total fertility rate has decreased dramatically since the late 1950s and in recent years it has generally been just under 1.70 for Canada overall, and slightly lower in Québec.

The decrease occurred as a result of changes in a variety of social, medical and economic factors. It seems unlikely that fertility will return to historical levels in the absence of significant societal change. Therefore, it has been assumed that the total fertility rate for Canada will increase slightly from its 1995 level of 1.64, to an ultimate level of 1.70 in 2016 (1.60 for Québec). This is consistent with the "medium" assumption adopted by Statistics Canada for its most recent population projections.

2.   Migration

Migration that influences the population eligible to participate in the CPP is the net result of several components. The largest of these is immigration to Canada from other countries. This has averaged 233,000 annually from 1992 to 1996. Historically, approximately 17% of immigrants settle in Québec. In its 1994 immigration plan, the government established an annual target of 250,000.

The second largest component of net migration is emigration from Canada to other countries. This has averaged 45,000 annually from 1992 to 1996, similar to historical levels. Historically, about 14% of the emigrants are from Québec. However, approximately 50% of all emigrants eventually return to Canada.

Net external migration to Canada was 0.61% of population in 1996. Based on a continuation of these migration levels, an ultimate assumption of 0.60% has been established, beginning in 2005. This is consistent with experience over the last 10 to 15 years and with the ultimate migration level incorporated in the "medium" Statistics Canada population projections. Immigrants, emigrants and returning Canadians have been assumed to be distributed by age and sex, and between Québec and the rest of Canada, in accordance with historical patterns.

Returning Canadians were not reflected in the migration assumptions used in previous reports, which accounts for one-third of the 0.20% increase in the ultimate net migration assumption.

Key Assumptions

Interprovincial migration is considered in the actuarial projections only with respect to movements between Québec and the rest of Canada, since this affects the population eligible to participate in the CPP. In recent years, net migration from Québec has averaged approximately 10,000 annually. This absolute level of net annual interprovincial migration has been assumed to prevail throughout the projection period.

3.   Mortality

Life expectancy in Canada has increased considerably during this century. The life expectancy at birth according to the most recent mortality tables available from Statistics Canada, the 1990-1992 Canada Life Tables, is 74.6 years for males and 80.9 years for females. Mortality improvements are expected to continue in the future. The ultimate rates of improvement were established by adjusting the results of a detailed study prepared by the United States Social Security Administration actuaries regarding trends in mortality by age, sex and cause of death to reflect, in part, historical differences in mortality improvements between Canada and the United States. Rates of improvement were assumed to grade from their recent levels to the ultimate by 2011. Adjustments were made to the resulting mortality rates to account for the impact of AIDS.

The improvements are expected to result in the following life expectancies:

Table III.2   Projected Trends in Life Expectancy - Canada

	1991	2000	2050	2100
At birth				
males	74.6	76.2	79.4	82.0
females	80.9	82.2	85.2	87.7
At age 65				
males	15.7	16.5	18.4	20.2
females	19.9	20.7	22.8	24.8

The life expectancies shown in Table III.2 were calculated as if the mortality rates experienced or assumed for the given year were applicable in all future years. Thus, they are not "cohort" life expectancies.

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4.   Disability

There are two main aspects of disability that must be considered when projecting the experience of the CPP: the incidence of new disabilities and the continuance of existing disabilities. CPP disability incidence rates have fluctuated over time, but increased sharply in the early 1990s. Since then, incidence rates have returned to more typical historical levels. This reversal was strongly influenced by changes in the administrative practices applied in adjudicating applications for CPP disability benefits. The change in disability qualification requirements contained in Bill C-2 will also reduce CPP disability incidence rates.

The actuarial projections in this report are based on the new provisions and administrative practices of the CPP. Accordingly, it has been assumed that CPP disability incidence rates will remain at approximately their current levels. Although these rates vary by age and sex, based on the current distribution of population, the resulting aggregate ultimate rate of incidence for years 2005 and later is 3.5 new disabilities per year among each 1,000 eligible workers (4.0 for males and 3.0 for females, on average).

Disability continuance rates reflect recoveries, deaths and conversions to retirement pensions at age 65. The rates assumed for future years have been based on the average experience during the period 1976 to 1993.

5.   Employment

Employment levels are reflected in the actuarial projection model through the assumption made regarding the proportions of the population, by age and sex, who have earnings in a given year. These proportions vary not only with the rate of unemployment, but also reflect trends in increased workforce participation by women, longer periods of formal education among young adults and the trends in retirement patterns of older workers.

The ultimate proportions of earners, assumed to apply in year 2010 and thereafter, were established based on a review of both historical trends and the results of projections prepared by Finance department economists using a cohort-based model. The assumptions are consistent with an ultimate unemployment rate of approximately 7.0%. The increases in the assumed proportions of earners produce an average annual increase in the workforce of 1.7% during the period 1997 to 2010.

Key Assumptions

6.   Wage Increases

Wage increases impact the financial balance of the CPP in two ways. In the short term, an increase in the average wage translates into higher contribution income, with little immediate impact on benefits. Over the longer term, higher average wages produce higher CPP benefits. The long-term projected financial position of the CPP is more dependent on the differential between the assumed annual rates of wage increases and price increases (the real-wage differential) than on the absolute level of wage increases assumed.

Historically, the real-wage differential has fluctuated significantly from year to year. The trend was generally downward through the late 1980s, with some improvement since then, e.g., the 10-year average annual real-wage differential was -0.59% for the period ending 1987 and 0.32% for the period ending 1997. Over the longer term, the annual real-wage differential averaged 1.52% for the 50-year period ending 1997.

Many factors have influenced the real rates of increase in average annual wages, including general productivity improvements, the move to a service economy and decreases in the average hours worked. Considering these factors, together with the historical trends and judgement regarding the long-term course of the economy, an ultimate real-wage differential of 1.0% has been assumed in years 2003 and thereafter. This ultimate differential is unchanged from the assumption used in recent CPP actuarial reports. Combined with the price increase assumption described below, it results in assumed nominal annual increases in wages of 4.0% in 2003 and thereafter. During the initial years of the projection period, the real-wage differential is assumed to increase uniformly from 0.6% in 1998 to its ultimate level.

The assumed increases in wages and proportions of earners result in projected average annual real increases in total employment earnings of 2.7% for 1998 to 2005. This decreases to about 1.5% ultimately, reflecting 1% increases in real wages and 0.5% annual growth in the working-age population.

7.   Price Increases

Price increases, as measured by changes in the Consumer Price Index (CPI), also tend to fluctuate from year to year. Over the last 50 years, the trend was generally upward through the early 1980s and downward since then. For example, the average annual increases in the CPI for the 50-, 25- and 10-year periods ending in 1997 were 4.44%, 5.83% and 2.80%, respectively.

Based on these trends and judgement regarding the long-term outlook for inflation, an ultimate annual rate of price increase of 3.0% has been assumed. This is 0.5% lower than the ultimate price increase assumption used in recent CPP actuarial reports. The rates of price increase are assumed to increase uniformly from 1.0% in 1998 to their ultimate level in 2003.

8.   Rate of Return on Investments

Assets of the CPP include the Operating Balance, which corresponds to three months of benefit payments, and the Fund, which represents the excess of all CPP assets over the Operating Balance. Assets of the Fund currently consist of 20-year loans to the provinces. In the future, assets of the Fund will also include investments managed by the new CPP Investment Board.

In accordance with the new policy of investing the Fund in a diversified portfolio, the ultimate real rate of return on the investment of future net cash flows is projected to be approximately 3.85%. This rate is a weighted average of a real rate of interest of 1.5% assumed on the Operating Balance and of a real rate of return of 4% on new investments in the Fund. These real rates, assumed for all future years, are the same real rates assumed for the Sixteenth Actuarial Report and compare to the assumptions of 1.5% and 2.5%, respectively, used for the Fifteenth Actuarial Report. (Note that all of the real rates of return referred to in this report are actually real-return differentials, i.e., the difference between the effective annual rate of return on investments and the rate of increase in prices. This differs from the technical definition of the real rate of return, which, in the case of the ultimate Fund assumption, would be $(1.07 \div 1.03) - 1 = 3.883\%$ rather than 4%.)

The assumed long-term real rate of return of 4% on the Fund was established taking into account the following factors:

•   from 1966 to 1995, the average real yield on the Québec Pension Plan (QPP) account, which has always been invested in a diversified portfolio, was close to 4%;

•   as reported in the Canadian Institute of Actuaries (CIA) Report on Canadian Economic Statistics 1924-1997, the average real yield over the period of 25 years ending in 1997 on the funds of a sample of the largest private pension plans in Canada was close to 5%;

Key Assumptions

- using historical results published by the CIA, the real average yields over the 50-year (39-to 46-year, in the case of mortgages) periods ending in the 1990s would have ranged from just under 4% to almost 5% in respect of a hypothetical portfolio invested equally in each of the following five areas: conventional mortgages, long-term federal bonds, Government of Canada 91-day Treasury Bills, Canadian equities and U.S. equities; and

- the market rate of return on Government of Canada real-return bonds is currently slightly above 4%.

From a larger perspective, assuming a real yield of 4% on the CPP Fund means that the CPP Investment Board would be expected to achieve investment returns comparable to those of the QPP and of large private pension plans.

IV.   Comparison With Previous Projections

The results presented in this report differ from those previously projected for a variety of reasons. Differences between the actual experience during 1994 through 1997 and that projected in the Fifteenth and Sixteenth Actuarial Reports are addressed in paragraph A below. Since historical results provide the starting point for the projections shown in this report, these historical differences also have an effect on projected future experience. The impacts of the experience update and the other factors that have significantly changed the projected future results are addressed in paragraph B.

A.   Financial Development - 1994 to 1997

The major components of changes in the CPP assets from 31 December 1993 to 31 December 1997 are summarised in Table IV.1. Note that assets are shown at book value.

Table IV.1   Financial Development - 1994 to 1997
(millions of dollars)

	Actual Experience	Report 15 Projected	Difference (A - P)	Ratio (A / P)
Assets at 31 December 1993	41,720	41,720		
+ Contributions	43,418	47,888	-4,470	0.91
– Expenditures	65,641	67,941	-2,300	0.97
+ Investment Earnings	16,964	17,346	-382	0.98
Change in Assets	-5,259	-2,707	-2,552	1.94
Assets at 31 December 1997	36,461	39,013	-2,552	0.93

Contributions during the period 1994 to 1997 were about $4.5 billion less than projected. Lower than expected contributory earnings account for a shortfall of $4.8 billion, which was partially offset by $0.3 billion in additional contributions due to the increase in the 1997 contribution rate from 5.85% to 6.00% in accordance with Bill C-2. Contributory earnings were depressed by a combination of lower than expected levels of employment, inflation and real-wage increases during the period.

Comparison With Previous Projections

Expenditures during the period were $2.3 billion less than projected, somewhat offsetting the negative impact of the lower contributions. The principal reason for this was a dramatic decrease in CPP disability incidence rates resulting from changes in administrative practices. Disability benefits were $2.4 billion less than projected, while other expenditures, overall, were slightly higher than projected.

Investment earnings were about $0.4 billion less than projected. This shortfall resulted largely from the lower net amount of assets available for investment.

Overall, assets decreased by $5.3 billion during this period, almost twice the projected decline of $2.7 billion.

B.   Changes in Projected Results - 1998 to 2100

The pay-as-you-go rate, which is the ratio of expenditures to contributory earnings in a given year, is an important measure of the cost of the CPP. One way of understanding the differences between the best-estimate projections in this report and those presented in the Fifteenth and Sixteenth Actuarial Reports is by looking at the effects of various factors on the pay-as-you-go rates. The most significant effects are identified in the reconciliation presented in Table IV.2 and the discussion below.

Bill C-2 had a significant impact on projected pay-as-you-go rates, as described in the Sixteenth Actuarial Report. In accordance with the Canada Pension Plan, the projections in that report were prepared based on the methods, assumptions and data underlying the Fifteenth Actuarial Report. In particular, this means that no update was done for actual CPP experience after 1993. For purposes of the reconciliation of pay-as-you-go rates, the effects of Bill C-2 have been shown on the basis presented in the Sixteenth Report, prior to any experience update or changes in methodology.

The methodology described in Section VII.B reflects a number of relatively minor improvements from that employed in previous reports. Overall, these refinements had the effect of increasing the projected pay-as-you-go rates slightly.

The primary variations in experience during 1994 to 1997 were discussed in paragraph A above. Overall, the long-term effect of the experience update was to increase the projected pay-as-you-go rates slightly.

Key assumptions, and changes made from the previous reports, are outlined in Section III of the report. The effects of these changes may be summarised as follows:

- the decrease in the ultimate fertility rate significantly increases the long-term pay-as-you-go rates, because its effect in slowing the growth in total contributory earnings outweighs the ultimate reductions in expenditures;

- conversely, the increase in the assumed level of net migration significantly decreases the pay-as-you-go rates, as the higher levels of contributory earnings outweigh the ultimate increases in expenditures;

- the more rapid mortality improvements assumed for this report increase the pay-as-you-go rates, because beneficiaries are expected to receive their monthly benefits over longer periods of time;

- the lower levels of disability incidence assumed in the future, reflecting the significant recent improvements in experience, reduce the pay-as-you-go rates by approximately one-half percent of contributory earnings, on average;

- the decrease in the assumed proportions of earners in the population increases the pay-as-you-go rates, although the effect declines with time as the lower earnings translate into lower benefit entitlements;

- the assumption that the real-wage differential will increase to its ultimate level over five years, rather than reaching it immediately as was assumed in previous reports, produced a small initial increase in the pay-as-you-go rates (with even smaller long-term impact); and

- the reduction in the assumed rate of price increases results in an increase in the pay-as-you-go rates, because the savings due to lower increases in benefits in payment are outweighed by the slower growth in total contributory earnings; this effect declines over time, as the lower earnings result in lower benefits.

Comparison With Previous Projections

Some of the less significant assumptions, which are described in Section VII.B, were also changed. For example, the proportions of people ages 18 to 24 attending school full-time, used in the projection of orphan benefits, and the experience adjustment factors applied in the projection of retirement, disability and survivor benefits were revised to reflect more recent experience. Overall, the changes in these "other" assumptions had the effect of decreasing the projected pay-as-you-go rates.

Bill C-2 included a schedule of contribution rates which increases from 1997 to 2003 and remains level at 9.9% in 2003 and thereafter, along with a requirement that the steady-state contribution rate be redetermined as a part of each future actuarial examination. Factors that lead to changes in the pay-as-you-go rates generally have comparable effects on the steady-state contribution rate. Furthermore, while the actual and assumed rates of return on investments of the CPP have no effect on pay-as-you-go rates, they may have a significant impact on the steady-state contribution rate.

A reconciliation of the change in the steady-state contribution rate from the 9.9% shown in the Sixteenth Report to the new level of 9.8% is provided in Table IV.3.

The comparison period used in determining the steady-state contribution rate was changed from that used in the Sixteenth Actuarial Report (see Section II.C). This change reduced the steady-state contribution rate by 0.1%.

The order used to determine the impact of each of the factors identified in these reconciliations influences the distribution of the total change among them. The order employed was as follows:

• Bill C-2 changes - as calculated for the Sixteenth Actuarial Report;

• methodology improvements, experience updates and changes in "other" assumptions - in the chronological order in which they were incorporated into the projection model;

• changes in key assumptions - the aggregate impact of such changes was allocated among these assumptions in proportion to the impact of changing each assumption independently; and

• the regulation prescribing the basis for calculating the steady-state rate was applied.

Table IV.2   Reconciliation of Changes in Pay-As-You-Go Rates
(percentages of contributory earnings)

		2000	2025	2050	2075	2100
Fifteenth Report rates		8.250	13.490	14.110	14.370	14.760
Bill C-2 changes		-0.450	-2.520	-3.130	-3.270	-3.370
Sixteenth Report rates		7.800	10.970	10.980	11.100	11.390
I.	Improvements in methodology	-0.003	0.024	0.034	0.049	0.063
II.	Experience update					
	Demographic	-0.206	0.033	0.151	0.133	0.124
	Economic	0.407	0.260	0.100	0.079	0.075
	Benefits	-0.204	-0.017	-0.003	-0.001	0.001
	Sub-total	-0.003	0.276	0.248	0.211	0.200
III.	Changes in assumptions					
	Fertility	0.000	0.165	0.597	0.627	0.663
	Migration	-0.087	-0.773	-0.835	-0.859	-0.913
	Mortality	-0.006	0.257	0.445	0.425	0.460
	Disability	-0.266	-0.683	-0.626	-0.603	-0.579
	Employment	0.475	0.263	0.218	0.130	0.110
	Real-wage differential	0.064	0.029	0.009	0.006	0.004
	Price increases	0.172	0.233	0.145	0.110	0.095
	Other assumptions	0.015	-0.172	-0.216	-0.241	-0.265
	Sub-total	0.367	-0.681	-0.263	-0.404	-0.425
Total of I to III		0.361	-0.381	0.019	-0.144	-0.162
Seventeenth Report rates		8.161	10.589	10.999	10.956	11.228

Comparison With Previous Projections

Table IV.3   Reconciliation of Changes in the Steady-State
                Contribution Rate
                (percentages of contributory earnings)

Sixteenth Report rate - after rounding	9.900
Sixteenth Report rate - before rounding	9.923
I. Improvements in methodology	0.037
II. Experience update	
Demographic	0.062
Economic	0.229
Benefits	-0.068
Sub-total	0.223
III. Changes in assumptions	
Fertility	0.279
Migration	-0.492
Mortality	0.318
Disability	-0.613
Employment	0.239
Real-wage differential	0.040
Price increases	0.209
Return on investments	0.000
Other assumptions	-0.300
Sub-total	-0.320
IV. Regulation prescribing calculation method	-0.099
Total of I to IV	-0.159
Seventeenth Report rate - before rounding	9.764
Seventeenth Report rate - after rounding	9.800

V.   Sensitivity Tests

A.   Introduction

An actuarial examination of the CPP involves the projection of its income and expenditures over a long period of time. The information required by statute, which is presented in Section II, has been derived using "best-estimate" assumptions regarding future demographic and economic trends. The key best-estimate assumptions, i.e., those for which changes within a reasonable range have the most significant impact on the long-term financial results, are described in Section III.

Both the length of the projection period and the number of assumptions required ensure that actual future experience will not develop precisely in accordance with the best-estimate assumptions. Sensitivity tests have been performed, consisting of projections of CPP financial results using alternative assumptions.

For the first set of sensitivity tests, each of the eight key assumptions was changed individually, with the other assumptions being maintained at their best-estimate levels. Two tests were performed with respect to each of the assumptions. The alternative assumptions selected are intended to represent a reasonable range of potential long-term experience. However, it is possible that actual experience could lie outside these ranges.

Each of these tests was then categorised as either a "low-cost" scenario or a "high-cost" scenario. In the "low-cost" scenarios, the alternative assumptions have the effect of reducing the steady-state contribution rate. Conversely, in the "high-cost" scenarios, the assumptions would increase the steady-state contribution rate.

The second set of sensitivity tests consists of projections under which all of the key assumptions were changed at the same time. The low-cost combined scenario shows the effect of all eight factors following their low-cost assumptions and vice-versa for the high-cost combined scenario. Historically, changes in certain factors are often accompanied by changes in other factors that have offsetting impacts on CPP costs. Therefore, it is unlikely that future experience, overall, would be either as favourable as the low-cost combined scenario or as unfavourable as the high-cost combined scenario.

Sensitivity Tests

Over the long term, economic cycles have little impact on pay-as-you-go rates as long as, on average, the ultimate assumptions are realized. Their impact on the steady-state contribution rate depends primarily on the assumed pattern of rates of return on investment. In general, it is advantageous to have higher rates of return early in the projection period, rather than later, even if the average rate of return is the same in either case. Considering the long-term focus of this report, scenarios testing the sensitivity of the CPP to assumed economic cycles have not been included.

B.   Assumptions

Table V.1 below summarises the alternative assumptions that were used in the sensitivity tests. It is followed by a brief discussion of each assumption and the impact its variation has on the results.

Table V.1   Sensitivity Test Assumptions - Ultimate Years

		Low-Cost	Best-Estimate	High-Cost
1.	Total fertility rate	Canada 1.90 Québec 1.80	Canada 1.70 Québec 1.60	Canada 1.50 Québec 1.40
2.	Net annual migration	0.75% of population	0.60% of population	0.40% of population
3.	Mortality	50% of best-estimate improvement rates.	1990-92 Canada Life Tables with improvements.	150% of best-estimate improvement rates.
4.	Aggregate rate of disability incidence per 1,000 eligible workers	males 3.5 females 2.5	males 4.0 females 3.0	males 5.5 females 4.5
5.	Employment - estimated unemployment rate	6.0%	7.0%	8.0%
6.	Real-wage differential	1.4%	1.0%	0.6%
7.	Rate of increase in prices	4.0%	3.0%	2.0%
8.	Real rate of return on new Fund investments	5.0%	4.0%	3.0%

1.   Fertility

The best-estimate assumption is that the total fertility rate for Canada will increase slightly from its 1995 level of 1.64, to an ultimate level of 1.70 in 2016 (1.60 for Québec). This is consistent with the "medium" assumption adopted by Statistics Canada for its most recent population projections.

The low-cost assumption has the fertility rate increasing to an ultimate level of 1.90 in 2016 (1.80 for Québec). This is consistent with Statistics Canada's "high" assumption and represents a return to the levels typical in the early 1970s. Under this scenario, the population grows to a level in 2100 that is 26% higher than under the best-estimate assumption.

Sensitivity Tests

The high-cost assumption has the fertility rate decreasing to an ultimate level of 1.50 in 2016 (1.40 for Québec). This is consistent with Statistics Canada's "low" assumption and represents a continuation of the historical trend of decreases. Under this scenario, the population grows much more slowly, to a level in 2100 that is 18% lower than under the best-estimate assumption.

Changes in the fertility rate have very little short-term effect on the CPP's financial position. However, the long-term impact of changes may be significant.

2.   Migration

Net migration to Canada was 0.61% of population in 1996. Based on a continuation of these migration levels, an ultimate best-estimate assumption of 0.60% has been established, beginning in 2005. This is consistent with experience over the last 10 to15 years and with the ultimate migration level incorporated in the "medium" Statistics Canada population projections.

The low-cost assumption has net migration increasing to an ultimate level of 0.75% of population in 2005. This is consistent with Statistics Canada's "high" assumption. Under this scenario, the population grows to a level in 2100 that is 26% higher than under the best-estimate assumption.

The high-cost assumption has net migration decreasing to an ultimate level of 0.40% of population in 2005. This is consistent with Statistics Canada's "low" assumption. Under this scenario, the population grows much more slowly, to a level in 2100 that is 24% lower than under the best-estimate assumption.

In recent years, net interprovincial migration from Québec has averaged approximately 10,000 annually. This absolute level of net annual interprovincial migration has been assumed to prevail throughout the projection period, under each of the scenarios.

3.   Mortality

Mortality improvements are expected to continue in the future. The best-estimate ultimate rates of improvement were established by adjusting the results of a detailed study prepared by the United States Social Security Administration actuaries regarding trends in mortality by age, sex and cause of death to reflect, in part, historical differences in mortality improvements between Canada and the United States. Rates of improvement were assumed to grade from their recent levels to the ultimate by 2011.

For the low-cost scenario, mortality is assumed to improve less rapidly. Rates of improvement were assumed to grade from recent levels to 50% of the best-estimate ultimate levels by 2011. Under this scenario, the population grows to a level in 2100 that is 3% lower than under the best-estimate assumption.

For the high-cost scenario, mortality is assumed to improve more rapidly. Rates of improvement were assumed to grade from recent levels to 150% of the best-estimate ultimate levels by 2011. Under this scenario, the population grows to a level in 2100 that is 8% higher than under the best-estimate assumption.

The adjustments made to the resulting mortality rates to account for the impact of AIDS were the same under the alternative scenarios as those applied under the best-estimate projections.

The differing rates of improvement would result in the following life expectancies:

Table V.2   Life Expectancy in 2100 Under Alternative Assumptions - Canada

		Low-Cost	Best-Estimate	High-Cost
At birth				
	males	78.5	82.0	85.3
	females	84.4	87.7	90.9
At age 65				
	males	17.9	20.2	22.6
	females	22.3	24.8	27.5

The life expectancies shown in Table V.2 were calculated as if the mortality rates assumed for year 2100 were applicable in all subsequent years.

Sensitivity Tests

4.   Disability

The best-estimate projections assume that CPP disability incidence rates will remain at approximately their current levels. Although these rates vary by age and sex, based on the current distribution of population, the resulting aggregate ultimate rate of incidence for years 2005 and later is 3.5 new disabilities per year among each 1,000 eligible workers (4.0 for males and 3.0 for females, on average).

For the low-cost scenario, CPP disability incidence rates are assumed to continue their recent trend of improvement, reaching ultimate levels in 2005 of 3.5 for males and 2.5 for females. Such incidence rates would be similar to those experienced under the CPP in the late 1970s.

For the high-cost scenario, CPP disability incidence rates are assumed to return to levels similar to those of the early 1990s. Ultimate incidence rates, reached in 2005, would be 5.5 for males and 4.5 for females.

Disability continuance rates assumed for future years, under all scenarios, have been based on average experience during the period 1976 to 1993.

5.   Employment

Employment levels are reflected in the actuarial projection model through the assumption made regarding the proportions of the population, by age and sex, who have earnings in a given year. These proportions vary not only with the rate of unemployment, but also reflect trends in increased workforce participation by women, longer periods of formal education among young adults and the trends in retirement patterns of older workers.

The ultimate proportions of earners, assumed to apply in year 2010 and thereafter, are consistent with an ultimate unemployment rate of approximately 7.0%.

For the low-cost scenario, the proportions of earners are assumed to increase more rapidly, to ultimate levels in year 2010 that are 101% of the best-estimate proportions for each age and sex. This is consistent with an unemployment rate of approximately 6.0%.

For the high-cost scenario, the proportions of earners are assumed to reach ultimate levels in year 2010 that are 99% of the best-estimate proportions. This is consistent with an unemployment rate of approximately 8.0%.

6.   Wage Increases

Wage increases impact the financial balance of the CPP in two ways. In the short term, an increase in the average wage translates into higher contribution income, with little immediate impact on benefits. Over the longer term, higher average wages produce higher CPP benefits. The long-term projected financial position of the CPP is more dependent on the differential between the assumed annual rates of wage increases and price increases (the real-wage differential) than on the absolute level of wage increases assumed.

An ultimate real-wage differential of 1.0% has been assumed in years 2003 and thereafter for the best-estimate projections. This ultimate differential is unchanged from the assumption used in recent CPP actuarial reports. Combined with the best-estimate price increase assumption of 3.0%, it results in assumed nominal annual increases in wages of 4.0% in 2003 and thereafter. During the initial years of the projection period, the real-wage differential is assumed to increase uniformly from 0.6% in 1998 to its ultimate level.

For the low-cost scenario, the assumed real-wage differential increases from 0.6% in 1998 to an ultimate level of 1.4% in 2003. This is roughly comparable to long-term historical averages, although much higher than recent experience.

For the high-cost scenario, a real-wage differential of 0.6% has been assumed in all years. While much lower than the long-term historical averages, it nevertheless represents an improvement from shorter-term historical averages. However, taking account of the factors which influenced the historical trends, this assumption seems appropriate as a conservative, long-term assumption.

7.   Price Increases

An ultimate annual rate of price increases of 3.0% has been assumed for the best-estimate projections. The rates of price increase are assumed to increase uniformly from 1.0% in 1998 to their ultimate level in 2003.

Sensitivity Tests

For the low-cost scenario, the annual rate of price increases is assumed to increase to an ultimate level of 4.0% in 2003. This level of inflation is comparable to long-term historical averages. Although a higher rate of increase in prices results in higher CPP expenditures, it also results in higher contributory earnings (this is because the same real-wage differential is added to a higher base of inflation, producing a higher nominal rate of wage increases). The net effect is a decrease in the contribution rate required.

For the high-cost scenario, the annual rate of price increases is assumed to increase to an ultimate level of 2.0% in 2003. This level of inflation is comparable to that of the 1990s.

8.   Rate of Return on Investments

Assets of the CPP include the Operating Balance, which corresponds to three months of benefit payments, and the Fund, which represents the excess of all CPP assets over the Operating Balance. Assets of the Fund currently consist of 20-year loans to the provinces. In the future, assets of the Fund will also include investments managed by the new CPP Investment Board.

In accordance with the new policy of investing the Fund in a diversified portfolio, the ultimate real rate of return on the investment of future net cash flows is projected to be approximately 3.85% under the best-estimate assumptions. This rate is a weighted average of a real rate of interest of 1.5% assumed on the Operating Balance and of the real rate of return of 4% on investments in the Fund.

For the low-cost scenario, real rates of return on new investments were assumed to be 1% higher, i.e., 2.5% on the Operating Balance and 5% on the Fund.

For the high-cost scenario, real rates of return on new investments were assumed to be 1% lower, i.e., 0.5% on the Operating Balance and 3% on the Fund.

The real rates of return have no effect on the pay-as-you-go rates, since they affect neither benefits nor contributory earnings. However, their impact on the ultimate contribution rate is greater under the higher funding levels projected as a result of Bill C-2 than was previously the case.

9.   Combined

For the low-cost scenario, all of the individual low-cost assumptions are used in combination. Therefore, the ultimate real-wage differential of 1.4% combined with price increases of 4.0% produces nominal annual increases in average wages of 5.4%. Similarly, the ultimate nominal annual rates of return on the Operating Balance and Fund are 6.5% and 9.0%, respectively.

For the high-cost scenario, the ultimate real-wage differential of 0.6% combined with price increases of 2.0% produces nominal annual increases in average wages of 2.6%. Similarly, the ultimate nominal annual rates of return on the Operating Balance and Fund are 2.5% and 5.0%, respectively.

C.   Results

Under each scenario, contribution rates were projected to follow the current schedule through 2002 and a new steady-state contribution rate was determined for years 2003 and thereafter. (There are two exceptions to this. For the Combined low-cost scenario, the steady-state rate of 8.1% applies from 2001. For the Combined high-cost scenario, annual increases in the contribution rate were limited to 0.8%, so the steady-state rate of 12.7% is not reached until 2007.) Table V.3 summarises the pay-as-you-go rates and contribution rates under each of the scenarios; details of the projections are in Appendix VII.C.

Under some of the sensitivity tests, the ultimate pay-as-you-go rates do not stabilize. In such cases, while the steady-state contribution rates shown in Table V.3 would be adequate through 2060, they could result in significant increases or decreases in the ratio of assets to expenditures in the later years of the projection period.

Sensitivity Tests

Table V.3   Sensitivity Test Results - Steady-State Contribution Rate and
              Pay-As-You-Go Rates
              (percentages; first row is low-cost scenario, second row is
               high-cost scenario)

	Assumptions Tested	Steady-State Rate	Pay-As-You-Go Rates				
			2000	2025	2050	2075	2100
0.	Best-Estimate	9.8	8.16	10.59	11.00	10.96	11.23
1.	Fertility	9.6	8.16	10.53	10.41	9.98	10.21
		9.9	8.16	10.66	11.66	12.13	12.45
2.	Migration	9.5	8.15	10.18	10.45	10.41	10.65
		10.2	8.18	11.19	11.84	11.79	12.11
3.	Mortality	9.5	8.14	10.38	10.55	10.37	10.47
		10.0	8.18	10.80	11.45	11.54	11.96
4.	Disability	9.6	8.16	10.42	10.84	10.81	11.09
		10.2	8.18	11.11	11.49	11.42	11.67
5.	Employment	9.7	8.14	10.51	10.97	10.96	11.23
		9.8	8.19	10.68	11.03	10.97	11.24
6.	Real Wages	9.4	8.13	10.01	10.28	10.24	10.49
		10.2	8.17	11.22	11.81	11.78	12.08
7.	Prices	9.5	8.14	10.26	10.71	10.73	11.03
		10.0	8.18	10.98	11.36	11.25	11.48
8.	Return on Investments	9.4	8.16	10.59	11.00	10.96	11.23
		10.2	8.16	10.59	11.00	10.96	11.23
9.	Combined	8.1	8.06	8.90	8.54	8.18	8.28
		12.7	8.28	13.32	15.30	16.09	16.68

Table V.4 summarises the projected impact on the ratio of the CPP assets to the
following year's CPP expenditures under each of the alternative sets of
assumptions, if the currently-scheduled contribution rate of 9.9% continues to
apply in years 2003 and thereafter. Accordingly, the results presented in this
table reflect neither future explicit actions on the part of the government in
response to developing experience nor the application of the default provisions
of the CPP for adjusting benefits and contribution rates.

Table V.4   Sensitivity Test Results - Funding Levels Under 9.9% Ultimate
             Contribution Rate
             (first row is low-cost scenario, second row is high-cost
              scenario)

	Assumptions Tested	Year Assets Depleted	Ratio of Assets to Following Year's Expenditures				
			2000	2025	2050	2075	2100
0.	Best-Estimate	N/A	1.94	5.16	5.18	5.85	6.61
1.	Fertility	N/A	1.94	5.17	5.93	9.17	14.11
		2091	1.94	5.14	4.42	2.33	*
2.	Migration	N/A	1.95	5.65	7.05	10.09	14.66
		2069	1.94	4.50	2.48	*	*
3.	Mortality	N/A	1.96	5.59	7.03	10.83	17.59
		2088	1.93	4.75	3.53	1.59	*
4.	Disability	N/A	1.95	5.59	6.32	8.28	11.23
		2068	1.93	3.93	1.93	*	*
5.	Employment	N/A	1.95	5.37	5.65	6.71	8.12
		N/A	1.94	4.94	4.69	4.96	5.03
6.	Real Wages	N/A	1.95	5.95	7.66	11.13	16.15
		2071	1.94	4.41	2.49	*	*
7.	Prices	N/A	1.94	5.69	6.90	9.53	13.54
		2091	1.95	4.63	3.31	1.68	*
8.	Return on Investments	N/A	1.95	6.14	9.00	16.28	31.74
		2086	1.94	4.34	2.73	0.94	*
9.	Combined	N/A	1.97	9.32	20.89	44.94	86.97
		2029	1.91	0.99	*	*	*

VI.   Actuarial Opinion

I am an actuary and a Partner in the consulting firm of Morneau Sobeco. I have been retained by the Office of the Superintendent of Financial Institutions to fill a temporary vacancy by serving as Acting Chief Actuary, Public Insurance and Pension Programs. One of the duties of this position is to prepare a periodic actuarial examination of the Canada Pension Plan, in accordance with section 115 of the Canada Pension Plan.

I have completed such an examination, the results of which are presented in this Seventeenth Actuarial Report as at 31 December 1997. I gratefully acknowledge the considerable assistance provided by actuaries and other staff within OSFI's Office of the Chief Actuary, both in conducting the examination and in preparing this report.

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

•   the methodology employed is appropriate and consistent with sound actuarial principles;

•   the data on which this report is based are sufficient and reliable; and

•   the assumptions used are, in aggregate, reasonable and appropriate.

This report has been prepared, and my opinion given, in accordance with accepted actuarial practice.

Michael Hafeman, F.S.A., F.C.I.A.

Ottawa, Canada
15 December 1998

VII. Appendix A - Main Provisions of the Canada Pension Plan

1.   Definitions

Note that the following description includes the amendments introduced in Bill C-2 which became effective 1 January 1998. These amendments were described in the Sixteenth CPP Actuarial Report.

Contributor
The Canada Pension Plan (CPP), which came into force on 1 January 1966, includes as contributors virtually all members of the labour force in Canada (both employees and self-employed persons) between the ages of 18 and 70 with employment earnings, other than persons in the province of Québec who are covered by the Québec Pension Plan (QPP). It should be noted that the Canada Pension Plan covers all members of the Canadian Forces and the Royal Canadian Mounted Police, including those residing in the province of Québec. The main exceptions are persons with earnings less than the Year's Basic Exemption (YBE, defined below), persons to whom a CPP retirement or disability pension is payable and members of certain religious groups.

Contributory Period
The contributory period corresponds to the number of months from attainment of age 18 or from 1 January 1966, if later, to the earliest of the month in which the contributor dies, the month preceding the one in which the retirement pension commences and the month preceding the one in which the contributor reaches 70 years of age, less the number of months during which the contributor received a CPP or QPP disability benefit (including the 3-month waiting period), or during which, after 1977, the contributor had at least one eligible child under 7 years of age and had earnings for that year less than the YBE.

Year's Maximum Pensionable Earnings (YMPE)
The YMPE for any calendar year corresponds to the limit above which that year's employment earnings are neither subject to contributions nor create additional benefit entitlements. The YMPE for a particular calendar year is prorated in individual cases to allow for the portion of the year before age 18 or after age 70, or after death, commencement of a CPP or QPP retirement pension, or disablement. The YMPE increases each year in accordance with the ratio of the average of the Industrial Aggregate (the measure of average wages and salaries by Statistics Canada) during the 12-month period ending 30 June of the

Appendix A - Main Provisions of the Canada Pension Plan

preceding year over the average during the corresponding period one year earlier. If the amount calculated by formula is not a multiple of $100, the next lower multiple of $100 is used (although the exact amount forms the basis for the following year's calculation). However, the YMPE is not allowed to decrease from one year to the next. For 1998, the YMPE is $36,900.

Year's Basic Exemption (YBE)
The YBE for any calendar year corresponds to the lower limit below which that year's employment earnings are not subject to contributions. Prior to 1998, it was calculated as 10% of the YMPE and rounded, if necessary, to the next lower multiple of $100. For each year after 1997 the YBE is $3,500. The YBE is prorated under the same circumstances and in the same manner as the YMPE.

Maximum Pensionable Earnings Average (MPEA)
"Maximum Pensionable Earnings Average", in respect of a contributor, for a year means the average of the Year's Maximum Pensionable Earnings (YMPE) for that year and,
(a)   where the year is before 1998 or the date of birth of the contributor is before 1933, the two previous years, or
(b)   for contributors born after 1932,
        (i)   where the year is 1998, the three previous years, and
        (ii)   where the year is after 1998, the four previous years.

Unadjusted Pensionable Earnings
Earnings are not recorded separately for individual months in a calendar year, rather all credited earnings in the year are averaged over the number of months in the year that are part of the contributory period. Unadjusted pensionable earnings of a contributor for any such month are limited to 1/12 of the YMPE applicable to the corresponding calendar year, provided that required contributions have been made for that year. The unadjusted pensionable earnings are zero for all months in a calendar year during which contributions are not required or not made.

Pensionable Earnings
Pensionable earnings of a contributor for a given month correspond to the product of the unadjusted pensionable earnings of that month and the ratio that the MPEA for the year when an earnings-related CPP pension becomes payable bears to the YMPE for the year to which the given month belongs. Hence, the application of this ratio escalates the earnings of a given month, in accordance with the current MPEA, for purposes of averaging earnings over the portion of the contributory period completed at the time of emergence of a benefit.

Pension Index
The Pension Index for a given calendar year is equal to the Consumer Price Index averaged over the 12-month period ending with October of the preceding year; however, the Pension Index of a given year may not be less than the previous year's Pension Index.

Contributory Earnings
Contributory earnings of a contributor for any calendar year correspond to the portion of unadjusted pensionable earnings on which contributions are payable, i.e., employment earnings between the YBE and the YMPE for that year (prorated, where applicable).

Contribution Rate
The contribution rate is the proportion of contributory earnings paid to the CPP as contributions. It is identical for all contributors in a year and is divided equally between the employer and the employee. Self-employed persons pay the combined employee/employer rate. The contribution rate applied to the CPP contributory earnings determines the amount of annual contributions. For 1998 the combined contribution rate is 6.4%.

The pay-as-you-go rate (paygo rate) is a measure of the cost of the CPP, which does not directly affect the contributions payable. It corresponds to the ratio of the year's expenditures (benefits plus administrative expenses) to the year's contributory earnings. For example, the paygo rate for 1997 was 8.67%.

2.   Retirement Pension

A person aged 60 or over becomes eligible for a retirement pension, upon application, provided contributions (see paragraph 11 below) have been made during at least one calendar year. An applicant for a retirement pension payable before age 65 must have wholly or substantially ceased to be engaged in paid employment or self-employment. After a retirement pension becomes payable or, in any event, after age 70, a person may not contribute to the CPP. Thus, except for annual adjustments of the amount of pension in payment in accordance with changes in the Pension Index (see paragraph 8 below), the amount of pension is fixed at the time the pension first becomes payable. The initial amount of retirement pension payable to a contributor is based on the

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whole history of pensionable earnings during the contributory period. The initial amount of monthly retirement pension is equal to 25% of the average of a number of the highest monthly pensionable earnings. This number is determined as follows:

For pensions retirement commencing	Number of months used in computing the initial pension
before 1976	120 less the number of months of disability;
after 1975	the number of months in the contributory period less

> (a) the number of months, after 1977, during which the contributor had at least one eligible child less than 7 years of age, and had earnings greater than 1/12 of the YBE which, if dropped out, would increase his or her average pensionable earnings, provided the remaining number of months is not thereby reduced to less than 120 months minus the months of disability (where months are dropped by this process, the pensionable earnings for those months are not used in the averaging calculation), less
>
> (b) the number of months, if any, between age 65 of the contributor and the earlier of age 70 and the commencement of the retirement pension, if later, provided the remaining number of months is not thereby reduced to less than 120 months minus the months of disability, less
>
> (c) 15% of the number of months remaining in the contributory period, provided the remaining number of months is not thereby reduced to less than 120 months.

A certain number of months associated with the lowest recorded monthly pensionable earnings are therefore excluded, in the calculation of benefits, by reason of pensions commencing after age 65 and of the disability, the child-rearing and the 15% drop-out provisions.

The resulting amount of pension is subject to an actuarial adjustment that depends on the contributor's age at commencement of the retirement pension: the initial rate of pension is accordingly decreased or increased, depending on

whether the pension begins before or after age 65, by 0.5% for each month between age 65 and the age when the pension commences or, if earlier, age 70. The maximum amount of a retirement pension commencing in 1998 for a person born after 1932 is, before the actuarial adjustment, $744.79 per month.

3.   Disability Benefit

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

A person who becomes disabled while under age 65 and not receiving a CPP retirement pension is eligible for a disability benefit provided that contributions have been made, at time of disablement,
•   for cases of disablement before 1998, for at least either 5 of the last 10 calendar years, or 2 of the last 3 calendar years; and
•   for cases of disablement after 1997, for at least 4 of the last 6 calendar years,

counting only years that are included wholly or partly in the contributory period. Contributions must be on earnings that are not less than 10% of the YMPE rounded, if necessary, to the next lower multiple of $100.

Disability benefits normally commence with the fourth month following the month of disablement and are payable until age 65 (when disability benefits are automatically replaced by retirement pensions) or until death or recovery from disability at an earlier age. If an application for a disability benefit is filed more than 11 months after the month in which the benefit would normally have commenced and the person remains disabled, eligibility to receive a disability benefit is determined as described above irrespective of the filing delay. For cases so eligible, the initial amount of the benefit is then determined as if disability had commenced 15 months before the filing date, and retroactive payments are made commencing with the eleventh month prior to the filing date.

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The amount of benefit payable is composed of a flat-rate portion depending only on the year in which the benefit is payable and an earnings-related portion depending, when it commences, only on the pensionable earnings record of the contributor as of the onset of disability. The monthly flat-rate portion is $336.77 for 1998. The earnings-related portion is equal, when it commences, to 75% of a pension calculated in the manner described earlier for retirement pensions, except that no actuarial adjustment applies and the number of months to be taken into account in determining the Average Pensionable Earnings is subject, in connection with the child-rearing drop-out period, to a minimum of 48 (24, in respect of disabilities that commenced before 1998) less the number of prior months of disability. The maximum initial monthly earnings-related portion is $558.59 for 1998.

For years after 1997, the automatic conversion at age 65 of a disability benefit into a retirement pension will be based on the MPEA at time of disablement rather than at age 65. In other words, the indexing from disablement to age 65, that is involved in the determination of the initial rate of the retirement pension, will be in line with increases in prices rather than wages. Moreover, special adjustments apply for this purpose to the YMPE included in the calculation of the MPEA for 1966 to 1986, in respect of disabilities that commenced before 1987. For this purpose, the MPEA shall be calculated as if the Year's Maximum Pensionable Earnings for a particular year before 1986 were calculated as the greatest multiple of $100 that is equal to or less than an amount calculated by multiplying the YMPE for 1986, which is $25,800, by the ratio A/B where,

> A   is the average for the twelve month period ending on 30 June of the year preceding that particular year of the average weekly wages and salaries of the Industrial Composite as published by Statistics Canada for each month in that period, and

> B   is the average for the twelve month period ending on 30 June 1985 of the average weekly wages and salaries of the Industrial Composite as published by Statistics Canada for each month in that period.

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4.   Survivor's Benefit

(a)   Eligibility
The surviving spouse of a contributor is eligible for a survivor benefit if the following three conditions are met as at the date of the contributor's death:
(i)   if the surviving spouse was not legally married to the deceased contributor, they must have cohabited for not less than one year immediately before the death of the contributor;
(ii)   the deceased contributor must have made contributions during the lesser of 10 calendar years, or one-third of the number of years included wholly or partly in his or her contributory period, but not less than three years;
(iii)   the surviving spouse must have dependent children (as described at item (b) below), be disabled or be at least 35 years of age.

(b)   Definition of surviving spouse with dependent children
A surviving spouse with dependent children means a surviving spouse who wholly or substantially maintains a child of the deceased contributor where the child is
•   under age 18, or
•   aged 18 or over but under age 25 and attending school full-time, or
•   aged 18 or over and disabled, having been disabled without interruption since attaining age 18 or the time of the contributor's death, whichever occurred later.

(c)   Amount of survivor's benefit
The amount of the survivor's benefit depends on the age of the survivor at the date of the contributor's death, the survivor's disability status and the presence of dependent children, and is subject to the rules on combined pensions (as described in paragraph 7 below). The following five cases are relevant.

(i)   Surviving spouses aged between 45 and 65 at date of contributor's death
The amount of benefit payable until the surviving spouse attains age 65 is composed of two portions: a flat-rate portion depending only on the year in which the survivor's benefit is payable, and an earnings-related portion depending initially only on the contributor's record of pensionable earnings as at the date of his or her death. The monthly flat-rate portion is $131.40 for 1998. The

initial earnings-related portion is equal to 37.5% of an earnings-related pension based on the deceased contributor's pensionable earnings record. The amount of the contributor's earnings-related pension is calculated in the manner described earlier for retirement pensions (see paragraph 3 above) except that no actuarial adjustment applies and that the number of months to be taken into account in determining the Average Pensionable Earnings may not be reduced to less than 36 minus the number of months of disability. The earnings-related portion is calculated as at the date of the deceased spouse's death or the commencement of his or her retirement pension, whichever is earlier, except that in the latter case the calculated pension is adjusted in accordance with the increase in the Pension Index (see paragraph 8 below) from the year in which the contributor's retirement pension became payable to the year of his or her death. The maximum initial monthly earnings-related portion in respect of surviving spouses under age 65 is $279.30 for 1998.

(ii) **Surviving spouses aged less than 45 at date of contributor's death, without dependent children and not disabled**
An eligible spouse, without dependent children and not disabled, who becomes widowed:
- while aged less than 35 years is not entitled to a survivor's benefit (but may be entitled at a later date; see (iv) and (v) below);
- while between 35 and 45 years of age is entitled to an amount of benefit, calculated as described in (i) above, reduced (until the earlier of disablement or attainment of age 65) by 1/120 of such amount for each month that the surviving spouse's age at onset of widowhood or widowerhood is less than 45.

(iii) **Surviving spouses aged less than 45 with dependent children at date of contributor's death**
An eligible spouse who becomes widowed while aged less than 45 and with dependent children is entitled to a survivor's benefit calculated as described in (i) above. If a surviving spouse in receipt of a survivor's benefit ceases to be a surviving spouse with dependent children before attaining age 45 (e.g., as the result of a child not in school attaining age 18) and is not disabled at that time, the survivor's benefit is discontinued or reduced in the manner described in (ii) above in accordance with the surviving spouse's

age at the time she or he ceased to be a surviving spouse with dependent children.

(iv) Disabled surviving spouses aged less than 65
An eligible surviving spouse aged less than 65 years is entitled to a survivor's benefit if she or he is either disabled at the date of death of the contributor or becomes disabled at a later date. The disabled surviving spouse's pension is payable from the month following the month in which the contributor dies or from the month following the month in which the surviving spouse becomes disabled, whichever is later. If the disabled surviving spouse recovers from disability before age 45, the amount of the survivor's benefit is discontinued or reduced in the manner described in (ii) above in accordance with the surviving spouse's age at the time of recovery. The initial amount of pension is calculated as described in (i) 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 (see paragraph 8 below) from the year in which the contributor died to the year in which disability occurs.

(v) Surviving spouses aged 65 or over
At age 65, or upon widowhood or widowerhood at a later age, an eligible surviving spouse is entitled to a pension equal to 60% of an earnings-related pension based on the pensionable earnings record of the deceased spouse. This earnings-related pension is calculated as described in (i) above (but replacing 37.5% by 60%) and is adjusted, where applicable, in accordance with changes in the Pension Index (see paragraph 8 below) from the year in which the contributor died or, if earlier, the year of retirement, to the year in which the surviving spouse attains age 65 or, if later, the year in which a survivor's benefit becomes payable to her or him. The maximum initial monthly pension in respect of survivors aged 65 and over is $446.87 for 1998.

5.   Death Benefit

A lump-sum benefit is payable to the estate of a deceased contributor if the eligibility rules described in 4(a)(ii) above are met. The amount of the death benefit is equal to:

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(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 10-year phase-in period ending 31 December 1975 or any actuarial adjustment applicable by reason of commencement of a retirement pension after 1986 at an age other than 65; and

(b)   in respect of any other contributor, one-half of the annual amount of an earnings-related pension calculated, exclusive of the actuarial adjustment, in the manner described for retirement pensions in paragraph 2 above,

subject to the limitation that the amount of benefit cannot exceed 10% of the YMPE applicable in the year of the contributor's death when the death occurred before 1998, and $2,500 thereafter.

6.   Children's Benefits

(a)   Disabled contributor's child's (DCC) benefit
Each dependent child of a contributor who is eligible for a CPP disability benefit is entitled to a DCC flat-rate benefit provided the child is under age 18, or is aged 18 or over but under age 25 and is attending school full-time.

(b)   Orphan's benefit
Each dependent child of a deceased contributor is entitled an orphan's flat-rate benefit if the eligibility rules described in 4(a)ii above are met and if the child is under age 18, or aged 18 or over but under age 25 and is attending school full-time.

(c)   Amount of children's benefits
The amount of the monthly flat-rate DCC or orphan's benefit payable in respect of each eligible child is $169.80 for 1998. Two children's benefits are payable in respect of each child if both parents died while eligible for a survivor benefit or are entitled a CPP disability benefit. Furthermore, where applicable, a child may simultaneously receive a DCC benefit and an orphan's benefit.

7.   Combined Pensions

Benefits payable to persons who were born before 1933 or became entitled to both a survivor benefit and either a disability or a retirement pension before 1998 are limited as follows:

(a)   Survivor benefit combined with a disability benefit
    (i)   the flat-rate portion of the combined pension is equal to the flat-rate portion of the disability benefit;
    (ii)   the earnings-related portion of the combined pension is equal to the sum of the earnings-related portions of the survivor and the disability annual pensions, but cannot initially exceed the maximum retirement pension applicable for the year in which the later of the two pensions commences; in such case, the earnings-related portion of the survivor benefit is reduced accordingly.

(b)   Survivor benefit combined with a retirement pension
    (i)   the flat-rate portion of the combined pension is equal to the flat-rate portion of the survivor benefit;
    (ii)   the earnings-related portion of the combined pension is equal to the sum of the earnings-related portion of the survivor benefit and of the survivor's actuarially adjusted retirement pension; however, the sum of the earnings-related portion of the survivor benefit and of the survivor's retirement pension before application of the actuarial adjustment cannot initially exceed the maximum retirement pension applicable for the year in which the later of the two pensions commences; in such case, the earnings-related portion of the survivor benefit is reduced accordingly, but any actuarially reduced retirement pension (i.e., a retirement pension commencing under age 65) is increased by an amount equal to the product of the applicable actuarial reduction percentage and the absolute reduction in the earnings-related survivor benefit computed as above.

Benefits payable to persons who were born after 1932 or become entitled to both a survivor benefit and either a disability or a retirement pension after 1997 are limited as follows:

(c)   Survivor benefit combined with a disability benefit
    (i)   the flat-rate portion of the combined pension is equal to the flat-rate portion of the disability benefit;

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(ii)   the earnings-related portion of the combined pension is equal to the greater of:
   •   100% of the earnings-related portion of the survivor's own disability benefit plus 60% of the earnings-related portion of the regular survivor benefit; and
   •   100% of the earnings-related portion of the survivor benefit plus 60% of the earnings-related portion of the survivor's regular disability benefit,

   provided it does not exceed the earnings-related portion of the maximum disability benefit applicable when the second of the two pensions emerges (if in excess, this serves as a ceiling).

(d)   Survivor benefit combined with a retirement pension
   (i)   the flat-rate portion of the combined pension is equal to the flat-rate portion of the survivor benefit;
   (ii)   the earnings-related portion of the combined pension is equal to the greater of:
      •   100% of the survivor's own retirement pension before application of the actuarial adjustment plus 60% of the earnings-related portion of the regular survivor benefit; and
      •   100% of the earnings-related portion of the survivor benefit plus 60% of the survivor's own regular retirement pension before application of the actuarial adjustment,

   provided it does not exceed the maximum retirement pension applicable when the second of the two pensions emerges; in such case, the earnings-related portion of the survivor benefit is reduced accordingly, but any actuarially reduced retirement pension (i.e., a retirement pension commencing under age 65) is increased by an amount equal to the product of the applicable actuarial reduction percentage and the absolute reduction in the earnings-related survivor benefit computed as above.

8.   Inflation Adjustments

All CPP benefits are payable in the form of monthly pensions, with the exception of the death benefit, which is payable in a lump sum. Once a CPP pension has commenced, its initial amount is adjusted thereafter in accordance with inflation. Pensions are accordingly multiplied on 1 January of each calendar year by the ratio of the Pension Index applicable for that calendar year to the Pension Index applicable for the year during which the pension commenced.

9.   Credit-splitting Upon Marital Union Breakdown

In the event of a divorce occurring after 1976 or of a separation or the breakdown of a marital common-law union after 1986, unadjusted pensionable earnings in respect of their period of cohabitation may be split equally between the two spouses. However, unadjusted pensionable earnings will not be split for any month in which the earnings allocated to each spouse would be less than 1/12 of the YBE. In case of divorce, splitting is automatic provided the Minister receives the prescribed information; in case of separation for at least 12 consecutive months or until the death of one of the former spouses during this period, splitting is mandatory, upon valid application by one spouse, provided the former spouses did cohabit for at least 12 months. In the case of a common law union, application must be made within four years after the relationship ended. Splitting can be waived by agreement between the two parties where expressly provided for by the applicable provincial law.

10.   Splitting of Retirement Pensions

If one of the spouses requests it, the retirement pensions proportionate to the number of years during which the spouses cohabited may be divided during the joint lifetime of the spouses. This applies provided both spouses are at least 60 years old and have commenced receiving any retirement benefit to which they are entitled under the CPP or QPP. On the death of the first spouse, or in the event of divorce or separation, any pension splitting previously applied is reversed. In the case of separation, the assignment ceases the twelfth month after the spouses separated.

11.   Contribution Rates and Contributions

Contributions are required during the contributory period in respect of the contributory earnings of each contributor. From 1966 to 1986, the annual rate of contribution applicable to contributory earnings was 1.8% for employees (and a like amount for their employers) and 3.6% in respect of self-employed earnings. This combined employer-employee contribution rate of 3.6% was subject, in accordance with the 25-year Schedule adopted pursuant to Bill C-116, to an annual increase of 0.2% for 1987 to 1991 and was subject, in accordance with the 25-year Schedule adopted pursuant to Bill C-39, to an annual increase of 0.2% for 1992 to 1996.

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Combined contribution rates for 1997 and thereafter are set pursuant to Bill C-2 which established annual increases of 0.4% for 1997, 0.4% for 1998, 0.6% for 1999, 0.8% for each year from 2000 to 2002 and 0.5% for 2003, with no subsequent increases scheduled.

Table VII.A.1   Current Schedule of Contribution Rates

Year	Contribution Rate %
1997	6.00
1998	6.40
1999	7.00
2000	7.80
2001	8.60
2002	9.40
2003+	9.90

The legislation gives the Ministers of Finance of Canada and the provinces the authority to make changes in contribution rates through regulation, in connection with a triennial review. However, year-over-year contribution rate increases in excess of 0.2% may not be implemented by regulation. A regulation to adjust contribution rates in accordance with a triennial review will take effect on 1 January of the year following the review period, provided that the regulation is made prior to 1 October of the third year of the period.

In the event that a triennial actuarial report projects a "steady-state" contribution rate in excess of the scheduled rate and if the Ministers cannot agree upon appropriate changes, the legislation applies a staged increase in the contribution rate together with a temporary freeze on inflation adjustments of benefits in payment.

12.   Account, Operating Balance and Investment Fund

Income (contributions, and investment earnings from the Operating Balance and the Investment Fund described below) and expenditures (benefits and administrative expenses) are posted to the CPP Account in the Consolidated Revenue Fund.

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At the end of each month, the excess of the balance to the credit of the Account over the Operating Balance (i.e., the estimated amount required in the ensuing three months to pay benefits and administrative expenses) constitutes an increase in the Investment Fund and is available to be invested in a diversified investment portfolio by the Canada Pension Plan Investment Board, which was formed late in 1998. (In this report, "Fund" is used to describe all assets of the CPP except the Operating Balance, i.e., it includes both the investments made by the Board and the loans to the provinces.)

The new Board is to operate at arm's length from the federal and provincial governments. The Board will use qualified professionals to meet its objective to manage and invest money transferred to it from the CPP Account in the best interests of the contributors and beneficiaries under the CPP. The Board's investments are to be made in accordance with the regulations and with investment policies, standards and procedures that the Board is required to establish under the Canada Pension Plan Investment Board Act.

The Board will broadly follow the same investment rules as other pension plans and will be accountable to the public and report on its investment results regularly. The following transitional and permanent measures will apply regarding future investment in provincial securities:

- provincial borrowings from the CPP will be at the same interest rate as provinces pay on their market borrowings;
- at their next respective maturity dates, all existing CPP 20-year provincial bonds will be renewable for another 20-year term, provided the funds are not required for the payment of benefits;
- in the 3-year period following the creation of the Board, not more than 50% of the new CPP funds that the Board chooses to invest in bonds will be in provincial securities; and
- after this 3-year period, new CPP funds invested in provincial securities will be limited to the proportion of provincial bonds held by pension funds in general.

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13.   Amendments

Unless specifically overridden by legislation, 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. A major amendment to the CPP requires the consent of at least two-thirds of the included provinces having in aggregate not less than two-thirds of the population of all of the included provinces.

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VII. Appendix B - Data, Assumptions and Methodology

Appendix B describes the data, the assumptions and the methodology used in making the CPP financial projections that appear in Section II of this report. The assumptions used for purposes of the sensitivity tests presented in Section V are described in that section.

I.   Population

The first step in the projection process is to project the population, by age and sex, in each year of the projection period. The population of the participating provinces is derived by taking the difference between the projected populations of Canada as a whole and Québec.

1.   Data

The following data were used in performing the demographic projections:

(a)   Quinquennial census
Catalogue No.93F0022XDB96000 published by Statistics Canada is the main reference used for Canadian census data. The calculation of future average earnings and benefits requires population figures not only for the projection period (1998 to 2100), but also for 1966 to 1997. Data from each of the seven quinquennial censuses of 1966 to 1996 are accordingly maintained not only for the projection of average earnings and benefits of all relevant cohorts of contributors and beneficiaries, but also for methodology validation purposes as described in section 3 below. The 1996 census data, by age and sex, for Canada and Québec separately, serve as the starting point for the projection of the population and deaths until year 2100. The census data used for projection purposes consist primarily of the numbers of live persons by age (last birthday) and sex, the ratio of male to female births and the adjustments for undercount.

(b)   Postcensal data
Between quinquennial censuses, Statistics Canada publishes annually various postcensal data. Data on actual past fertility rates and migration levels, taken from catalogues No.84-210-XMB, 91-520-XPB and

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93F0023XDB96006, are used as a basis for determining the assumptions
required for projecting the actual 1996 population by age and sex.
Moreover, previously assumed fertility rates and migration values for the
period 1993 to 1996 were replaced by actual values in the projection
process that, in a technical sense, starts in 1966.

(c)   Life Tables, Canada and the Provinces, 1990-1992
        These mortality tables, published by Statistics Canada (catalogue No. 84-
        537-XDB), are used as a basis for the determination of the assumptions
        required for projecting the population into the future. The Life Tables
        for 1995-1997 were not yet available when this report was completed.
        The 1990-1992 Life Tables for Canada, the corresponding tables for
        Québec, and the ultimate mortality tables derived therefrom consist of
        one-year probabilities of death for individual ages from 0 to 109.

(d)   Canadian Institute of Actuaries (CIA) Task Force on AIDS
        The reports of this task force, published each year from 1988 to 1992, are
        the main reference used to estimate the effect of AIDS on mortality rates.

(e)   Social Security Administration 1997 and 1998 trustees reports
        These reports, prepared by the Social Security Administration (SSA) in
        the United States, show the extent to which mortality rates could be
        expected to decrease annually until year 2100. These annual rates of
        mortality improvement were determined by analysing the current trends
        in mortality decrease separately for each of 10 broad causes of death.

2.   Demographic Assumptions

        This section describes the assumptions most central to the demographic
        projections.

        As in preceding reports, various auxiliary projections (see Section V of
        this report) provide an appreciation of the sensitivity of the financial
        projections to certain variations in key assumptions.

(a)   Fertility
        The fertility rate for a given age and year corresponds to the average
        number of live births per female of that age during that year. The total
        fertility rate for a year represents the average number of children that
        would be born to a woman in her lifetime if she were to experience the
        age-specific fertility rates observed in, or assumed for, that year. The

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actual total fertility rates for 1995, i.e., 1.639 and 1.579 for Canada and Québec, respectively, are 7.0% and 7.5%, respectively, lower than those assumed for 1995 in the preceding actuarial report. The ultimate total fertility rates of 1.85 for Canada and 1.80 for Québec, used in the previous six actuarial reports, have been reduced to 1.70 and 1.60 for Canada and Québec, respectively.

These new assumed ultimate total fertility rates for Canada and Québec reflect historical trends experienced over the 20 years ended 1995 and correspond to the ultimate medium assumption assumed in the most recent Statistics Canada population projections 1993-2016 (Catalogue No. 91-520). For 1996 to 2015, the assumed total fertility rates were calculated by linear interpolation between the actual 1995 values and the assumed ultimate values of 1.70 for Canada and 1.60 for Québec for 2016. The distribution of assumed ultimate total fertility rates for Canada and Québec into age-specific rates corresponds to their respective 1995 experience. In accordance with experience over the last 25 years, the assumed ratio of male to female births was maintained at 1.056.

Fertility rates are used not only for the demographic projections, but also for the valuation of the child rearing drop-out provision and for the projection of children's benefits.

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Table VII.B.1   Annual and Total Fertility Rates

Age Group	Canada					
	1975	1980	1985	1990	1995	2016+
15-19	0.0348	0.0270	0.0233	0.0255	0.0245	0.0254
20-24	0.1084	0.0952	0.0815	0.0792	0.0706	0.0732
25-29	0.1288	0.1241	0.1207	0.1226	0.1097	0.1137
30-34	0.0642	0.0666	0.0724	0.0835	0.0868	0.0900
35-39	0.0214	0.0190	0.0216	0.0277	0.0313	0.0325
40-44	0.0048	0.0030	0.0030	0.0038	0.0048	0.0050
45-49	0.0004	0.0002	0.0001	0.0001	0.0002	0.0002
Total	1.8140	1.6755	1.6130	1.7120	1.6395	1.7000
Age Group	Québec					
	1975	1980	1985	1990	1995	2016+
15-19	0.0187	0.0156	0.0144	0.0182	0.0170	0.0172
20-24	0.0906	0.0876	0.0717	0.0803	0.0723	0.0732
25-29	0.1286	0.1299	0.1139	0.1280	0.1157	0.1172
30-34	0.0661	0.0677	0.0608	0.0757	0.0811	0.0822
35-39	0.0223	0.0192	0.0170	0.0224	0.0258	0.0261
40-44	0.0049	0.0029	0.0022	0.0029	0.0039	0.0040
45-49	0.0005	0.0002	0.0001	0.0001	0.0001	0.0001
Total	1.6585	1.6155	1.4005	1.6380	1.5795	1.6000

Graph VII.B.1   Historical and Assumed Fertility Rates
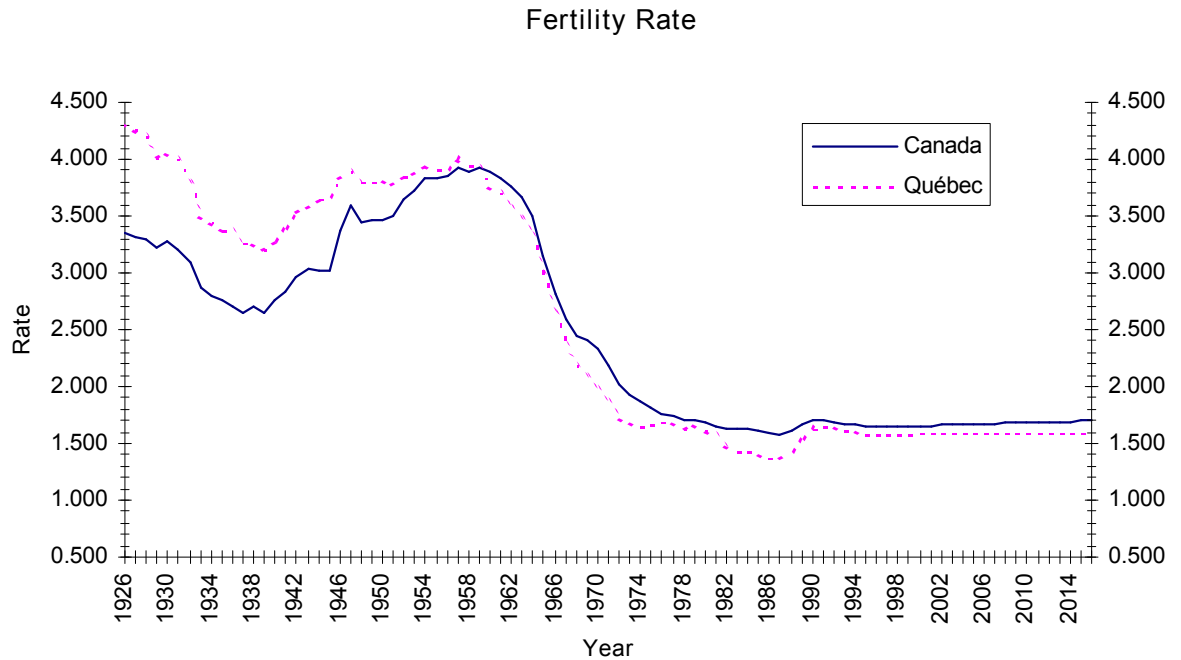
Fertility Rate

Note that differences between the historical fertility rates presented above and those of the previous reports are due to the change in the population basis adopted by Statistics Canada since 1991, which now accounts for undercount and non-permanent residents.

(b)   Mortality
Usually about two years following every population census new mortality tables, i.e., the Canadian Life Tables (CLTs), are produced. However, the 1995-1997 CLTs were not yet published at the time of this report. For this reason the 1990-1992 CLTs have been used. Therefore, mortality rates shown in Life Tables, Canada and the Provinces, 1990-1992, assumed to be applicable for 1991, were used as the starting point

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for mortality assumptions. Canada CLT rates are given only to age 105 and Québec rates to age 85. Canada CLT rates were linearly extrapolated from the rate at age 105 to a rate of 1.0 at age 109. Québec CLT rates were extrapolated from the rate at age 85 to a rate of 1.0 at age 109 based on the pattern of Canada CLT rates.

To reflect anticipated sustained improvements in life expectancy, the 1991 Canada and Québec mortality rates were projected to the year 2100 using the following annual rates of mortality improvement:

i)   For 1992 to 2010, the annual rates of mortality improvement, varying by age, sex and calendar year, were determined by linear interpolation between:
        •   the average improvement rates experienced in Canada between 1981 and 1991, and
        •   the fixed improvement rates, described in ii) below, in respect of the period 2011 to 2100.

ii)   For 2011 and subsequent years, the assumed annual rates of improvement, varying by age and sex only, not by calendar year, correspond to the SSA ultimate assumption for all causes of death, identified as Alternative II (medium) in the preliminary demographic projection results of the 1998 SSA trustees report (the SSA Actuarial Study had not yet been published at the time this report was prepared). These ultimate rates were then adjusted, to reflect Canadian experience, for age 0 and by quinquennial age-group from ages 1 to 94, by the ratio of the average improvement rates experienced in Canada between 1921 and 1991 for the particular age-group to the average improvement rates experienced in the United States for the same age-group over the same period. However, to moderate the influence of historical differences between the two countries, these ratios were increased or decreased, where necessary, to keep them within a range of 0.85 to 1.15.

The adjustment for each individual age in the age-group was assumed to be equal to the overall age-group adjustment as calculated above. The resulting assumed annual mortality improvement rates for Canada and Québec for 1992 and 2011 and thereafter are shown in the following table:

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Table VII.B.2   Assumed Annual Mortality Improvement Rates
                 (percentages)

Age	Males		Females	
	1992	2011+	1992	2011+
0	4.10	1.47	3.61	1.54
1-4	4.35	1.06	4.26	1.05
5-9	4.87	1.12	5.37	1.09
10-14	3.86	0.94	3.20	0.98
15-19	3.05	0.50	2.11	0.51
20-24	2.55	0.51	2.06	0.53
25-29	1.62	0.58	2.19	0.60
30-34	0.09	0.58	1.69	0.59
35-39	0.42	0.63	2.05	0.58
40-44	2.10	0.59	2.72	0.54
45-49	2.98	0.58	2.10	0.50
50-54	3.12	0.54	2.07	0.49
55-59	2.71	0.53	1.75	0.49
60-64	2.18	0.52	1.54	0.52
65-69	2.09	0.40	1.61	0.41
70-74	1.75	0.41	1.53	0.41
75-79	1.33	0.42	1.27	0.44
80-84	0.89	0.43	1.19	0.47
85-89	0.56	0.43	1.10	0.55
90+	0.35	0.45	1.00	0.51
Average (1)	1.69	0.45	1.51	0.48

(1) Weighted by the 1990 distribution of population by age and sex.

VII.   Appendix B - I. Population

To take AIDS into account, male mortality rates for ages 23 to 65 for
Canada and Québec were increased for 1992 and thereafter based on
adjustments to the extra AIDS mortality scenario of new infections
forever as presented in the March 1992 CIA Guidance Notes on AIDS.
These AIDS extra mortality rates were adjusted so as to produce a
scenario where no new infections would occur after 2005. Moreover,
because the assumed mortality improvement factors already include the
effect of AIDS up to 1991, the levels of AIDS extra mortality assumed
for 1992 and subsequent years have been further reduced by the level of
the 1991 AIDS extra mortality. On the basis of the cumulative number
of deaths attributable to AIDS (as reported by the U.S. Federal Center for
AIDS), female mortality was also increased, but only by 10 percent of the
above increments for males.

Table VII.B.3 shows sample values of the extra mortality assumed to
apply in connection with AIDS for ages 30 to 45, the ages at which the
adjustments are most significant. Table VII.B.4 below sets out sample
values of the ultimate mortality rates as well as sample values of
mortality rates of the 1990-92 CLTs.

Table VII.B.3   AIDS Extra Mortality
                  (annual deaths per 1,000 persons)

Age	1992	1995	2000	2005	2010
30	0.00	0.13	0.13	0.10	0.00
35	0.02	0.08	0.15	0.13	0.04
40	0.01	0.05	0.04	0.07	0.03
45	0.01	0.05	0.02	0.00	0.00

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

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Table VII.B.4   Mortality Rates for Canada and Québec
                 (annual deaths per 1,000 persons)

	Males			
	1990-1992 CLT		Assumed for 2100	
Age	Canada	Québec	Canada	Québec
0	7.09	6.57	1.09	1.01
1	0.51	0.47	0.12	0.11
5	0.20	0.19	0.04	0.04
10	0.15	0.19	0.04	0.05
20	1.09	1.13	0.51	0.53
30	1.22	1.34	0.68	0.74
40	1.85	1.92	0.84	0.87
50	4.49	4.91	1.93	2.11
60	12.75	14.12	6.17	6.83
70	31.99	35.70	18.02	20.11
80	79.91	85.09	47.63	50.72
90	181.45	187.65	111.95	115.78
100	354.75	366.88	218.88	226.36
105	473.84	490.04	292.36	302.35
109	1,000.00	1,000.00	1,000.00	1,000.00

	Females			
	1990-1992 CLT		Assumed for 2100	
Age	Canada	Québec	Canada	Québec
0	5.77	5.16	0.87	0.78
1	0.45	0.41	0.10	0.10
5	0.14	0.16	0.03	0.03
10	0.12	0.13	0.03	0.04
20	0.36	0.35	0.17	0.17
30	0.47	0.48	0.22	0.23
40	0.99	1.07	0.45	0.48
50	2.72	2.70	1.37	1.36
60	6.79	6.95	3.50	3.59
70	16.74	17.00	9.66	9.81
80	47.35	48.47	26.47	27.10
90	132.24	134.12	72.30	73.32
100	315.19	319.66	172.32	174.76
105	457.25	463.74	249.98	253.53
109	1,000.00	1,000.00	1,000.00	1,000.00

VII.   Appendix B - I. Population

Life expectancies (longevity expressed in years) resulting from the above mortality assumptions are shown below for Canada if the mortality rates assumed for the year shown applied forever.

Table VII.B.5   Projected Life Expectancies for Canada

	At birth			At age 65	
Year	Males	Females		Males	Females
2000	76.2	82.2		16.5	20.7
2025	78.0	83.8		17.5	21.8
2050	79.4	85.2		18.4	22.8
2075	80.7	86.5		19.3	23.8
2100	82.0	87.7		20.2	24.8

(c)   Migration
Immigration and emigration are generally recognized to be volatile parameters of future population growth, since they are subject to a variety of demographic, economic, social and political factors; immigration, especially, is subject to government control. During the period from 1972 to 1996, for example, annual immigration to Canada varied from 83,691 to 265,405, and annual emigration from Canada is estimated to have fluctuated between 39,760 and 111,500.

For the first time, in this report, emigrants returning to Canada have been taken into account. The annual numbers of returning Canadians have fluctuated between 20,062 and 39,457 over the period 1972 to 1996 and represent, on average over the same period, about 50% of emigrants.

For purposes of this report, net migration was assumed to start from the 1996 level of 208,791 immigrants to Canada, 47,230 emigrants leaving Canada and 22,565 returning Canadians. These figures represent a ratio of net migration to total Canadian population of about 0.61% for 1996. This ratio of 0.61% also corresponds to the average ratio experienced in Canada over the last 15-year period 1982 to 1996. These levels of immigration, emigration and returning Canadians are then increased with time so as to maintain a constant ratio of net migration to total current Canadian population of 0.6% for 2005 and later.

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For purposes of projecting the population of Québec, it was assumed, as for the previous report, on the basis of the 1972 to 1996 averages, that 17% of the immigrants and 14% of the emigrants and returning Canadians assumed for Canada would be attributable to that province. Statistics Canada data for 1982 to 1996 indicate that 17.3% of immigrants, 14.3% of emigrants and 14.7% of returning Canadians are attributable to Québec on average. In addition, it was assumed that Québec would experience net interprovincial emigration of about 10,000 for 1997 and subsequent years, based on the trends observed over the 1982 to 1996 period.

The distributions of immigrants, emigrants and returning Canadians by age group and sex used for the demographic projections correspond to Statistics Canada data averaged over the period 1992 to 1996.

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Table VII.B.6   Distribution of Immigrants, Emigrants and Returning
                Canadians - 1992 to 1996

Age Group	Immigrants		Canada Emigrants		Returning	
	Males %	Females %	Males %	Females %	Males %	Females %
0-4	2.927	2.977	2.475	2.349	3.438	3.386
5-9	3.857	3.630	3.723	3.646	2.993	2.884
10-14	3.966	3.662	3.829	3.837	3.015	2.636
15-19	3.720	3.984	3.394	3.209	3.757	3.838
20-24	4.611	6.141	2.024	3.551	6.673	7.758
25-29	6.870	7.641	6.240	7.038	8.415	7.651
30-34	6.257	6.499	7.536	6.952	5.960	5.818
35-39	4.681	4.873	6.363	6.127	3.994	4.207
40-44	3.337	3.297	5.643	4.974	3.798	3.219
45-49	2.051	2.072	3.483	2.959	2.541	2.109
50-54	1.331	1.696	1.955	1.651	1.902	1.331
55-59	1.362	1.777	1.155	0.963	1.427	1.395
60-64	1.279	1.521	0.678	0.541	1.021	1.120
65-69	0.888	1.060	0.730	0.988	0.751	0.878
70+	0.869	1.165	0.961	1.025	0.854	1.231
Total:	48.006	51.994	50.189	49.811	50.540	49.460
Average Age	29.43	30.26	31.44	30.82	29.26	29.27

Table VII.B.6   Distribution of Immigrants, Emigrants and Returning
                  Canadians - 1992 to 1996 (continued)

Age Group	Québec					
	Immigrants		Emigrants		Returning	
	Males (%)	Females (%)	Males (%)	Females (%)	Males (%)	Females (%)
0-4	3.470	4.298	2.473	2.349	3.454	3.402
5-9	4.309	4.090	3.719	3.644	2.994	2.877
10-14	4.166	3.800	3.827	3.830	3.026	2.637
15-19	3.780	3.907	3.387	3.212	3.765	3.823
20-24	5.248	5.947	2.030	3.553	6.616	7.724
25-29	8.217	7.564	6.238	7.041	8.379	7.621
30-34	6.999	6.160	7.539	6.950	5.910	5.774
35-39	5.125	4.582	6.358	6.124	3.992	4.193
40-44	3.252	2.962	5.639	4.975	3.823	3.227
45-49	1.939	1.748	3.482	2.958	2.547	2.112
50-54	1.168	1.211	1.959	1.653	1.886	1.341
55-59	0.882	1.049	1.155	0.960	1.439	1.413
60-64	0.750	0.910	0.687	0.547	1.037	1.134
65-69	0.503	0.660	0.732	0.986	0.713	0.875
70+	0.512	0.791	0.966	1.028	0.972	1.296
Total:	50.321	49.679	50.190	49.810	50.551	49.449
Average Age	27.49	27.43	31.45	30.83	29.37	29.36

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Graph VII.B.2   Historical and Assumed Migration as % of Population

Net Migration to Population Ratio
Canada
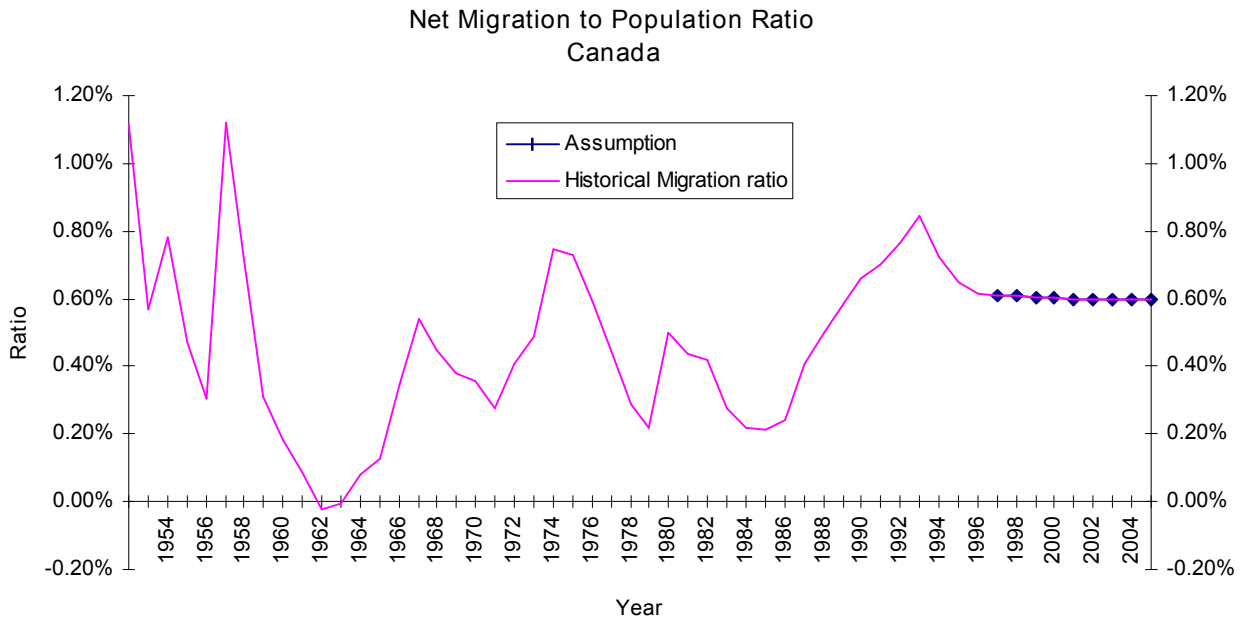
3.   Methodology

The most recent Canada population census is as at 1 July 1996. The starting point for demographic projections accordingly corresponds to mid-1996 and consists of numbers of males and females by age. However, population data for 1966 to 1995 are also required for the calculation of future benefits of the relevant cohorts of contributors and beneficiaries. For this latter purpose, use is made of historical data developed by Statistics Canada. These historical data take into account the 1991 change in the definition of the census population, which now includes both permanent and non-permanent residents of Canada.

The 1996 census data for Canada and Québec are available by individual ages up to 89, but the data for ages 90 and over are grouped. Hence, the latter data were disaggregated for individual ages 90 to 109 by surviving the population at age 89, using the extrapolated 1990-1992 Canada Life Tables, up to age 109. A constant proportional adjustment was made to the disaggregated population for each age from 90 to 109 to match its total with the census aggregate value for this age group.

To compensate for the census undercount, adjustment factors developed by Statistics Canada were applied to the 1996 census population data. These factors vary by age, sex and area, i.e., Canada and Québec separately.

The population, by age and sex, was then projected from one year to the next by adding births, immigrants and returning Canadians, subtracting deaths and emigrants, and adjusting for net migration between Québec and the rest of Canada. The annual numbers of births, deaths, immigrants, emigrants and returning Canadians were developed by applying the fertility, mortality and migration assumptions to the mid-year population. The projections carry forward to 2100.

The populations covered by the CPP pertain to Canada excluding Québec, but include all members of the Canadian Forces and the Royal Canadian Mounted Police. The population and deaths projections used for purposes of the financial projections were obtained by simple subtraction of the projected figures for Québec from the projected figures for Canada. Consequently, the projected populations do not make explicit allowance for members of the Canadian Forces and Royal Canadian Mounted Police who reside in Québec or outside Canada. However, provision for this group was made implicitly through the development of the proportions of contributors described in section II-3(d) of this appendix.

4.   Population Tables

The first three tables below show, for Canada excluding Québec, the 1996 starting population (1996 census adjusted for undercount) and the projected mid-year populations for 2000, 2025, 2050, 2075 and 2100. The populations shown are distributed by sex and broad age groups. The fourth table shows corresponding dependency ratios.

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Table VII.B.7   Population of Canada Less Québec - Both Sexes (thousands)

Age Group	1996	2000	2025	2050	2075	2100
0-4	1,492	1,466	1,680	1,896	2,132	2,400
5-9	1,554	1,570	1,721	1,925	2,170	2,448
10-14	1,555	1,608	1,737	1,959	2,219	2,507
15-19	1,501	1,593	1,737	1,992	2,267	2,560
0-19	6,102	6,237	6,875	7,772	8,788	9,915
20-24	1,558	1,559	1,771	2,049	2,326	2,620
25-29	1,705	1,680	1,883	2,171	2,445	2,747
30-34	1,990	1,820	2,048	2,285	2,557	2,878
35-39	1,993	2,096	2,100	2,322	2,612	2,954
40-44	1,779	1,987	2,065	2,301	2,624	2,978
45-49	1,606	1,749	1,972	2,272	2,611	2,961
50-54	1,218	1,545	1,966	2,240	2,576	2,906
55-59	983	1,151	1,961	2,237	2,509	2,819
60-64	899	938	2,087	2,141	2,389	2,706
20-64	13,731	14,525	17,853	20,018	22,649	25,569
65-69	840	849	1,840	1,954	2,207	2,542
70-74	737	753	1,468	1,696	1,991	2,327
75-79	536	620	1,119	1,472	1,732	2,047
80-84	359	390	662	1,183	1,423	1,673
85-89	183	225	367	896	1,007	1,214
90+	93	113	270	697	931	1,276
65+	2,748	2,950	5,726	7,898	9,291	11,079
Grand Total	22,581	23,712	30,454	35,688	40,728	46,563

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Table VII.B.8   Population of Canada Less Québec - Males
(thousands)

Age Group	1996	2000	2025	2050	2075	2100
0-4	765	750	862	974	1095	1233
5-9	795	803	880	985	1110	1252
10-14	795	820	887	999	1131	1278
15-19	769	813	885	1013	1153	1303
0-19	3124	3186	3514	3971	4489	5066
20-24	790	795	896	1,037	1,178	1,328
25-29	857	843	942	1,088	1,227	1,379
30-34	1,007	910	1,020	1,137	1,273	1,433
35-39	1,004	1,055	1,039	1,149	1,292	1,462
40-44	887	997	1,021	1,135	1,294	1,470
45-49	808	872	976	1,118	1,287	1,462
50-54	613	776	967	1,100	1,268	1,434
55-59	490	577	966	1,100	1,235	1,390
60-64	445	465	1,035	1,048	1,172	1,330
20-64	6,901	7,290	8,862	9,912	11,226	12,688
65-69	404	413	899	946	1,069	1,235
70-74	329	348	695	802	941	1,107
75-79	224	261	512	664	788	941
80-84	137	149	282	500	610	728
85-89	61	75	137	343	389	481
90+	25	30	76	209	283	400
65+	1,180	1,276	2,601	3,464	4,080	4,892
Grand Total	11,205	11,752	14,977	17,347	19,795	22,646

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Table VII.B.9   Population of Canada Less Québec - Females
(thousands)

Age Group	1996	2000	2025	2050	2075	2100
0-4	727	716	818	922	1,037	1,167
5-9	759	767	841	940	1,060	1,196
10-14	760	788	850	960	1,088	1,229
15-19	732	780	852	979	1,114	1,257
0-19	2,978	3,051	3,361	3,801	4,299	4,849
20-24	768	764	875	1,012	1,148	1,292
25-29	848	837	941	1,083	1,218	1,368
30-34	983	910	1,028	1,148	1,284	1,445
35-39	989	1,041	1,061	1,173	1,320	1,492
40-44	892	990	1,044	1,166	1,330	1,508
45-49	798	877	996	1,154	1,324	1,499
50-54	605	769	999	1,140	1,308	1,472
55-59	493	574	995	1,137	1,274	1,429
60-64	454	473	1,052	1,093	1,217	1,376
20-64	6,830	7,235	8,991	10,106	11,423	12,881
65-69	436	436	941	1,008	1,138	1,307
70-74	408	405	773	894	1,050	1,220
75-79	312	359	607	808	944	1,106
80-84	222	241	380	683	813	945
85-89	122	150	230	553	618	733
90+	68	83	194	488	648	876
65+	1,568	1,674	3,125	4,434	5,211	6,187
Grand Total	11,376	11,960	15,477	18,341	20,933	23,917

Table VII.B.10   Population Dependency Ratios
                  (percentages)

Year	Children (1)	Seniors (2)	Total
1996	44.4	20.0	64.5
2000	42.9	20.3	63.2
2025	38.5	32.1	70.6
2050	38.8	39.5	78.3
2075	38.8	41.0	79.8
2100	38.8	43.3	82.1

(1)   Population aged 19 years and under as a percentage of population aged 20 to
       64 years.
(2)   Population aged 65 years and over as a percentage of population aged 20 to 64
       years.

II. Earnings and Benefits

1. Data

(a) Demographic
Historical (1966 to 1996) and projected (1997 to 2100) populations and deaths for Canada less Québec, the output of section I above, are used for various computational purposes in the economic projections. For example,
- ratios of the actual number of earners to the population correspond to the proportions of earners;
- the relevant population times the benefit eligibility rate, and times the computed average benefit factor for each age-sex cohort, produces the amount of projected benefits; and
- numbers of deaths by age, sex and year are used in computing death, survivor and orphan benefits.

(b) Economic indices
The Consumer Price Index (CPI) and the Average Industrial Aggregate Wages statistic (AIAW, the current measure of the average rate of weekly wages and salaries) are produced by Statistics Canada (catalogues 72-002 and 11-010, respectively). The observed (1966 to 1997) annual increases in the CPI and the AIAW replace, for methodology validation purposes, values assumed in previous actuarial reports; they are also used as a basis for the determination of corresponding assumptions for the future. Rates of interest, which come into play only in the asset projections, are discussed in section III below. For purposes of selecting related assumptions, use was also made of these CPI and AIAW indices averaged over the last 5, 10, 15, 25 and 50 years as determined by the Canadian Institute of Actuaries in its Report on Canadian Economic Statistics 1924-1997. Actual past values of the YMPE, the YBE, the amount of the various monthly flat-rate benefits, and the distribution of retirement pensions, over six categories expressed as a percentage of the YMPE, constitute other economic indices used in the actuarial valuation process.

(c) Monthly Information Reports
Monthly Reports on the financial transactions of the CPP Account, flowing from the administration of the CPP by the Ministry of Human Resources Development Canada (HRDC), provide aggregate financial data (e.g., total contributions for the year, total benefits, administrative

expenses) that serve as a basis for the CPP annual accounting report of the Comptroller General. Although these reports are basically prepared on a cash basis, their income (contributions and investment earnings) component is based, in respect of a given fiscal year, on projections made by the Finance Ministry about six months before the start of that fiscal year. These projections are used, in lieu of actual data, for both budgeting and accounting purposes because of the delay of about 12 months by Revenue Canada in allocating monthly pay deductions between Employment Insurance and CPP contributions.

For the methodology validation process, the total amounts of actual benefits obtained from the benefits statistics described in section (f) below, are linearly adjusted to correspond to the aggregate cash-basis results shown in the monthly information reports because they form the basis of the formal accounting reports on the CPP.

Aggregate data from the Monthly Reports on the financial transactions of the CPP Account are also compiled over each calendar year after the preparation of an actuarial report and compared with corresponding aggregate projected values of that report for further methodology validation purposes until the next report comes due.

(d)   Monthly statistics
Statistics published monthly by HRDC are similar to benefits statistics (section (f) below), but are generally combined for some age-groups, and are less detailed (e.g., no information on terminations). Because the more detailed benefits statistics are not produced as frequently as monthly statistics, these monthly statistics are used for various preliminary experience studies between valuation dates.

(e)   Earnings statistics
Statistics on the average employment earnings, by sex and age-group, of all workers covered by the CPP are prepared annually and transmitted as machine-readable files by HRDC. These data originate from Revenue Canada, which is responsible for the processing of CPP contributions through salary deductions. The complete employment earnings data pertaining to a given calendar year normally becomes available only in the second year (about mid-year) following that given year. This delay is partly due to the contribution adjustments resulting from tax returns filed

after the given year, but mainly by the annual (as opposed to monthly) cycle of Revenue Canada's allocation of monthly pay deductions between Employment Insurance and CPP contributions. The data is validated and aggregates are compared with the published annual HRDC report on CPP contributors and contributions.

In summary, these earnings statistics include the number of earners, their average annual employment earnings and the distributions, over 78 earnings categories, of earners and of their average employment earnings by quinquennial age-groups and sex. For example, the distributions of earners and of their average employment earnings could indicate that 60% of earners (distribution of earners) for a particular age-sex cell earn less than 120% of average earnings for the cell and account for 40% of total earnings (distribution of average employment earnings) for the cell. By linear interpolation between the relevant points of the distributions, it is possible to determine, for a given percentage of average earnings in any age-sex cell, what percentage of earners earn less than that given percentage of average earnings, and what percentage of the total earnings for the cell is earned by such earners.

One might expect that earnings statistics would include few, if any, individuals earning less than the Year's Basic Exemption (YBE), since, except in unusual circumstances, the CPP employee contributions are refundable in such cases and earnings are not counted for purposes of calculating pensionable earnings. However, each year's data reveal a large number of earners earning less than the YBE, a number 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 the course of a year have low annual 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 individual earnings exceed 1/12 of the YBE (unless the year's maximum has already been deducted). Although the employee contributions may be refundable if the employee earns less than the YBE during the year, the employer contributions are not. Hence, most earners earning less than the YBE in any year would have employer contributions to their credit. They would therefore have records of their employment earnings for that year maintained on the CPP Record of Earnings, even though

those earnings are not counted for pensionable earnings purposes. For this reason, it appeared reasonable to consider the cumulative distributions of earners and of their average earnings as being generally representative of cumulative distributions for all covered earners and of their average employment earnings.

Therefore, earnings statistics available for the most current year (1996) are used as the basis for projecting (by age, sex and calendar year) average employment, pensionable and contributory earnings, contributions, and benefits. For methodology validation purposes, they also prove to be a better basis for the comparison of projected to actual contributions because those from Monthly Information Reports (item (c) above) are themselves projected rather than actual.

(f)   Benefits statistics
Benefits statistics correspond to extracts from individual records in the Master Benefit File administered by officials in HRDC. These include primarily, but not exclusively, for each past and existing beneficiary, separately for each type of benefit, the date (month and year) of emergence of the benefit, the beneficiary's age at emergence and sex, the initial monthly amount of the benefit, and, when applicable, the date of, and reason for, benefit termination. The data is tested for validity (e.g., age and year at emergence of the benefit, maximum level of benefit) and are aggregated to be compared with prior extracts and HRDC published historical aggregates (e.g., Monthly Reports on the transactions of the CPP Account, monthly statistical reports).

Extracts as at 31 December 1997 from each individual record in the CPP Master Benefit file play an important role in the actuarial valuation process since they are used for three distinct purposes:

i)   The number and amount of benefits by type, both emerging and in force, can be obtained by age, by sex and by calendar year. This information is used in a methodology validation algorithm integrated into the computer actuarial valuation system. The various values computed in this valuation system for years preceding 1998 are accordingly compared with actual values to validate the valuation methodology or to detect areas where it should be improved, and to ensure that benefits statistics are correctly interpreted. It must be pointed out that this validation process looks only at methodology, not assumptions; accordingly,

in the methodology validation process, the assumptions made in previous reports are replaced by actual values. The results of the methodology validation process are favourable, taking into account the adjustment of benefits statistics to match in aggregate the official CPP reports (see section (d) above) which are prepared on a cash basis, while actuarial valuation results data are computed on an accrual basis. However, the effect of this inconsistency is practically negligible as regards benefits because, in contrast to contributions, cash benefits are, as a general rule, nearly the same as accrued benefits due to the relatively fast handling of most CPP claims. Some disability benefit cases do, however, constitute exceptions to this rule.

ii) The benefits paid during 1997 are converted into benefits in pay as at the valuation date (31 December 1997) and used as the starting point for the projections.

iii) Various demographic and economic assumptions are selected based on past experience. These assumptions relate, for example, to the age at which contributors elect to start receiving the retirement pension, the proportions of contributors married at death, distribution of spouses by age, disability incidence and termination rates, and mortality rates of retirement and survivor pensions beneficiaries.

2.   Assumptions

The exhaustive list of assumptions is quite extensive. The following 14 sections cover the majority of these assumptions. For example, a fifteenth assumption, flowing implicitly from the valuation methodology, is described in section 3(a)i) below (i.e., earnings of contributors dying before retirement are assumed to be the same, on average each year until death, as those of all other contributors). Rates of interest, which come into play only in the asset projections, are discussed in section III below.

The assumptions described were used in the "best-estimate" projections.

Appendix B - II. Earnings and Benefits

(a)   Annual rates of increase in average employment earnings and in the
       CPI
       For the period 1999 to 2002, the assumptions were derived to fall
       smoothly between the 1998 assumptions and the ultimate (2003 and
       subsequent years) assumptions described below.

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

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

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

       •   Historically, the real-wage differential has fluctuated significantly
            from year to year. The trend was generally downward through the
            late 1980s, with some improvement since then, e.g., the 10-year
            average annual real-wage differential was -0.59% for the period
            ending 1987 and 0.32% for the period ending 1997. Over the longer
            term, the annual real-wage differential averaged 1.52% for the 50-
            year period ending 1997. Many factors have influenced real rates of
            wage increases, including general productivity improvements, the
            move to a service economy and decreases in the average hours
            worked. Considering these factors, together with the historical
            trends and judgement regarding the long-term course of the
            economy, an ultimate real-wage differential of 1.0% has been
            assumed in years 2003 and thereafter.

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

       •   Price increases, as measured by changes in the Consumer Price
            Index (CPI), also tend to fluctuate from year to year. Over the last
            50 years, the trend was generally upward through the early 1980s
            and downward since then. For example, the average annual
            increases in the CPI for the 50-, 25- and 10-year periods ending in
            1997 were 4.44%, 5.83% and 2.80%, respectively.

For the above reasons it was accordingly decided to reduce the ultimate assumptions for the annual increase in prices and average employment earnings to 3.0% and 4.0%, respectively, as compared to 3.5% and 4.5% for the previous CPP actuarial report.

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

Table VII.B.11   Annual Rates of Increase in Prices and Average Employment Earnings (percentages)

Year	Prices	Earnings	Real-Wage Differential
1996	1.60	2.10	0.50
1997	1.50	2.10	0.60
1998	1.00	1.60	0.60
1999	1.40	2.08	0.68
2000	1.80	2.56	0.76
2001	2.20	3.04	0.84
2002	2.60	3.52	0.92
2003+	3.00	4.00	1.00

(b)   Proportions of earners
In respect of each past year (1966 to 1996), actual proportions of earners are computed, by age and sex, as the ratio of the number of earners (from earnings statistics) to the corresponding population (from demographic computations). In addition to being used for the computation of the past and future benefits of the relevant cohorts of contributors, these historical values constitute an important reference for the selection of assumed future proportions of earners.

These proportions for the future were accordingly determined taking partly into account the trends in their counterpart actual, adjusted (see 3(c) below) values for 1966 to 1996. These trends reveal quite variable proportions for males, and significant year to year increases for females.

Employment levels are reflected in the actuarial projection model through the assumption made regarding the proportions of the population, by age and sex, who have earnings in a given year. These proportions vary not only with the rate of unemployment, but also reflect trends in increased workforce participation by women, longer periods of

formal education among young adults and the trends in retirement patterns of older workers.

The ultimate proportions of earners, assumed to apply in year 2010 and thereafter, were established based on a review of both historical trends and the results of projections prepared by Finance department economists using a cohort-based model. The assumptions are consistent with an ultimate unemployment rate of approximately 7.0%. Assumed proportions for 1997 to 2009 were obtained by linear interpolation between the latest experience figures (i.e., 1996) and the values assumed for 2010 and subsequent years. The assumed increases in proportions of earners for the years 1997 through 2010 produce an average annual increase in the workforce of 1.7% during that period.

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

(c)   Average employment earnings
In respect of a cohort of earners of a given age and sex, the average employment earnings for a given calendar year corresponds to the ratio of the sum of individual employment earnings earned during the year to the number of earners in the cohort. On the other hand, the AIAW, compiled by Statistics Canada, corresponds to the weekly rate of pay, at a particular point in time, averaged over all industries.

For a given age, average employment earnings are deemed to increase from one year to the next at the assumed rate of increase in the AIAW. Consistent with past experience, the annual seniority and promotional increases are accordingly implicitly assumed constant at the actual 1996 rates for every year of the projection period. The seniority and promotional increase for a given age/year cell is accordingly deemed equal to the ratio, minus one, of the average earnings for that age/year cell to the average earnings for the preceding age/same year cell. Therefore, projected average earnings for a given age/year cell are obtained simply by applying the annual increase in the AIAW assumed for this year to the average earnings for the same age/previous year cell.

$$\text{EMPEAR}_x^N = \text{EMPEAR}_{x-1}^{N-1} * (1 + p_x^N) * (1 + s^N) = \text{EMPEAR}_x^{N-1} * (1 + s^N)$$

where   N   = calendar year
          x   = age attained during calendar year N
   EMPEAR = average employment earnings
       p_x^N = constant (by year) promotional and seniority rate of change
                in EMPEAR from age x-1 to age x
               = $\{\text{EMPEAR}_x^{1996} / \text{EMPEAR}_{x-1}^{1996}\}$ -1
       s^N = assumed constant (for any given age or sex) overall annual
                increase in EMPEAR from year N-1 to N

Graph VII.B.3   Changes in Average Employment Earnings by Age - 1996
                          (percentages)

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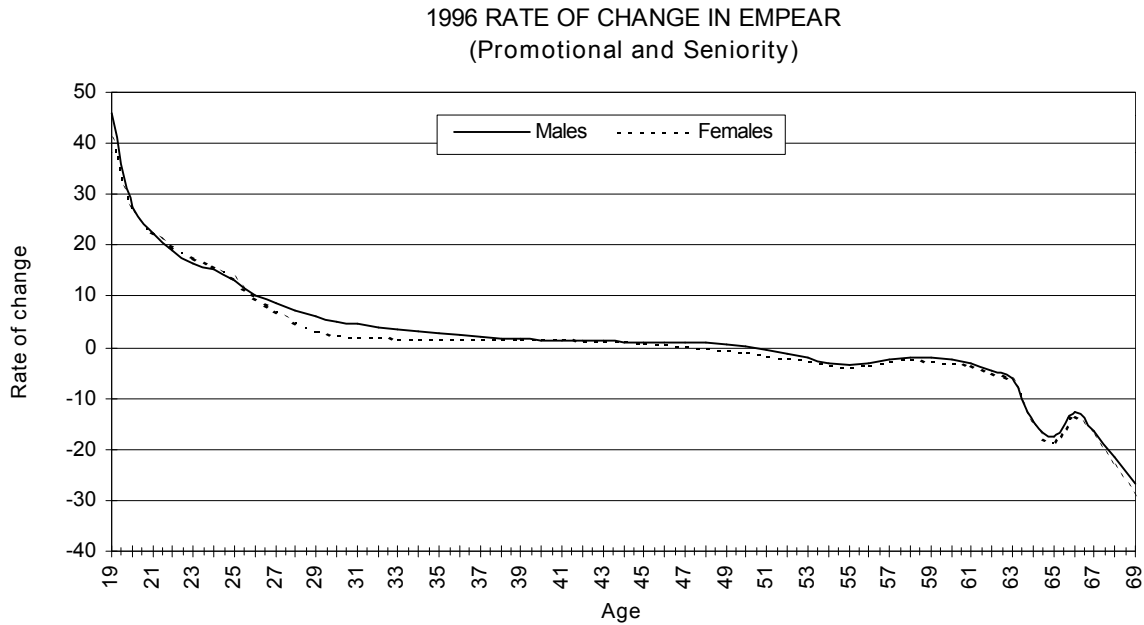
Appendix B - II. Earnings and Benefits

However, this assumed rate of increase in average employment earnings is subject to the following two adjustments:

- The preceding statement of the above assumption implies that the effect, on average employment earnings, of unemployment levels prevailing on average during the base year (1996) of earnings projections, will remain constant each year in the future.

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

(d) Distributions of earners and earnings over 78 earnings categories
The distributions of earners and earnings relative to average earnings are assumed for the projection period to be constantly equal to their actual adjusted five-year (1992 to 1996) average described and shown in section 3(c) below.

(e) Credit-splitting on marital union breakdown
The effect (not more than 0.02% of contributory earnings) of the equal apportionment of unadjusted pensionable earnings between spouses, in event of marital union breakdown, is accounted for by adjusting projected proportions of contributors and average (unadjusted) pensionable earnings of the respective spouses. These adjustments were achieved by assuming the following:

- On the basis of past medium-term average experience, the annual incidence rate of divorce is assumed at 1% for any age-sex-year cell. Divorce rates show a pattern of increases, but this was ignored because of its negligible effect on financial projections.

- The proportions of married contributors were derived from the proportions of contributors married at death mentioned at item (j) below, by multiplying the latter by ratios of mortality rates of both married and unmarried persons to mortality rates of married persons. These ratios, not available from CPP data, were taken from 1986 Canada Census data (catalogue 84-536E). The proportions of married persons (as opposed to married CPP contributors) were derived taking into account the above procedure and the assumption described in the following paragraph.

- The proportions of contributors (see section 3(d) below) are deemed not to vary by marital status for males, and the corresponding proportions for single females are deemed the same as those for males having the same age. Assumed proportions for married females are then obtained as the weighted differences between overall female proportions of contributors and single female proportions of contributors assumed as above.

- The distribution of average employment earnings of the cohort of spouses (sorted by age in accordance with the distribution of surviving spouses, described in section (l) below) of a cohort of contributors of a given age is assumed to apply uniformly to each of the 78 earnings categories of the given cohort of contributors.

(f)   Employment mobility rate
In respect of a cohort of persons born in a given calendar year, the employment mobility rate corresponds to the ratio, of those persons not contributing to CPP in respect of the calendar year who are assumed to never contribute to CPP, versus this cohort's highest annual proportion of contributors over its entire contributory period. For actuarial valuation purposes, the remainder of persons, i.e., those deemed to contribute for at least one year during the contributory period, is assumed to contribute randomly during the contributory period.

Appendix B - II. Earnings and Benefits

The employment mobility rate, which is required for the estimate of eligibility rates (see section 3(g) below), and of the effect of the drop-out provisions (see section 3(h) below), is assumed to be constantly equal to 50%.

For example, if the highest proportion of contributors of a cohort of persons over its entire contributory period is 80%, then 10% (i.e., half of the proportion not contributing for that year) are assumed to never contribute and 90% (i.e., the difference between 100% and 10%) are assumed to contribute randomly.

(g)   Drop-out period
Assumptions must be made regarding the child-rearing period and the years for which contributions are made over age 65:

i)   Period during which the contributor had at least one dependent child under 7 years of age
Because the actual proportions of males benefiting from the child-rearing drop-out provision are very small, it was assumed that all years of child-rearing would relate to female contributors. In any event, this alternative approach has no significant effect on financial projections. For a female born in a given calendar year, the cumulative number of years to be dropped on account of the child-rearing drop-out provision was computed for each year during her contributory period. The calculation uses actual past and future assumed fertility rates (adjusted, to correspond to Canada less Québec, by weighting them by the population for the appropriate age, calendar year and residence) to yield the number of children born so far to the female. Assuming a uniform age difference of exactly two years between any two consecutive births, the child-rearing period could then be computed taking into account the limit of seven years per child. Further, since years of child-rearing are not necessarily the years of lowest earnings, only half of the computed period was taken into account.

ii) Years for which contributions are made over age 65
The provision for the replacement of years of low earnings under age 65 by any years of higher earnings beyond age 65 is assumed to have a nil effect on retirement benefits.

(h) Retirement election proportions and retirement prevalence rates
The assumed proportions, by age, sex and calendar year, of contributors electing to start receiving the retirement pension at a given age last birthday (ELECT) were determined by extrapolating the corresponding CPP experience for 1987 to 1997. These proportions correspond to the ratio of the number of emerging retirement beneficiaries (NUMRET) to the product of the population (POP) times the retirement benefit eligibility rate ELIRET (described in section 3(g) below).

$$ELECT_x^N = \frac{NUMRET_x^N}{POP_x^N * ELIRET_x^N}$$

Given the negligible proportion of contributors actually electing to start receiving the retirement pension after age 65 (less than 2.5%), it was decided to assume that all contributors would be retired by age 65. For each year after 1997, the retirement election proportion for males age 65 was taken as 100% minus the sum of proportions experienced by, or assumed for, the underlying cohort (of contributors reaching age 65 in the given year) for ages 60 to age 64. Actual experience for 1987 to 1997 reveals that only about 85% of eligible females have applied for retirement benefits by age 65. For this reason, the assumption that 100% of all eligible females will have applied for retirement by age 65 is attained only gradually over 5 years. With this approach, it is implicitly assumed that all eligible contributors will have applied for the retirement pension by age 65.

Retirement prevalence rates at mid-year (RETPRV) were derived from the retirement election proportions and retirement eligibility rates using the following formula:

$$RETPRV_x^N = \sum_{t=60}^{x-1} ELECT_t^{N-(x-t)} * ELIRET_t)^{N-(x-t)} + ELECT_x^N * ELIRET_x^N * 13/24$$

In the above equation, the 13/24 factor is meant to reflect that, on average, 13/24 of the emerging retirements of the current year have occurred before mid-year.

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The retirement election proportions, and the underlying prevalence rates of retirement, are used for the following three estimates:

- the emergence of retirement benefits (using election proportions) described in section 3(i)i) below
- the reduction (using prevalence rates) effect of early retirement on disability incidence rates (described in section (i) below)
- the limit (using prevalence rates) on combined survivor-retirement pensions (described in section 3(i)iii) below)

A sample of some past actual and future assumed retirement election proportions is shown below by age, by sex and by calendar year.

Table VII.B.12   Retirement Election Proportions

	Males					
Year	60	61	62	63	64	65
1987	0.262	0.201	0.232	0.247	0.293	0.815
1988	0.224	0.085	0.097	0.094	0.152	0.636
1989	0.230	0.068	0.069	0.070	0.110	0.556
1990	0.241	0.066	0.065	0.063	0.091	0.530
1991	0.274	0.077	0.078	0.072	0.096	0.502
1992	0.289	0.073	0.071	0.065	0.084	0.473
1993	0.306	0.077	0.073	0.066	0.081	0.468
1994	0.326	0.077	0.072	0.062	0.080	0.446
1995	0.343	0.073	0.067	0.061	0.070	0.460
1996	0.364	0.076	0.068	0.061	0.069	0.424
1997	0.360	0.065	0.058	0.050	0.064	0.404
1998	0.363	0.068	0.060	0.053	0.066	0.425
1999	0.367	0.072	0.063	0.057	0.068	0.417
2000	0.370	0.075	0.065	0.060	0.070	0.402
2001	0.370	0.075	0.065	0.060	0.070	0.384
2002	0.370	0.075	0.065	0.060	0.070	0.379
2003	0.370	0.075	0.065	0.060	0.070	0.370
2004	0.370	0.075	0.065	0.060	0.070	0.363
2005	0.370	0.075	0.065	0.060	0.070	0.360

	Females					
Year	60	61	62	63	64	65
1987	0.313	0.221	0.238	0.248	0.320	0.610
1988	0.265	0.085	0.090	0.091	0.177	0.442
1989	0.263	0.066	0.060	0.061	0.123	0.369
1990	0.270	0.059	0.054	0.047	0.095	0.336
1991	0.280	0.065	0.055	0.051	0.091	0.311
1992	0.290	0.062	0.055	0.049	0.080	0.289
1993	0.303	0.068	0.058	0.051	0.076	0.290
1994	0.334	0.067	0.057	0.051	0.076	0.281
1995	0.346	0.065	0.056	0.050	0.069	0.299
1996	0.367	0.068	0.057	0.048	0.074	0.277
1997	0.375	0.060	0.048	0.043	0.070	0.265
1998	0.377	0.063	0.052	0.047	0.072	0.285
1999	0.378	0.067	0.056	0.051	0.073	0.282
2000	0.380	0.070	0.060	0.055	0.075	0.295
2001	0.380	0.070	0.060	0.055	0.075	0.297
2002	0.380	0.070	0.060	0.055	0.075	0.302
2003	0.380	0.070	0.060	0.055	0.075	0.318
2004	0.380	0.070	0.060	0.055	0.075	0.337
2005	0.380	0.070	0.060	0.055	0.075	0.360

Proportions for 1987 to 1997 are actual experience proportions.

Appendix B - II. Earnings and Benefits

(i)   Disability incidence and termination rates
       Actual disability incidence rates (DIR, i.e., number of new cases as a
       proportion of the eligible population) by age and sex for each year of the
       study period (1970 to 1997) were developed as the ratio of the number of
       emerging disability beneficiaries (NUMDIS) to the product of the
       population (POP), the disability flat-rate benefit eligibility rate (ELIDFR,
       described in section 3(g) below) and the complement of the retirement
       prevalence rate (RETPRV; see previous page).

$$DIR = \frac{NUMDIS}{POP * ELIDFR * (1 - RETPRV)}$$

       Actual disability termination rates were obtained, separately for death
       and recovery, by age, sex, duration, for each year from 1976 to 1993, as
       the ratio of the number of cases dying of, and recovering from, disability,
       respectively, at a particular duration (i.e., disability year) to the
       corresponding number of original emergences. In respect of any
       individual case exposed to risk (death and recovery) only partially during
       any year of disability due to occurrence of the risk or to the starting or
       termination of the study period, the denominator (number of original
       emergences) was adjusted in accordance with the Balducci formula (i.e.,
       $_{1-t|}q_{x+t} = (1-t)*q_x$). The total (death and recovery) disability termination
       rate for each age-sex cell was obtained as the sum of the death and
       recovery rates minus the product of the two same rates.

       Historical values of disability incidence and termination rates obtained
       using the above procedures, for all ages combined, are summarized in the
       graph and the table below.

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Graph VII.B.4   Historical Disability Incidence Rates
(per 1,000)

DISABILITY INCIDENCE RATES
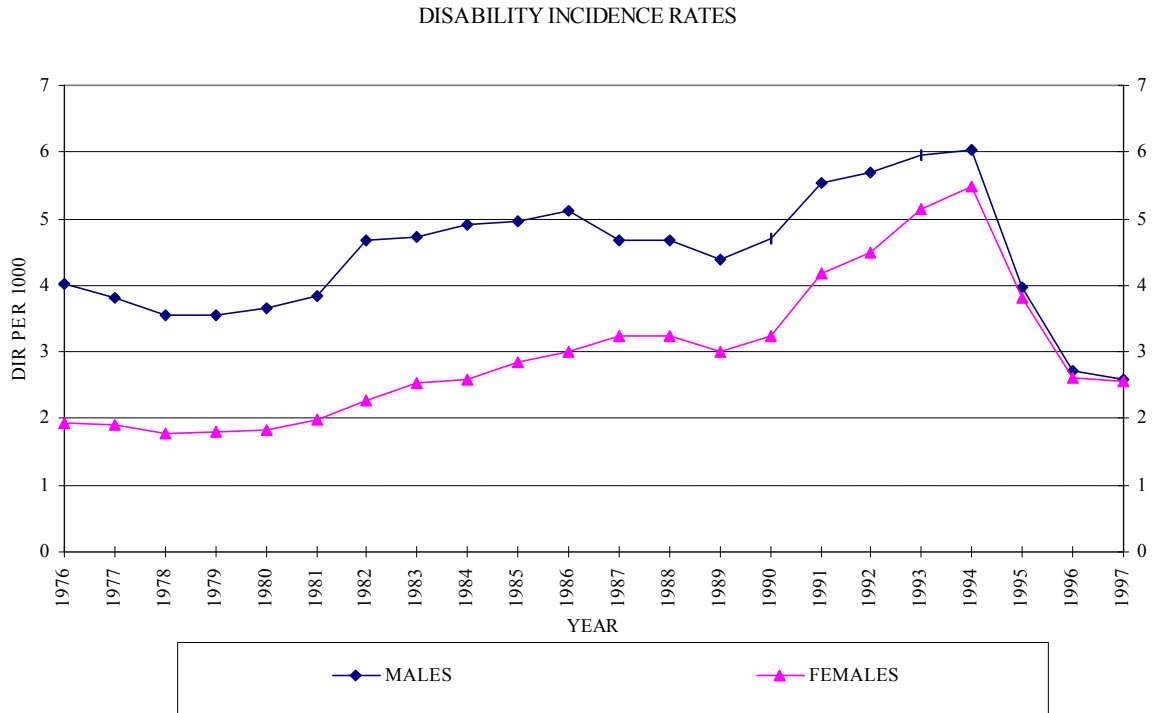
Appendix B - II. Earnings and Benefits

Table VII.B.13   Historical Disability Termination Rates
                  (per 1,000)

Attained Year	Males Duration of Disability					
	1	2	3	4	5	6+
1976	100.207	88.419	66.819	60.690	57.613	47.487
1977	118.273	108.888	81.129	63.887	60.419	57.387
1978	137.027	99.261	67.936	62.832	65.817	53.070
1979	144.219	97.624	70.600	63.475	55.748	53.955
1980	137.481	91.778	71.906	56.494	52.873	51.421
1981	136.766	94.509	72.736	60.781	53.720	48.481
1982	111.181	76.792	52.788	47.005	45.944	41.416
1983	120.260	81.536	56.598	44.873	42.267	41.730
1984	110.926	83.068	56.549	46.798	43.997	40.203
1985	112.913	79.354	59.063	51.563	47.675	42.547
1986	103.997	79.723	57.260	53.912	45.261	41.463
1987	102.011	69.527	49.185	43.629	40.255	40.333
1988	93.034	74.563	49.992	41.687	39.111	38.645
1989	99.786	72.904	52.097	41.128	37.839	39.412
1990	93.455	69.987	48.125	39.905	35.818	35.724
1991	80.659	62.471	44.706	34.357	33.750	32.757
1992	82.207	60.846	45.142	37.615	32.486	32.546
1993	105.692	58.774	41.957	34.036	30.112	30.377
Average	107.339	77.357	55.106	46.227	42.199	38.717

Table VII.B.13   Historical Disability Termination Rates
            (per 1,000) (continued)

Attained Year	Females					
	Duration of Disability					
	1	2	3	4	5	6+
1976	53.571	54.991	37.135	32.277	42.395	37.411
1977	69.379	64.249	44.681	43.572	39.386	43.982
1978	87.146	57.879	42.217	31.156	39.703	35.425
1979	98.511	58.400	45.178	31.981	26.701	32.445
1980	87.708	62.861	37.984	34.874	29.942	25.845
1981	93.267	68.996	39.850	32.893	31.774	26.645
1982	85.591	61.156	37.312	26.030	27.225	23.929
1983	96.825	60.515	38.742	25.198	18.017	22.395
1984	82.206	53.623	38.815	30.640	25.386	21.629
1985	92.152	60.442	39.042	31.092	24.150	23.647
1986	87.152	63.601	39.248	25.421	20.808	22.782
1987	78.471	51.954	37.214	27.394	17.127	22.362
1988	69.120	51.041	34.092	21.091	22.620	19.941
1989	70.073	51.814	36.863	26.415	26.002	20.394
1990	64.902	47.769	31.750	22.657	18.457	19.447
1991	56.965	46.621	33.040	19.615	15.869	16.899
1992	56.320	45.156	30.396	21.944	17.028	17.894
1993	83.284	42.136	24.048	19.130	18.492	15.153
Average	75.663	52.949	35.016	25.422	22.095	20.297

It can be seen from the preceding graph and table that the incidence (i.e., number of new cases as a proportion of the eligible population) and duration of disability have gradually increased since 1980. The annual rate of change in incidence rates was particularly acute in 1993 to a lesser extent in 1994. The disability incidence rate has declined rapidly since 1995 and currently (1997) is at a level that is more typical of historical levels. Factors which strongly influenced this reversal in the trend are related to administrative changes put in place since 1994. Beginning in 1994, the CPP administration initiated a range of measures

designed to effectively manage the growing pressure on the disability program. In September 1995, the guidelines for the determination of disabilities were revised, on the basis of judicial positions, to put the emphasis back on the medical basis and to de-emphasize the use of socio-economic factors. The guidelines are used at all levels in the determination process, thus greatly increasing consistency in decision making. Other measures, including increased reassessments of the disability status, expansion of vocational rehabilitation services and the implementation of a formal quality assurance program also contributed to reduce the aggregate level of disability incidence.

After considering the above factors it was decided to adopt the following disability assumptions for purposes of this report:

Incidence rates
• The aggregate (all ages combined using the 1997 population for weights) ultimate incidence rates for 2005 and subsequent years are taken to be 4.0 and 3.0 per 1,000 for males and females, respectively. These aggregate incidence rates correspond closely to the average pre-1990s experience of about 4.5 and 3.5 per 1,000 for males and females, respectively, but reduced to take account of the more stringent disability eligibility rules introduced in Bill C-2 which become effective after 1997. These were distributed by age in accordance with the average 1997 experience for each sex.

• For intervening years (1998 to 2004), the male and female rates by age are assumed to increase gradually from their current levels of 2.58 and 2.55 per 1,000 in 1997 towards the assumed aggregate ultimate level for 2005.

Termination (death and recovery) rates
The following termination rates are deemed to apply by age, sex and duration on an attained calendar year basis (i.e., on all cases being in pay during the attained calendar year irrespective of the calendar year of emergence of disability):
• The average 1976 to 1993 experience is assumed to apply for 1998 and subsequent calendar years.

A sample of the assumed disability ultimate incidence and termination rates is shown in the following tables.

Table VII.B.14 Assumed Ultimate Disability Incidence Rates
(per 1,000 population)

Age	Males	Females
20	0.124	0.049
25	0.635	0.392
30	1.408	1.116
35	1.608	1.372
40	2.210	2.200
45	3.584	3.396
50	4.731	4.376
55	10.578	7.919
60	21.220	16.126

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Table VII.B.15   Assumed Disability Termination Rates
                 (per 1,000 beneficiaries)

| Age at disablement | Males | | | | | | Attained Age |
| | Year of Disability | | | | | | |
	1	2	3	4	5	6 & over	
20	134.662	181.647	143.156	96.758	68.868	49.840	25
25	129.709	149.106	121.218	84.667	61.759	40.750	30
30	126.617	129.847	101.246	71.373	54.407	32.432	35
35	122.737	117.655	91.769	57.342	46.900	28.678	40
40	120.129	106.846	73.340	51.988	42.537	28.031	45
45	125.606	95.792	60.266	47.098	40.363	29.321	50
50	127.083	85.193	55.305	44.014	39.164	36.067	55
55	107.530	72.878	48.260	43.585	40.711	42.711	60
60	89.507	61.942	48.020	46.161	43.371	0.000	65

| Age at disablement | Females | | | | | | Attained Age |
| | Year of Disability | | | | | | |
	1	2	3	4	5	6 & over	
20	103.173	133.140	102.647	81.509	46.610	34.259	25
25	97.778	109.435	80.909	62.643	38.626	28.867	30
30	96.739	85.310	62.922	45.346	32.029	24.506	35
35	99.785	74.784	50.323	35.235	25.489	19.944	40
40	103.152	72.671	46.801	31.303	21.801	17.844	45
45	104.214	64.961	45.297	27.169	21.138	17.150	50
50	90.539	58.017	36.513	23.858	21.220	18.514	55
55	71.320	47.478	28.911	22.747	21.243	20.823	60
60	58.169	37.988	27.317	22.481	21.319	0.000	65

(j)   **Proportions of contributors married at death**
The assumed proportions of contributors married at time of their death
were determined from benefits statistics as at 31 December 1997. The
number of emerging surviving spouse benefits, sorted according to the
age and sex of the deceasing contributing spouse, was divided by the
number of all emerging death benefits relating to the same age and sex.
This measure corresponds exactly to the proportion required for the
valuation of survivor benefits since eligibility for survivor benefits is the
same as for death benefits. For each age-sex cell, the resulting actual
proportions for 1996 were:

- smoothed; with only a few slight adjustments required for this
  purpose; and
- uniformly adjusted, for each age, so that the overall average over all
  ages combined, separately for each sex, equals the actual average
  for 1996.

The resulting adjusted proportions are deemed to correspond to 1996.
On the basis of the trends shown over the period 1987 to 1996, the
proportions assumed for the projection period were obtained by
decreasing geometrically these 1996 proportions by 1.1% and 0.4% for
males and females under age 65, respectively, and by decreasing 0.6%
and increasing 1.3% for males and females over 65, respectively, each
year from 1997 to 2001. Proportions are assumed to remain constant
(ultimate) after 2001. Sample ultimate values are shown below.

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Table VII.B.16   Assumed Ultimate Proportion of Contributors Married at
Death (percentages)

Age	Males	Females
20	5.64	4.55
25	14.84	15.23
30	29.09	40.70
35	41.40	57.55
40	49.46	65.19
45	57.94	68.88
50	65.38	67.87
55	70.32	67.68
60	72.15	64.22
65	72.63	61.15
70	72.67	48.83
75	71.14	33.75
80	65.24	20.70
85	57.16	10.88
90	45.58	3.54

(k)   Proportion of survivors emerging under age 45 with reduced benefits
Surviving spouses emerging under age 45, if then not disabled and in the
absence of any eligible children under their care, are only entitled to
reduced survivor benefits. To account for this provision, it was assumed
that 75% of all surviving spouses emerging under age 45 would then be
disabled or have at least one eligible dependent child.

(l)   Distributions of spouses by age
The distributions of spouses by age are required in the valuation process
for:

•   the survivorship of survivor benefits' beneficiaries;

•   estimating the effect of limits applying to combined pensions; and

•   estimating orphan's benefits, regarding the numbers of children
born to the female spouses of deceased male contributors.

For a cohort of married contributors of a given age and sex at time of death, the distribution of their spouses by age is assumed, throughout the projection period, to be the same as the actual distribution over 1988 to 1997 derived from benefits statistics. The assumed distributions of spouses by age are shown in the table below.

Table VII.B.17   Distributions of Surviving Spouses by Age
(percentages)

Age of Wife at Death	Age of Surviving Widower at Wife's Death															
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+
15-19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-24	0.0	25.8	51.5	12.1	9.1	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-29	0.0	2.0	32.8	40.2	19.7	3.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-34	0.0	0.0	4.3	37.7	42.4	11.4	2.6	0.7	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0
35-39	0.0	0.0	0.6	5.8	45.1	35.3	9.3	2.5	1.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0
40-44	0.0	0.0	0.1	0.8	8.3	41.1	35.3	9.5	3.3	1.1	0.3	0.2	0.0	0.0	0.0	0.0
45-49	0.0	0.0	0.0	0.1	2.0	8.4	38.8	35.1	10.8	3.1	1.0	0.4	0.1	0.0	0.0	0.0
50-54	0.0	0.0	0.0	0.0	0.6	1.9	7.8	36.1	36.8	12.4	3.2	0.8	0.3	0.0	0.0	0.0
55-59	0.0	0.0	0.0	0.0	0.2	0.5	2.0	7.5	37.6	38.0	10.8	2.7	0.5	0.2	0.0	0.0
60-64	0.0	0.0	0.0	0.0	0.0	0.1	0.6	1.7	8.0	40.1	36.7	9.8	2.3	0.5	0.1	0.0
65-69	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	2.6	10.8	40.3	32.6	9.9	2.5	0.5	0.0
70-74	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.9	3.8	13.0	40.1	31.2	9.0	1.6	0.2
75-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	1.7	4.8	16.2	40.8	28.2	6.5	1.0
80-84	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.9	2.6	7.0	19.3	43.6	21.8	4.5
85-89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.6	1.1	3.7	9.5	24.5	43.9	16.5
90+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	1.8	2.8	7.8	11.1	28.6	47.0

Table VII.B.17 Distributions of Surviving Spouses by Age
(percentages) (continued)

Age of Husband at Death	Age of Surviving Widow at Husband's Death															
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+
15-19	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-24	10.4	62.1	21.0	3.8	1.4	0.5	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3
25-29	1.3	26.3	53.1	14.2	3.1	1.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-34	0.2	3.8	28.0	50.2	13.3	3.4	0.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35-39	0.1	0.6	6.2	31.9	48.3	9.7	2.4	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-44	0.0	0.2	1.6	8.3	34.5	43.7	9.1	2.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
45-49	0.0	0.1	0.5	2.4	10.8	35.4	41.0	7.6	1.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0
50-54	0.0	0.0	0.2	0.7	3.5	11.4	36.7	37.9	7.3	1.7	0.4	0.1	0.0	0.0	0.0	0.0
55-59	0.0	0.0	0.0	0.2	1.3	3.9	12.1	35.2	36.8	7.9	1.8	0.5	0.1	0.0	0.0	0.0
60-64	0.0	0.0	0.0	0.1	0.5	1.4	4.1	11.5	34.2	36.9	8.9	1.8	0.5	0.1	0.0	0.0
65-69	0.0	0.0	0.0	0.0	0.2	0.5	1.5	3.8	11.4	34.6	37.3	8.7	1.6	0.3	0.1	0.0
70-74	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.3	3.8	13.3	37.0	34.7	7.5	1.2	0.2	0.0
75-79	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.5	1.3	4.7	16.9	38.6	30.8	6.1	0.7	0.1
80-84	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	2.0	6.8	20.5	38.9	26.4	3.9	0.4
85-89	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.9	3.1	10.0	24.8	39.1	19.3	2.2
90+	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.6	2.0	5.5	14.1	30.0	33.5	13.8

(m)   Proportions of children at school in age-range 18 to 25
Assumed proportions of children at school in age group 18 to 25 are
required for the valuation of children's benefits (Disabled Contributor's
Child and Orphan). They were taken from Statistics Canada publication
Education in Canada (catalogue 81-229-XPB for 1973-1996) and are
assumed for 1997 and later to be equal to the actual 1996 proportions.

Table VII.B.18   Assumed Proportions of Children at School

Age	Proportion
18	0.589
19	0.472
20	0.387
21	0.349
22	0.268
23	0.180
24	0.121
25	0.097

(n)   Distribution, by amount, of average retirement pensions
Since earnings-related benefits are computed for age-sex cohorts of persons as opposed to individual persons, a distribution of average retirement pensions by amount is required for estimating the effect of limits applying to the earnings-related portion of combined survivor-retirement and survivor-disability pensions, and to the death benefit.

Distributions, expressed as a percentage of the CPP maximum annual retirement pension and available from benefits statistics for six categories of amount (0-20%, 20-40%, 40-60%, 60-80%, 80-99% and 100%), of past actual emerging retirement pensions, grouped by age, sex and calendar year, were used as a basis for developing a mathematical formula reproducing closely these actual distributions.

This formula produces a continuous distribution that varies according to the ratio of the average retirement pension to the maximum retirement pension. Distributions were then retained only for each of the 100 integer values of the ratio equal to 1%, 2%, and so on up to 100%. For each of these 100 values of the ratio, the average retirement pension continuous distribution, expressed as a proportion of the maximum retirement pension, was aggregated within each of 10 equal groups of persons in the cohort. For this purpose, persons in the cohort are sorted by order of magnitude of their earnings.

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A sample of the resulting model distribution is shown below for 21
values selected from the retained 100 values of the ratio.

Table VII.B.19   Distribution of the Average Retirement Pension as a Proportion of the
Maximum Pension

	Rank of each of the 10 10%-categories of persons in the cohort									
Ratio	1	2	3	4	5	6	7	8	9	10
0.01	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0098	0.0118
0.05	0.0165	0.0224	0.0253	0.0272	0.0293	0.0326	0.0389	0.0523	0.0846	0.1709
0.10	0.0249	0.0381	0.0446	0.0490	0.0537	0.0611	0.0754	0.1054	0.1780	0.3698
0.15	0.0333	0.0539	0.0640	0.0707	0.0780	0.0897	0.1118	0.1586	0.2715	0.5686
0.20	0.0411	0.0692	0.0853	0.0978	0.1115	0.1312	0.1650	0.2296	0.3705	0.6989
0.25	0.0488	0.0844	0.1067	0.1249	0.1449	0.1728	0.2181	0.3007	0.4694	0.8291
0.30	0.0534	0.1003	0.1362	0.1691	0.2037	0.2452	0.3014	0.3884	0.5453	0.8570
0.35	0.0580	0.1161	0.1658	0.2132	0.2625	0.3176	0.3847	0.4760	0.6212	0.8848
0.40	0.0625	0.1319	0.1953	0.2574	0.3213	0.3901	0.4680	0.5637	0.6971	0.9126
0.45	0.0671	0.1478	0.2248	0.3016	0.3801	0.4625	0.5514	0.6514	0.7730	0.9405
0.50	0.0716	0.1636	0.2544	0.3457	0.4389	0.5349	0.6347	0.7390	0.8488	0.9683
0.55	0.0818	0.1984	0.3132	0.4205	0.5200	0.6134	0.7031	0.7913	0.8820	0.9762
0.60	0.0919	0.2333	0.3719	0.4953	0.6011	0.6919	0.7715	0.8436	0.9152	0.9842
0.65	0.1020	0.2681	0.4307	0.5701	0.6823	0.7704	0.8399	0.8960	0.9484	0.9921
0.70	0.1121	0.3030	0.4895	0.6449	0.7634	0.8489	0.9083	0.9483	0.9816	1.0000
0.75	0.1361	0.3755	0.5867	0.7395	0.8415	0.9072	0.9488	0.9738	0.9908	1.0000
0.80	0.1601	0.4481	0.6840	0.8341	0.9196	0.9655	0.9892	0.9994	1.0000	1.0000
0.85	0.2700	0.6163	0.7960	0.8954	0.9505	0.9788	0.9934	0.9996	1.0000	1.0000
0.90	0.3798	0.7846	0.9081	0.9566	0.9814	0.9920	0.9975	0.9999	1.0000	1.0000
0.95	0.6041	0.9182	0.9824	0.9953	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

The distribution of the average retirement pension, as defined above, is
assumed to be static over the years. However, it is nonetheless
effectively dynamic since it is properly designed to apply to the average
retirement benefit factor computed, as described in section 3(h) below,
on a dynamic basis, i.e., varying by age and sex and year of emergence of
the retirement pension. If, for example, the average retirement pension
of a cohort of contributors retiring in a given year is equal to 70% of the
maximum retirement pension applicable to cases emerging during that
year, the table below indicates that 10% of the cohort have a retirement

pension averaging 11.21% of the maximum retirement pension, the next 10% have a retirement pension averaging 30.30% of the maximum retirement pension, and so on, with the tenth 10% sub-group of the cohort having a retirement pension averaging 100% of the maximum retirement pension. Summing these 10 average percentages and dividing by 10 accordingly equals the underlying ratio of 70%. For any value of the ratio falling in between two consecutive values of the 100 model values, linear interpolation is used to determine the desired distribution of the average retirement pension.

3.   Methodology

(a)   General approach
        Given the inherent complexity of the valuation methodology and the intent here to facilitate its comprehension as much as possible, it is appropriate at this stage to point out two significant characteristics of the general approach underlying the valuation methodology.

        i)   The actuarial approach used for projections is macro-simulated as opposed to micro-simulated. One of the important characteristics of such macro-simulation is that projections are made relying on grouped, as opposed to individual, data (mainly numbers of persons and earnings). This results in the need for a considerably smaller volume of data to be processed. Using micro-simulation, individual benefits can be easily determined via calculations involving individual data. Using macro-simulation, only aggregate benefits (i.e., combined by age and sex separately for each year of benefit emergence) can be obtained directly, since the data used in the computational processes are aggregate values. Through macro-simulation, the average initial annual retirement pension of all persons (as opposed to all contributors) born in a given calendar of birth, split by sex is obtained, generally speaking (i.e., ignoring the 25% benefit proportion, the wage escalation provision, the drop-out provisions, etc.), by summing, over the contributory period of this cohort, the annual products of the proportion of contributors by the average pensionable earnings deemed to apply to the given cohort, and by dividing this sum by the number of years included in the contributory period. The preceding formula reproduces correctly the average employment earnings of the cohort, except that it implicitly assumes that the average annual earnings of those who die before retirement is exactly the same as all other persons of the

underlying age-sex cohort for each calendar year until the year of death. This formula was retained given that this implicit assumption is generally reasonable. A minor exception occurs in respect of the year in which a contributor dies, when, on average, employment earnings would be earned for only half of a year. However, given the low proportions of deaths before retirement, such part-year earnings have a negligible effect on the financial projections.

ii) All projections are made using 1966 as the starting point of projections instead of the beginning (1998) of the statutory valuation period. This is done for the following three reasons:

- The valuation methodology can be validated for the pre-valuation years (1966 to 1997) by comparing the values (benefits, contributions, numbers of beneficiaries, of contributors, etc.) computed for these years with actual results. The computerized valuation system incorporates an extensive methodology validation process that examines the numbers and amounts of all past benefits by age (both at emergence and attained), by sex and by calendar year.

- The projection of those benefits already in pay on the valuation date (31 December 1997) is fully integrated with that of benefits emerging after this date, thus ensuring full consistency of the various valuation processes used for these two series of beneficiaries.

- Certain amendments to the plan, e.g., the one underlying Bill C-57, which was the subject of the CPP thirteenth statutory actuarial report, instate beneficiaries rejected before the effective date of the amendment. Though such instatements are made without retroactive payments, their proper evaluation can be made only by hypothetically instating them at the prior rejection date.

(b) Projection of economic indices

i) Consumer Price Index (CPI)
The CPI is projected for each calendar year of the valuation period by increasing geometrically its most recent average, over the 12-

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month period ending in December, in accordance with the assumed annual increase in prices. Designating this assumed rate of increase in prices as "c" (e.g., c = 0.03 in respect of a 3.0% assumption), the CPI for a given calendar year is accordingly obtained by multiplying the previous year's CPI by "1+c".

ii)   Pension Index (PI)
The PI for a given calendar year corresponds to the CPI averaged over the 12-month period ending in October of the previous year. It is therefore computed simply as the sum of 5/6 of the previous year's CPI plus 1/6 of the CPI for the year preceding that previous year. PI values are used for the price-escalation of benefits.

iii) Average Industrial Aggregate Wage (AIAW)
The most current (1997) value for the AIAW is projected into the future using the assumed annual rate of increase in earnings in a manner exactly parallel to that used for the CPI projections. Values of the AIAW are used in projecting future values of the YMPE.

iv) Year's Maximum Pensionable Earnings (YMPE)
Year's Basic Exemption (YBE)
The YMPE is projected for each calendar year of the valuation period by increasing its most recent unrounded value in accordance with the applicable increase in the AIAW computed as above. The AIAW increase applicable to the YMPE of a given year, to produce the YMPE for the following year, is the one experienced on average during the 12-month period ending with 30 June of the given year. Therefore, the increase factor corresponds on average to the ratio of the AIAW as at 1 January of the given year to that as at 1 January of the preceding year. Since AIAWs computed as described in paragraph iii) above correspond to 1 July as opposed to 1 January, the YMPE for a given calendar year is accordingly obtained by multiplying the previous year's unrounded YMPE by the square root of the ratio of the AIAW for the previous year to the AIAW for the third year preceding the given year, and by rounding the result to the next lower multiple of $100. The calculation of the unrounded YMPE for a given calendar year N can therefore be expressed as:

$$YMPE_N = YMPE_{N-1} * \sqrt{\frac{AIAW_{N-1}}{AIAW_{N-3}}} = YMPE_{N-1} * \sqrt{(1+s_{N-2})(1+s_{N-1})}$$

where s_N corresponds to the assumed annual increase in average employment earnings from year N-1 to year N.

The unrounded value of the YMPE is $36,902.19 for 1998. The first year for which the YMPE was projected is 1999.

For any year after 1997, according to Bill C-2 (effective 1 January 1998) the YBE is defined as $3,500. For years prior to 1998, the YBE was obtained by taking 10% of the rounded value of the YMPE for that year and by rounding the result to the next lower multiple of $100.

v)   Earnings index
       In the computation of actual CPP earnings-related benefits, each year's pensionable earnings are escalated (see definition of pensionable earnings in paragraph 1 of Appendix A). To reflect this plan provision, an earnings index is computed for each year as the ratio of the Maximum Pensionable Earnings Average (MPEA) to the Pension Index (PI) for the given year. The denominator of the year's earnings index is the year's PI instead of the year's YMPE for the following two reasons:

•   the year's YMPE adjustment is included in the calculation of the average earnings-related benefit factor (see paragraph 3(h)i) below); and

•   the price indexation of CPP earnings-related pensions involves the ratio of the Pension Index (PI) of the year of payment to the PI of the year of emergence of the benefit. It is accordingly convenient and efficient for computational purposes to include the year-of-emergence PI in the denominator of the earnings index. Then, ignoring survivorship considerations, the computation of benefits for any year following emergence can simply multiply the emergence year's benefits by the PI for the payment year.

vi) Maximum retirement pension

With the exception of the actuarial adjustment in connection with the variable retirement age provision, the maximum annual pension payable in respect of a retirement benefit emerging in a given year is equal to 25% of the MPEA. Then, for computational efficiency as well as consistency with the structure and usage of the earnings index described above, this maximum pension is divided by the year's PI. The maximum pension is used to:

- identify the limit, incidentally equal to the maximum retirement pension, applying to combined survivor-retirement and survivor-disability pensions;

- compute the ratio used for the distribution of average retirement pensions involved in estimating the effect of the limits on combined earnings-related survivor-retirement and survivor-disability pensions as well as on the death benefit (see sections (i)iii) & (i)iv) below);

- adjust benefit eligibility rates (see section 3(g) below) whenever required for consistency purposes.

(c) Proportions of earners, average employment earnings and distributions of earners and earnings

As mentioned in section 1(e) above, earnings statistics are combined into quinquennial age groups. Since the valuation process works on an individual age basis, actual past (1966 to 1996) proportions of earners, average employment earnings and distributions of earners and earnings are desegregated to an individual age basis using appropriate interpolation formulae.

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

A sample of past actual and future assumed proportions of earners and average employment earnings, and of the assumed (constant over the years) distributions of earners and of their average employment earnings over 78 earnings categories is shown in the tables below.

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Table VII.B.20   Historical and Assumed Proportions of Earners

	Males						
Age	1985	1995	2000	2025	2050	2075	2100
20	0.8229	0.7636	0.7994	0.8824	0.8824	0.8824	0.8824
25	0.9173	0.8502	0.8765	0.9236	0.9236	0.9236	0.9236
30	0.9208	0.8672	0.8929	0.9374	0.9374	0.9374	0.9374
35	0.9583	0.8671	0.8834	0.9424	0.9424	0.9424	0.9424
40	0.9462	0.8664	0.8935	0.9274	0.9274	0.9274	0.9274
45	0.9219	0.8732	0.8764	0.9097	0.9097	0.9097	0.9097
50	0.8999	0.8545	0.8478	0.8847	0.8847	0.8847	0.8847
55	0.8418	0.7901	0.7942	0.8301	0.8301	0.8301	0.8301
60	0.7578	0.5802	0.5374	0.4500	0.4500	0.4500	0.4500
65	0.3626	0.2369	0.2070	0.1500	0.1500	0.1500	0.1500
	Females						
Age	1985	1995	2000	2025	2050	2075	2100
20	0.7823	0.7231	0.7629	0.8512	0.8512	0.8512	0.8512
25	0.7968	0.7703	0.7911	0.8355	0.8355	0.8355	0.8355
30	0.7301	0.7610	0.7764	0.7974	0.7974	0.7974	0.7974
35	0.7520	0.7565	0.7723	0.8274	0.8274	0.8274	0.8274
40	0.7576	0.7793	0.7995	0.8274	0.8274	0.8274	0.8274
45	0.7251	0.7957	0.7890	0.8010	0.8010	0.8010	0.8010
50	0.6482	0.7394	0.7396	0.7760	0.7760	0.7760	0.7760
55	0.5320	0.6195	0.6497	0.7398	0.7398	0.7398	0.7398
60	0.3973	0.3986	0.3983	0.4000	0.4000	0.4000	0.4000
65	0.1674	0.1446	0.1365	0.1250	0.1250	0.1250	0.1250

Table VII.B.21   Historical and Assumed Average Employment Earnings

	Males						
Age	1985	1995	2000	2025	2050	2075	2100
20	8,268	9,240	10,059	25,878	67,658	177,336	466,735
25	17,322	20,476	22,209	57,237	149,992	393,853	1,038,065
30	23,257	29,279	31,716	80,936	210,955	551,570	1,449,101
35	27,507	34,992	37,804	96,063	248,750	647,329	1,694,488
40	30,139	38,539	41,361	104,992	271,604	706,269	1,847,669
45	30,174	41,085	43,931	111,123	287,924	748,983	1,960,054
50	29,412	42,202	45,447	115,276	297,644	772,695	2,019,157
55	27,634	37,697	40,879	104,400	268,799	696,833	1,818,610
60	24,521	33,273	36,316	93,326	240,408	622,541	1,623,643
65	13,025	20,540	22,263	57,451	147,978	382,926	998,213
	Females						
Age	1985	1995	2000	2025	2050	2075	2100
20	6,652	7,146	7,710	21,178	58,099	157,848	426,840
25	12,408	16,215	17,474	47,745	130,645	354,337	957,056
30	14,345	20,808	22,880	63,397	175,398	479,256	1,301,326
35	15,282	22,639	25,050	70,855	197,977	544,558	1,485,239
40	15,648	24,758	27,184	77,001	215,282	592,350	1,615,860
45	15,386	26,276	29,080	81,903	229,035	629,830	1,717,515
50	14,921	25,886	28,959	82,746	232,313	640,774	1,751,021
55	14,084	22,542	25,303	73,458	206,832	571,881	1,564,960
60	13,453	19,763	22,018	64,746	183,143	507,198	1,389,656
65	7,968	11,776	13,107	39,072	111,157	308,813	847,940

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Table VII.B.22   Assumed Distributions of Earners by Earnings Category

Earnings Category (*)	Males Age										
	18	20	25	30	35	40	45	50	55	60	65
5	0.0398	0.0382	0.0376	0.0343	0.0325	0.0316	0.0313	0.0324	0.0400	0.0691	0.1246
10	0.0810	0.0729	0.0674	0.0607	0.0577	0.0567	0.0561	0.0574	0.0687	0.1055	0.1780
20	0.1572	0.1392	0.1257	0.1133	0.1098	0.1100	0.1108	0.1146	0.1329	0.1722	0.2523
30	0.2291	0.2069	0.1866	0.1688	0.1621	0.1607	0.1621	0.1676	0.1928	0.2355	0.3161
40	0.2988	0.2768	0.2462	0.2199	0.2108	0.2092	0.2093	0.2157	0.2470	0.2907	0.3704
50	0.3667	0.3477	0.3028	0.2682	0.2584	0.2550	0.2550	0.2624	0.2978	0.3419	0.4188
60	0.4292	0.4158	0.3569	0.3161	0.3065	0.3021	0.3021	0.3104	0.3474	0.3907	0.4636
70	0.4866	0.4768	0.4088	0.3651	0.3569	0.3535	0.3537	0.3628	0.3975	0.4380	0.5067
80	0.5386	0.5308	0.4593	0.4162	0.4109	0.4114	0.4143	0.4236	0.4510	0.4851	0.5477
90	0.5855	0.5790	0.5083	0.4687	0.4706	0.4741	0.4797	0.4899	0.5104	0.5343	0.5845
100	0.6291	0.6218	0.5547	0.5245	0.5333	0.5427	0.5463	0.5530	0.5708	0.5871	0.6224
200	0.8776	0.8706	0.9061	0.9376	0.9464	0.9523	0.9586	0.9553	0.9341	0.9120	0.8822
500	0.9930	0.9968	0.9995	0.9998	0.9997	0.9997	0.9997	0.9997	0.9992	0.9983	0.9933
1000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Earnings Category (*)	Females Age										
	18	20	25	30	35	40	45	50	55	60	65
5	0.0314	0.0330	0.0420	0.0487	0.0480	0.0429	0.0390	0.0408	0.0488	0.0730	0.1253
10	0.0656	0.0646	0.0745	0.0834	0.0816	0.0731	0.0665	0.0686	0.0793	0.1102	0.1798
20	0.1326	0.1272	0.1351	0.1456	0.1428	0.1300	0.1198	0.1229	0.1375	0.1733	0.2559
30	0.1995	0.1944	0.1942	0.2034	0.2023	0.1880	0.1775	0.1830	0.2009	0.2320	0.3101
40	0.2647	0.2638	0.2534	0.2604	0.2593	0.2435	0.2326	0.2398	0.2625	0.2943	0.3674
50	0.3304	0.3334	0.3102	0.3126	0.3127	0.2980	0.2882	0.2966	0.3200	0.3477	0.4137
60	0.3932	0.4002	0.3645	0.3629	0.3655	0.3512	0.3423	0.3510	0.3750	0.3993	0.4577
70	0.4523	0.4639	0.4171	0.4115	0.4157	0.4021	0.3940	0.4028	0.4263	0.4484	0.5013
80	0.5080	0.5214	0.4669	0.4579	0.4627	0.4518	0.4456	0.4528	0.4747	0.4941	0.5403
90	0.5599	0.5727	0.5136	0.5027	0.5088	0.5015	0.4993	0.5042	0.5202	0.5375	0.5794
100	0.6078	0.6188	0.5575	0.5467	0.5548	0.5539	0.5554	0.5581	0.5653	0.5777	0.6159
200	0.8869	0.8704	0.8962	0.9027	0.9024	0.9060	0.9055	0.8986	0.8940	0.8913	0.8724
500	0.9961	0.9978	0.9995	0.9994	0.9992	0.9994	0.9995	0.9994	0.9988	0.9973	0.9909
1000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

*   Percentage of earners earning less than the earnings category percentage of the average earnings of the age-sex cell.

Table VII.B.23   Assumed Distributions of Employment Earnings

Earnings Category (*)	Males										
	Age										
	18	20	25	30	35	40	45	50	55	60	65
5	0.0011	0.0010	0.0009	0.0008	0.0007	0.0007	0.0007	0.0007	0.0009	0.0014	0.0026
10	0.0042	0.0035	0.0031	0.0028	0.0027	0.0027	0.0027	0.0027	0.0032	0.0044	0.0068
20	0.0158	0.0135	0.0120	0.0108	0.0109	0.0111	0.0114	0.0119	0.0136	0.0152	0.0182
30	0.0339	0.0306	0.0274	0.0248	0.0243	0.0243	0.0249	0.0260	0.0294	0.0320	0.0352
40	0.0583	0.0558	0.0483	0.0429	0.0418	0.0419	0.0422	0.0438	0.0495	0.0528	0.0554
50	0.0886	0.0893	0.0736	0.0651	0.0639	0.0634	0.0639	0.0660	0.0737	0.0775	0.0788
60	0.1224	0.1289	0.1029	0.0921	0.0911	0.0904	0.0913	0.0940	0.1026	0.1062	0.1055
70	0.1593	0.1703	0.1364	0.1245	0.1249	0.1253	0.1266	0.1300	0.1373	0.1390	0.1364
80	0.1981	0.2117	0.1741	0.1635	0.1667	0.1706	0.1745	0.1782	0.1800	0.1767	0.1706
90	0.2381	0.2529	0.2157	0.2087	0.2191	0.2261	0.2332	0.2378	0.2337	0.2213	0.2044
100	0.2798	0.2931	0.2596	0.2623	0.2805	0.2940	0.2997	0.3011	0.2945	0.2749	0.2433
200	0.6363	0.6160	0.7682	0.8472	0.8691	0.8824	0.8982	0.8892	0.8339	0.7585	0.6443
500	0.9543	0.9850	0.9982	0.9989	0.9987	0.9987	0.9989	0.9983	0.9965	0.9872	0.9622
1000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Earnings Category (*)	Females										
	Age										
	18	20	25	30	35	40	45	50	55	60	65
5	0.0008	0.0008	0.0010	0.0011	0.0011	0.0009	0.0008	0.0009	0.0010	0.0014	0.0023
10	0.0034	0.0031	0.0034	0.0037	0.0036	0.0032	0.0029	0.0029	0.0033	0.0042	0.0064
20	0.0136	0.0126	0.0125	0.0130	0.0128	0.0118	0.0110	0.0111	0.0121	0.0138	0.0177
30	0.0303	0.0299	0.0272	0.0275	0.0279	0.0265	0.0256	0.0263	0.0282	0.0289	0.0305
40	0.0529	0.0553	0.0477	0.0476	0.0480	0.0462	0.0450	0.0463	0.0498	0.0510	0.0508
50	0.0821	0.0883	0.0729	0.0714	0.0722	0.0711	0.0703	0.0720	0.0759	0.0754	0.0713
60	0.1163	0.1270	0.1024	0.0994	0.1016	0.1006	0.1004	0.1021	0.1064	0.1043	0.0951
70	0.1541	0.1706	0.1361	0.1314	0.1345	0.1341	0.1343	0.1359	0.1400	0.1367	0.1239
80	0.1957	0.2152	0.1731	0.1664	0.1701	0.1718	0.1734	0.1736	0.1766	0.1716	0.1535
90	0.2398	0.2596	0.2127	0.2047	0.2096	0.2146	0.2195	0.2176	0.2155	0.2089	0.1883
100	0.2855	0.3034	0.2545	0.2468	0.2538	0.2650	0.2733	0.2690	0.2589	0.2475	0.2250
200	0.6886	0.6211	0.7510	0.7570	0.7519	0.7625	0.7660	0.7444	0.7224	0.7040	0.6215
500	0.9769	0.9898	0.9978	0.9983	0.9972	0.9972	0.9978	0.9971	0.9958	0.9909	0.9549
1000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

*   Percentage of average employment earnings earned by earners earning less than the earnings category percentage of the average earnings of the age-sex cell.

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(d)   Proportions of contributors
        In respect of a given calendar year, one of the conditions to be a CPP
        contributor is to have employment earnings over the YBE. Proportions of
        contributors are accordingly determined by multiplying proportions of
        earners by the complement of the fraction of earners earning less than the
        YBE. This fraction was determined for each age, sex and calendar year
        by expressing the YBE as a percentage of average employment earnings
        and using the distribution of earners described in paragraph (c) above.
        The resulting proportions of contributors are those used for the
        calculation of average contributory earnings. Sample values of these
        proportions of contributors are shown below.

Table VII.B.24   Assumed Proportions of Earners for Contributory Earnings Purposes

	Males					
Age	1995	2000	2025	2050	2075	2100
18	0.342	0.375	0.627	0.717	0.754	0.768
20	0.569	0.609	0.799	0.848	0.869	0.877
25	0.760	0.789	0.883	0.908	0.917	0.921
30	0.807	0.834	0.910	0.927	0.933	0.936
35	0.818	0.836	0.920	0.934	0.939	0.941
40	0.822	0.850	0.908	0.920	0.925	0.926
45	0.832	0.836	0.892	0.903	0.907	0.909
50	0.814	0.809	0.868	0.878	0.882	0.884
55	0.740	0.747	0.808	0.822	0.827	0.829
60	0.518	0.482	0.427	0.441	0.447	0.449
65	0.183	0.161	0.130	0.141	0.147	0.149
	Females					
Age	1995	2000	2025	2050	2075	2100
18	0.303	0.333	0.617	0.712	0.747	0.759
20	0.494	0.535	0.763	0.818	0.839	0.847
25	0.662	0.685	0.788	0.817	0.829	0.833
30	0.667	0.686	0.756	0.782	0.792	0.795
35	0.671	0.691	0.789	0.814	0.822	0.826
40	0.706	0.728	0.796	0.816	0.823	0.826
45	0.730	0.728	0.775	0.792	0.798	0.800
50	0.676	0.681	0.750	0.767	0.773	0.775
55	0.552	0.584	0.706	0.728	0.735	0.738
60	0.336	0.340	0.370	0.389	0.396	0.399
65	0.101	0.097	0.104	0.115	0.121	0.124

Proportions of contributors from the above table were then adjusted for benefit computation purposes. The adjustment reflects the effect of the provision for the equal apportionment between spouses of unadjusted pensionable earnings upon marital union breakdown. For benefit purposes, the effect of this provision was accounted for using appropriate

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mathematical formulae, on the basis of the assumptions described in
section 2(e) above. Sample values of proportions of contributors,
adjusted for credit-splitting on spousal union breakdown, are shown in
the table below.

Table VII.B.25   Assumed Proportions of Earners for Benefit Computation
Purposes

	Males					
Age	1995	2000	2025	2050	2075	2100
18	0.343	0.376	0.633	0.725	0.761	0.775
20	0.581	0.621	0.809	0.857	0.877	0.885
25	0.783	0.810	0.897	0.919	0.928	0.931
30	0.833	0.856	0.923	0.938	0.944	0.946
35	0.844	0.860	0.933	0.945	0.950	0.951
40	0.847	0.872	0.923	0.933	0.937	0.938
45	0.854	0.858	0.907	0.917	0.920	0.922
50	0.833	0.829	0.882	0.892	0.896	0.897
55	0.757	0.763	0.824	0.837	0.842	0.844
60	0.530	0.495	0.443	0.458	0.463	0.466
65	0.183	0.161	0.130	0.141	0.147	0.149
	Females					
Age	1995	2000	2025	2050	2075	2100
18	0.305	0.346	0.622	0.716	0.751	0.763
20	0.545	0.589	0.795	0.844	0.864	0.871
25	0.724	0.749	0.839	0.864	0.873	0.877
30	0.745	0.761	0.822	0.843	0.850	0.853
35	0.744	0.761	0.843	0.862	0.869	0.871
40	0.761	0.784	0.841	0.857	0.863	0.865
45	0.776	0.775	0.816	0.831	0.836	0.838
50	0.719	0.723	0.785	0.801	0.806	0.808
55	0.595	0.623	0.735	0.755	0.762	0.764
60	0.365	0.365	0.390	0.409	0.416	0.418
65	0.101	0.097	0.104	0.115	0.121	0.124

(e)   Average pensionable earnings
Average pensionable earnings by age, sex and calendar year, unadjusted for the earnings index (i.e., the wage escalation factor), correspond to the average portion of individual employment earnings below the YMPE for a cohort's earners earning more than the YBE. Average pensionable earnings are accordingly computed by removing from average employment earnings the earnings of earners earning less than the YBE and the portion of earnings in excess of the YMPE. Since earnings statistics are aggregate (by age, sex and calendar year) as opposed to individual, such removal is made using the distributions of earners and earnings. The formula below used for the computation of average pensionable earnings (used for the later calculation of contributory earnings, but before the adjustments later required for benefits calculation purposes) applies for each age, sex and calendar year:

$$\text{PENEAR} = \frac{\text{EMPEAR}*(\text{EU} - \text{EL}) + \text{YMPE}*(1 - \text{CU})}{1 - \text{CL}}$$

where:

PENEAR = Average Pensionable Earnings
EMPEAR = Average Employment Earnings
CL = Proportion of earners earning less than the YBE (computed using the distribution of earners)
CU = Proportion of earners earning less than the YMPE (computed using the distribution of earners)
EL = Proportion of employment earnings in the age-sex cell attributable to earners earning less than the YBE (computed using the distribution of earnings)
EU = Proportion of employment earnings in the age-sex cell attributable to earners earning less than the YMPE (computed using the distribution of earnings)

Sample values of unadjusted average pensionable earnings, which are the earnings used for calculating contributory earnings, are shown below. For comparison purposes, the YMPE is also shown, for the selected years, at the end of the table.

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Table VII.B.26   Assumed Average Pensionable Earnings for Contributory
Earnings Purposes

	Males					
Age	1995	2000	2025	2050	2075	2100
18	7,990	8,544	16,850	39,400	98,679	255,579
20	11,678	12,554	28,155	69,745	178,600	466,101
25	20,810	22,534	54,984	141,041	368,036	969,133
30	25,675	27,890	69,046	178,819	468,944	1,237,572
35	27,563	29,970	74,583	193,880	509,342	1,344,707
40	28,435	30,896	77,085	200,973	528,681	1,397,392
45	28,929	31,434	78,510	205,143	540,430	1,429,454
50	28,967	31,517	78,782	205,805	541,856	1,433,504
55	27,563	30,004	74,563	193,366	507,200	1,338,724
60	26,254	28,594	69,888	178,125	463,672	1,218,822
65	21,838	23,607	55,353	132,694	334,226	865,610
	Females					
Age	1995	2000	2025	2050	2075	2100
18	6,709	7,107	14,239	34,482	89,230	236,912
20	9,629	10,249	23,468	60,412	160,096	428,846
25	18,102	19,456	48,749	128,147	341,363	914,385
30	21,340	23,289	58,993	155,622	415,796	1,115,211
35	22,191	24,295	62,336	165,239	442,731	1,188,646
40	23,185	25,302	65,355	174,019	466,811	1,253,298
45	23,812	26,103	67,467	180,119	483,280	1,297,487
50	23,449	25,846	67,223	179,563	482,082	1,294,991
55	21,738	24,005	62,808	167,096	448,705	1,206,177
60	20,603	22,644	58,872	154,332	412,238	1,106,983
65	15,687	17,199	43,444	110,593	289,194	774,526
YMPE:	34,900	38,200	98,300	262,100	698,800	1,863,000

Average pensionable earnings from the above table, used for average contributory earnings computation purposes, were then adjusted for benefit computation purposes to reflect the effect of:

i) **Retirement pensions commencing before age 65**
    Retirement pensions commencing before age 65 have the effect of reducing the amount of contributions that would otherwise have been made to CPP. Such effect is already accounted for in the average pensionable earnings described and shown above. For benefit computation purposes, however, such effect must be removed in respect of contributors having not yet retired at a given age before age 65. This was done by dividing the above average pensionable earnings by the difference between unity and 40% (assuming retirements are taking place mid-year, and taking into account the fact that higher-paid earners will have made more than 50% of their normal contributions by mid-year) of the appropriate retirement election proportion.

ii) **Credit-splitting on spousal union breakdown**
    This provision is designed to affect benefits but not contributions. For benefit purposes, the effect of this provision on average pensionable earnings was accordingly accounted for using appropriate mathematical formulae, on the basis of the assumptions described in section 2(e) above.

    Sample values of average pensionable earnings, adjusted for benefit computation purposes as described above, are shown below. For comparison purposes, the YMPE is also shown, for the selected years, at the end of the table.

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Table VII.B.27   Assumed Average Pensionable Earnings for Benefit
                  Computation Purposes

	Males					
Age	1995	2000	2025	2050	2075	2100
18	7,965	8,475	16,698	39,069	97,922	253,716
20	11,224	12,100	27,497	68,446	175,707	459,163
25	19,643	21,335	52,873	136,369	356,898	941,418
30	23,958	26,135	65,638	170,899	449,484	1,188,355
35	25,611	28,023	71,107	185,820	489,627	1,295,121
40	26,663	29,151	73,761	193,192	509,560	1,349,106
45	27,394	29,824	75,310	197,525	521,477	1,381,242
50	27,472	29,964	75,727	198,453	523,470	1,386,503
55	26,183	28,606	71,856	186,900	491,102	1,297,680
60	28,990	31,964	77,933	198,986	518,605	1,364,407
65	26,763	28,130	64,665	155,016	390,451	1,011,227
	Females					
Age	1995	2000	2025	2050	2075	2100
18	6,655	6,955	14,115	34,241	88,599	235,174
20	9,145	9,747	23,033	59,543	157,795	422,285
25	17,275	18,616	47,433	125,020	332,997	890,990
30	20,387	22,368	57,412	151,895	405,562	1,085,978
35	21,406	23,514	61,429	163,173	436,673	1,170,165
40	22,548	24,699	64,386	171,600	459,732	1,232,318
45	23,285	25,495	66,248	176,916	474,150	1,271,242
50	22,923	25,229	66,024	176,390	473,084	1,269,403
55	21,095	23,366	61,676	164,155	440,444	1,182,846
60	22,948	25,628	66,777	175,153	467,643	1,254,944
65	17,818	19,500	50,753	129,198	337,843	904,820
YMPE:	34,900	38,200	98,300	262,100	698,800	1,863,000

(f)   **Average and total contributory earnings**
Average contributory earnings were computed in respect of any given age-sex-year cell of contributors by subtracting the YBE from the average pensionable earnings computed for contributory earnings purposes (as opposed to benefits computation purposes).

In respect of a given age-sex cell, total contributory earnings for a given year were calculated as the product of:
- the proportion of contributors computed for contributory earnings purposes (as opposed to benefits computation purposes),
- the average contributory earnings computed as above, and
- the population number.

Total contributory earnings for the given year were obtained by summing contributory earnings computed for each age-sex cell. Total annual contributions for each past year (1966 to 1996), obtained as the product of the total contributory earnings computed as above and the actual contribution rate, are very close to those taken from earnings statistics, which validates average contributory earnings used for benefit computation purposes. Indeed, the deviation is -0.3% on average for 1987 to 1996, and 1% for 1972 to 1996. However, computed contributions are 2.52% (1987 to 1996) and 4.28% (1972 to 1996) lower than corresponding actual contributions as taken from monthly information reports. Total future contributory earnings computed as above were accordingly increased by 3.0%, which accounts for the non-refundable portion of employers' contributions corresponding to contributions in excess of the maximum contribution (arising generally in respect of employees with multiple employers during a year) or to contributions made in respect of employees earning less than the YBE during a given year.

Total contributions so projected for 1997 and 1998 (projections are based on the actual data on earnings for 1996) are compared below with actual data (reported in November 1998) for 1997 and with the estimates for 1997 and 1998 made by the Finance Ministry (these Finance estimates are generally done at the end of the previous year and are used for CPP accounting purposes). Considering the relatively small difference between the actual and projected 1997 results, and between the projected for 1998 and the Finance estimate, it was not deemed necessary to adjust the actuarial projections.

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Table VII.B.28   Contributions - 1997 and 1998
(millions of dollars)

	1997	1998
Finance estimate	12,165	14,333
Actual	12,655	n/a
Report #17 Best Estimate	12,672	14,233

(g)   Benefit eligibility rates

    i)   Introduction
As mentioned in appendix A (plan provisions), the eligibility for
CPP benefits varies according to the type of benefit involved.
Although the eligibility rules themselves do not vary as between the
flat-rate and the earnings-related portions of a given type of benefit,
it will be seen below that each portion requires a distinct eligibility
factor for valuation purposes.

    ii)   Usage
Benefit eligibility rates are used in the valuation process for the
computation of historical retirement election proportions and of
benefits of all types except retirement.

    iii)   General approach
Benefit eligibility rates are computed using mathematical formulae
that were developed so as to closely reproduce the outcome of a
distinct earnings micro-simulation ancillary model. The model
takes into account the applicable eligibility rules for each type of
benefit, the assumed proportions of contributors and average
employment earnings for all existing and future cohorts of earners,
and the proportions, determined in accordance with the assumed
50% employment mobility rate, of persons who never contribute
and of persons who contribute randomly.

Observed data on benefit eligibility rates show some unexplained
inconsistencies. It was therefore not possible to use them for either
computing the eligibility rates required for the valuation, or
validating the eligibility rates derived for the valuation process.

iv) **Retirement benefits**
To be eligible for a retirement pension, a person must have made contributions, i.e., have had employment earnings in excess of the YBE, for at least one calendar year over his/her contributory period. In accordance with the assumed 50% employment mobility rate, the micro-simulation ancillary model produces retirement benefit eligibility rates corresponding closely, in most cases, to the value half way between the highest annual proportion of contributors over the contributory period of a cohort and unity. In this report the previous 1/2 factor was refined to take account of the contributory period. Therefore,

$$ELIRET = MAXPRC + f(CONPER.MAXPRC) *(1 - MAXPRC)$$

where ELIRET   =   retirement benefit eligibility rate
MAXPRC   =   highest annual proportion of contributors over the contributory period of a given sex, birth-year cohort
CONPER   =   contributory period
f(CONPER)=   polynomial function which depends on the length of the contributory period and MAXPRC.

v) **Flat-rate benefits**
Given the relative complexity of the eligibility rules in respect of other types of benefits (disability and survivor), more complex mathematical formulae had to be developed reflecting the results from the micro-simulation model.

Mathematical formulae, relying exclusively on the relevant proportions of contributors for all age-sex cohorts involved over the years in the valuation process, were therefore developed for the determination of all past and future eligibility rates separately for disability (ELIDFR) and survivor (ELIWFR) flat-rate benefits.

vi) **Earnings-related benefits**
The average earnings-related benefit factors (see section (h) below), to which disability and survivor benefit eligibility rates described above should normally apply, already implicitly incorporate the value of ELIRET, the retirement benefit eligibility rate. Therefore,

the disability and survivor benefit eligibility rates, ELIDFR and ELIWFR, developed for flat-rate benefit purposes must be divided by the retirement benefit eligibility rate, ELIRET, for purposes of computing the earnings-related portion of these two types of benefit. This operation converts these eligibility rates into gross proportions of earnings eligible for the earnings-related portion of the disability or survivor benefit:

disability gross eligible earnings proportion $=$ ELIDFR/ELIRET

survivor gross eligible earnings proportion $=$ ELIWFR/ELIRET

Moreover, since the eligibility rules for disability and survivor benefits are more stringent than for retirement pensions, contributors eligible for either a disability or survivor benefit have on average a lesser number of years of nil earnings than contributors solely eligible for a retirement benefit. They consequently have higher aggregate earnings than contributors solely eligible for a retirement pension. In accordance with the outcome of the ancillary micro-simulated earnings model, the above ratios were consequently adjusted accordingly as follows:

ELIDER = {ELIDFR/ELIRET}*(2/3) + 1/3

ELIWER = {ELIWFR/ELIRET}*(2/3) + 1/3

where ELIDER and ELIWER are the net proportions of earnings eligible for disability and survivor earnings-related benefits, respectively.

vii) Consistency tests
Extensive testing was conducted thereafter to ensure that the results from the application of all these formulae are consistent. For example,

- disability and survivor benefit eligibility rates ELIDFR and ELIWFR should, for any age-sex-year cell, be lower than the retirement benefit eligibility rates ELIRET given that eligibility for retirement benefits is in all cases less stringent than for disability or survivor benefits; and

- the average retirement pension, converted from a per population basis (i.e., averaged over total population at the given age and sex) to a per beneficiary (i.e., averaged over the number of retirement pension beneficiaries) by dividing it by the retirement benefit eligibility rate ELIRET, should correspond to statistics on the actual average retirement pension.

  Retirement benefit eligibility rates are computed for ages below the minimum retirement age (60) because they are required in the computation of eligibility rates for the earnings-related portion of the disability and the survivor benefits.

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Table VII.B.29   Assumed Benefit Eligibility Rates for Year 2050

	Males				
	Retirement	Disability		Survivor	
Age	Earnings Related ELIRET	Flat-Rate ELIDFR	Earnings Related ELIDER	Flat-Rate ELIWFR	Earnings Related ELIWER
20	0.865	0.412	0.651	0.787	0.940
25	0.940	0.902	0.973	0.931	0.993
30	0.969	0.943	0.982	0.967	0.999
35	0.985	0.954	0.979	0.971	0.991
40	0.990	0.950	0.973	0.970	0.987
45	0.990	0.943	0.968	0.969	0.986
50	0.990	0.929	0.959	0.968	0.985
55	0.990	0.910	0.946	0.966	0.984
60	0.990	0.858	0.911	0.963	0.982
65	0.990	0.710	0.811	0.956	0.977
	Females				
	Retirement	Disability		Survivor	
Age	Earnings Related ELIRET	Flat-Rate ELIDFR	Earnings Related ELIDER	Flat-Rate ELIWFR	Earnings Related ELIWER
20	0.853	0.374	0.625	0.782	0.944
25	0.897	0.885	0.991	0.888	0.993
30	0.919	0.886	0.976	0.910	0.993
35	0.942	0.892	0.965	0.929	0.991
40	0.960	0.902	0.959	0.927	0.977
45	0.975	0.899	0.948	0.925	0.966
50	0.984	0.885	0.933	0.923	0.959
55	0.989	0.849	0.906	0.921	0.954
60	0.989	0.787	0.864	0.918	0.952
65	0.988	0.554	0.707	0.911	0.948

(h)   **Average earnings-related benefit factor**
The average earnings-related benefit factor is designed to produce, when multiplied by the population and the Pension Index of a given calendar year successively for both sexes and all relevant ages, the total annual earnings-related benefit expenditure for that year.

i)   **Gross factor**
In respect of a given cohort of contributors, the gross (i.e., before accounting for the drop-out provisions and the earnings index) average earnings-related benefit factor was determined by sex and calendar year for each (attained) age from 18 to 70, as the product of 0.25 (the retirement pension benefit proportion) and the ratio of:

- the sum, over the elapsed contributory period (i.e., from age 18 to the attained age), of the ratios of:
    ▸ the product of the year's proportion of contributors (adjusted for benefit computation purposes) times the year's average pensionable earnings (adjusted for benefit computation purposes), to
    ▸ the YMPE, to

- the elapsed contributory period at the attained age.

$$BENFAC_{attained\ age} = 0.25 * \frac{\sum_{I=18}^{attained\ age}\left(\frac{PROCON_I * PENEAR_I}{YMPE_{N+I-18}}\right)}{CONPER_{attained\ age}}$$

where

I = age
N = year during which the contributor attains age 18
$BENFAC$ = gross average earnings-related benefit factor
$PROCON$ = proportion of contributors (adjusted for benefit purposes)
$PENEAR$ = average wage-unescalated pensionable earnings (adjusted for benefit purposes)
$CONPER$ = elapsed contributory period

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ii)   Accounting for the drop-out provisions

• Amount of lowest earnings to be dropped-out
The earnings/YMPE ratios that have to be dropped out from
the numerator of the gross average benefit factor described
above, in respect of an individual, are the lowest annual
earnings/YMPE ratios for a number of years equal to half (see
assumption described in section 2(g) above) of the child-
rearing period plus 15% of the residual contributory period.
Since the general valuation approach is based on macro-
simulation (aggregate), there is no explicit way of determining
the lowest earnings/YMPE ratios of each individual that would
have to be dropped out from the denominator above to account
for these two drop-out provisions.

Consequently, on the basis of the outcome of the micro-
simulation model described in section (g) above and of a more
comprehensive micro-simulation model recently developed for
HRDC called DYNACAN, the formula used in the previous
report was refined (especially at the low end) for determining
the multiplying factor DROFAC.

Range of PRCFAC	Multiplying factor DROFAC
0.0 to 0.4	PRCFAC * 0.85
0.4 to 0.8	0.54 - 0.50 * PRCFAC
0.8+	$0.55 + 0.45 * \frac{(PRCFAC-1)}{(MAXFAC-1)}$

where:

PRCFAC = Average contributing proportion factor=DROPRO/(1-AVRPRC)

DROPRO= Drop-out proportion (i.e., 15% + child rearing period percentage)

AVRPRC = Average proportion of contributors over the elapsed contributory
period

MAXFAC = Maximum average contributing proportion factor = 1/(1-
AVRPRC)

It can thus be seen that the multiplying factor DROFAC varies
according to the total drop-out percentage (15% plus the child-
rearing period as a percentage of the elapsed contributory
period) and the average proportion of contributors over the
elapsed contributory period.

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The multiplying factor DROFAC is designed so that when multiplied by the sum, for a number of years equal to the total drop-out period, of the products of the successive lowest proportions of contributors and the lowest successive average earnings, it gives the amount of earnings deemed to be dropped from the numerator above in connection with the drop-out provisions.

• Period to be dropped-out
The average period that has to be dropped from the contributory period (i.e., the denominator of the gross average benefit factor described above), is computed as the sum of the three periods determined as follows in respect of the disability, the child-rearing and the 15% drop-out provisions.

The disability period was determined, by age, sex and calendar year, using the assumed disability incidence and termination rates, the disability benefit eligibility rates and the appropriate actuarial formula (i.e., for a given attained age, the sum of the products, in respect of each age from 18 to the one preceding the attained age, of the disability incidence rate by the elapsed duration of disability, such duration being computed relying on disability termination rates).

In accordance with:
▸ the prescribed limit of 7 years per child,
▸ the assumed age difference of 2 years between any two consecutive children,
▸ and the assumed effect of 50% in connection with employment earnings during the child rearing period not all being lowest earnings,

the child-rearing drop-out period was determined, for females, as 50% of:

{7*(NUMCHI)},   if NUMCHI < 1,

and
{7*(1)} + {2*(NUMCHI-1)},   if NUMCHI $1

where NUMCHI, not necessarily an integer, is the average number of children (born so far to a female contributor)

computed using the Canada and Québec fertility rates adjusted, to correspond to Canada less Québec, by taking as weights the relevant populations. In accordance with the assumption described in section 2(g) above, the child-rearing period was uniformly set equal to zero in respect of male contributors.

The drop-out period in respect of the 15% provision was determined as 15% of the difference between the elapsed contributory period and the disability and child-rearing periods computed as above at the contributor's attained age.

iii) Accounting for the earnings index (wage escalation)
The average earnings-related benefit factor, was finally determined by multiplying the gross factor (see item i) above), adjusted for the drop-out provisions (see item ii) above), by the earnings index which accounts for the wage escalation provision underlying the calculation of the initial rate of a benefit when it emerges.

(i)   Annual expenditures

i)   Retirement pensions
In accordance with the eligibility rules, CPP retirement pensions became payable for the first time in 1967.

Hence, for each cohort of contributors reaching a given retirement age from 60 to 70 in each of the calendar years from 1967 to 2100, an average retirement benefit factor was computed, by age, sex and calendar year of emergence of the pension, as the product of:

•   the assumed proportion of contributors electing to retire,
•   the actuarial adjustment factor in connection with the flexible retirement age provision, and
•   the average earnings-related benefit factor.

These benefit factors correspond to the annualized rate of retirement pension, averaged for the population (as opposed to contributors), payable during the year of emergence of the pension.

It was assumed that retirements occur mid-year on average. Therefore, the retirement pension expenditure for the year of

emergence was taken as 50% of the annualized rate of pension multiplied by the population for the appropriate age (60 to 70), sex and calendar year.

The retirement pension expenditure for each year following the year of retirement of a given age-sex-year population cohort, until the year during which the cohort attains age 109, was computed as the product of:

• the relevant annualized average rate of retirement pension payable during the year of emergence (described above);

• the population of retirement beneficiaries at emergence;

• the probability of survival from the emergence age to the appropriate attained age. This probability is defined as the product of the complement of the mortality rates from year and age at emergence to the attained year and age. The underlying mortality rates vary by calendar year, sex, age and four levels of emerging pension (0-25%, 25%-50%, 50-75% and 75%-100% of the Maximum Retirement Pension at emergence). These mortality rates were developed by looking at the CPP retirement beneficiaries' mortality experience from 1967 to 1997. Ratios of the average 1991 CPP mortality experience by age, sex and level of pension to the 1991 base population mortality for Canada less Québec were developed. These resulting ratios were then graduated and used to adjust projected population mortality rates to obtain specific CPP retirement beneficiaries' mortality rates for each year in the projection; and

• the Pension Index (which accounts for the CPI escalation of a pension each year after its emergence).

The retirement pension expenditure for the beneficiary's year of death is assumed to be 50% of the annualized pension. This is implicitly accounted for in the approach described above, since the population is computed as at mid-year.

The amounts of all retirement pensions payable during any given past or future calendar year were obtained by simply summing the

annual expenditure, applying for the given calendar year as described above, in respect of all age-sex cohorts having emerged in the given and each of the previous calendar years.

As part of the methodology validation process, the amounts of total annual emerging retirement pensions computed as above were compared to their CPP historical data counterparts for 1967 through 1997. The comparisons revealed that the actual retirement benefits tend to be about 100% for males and 97% for females of the corresponding projected benefits over the last 10 years, 1988 to 1997, and 98% and 96% over the last 31 years, 1967 to 1997. For this purpose, experience adjustment factors of 1.00 and 0.97 for males and females, respectively, were applied to all future emerging retirement pensions calculated using the methodology described above.

However, in order to account for the exact distribution by age and sex of retirement pensions already in pay at the end of 1997, computed retirement pensions deemed to be payable during 1997 were replaced, by age and sex, by benefits actually paid during that year (see, in section 1(f) above, benefits statistics adjusted to match results shown in monthly information reports), and projected until death of the last survivor using the methodology described above for the survival of the computed emerging retirement pensions.

ii) Disability pensions
In accordance with the eligibility rules, CPP disability pensions became payable for the first time in 1970. Hence, the general approach used to estimate disability pensions was to:

- Compute the initial value of flat-rate benefits emerging by age and sex each year after 1969 as the product of:
  ▸ the actual or assumed disability incidence rate;
  ▸ the probability (ELIDFR) of being eligible for disability benefits;
  ▸ the annual amount of the disability flat-rate benefit (projected using the PI); and
  ▸ the population.

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- Compute the initial value of earnings-related benefits emerging by age and sex each year after 1969 as the product of:
  - ▸ the actual or assumed disability incidence rates;
  - ▸ the proportion (ELIDER) of earnings eligible for disability benefits;
  - ▸ 0.1875, corresponding to the applicable earnings-related disability benefit proportion, i.e., 75% of the retirement pension proportion of 25%;
  - ▸ the average earnings-related benefit factor (see section (h) above); and
  - ▸ the population.

- Project by age and sex initial flat-rate and earnings-related benefits to each future year until termination (due to recovery, death, or attaining age 65) using year after year actuarial formulae incorporating the disability termination rates for the appropriate duration and the Pension Index.

Total disability benefits for any particular year are equal to 100% of the sum of the annualized disability pensions projected to that year in respect of all age-sex cohorts having emerged so far. However, assuming that emergences and terminations occur on average at mid-year, 50% was used instead of 100% in respect of cases having either emerged or terminated during the given year.

Through the methodology validation process, emerging disability benefits and disability benefits in pay computed as above by age, sex and type of benefit (flat-rate, earnings-related) for each past applicable year (1970 to 1997) were compared with actual data. The outcome of this process shows actual over expected experience ratios generally close to 99% and 97% for males and females, respectively. The following experience adjustment factors were accordingly applied in projecting future disability benefits using the above methodology.

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Table VII.B.30   Disability Benefits Experience Adjustment Factors

Sex	Flat-Rate	Earnings-Related
Male	0.986	0.992
Female	0.974	0.967

However, in order to account for the exact distribution of disability benefits already in pay at the end of 1997 by age, sex and year of emergence, computed disability benefits deemed to be payable during 1997 were replaced, separately by age, sex and year of emergence, by benefits actually paid during that year (see, in section 1(f) above, benefits statistics adjusted to match results shown in monthly information reports) and projected until termination (due to recovery, death, or attaining age 65) using the disability termination rates and the Pension Index.

iii) Survivor pensions
In accordance with the eligibility rules, CPP survivor pensions became payable for the first time in 1968. Hence, for each year after 1967, the numbers of male and female deaths, taken from demographic projections for each individual age 18 and over, were multiplied by proportions of contributors married at death to produce the numbers of spousal deaths emerging by age, sex and calendar year.

For purposes of the flat-rate portion of survivor pensions, the numbers of spousal deaths, by sex and by calendar year, were categorized by age of the surviving spouses using the age distributions described in section 2(l) above, and each resulting number was multiplied by:

• the annual flat-rate benefit amount (projected using the PI);

• the probability (ELIWFR), for the deceased spouse, of being eligible for survivor benefit;

• the appropriate factor accounting for the reductions of survivor pensions in respect of survivors emerging under age 45 without dependent children and not disabled; and

- the appropriate factor accounting for the limit applying to combined survivor-disability pensions. This factor is equal to the difference between unity and the disability prevalence rate.

For purposes of the earnings-related portion of the survivor pensions, the numbers of spousal deaths, by sex and calendar year, were categorized by age of the surviving spouses using the age distributions described in section 2(l) above, and each resulting number was multiplied by:

- the average earnings-related benefit factor for the deceased spouse (see section (h) above);

- the proportion ELIWER of the deceased spouse's earnings eligible for a survivor benefit;

- the appropriate factor accounting for the reductions of survivor pensions in respect of survivors emerging under age 45 without dependent children and not disabled; and

- the appropriate factor accounting for the limit applying to combined survivor-retirement and survivor-disability pensions. This factor was computed using the maximum retirement pension, the assumed distribution of average retirement pensions, and the retirement and disability prevalence rates.

The annual initial amount of all survivor pensions emerging by year as well as by age and sex of the surviving spouse, computed as described above, was then projected to each subsequent year:

- surviving beneficiaries by applying actuarial formulae incorporating actual or assumed mortality rates (see section I-2(b) above) which were adjusted to correspond to Canada less Québec by taking as weights the population for the appropriate age, sex, year and geographic component (i.e., Canada or Québec), and further adjusted, using results of an actuarial study of the mortality of CPP survivors, to reflect the higher mortality of widows and widowers as compared to that of the general population;

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- making allowance for the Pension Index (CPI) escalation; and

- multiplying by 0.375 for ages under 65, and by 0.60 for ages 65 and over of the surviving spouse, to account for the applicable survivor earnings-related benefit proportion.

Total survivor benefits for any particular year are equal to 100% of the sum of the annualized survivor pensions projected to that year in respect of all age-sex cohorts of survivors having emerged so far. However, assuming that emergences and terminations occur mid-year on average, 50% is used instead of 100% in respect of cases having either emerged or terminated during the given year.

Through the methodology validation process, emerging survivor benefits and survivor benefits in pay computed as above by age, sex and type of benefit (flat-rate, earnings-related) for each past year (1968 to 1997) were compared with actual data. Irrespective of the further methodology improvements made since the completion of the fifteenth report, the outcome of this process still shows significant differences between actual and expected values for widowers. The relatively low level of past actual widowers benefits as compared to those computed could be due to a significant proportion of widowers' benefits not being applied for in the case of death of eligible female contributors, or to an overestimate of the proportion ELIWFR of females giving entitlement at death to a widower's benefit, or to a combination of both. In any event, due to these significant differences, it was decided to adjust estimates of all future survivor benefits, determined using the above methodology, by applying the following experience factors varying by sex and by type of benefit:

Table VII.B.31   Survivor Benefits Experience Adjustment Factors

	Flat-Rate	Earnings-Related
Widows	0.854	0.890
Widowers	0.671	0.650

Moreover, in order to account for the exact distribution of survivor benefits already in pay at the end of 1997 by age, sex and year of emergence, computed benefits deemed to be payable during 1997 were replaced by benefits actually paid during that year and

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projected until death of the last survivor using the methodology described above for the survival of the computed emerging survivor pensions.

iv)   Death Benefits
In accordance with the eligibility rules, CPP death benefits became payable for the first time in 1968. Hence, the amount of lump sum death benefits payable each year after 1967 was determined by age and sex as the product of:

- the number of deaths, derived by sex for each individual age 18 and over consistent with the population data and projections;

- 50% of the average earnings-related benefit factor (the lump sum death benefit is equivalent to six months of a retirement pension) reduced, using the maximum retirement pension and the assumed distribution of average retirement pensions, to allow for the provision limiting the death benefit to 10% of the YMPE for the year of death prior to 1997 and to $2,500 according to Bill C-2 for years after 1997; and
- the proportion (ELIWER) of the deceased contributor's earnings eligible for survivor benefits (the eligibility for death benefits is the same as for survivor benefits).

Through the methodology validation process, death benefits so computed for males and females were multiplied by experience adjustment factors of 0.92 and 0.73, respectively, to account for the difference between actual results of recent years and those computed as above. The relatively low level of past actual female death benefits as compared to those computed could be due to a significant proportion of CPP death benefits not being applied for in the case of death of eligible female contributors, or to an overestimate of the proportion ELIWFR of females eligible for the death benefit, or to a combination of both. These significant differences will be the subject of further research.

v)   Children's benefits
In accordance with the eligibility rules, Disabled Contributor's Child's (DCC) and orphan benefits became payable for the first time in 1970 and 1968, respectively. Hence, the numbers of DCC

and orphan benefits emerging each year after 1969 and 1967, respectively, were determined, as described below, so as to correspond to the number of children born, up to the date of emergence, to the previously computed number, emerging during the given year, of beneficiaries of disability and/or survivor pensions.

For this purpose, the numbers of emerging disabled contributors and deaths were first split by age, sex and calendar year. Canada fertility rates, adjusted to correspond to Canada less Québec, by taking as weights the population for the appropriate age, sex, year and geographic component (i.e., Canada or Québec), were then applied appropriately to these numbers, i.e., to

- the female disabled contributors and the spouses of male disabled contributors, and to

- the female deaths and the spouses of deceased males, for the appropriate age of the female. For this purpose, the age of spouses of male disabled contributors were distributed in accordance with the assumed distribution of spouses by age. As for the demographic projections (see section I above), the constant proportion of male births was assumed to be 1.056 of female births.

The resulting emerging numbers of children by age, sex and calendar year were thereafter survived, from one year to the next, incorporating the following reasons for termination of benefits:

- attainment of age 25 by the child. For this purpose, use was made of mortality rates determined by age as the yearly ratios of the number of deaths to the population, both taken from demographic projections (see section I above);

- stopping full attendance at school while over age 18; and

- regarding DCC benefits only, termination (recovery, death or attainment of age 65) of the parent's disability benefits.

Total children's benefits were then obtained for any given calendar year as the product of:

- the sum of all child beneficiaries having emerged so far, and having survived until that date; and

- the applicable annualized amount of the child flat-rate benefit obtained by adjusting the actual 1998 rate in accordance with the Pension Index. However, assuming that emergences and terminations occur mid-year on average, 50% instead of 100% of the annualized amount was used in respect of cases emerging or terminating during the year.

The actual DCC and orphan benefits paid each year from 1966 to 1997 were compared by age with the corresponding benefits computed by age for each of these years using the above approach. They correspond over the last 10 years of experience to about 88% and 93% of benefits computed as above for DCC and orphan benefits, respectively. Accordingly, DCC and orphan benefits projected for all years after 1997 were reduced 12% and 7%, respectively. The difference between actual orphan benefits as compared to those computed could be due to a proportion of CPP death benefits not being applied for in the case of death of eligible female contributors, or to an overestimate of the proportion ELIWFR of females eligible for the death benefit, or to a combination of both. These significant differences will continue to be the subject of further research.

vi) Administrative expenses
On the basis of past average experience, CPP annual administrative expenses have averaged about 0.1% of total annual contributory earnings from 1966 to 1997. For the projection period 0.1% and an additional 0.025% of contributory earnings was assumed for the extra investment expenses that will be generated by the new CPP Investment Board. This extra 0.025% of contributory earnings corresponds approximately to a reduction of about 0.1% in the gross rate of return, which is assumed for actuarial projections of QPP investment expenses. The QPP fund has historically been invested in a variety of asset classes.

III.   Pay-As-You-Go Rates, Contribution Rates and Assets

1.   Data (year-end amounts)

Assets of the CPP have been included at their book values, since they currently consist of short-term securities and non-marketable loans to the provinces.

(a)   Historical (1966 to 1997)

    i)   taken from HRDC Monthly Information Reports:
- the Account
- the Operating Balance
- the amount of investment earnings from the Operating Balance
- total expenditures

    ii)   taken from CPP Investment Fund Reports prepared by the Department of Finance:
- the Fund (i.e., historically, loans made to provinces each month)
- the average nominal annual interest rate, compounded semi-annually, applying to loans made during the year

    iii)   taken from the Canada Pension Plan:
- the annual contribution rates

    iv)   taken from section II-3(f) above:
- contributory earnings

(b)   Projection period (1998 to 2100)

- the annual contribution rates from the Canada Pension Plan
- the projected contributory earnings (from section II-3(f) above)
- the projected total expenditures (from section II-3(i) above)

Appendix B - III. Pay-As-You-Go Rates, Contribution Rates and Assets

2. Assumptions

(a) Real rate of return applying to the CPP Fund
The CPP Fund at the end of 1997 was composed of 20-year bonds consisting of loans made to provinces. The provinces will be allowed to roll over the existing bonds at maturity one last time after 1997, at the new money rate. However, additional net cash flows will be invested in a diversified portfolio.

In accordance with the new policy of investing the Fund in a diversified portfolio, the ultimate implicit real rate of return assumed on future net cash flows is about 3.85%. This rate is a weighted average of the real rate of interest of 1.5% assumed on the Operating Balance and of the real rate of return of 4% on new money invested in the Fund, which replaces the real rate of 2.5% assumed on the Fund in previous actuarial reports.

The assumed ultimate new money annual effective rate of return is 7% for 2003 and later. This reflects the assumed real annual rate of 4% and the ultimate assumed increases in the CPI of 3%.

Table VII.B.32   Assumed Annual Effective Rates of Return for New Fund Investments (percentages)

1998	1999	2000	2001	2002	2003+
5.0	5.4	5.8	6.2	6.6	7.0

Note that all of the real rates of return referred to in this report are actually real-return differentials, i.e., the difference between the effective annual rate of return on investments and the rate of increase in prices. This differs from the technical definition of the real rate of return, which, in the case of the ultimate Fund assumption, would be $(1.07 \div 1.03) - 1 = 3.883\%$ rather than 4%.

The long term real rate of return of 4% on the Fund was assumed taking into account the following factors:

- from 1966 to 1995, the average real yield on the Québec Pension Plan (QPP) account, which has always been invested in a diversified portfolio, was close to 4%;

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- as reported in the Canadian Institute of Actuaries' (CIA) Report on Canadian Economic Statistics 1924-1997, the average real yield over the period of 25 years ending in 1997 on the funds of a sample of the largest private pension plans in Canada was close to 5%;

- using historical results published by the CIA, the real average yields over the 50-year (39 to 46 year in the case of mortgages) periods ending in the 1990s would have ranged from just under 4% to almost 5% in respect of a hypothetical portfolio invested equally in each of the following five areas: conventional mortgages, long-term federal bonds, Government of Canada 91-day Treasury Bills, Canadian equities and U.S. equities; and

- the market rate of return on Government of Canada real-return bonds is currently slightly above 4%.

The assumed real rate of 4% retained for the Fund is therefore deemed realistic but erring on the safe side, especially considering that:

- replacing federal bonds by provincial bonds in this model portfolio would increase the average yield to the extent that provincial bonds carry a higher return than federal bonds; and

- the 3-month Treasury Bills, which bear lower returns, would normally be invested for the Operating Balance rather than the Fund.

From a larger perspective, assuming an ultimate real yield of 4% on the CPP Fund means that the CPP Investment Board would be expected to achieve investment returns comparable to those of the QPP and of large private pension plans.

In any event, it must be recognized that although rates of interest may have a significant effect on the ratio of the assets to expenditures, they do not have a significant effect on contribution rates unless a relatively high degree of funding is contemplated. They now have a slightly higher impact than in the past, due to the higher level of funding contemplated under Bill C-2. Also, the assumed rate of return is highly significant in calculating both the contribution rate on an actuarially funded basis and the related unfunded actuarial liability (see Appendix D).

Appendix B - III. Pay-As-You-Go Rates, Contribution Rates and Assets

(b)   Real interest rate applying to the CPP Operating Balance
Since the Operating Balance is generally invested in very short-term
securities, it is assumed to be totally reinvested yearly and to earn a real
interest rate of 1.5%. The average real rate of return on Treasury Bills
over the last 50 years was 1.92%, according to the Report on Canadian
Economic Statistics 1924-1997 published by the CIA. By using a lower
assumed interest rate for the Operating Balance, the assumed ultimate
combined (i.e., Fund and Operating Balance) real yield on the assets of
the CPP is accordingly less than 4%. For example, this combined
ultimate real yield would be about 3.8% if one assumed that the year-end
assets are exactly equal to four times the expenditures of the ensuing year
and the year-end Operating Balance is exactly equal to 1/4 of the
expenditures.

(c)   Timing of Fund investments made during the calendar year
Of all new Fund investments during any calendar year, 60% are assumed
to be made during the first half of the year. This percentage reflects the
timing of contributions received during the year; indeed, earners with
earnings above the YMPE would normally complete the full payment of
their contributions once they have earned the YMPE during the year. This
60% assumption corresponds to the underlying actual average experience
for 1966 to 1997. It is used, for a given calendar year, in connection with
the new loans arising out of the first semi-annual coupon payable from the
new loans made in the first six months of that calendar year.

3.   Methodology

(a)   Pay-as-you-go rates
The pay-as-you go rate for a given year corresponds to the ratio of the
year's total expenditures to the year's total contributory earnings.

(b)   Contribution rate
The steady-state contribution rate was computed in accordance with
subsection 113.1 of the Canada Pension Plan. The financing objective is
to have a contribution rate that is no lower than the rate that, beginning
with the year 2003, is the lowest constant rate that can be maintained over
the foreseeable future, and that results in the ratio of the projected assets
of the Canada Pension Plan at the end of any given year over the projected
annual expenditures of the Canada Pension Plan in the following year
(assets-to-expenditures ratio) being generally constant.

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For purposes of this report, the steady-state contribution rate was determined as the lowest rate which would make the assets-to-expenditures ratio in year 2060 equal to that in year 2010, in accordance with a regulation recently approved by the federal Cabinet and awaiting approval by the provinces (for the Sixteenth Actuarial Report, the assets-to-expenditures ratios in years 2030 and 2100 were compared). The resulting contribution rate is then rounded to the nearest 0.1%.

(c)   Contributions
The amount of total annual contributions corresponds, for a given year, to the product of the year's contribution rate and the year's total contributory earnings.

(d)   Assets
As for the projection of contributory earnings and expenditures, asset projections are made using 1966 as the starting point, rather than using the beginning (1998) of the valuation period. This is done for the following three objectives:

- The reproduction, for methodology validation purposes, of the past values of the total assets, the Fund and the Operating Balance.

- The availability of a reliable set of 1997 values for the proper projection of the assets to 1998 and subsequent years. The projection of the assets is accordingly started accurately by using actual information on their components, e.g., the amount, the yield and the 20-year renewal date of each loan made each year from 1966 to 1997.

- This approach facilitates the integration of the existing assets with those emerging after the valuation date, thus ensuring full consistency of the valuation process as it applies to past and future values.

The projected pattern of cash flows from investments is assumed to be consistent with continued investment in 20-year bonds. This assumption may be revised for future actuarial reports, once the CPP Investment Board has developed its investment policy.

Appendix B - III. Pay-As-You-Go Rates, Contribution Rates and Assets

i)   Annual increase in the assets
The assets at the end of a given year are obtained by adding to the previous year-end assets the year's increase in the assets. The annual increase in the assets is computed as the sum of the respective annual increases in the Operating Balance and the Fund.

These two main components of the annual increase were computed as follows:

ii) Annual increase in the Operating Balance
The Operating Balance at the end of a given year, deemed to correspond to the expenditures of the first three months of the ensuing year, is first computed as follows:

YEAR-END OPERATING BALANCE=
3/32 of year's expenditure + 5/32 of ensuing year's expenditure

The annual increase in the Operating Balance (DELOPE) for a given year is then easily obtained by taking the difference between the year-end Operating Balance and the corresponding amount for the previous year.

The increase in the Operating Balance (DELOPE) may be split into two components: the investment earnings on the Operating Balance (INVOPE) and the residual amount (DELOPE-INVOPE), positive or negative, corresponding to an amount otherwise available for Fund investments. To compute this residual amount, required for the computation of the yearly Fund increase described below, DELOPE is obtained as described above and INVOPE is obtained using the following approximation formula for the internal rate of return on the Operating Balance:

$$INTOPE_N = 2*INVOPE_N / \{OPEBAL_{N-1} + OPEBAL_N - INVOPE_N\}$$

where INTOPE corresponds to the actual or assumed annual rate of return on the Operating Balance as described in section 2(b) above, and $OPEBAL_{N-1}$ and $OPEBAL_N$ correspond to the Operating Balance at the end of years N-1 and N, respectively.

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iii) Annual increase in the Fund
The annual increase in the Fund (DELFUN) is computed by relying on the following relationship:

DELFUN= {CASHF-(DELOPE-INVOPE)+CUMINVDELFUN}*{1+0.5*0.6*INTFUN}

where   CASHF =   the year's cash flow (i.e., contributions minus expenditures)

DELOPE-INVOPE =   the year's residual amount described above

CUMINVDELFUN =   the year's investment earnings from all investments made in previous years (in other words from all previous annual Fund increases). In respect of each such previous year, the component of CUMINVDELFUN is equal to that year's Fund increase (DELFUN) times that year's actual or assumed interest rate (INTFUN) on new investments made during the year. These calculations were made taking into account the renewal new money interest rate applying (actual or assumed) every 20 years after a loan is originally made. If the amount to be invested in any year (DELFUN) should turn out to be negative, investment maturities (additional to normal 20-year renewals) are assumed for that year, sufficient to provide a positive investment, and to release sufficient cash in that year to meet all expected expenditures. These additional maturities are assumed to be implemented on a first-in, first-out basis.

1 + 0.5*0.6*INTFUN   =   the factor which increases the yearly gross amounts available for loans, i.e.,
CASHF - DELOPE + INVOPE + CUMINVDELFUN, due to the first semi-annual interest coupon earned on loans made during the first six months of the given year (INTFUN and 0.6 are assumptions described in sections 2(a) and 2(c) above).

Once the assets have been so computed in respect of any year prior to the projection period (1966 to 1997), they are recomputed by adjusting the 0.6 factor (in connection with the timing of investments) so that the computed amount is equal to its actual known value. Each of the annual adjusted timing-of-investment factors is very close to the actual ones for 1966 to 1997, indicating that the methodology used for asset projections is acceptable. For methodology validation purposes, the annual increase in the Fund (loans to provinces), computed as described above, was compared with actual data; ratios of actual to expected increases obtained in this manner are very close to 1 for most years. The deviation is about 1.1%, on average, for 1966 to 1997.

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Table VII.C.1 Historical Results

Year	Paygo Rate %	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change in Operating Balance	Operating Balance at 31 Dec.	Change in Fund	Fund at 31 Dec.	Securities Redeemed	Securities Purchased	Change in Assets	Assets at 31 Dec.	Assets / Expenditures Ratio
1966	0.05	3.60	14,744	531	8	523	5	61	61	463	463	0	463	525	525	52.47
1967	0.06	3.60	17,316	623	10	614	37	-19	42	670	1,134	0	672	651	1,175	48.98
1968	0.13	3.60	19,056	686	24	662	79	26	68	715	1,848	0	711	741	1,916	35.49
1969	0.26	3.60	20,485	737	54	683	128	-2	66	813	2,661	0	809	811	2,727	28.12
1970	0.45	3.60	21,475	773	97	676	193	7	73	863	3,524	0	868	869	3,596	24.14
1971	0.66	3.60	22,663	816	149	666	260	5	78	921	4,445	0	922	927	4,523	21.33
1972	0.88	3.60	24,148	869	212	657	333	21	98	970	5,415	0	961	990	5,513	19.83
1973	1.07	3.60	26,072	939	278	661	406	19	118	1,046	6,461	0	1,046	1,065	6,578	16.78
1974	1.17	3.60	33,429	1,203	392	812	497	65	182	1,244	7,704	0	1,240	1,308	7,887	14.06
1975	1.42	3.60	39,617	1,426	561	865	608	86	269	1,386	9,091	0	1,400	1,472	9,359	11.47
1976	1.80	3.60	45,288	1,630	816	815	746	19	288	1,542	10,632	0	1,519	1,561	10,920	10.48
1977	2.05	3.60	50,782	1,828	1,042	786	889	42	330	1,633	12,265	0	1,656	1,675	12,596	9.72
1978	2.31	3.60	56,176	2,022	1,296	727	1,043	97	427	1,673	13,938	0	1,675	1,770	14,365	9.03
1979	2.47	3.60	64,374	2,317	1,590	727	1,235	47	474	1,915	15,854	0	1,914	1,962	16,328	8.31
1980	2.72	3.60	72,325	2,604	1,965	638	1,467	182	656	1,923	17,777	0	1,923	2,105	18,433	7.64
1981	2.89	3.60	83,566	3,008	2,413	595	1,785	168	824	2,211	19,988	0	2,211	2,379	20,812	7.03
1982	2.91	3.60	101,810	3,665	2,958	707	2,160	142	966	2,725	22,713	0	2,725	2,867	23,679	6.58
1983	3.73	3.60	96,507	3,474	3,598	-124	2,494	90	1,056	2,280	24,992	0	2,280	2,369	26,049	6.22
1984	3.66	3.60	114,386	4,118	4,185	-67	2,829	264	1,320	2,499	27,491	0	2,499	2,763	28,811	5.97
1985	4.31	3.60	111,993	4,032	4,826	-795	3,114	206	1,526	2,113	29,605	0	2,112	2,319	31,130	5.66
1986	4.20	3.60	131,131	4,721	5,503	-782	3,395	134	1,659	2,479	32,084	379	2,859	2,613	33,743	4.73
1987	5.02	3.80	141,927	5,393	7,130	-1,736	3,653	209	1,868	1,708	33,792	646	2,354	1,917	35,660	4.31
1988	5.41	4.00	152,832	6,113	8,272	-2,159	3,885	225	2,093	1,502	35,294	733	2,235	1,727	37,387	3.98
1989	5.89	4.20	159,373	6,694	9,391	-2,698	4,162	331	2,424	1,134	36,428	865	1,999	1,465	38,852	3.72
1990	5.82	4.40	179,290	7,889	10,438	-2,549	4,387	329	2,753	1,508	37,936	779	2,288	1,838	40,689	3.53
1991	6.31	4.60	182,518	8,396	11,518	-3,122	4,476	180	2,933	1,174	39,110	911	2,084	1,353	42,043	3.22
1992	7.07	4.80	185,062	8,883	13,076	-4,193	4,498	-190	2,743	494	39,605	997	1,483	305	42,347	2.97
1993	7.79	5.00	183,329	9,166	14,273	-5,106	4,479	119	2,862	-746	38,858	1,755	1,017	-627	41,720	2.72
1994	8.33	5.20	184,324	9,585	15,362	-5,778	4,404	156	3,018	-1,529	37,329	1,723	193	-1,374	40,346	2.52
1995	7.91	5.40	202,061	10,911	15,986	-5,075	4,411	197	3,215	-861	36,468	2,235	1,379	-664	39,683	2.37
1996	8.71	5.60	192,084	10,757	16,723	-5,966	4,178	35	3,250	-1,824	34,644	2,994	1,207	-1,788	37,894	2.16
1997	8.67	6.00	202,756	12,165	17,570	-5,405	3,971	315	3,566	-1,749	32,894	2,799	1,008	-1,434	36,460	2.00

Table VII.C.2   Projected Financial Results - Annually - 1998 to 2100

Year	Paygo Rate %	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets at 31 Dec.	Yield %	Assets / Expenditures Ratio
1998	8.21	6.40	222,386	14,233	18,252	-4,019	3,850	-169	36,291	10.51	1.91
1999	8.19	7.00	231,677	16,217	18,967	-2,750	3,795	1,045	37,336	10.39	1.89
2000	8.16	7.80	242,196	18,891	19,770	-879	3,763	2,884	40,220	10.03	1.94
2001	8.13	8.60	254,455	21,883	20,684	1,199	3,822	5,021	45,241	9.34	2.08
2002	8.09	9.40	268,567	25,245	21,738	3,507	3,997	7,504	52,745	8.44	2.30
2003	8.06	9.90	284,703	28,186	22,956	5,230	4,313	9,543	62,288	7.72	2.56
2004	8.05	9.90	302,690	29,966	24,365	5,601	4,872	10,473	72,760	7.42	2.81
2005	8.05	9.90	321,666	31,845	25,904	5,941	5,440	11,381	84,142	7.13	3.05
2006	8.07	9.90	341,621	33,820	27,560	6,260	6,131	12,392	96,534	6.98	3.29
2007	8.10	9.90	362,505	35,888	29,364	6,524	6,905	13,429	109,963	6.88	3.51
2008	8.15	9.90	384,160	38,032	31,328	6,704	7,770	14,474	124,437	6.82	3.72
2009	8.21	9.90	407,388	40,331	33,437	6,894	8,703	15,598	140,035	6.77	3.92
2010	8.27	9.90	431,278	42,697	35,682	7,015	9,724	16,738	156,773	6.74	4.12
2011	8.39	9.90	453,439	44,890	38,062	6,828	10,784	17,613	174,386	6.70	4.29
2012	8.51	9.90	476,918	47,215	40,603	6,612	11,932	18,544	192,930	6.69	4.45
2013	8.65	9.90	501,275	49,626	43,337	6,289	13,170	19,459	212,389	6.70	4.59
2014	8.79	9.90	525,894	52,064	46,244	5,820	14,512	20,332	232,721	6.72	4.72
2015	8.94	9.90	551,896	54,638	49,326	5,312	15,906	21,218	253,938	6.74	4.83
2016	9.09	9.90	578,372	57,259	52,592	4,667	17,355	22,022	275,961	6.76	4.92
2017	9.25	9.90	606,195	60,013	56,053	3,960	18,861	22,821	298,782	6.78	5.00
2018	9.41	9.90	634,884	62,854	59,726	3,128	20,419	23,547	322,329	6.79	5.07
2019	9.57	9.90	664,512	65,787	63,621	2,166	22,037	24,203	346,532	6.81	5.11
2020	9.75	9.90	695,029	68,808	67,751	1,057	23,721	24,778	371,310	6.83	5.15
2021	9.93	9.90	726,538	71,927	72,119	-192	25,464	25,273	396,582	6.85	5.17
2022	10.10	9.90	759,648	75,205	76,710	-1,505	27,260	25,756	422,338	6.87	5.18
2023	10.27	9.90	793,840	78,590	81,534	-2,944	29,073	26,129	448,467	6.88	5.18
2024	10.44	9.90	829,314	82,102	86,582	-4,480	30,871	26,391	474,858	6.88	5.17
2025	10.59	9.90	866,768	85,810	91,825	-6,015	32,686	26,671	501,528	6.88	5.16
2026	10.73	9.90	906,004	89,694	97,233	-7,539	34,519	26,980	528,508	6.88	5.14
2027	10.85	9.90	947,597	93,812	102,771	-8,959	36,372	27,413	555,922	6.88	5.13
2028	10.94	9.90	991,448	98,153	108,447	-10,294	38,256	27,962	583,884	6.88	5.11
2029	11.02	9.90	1,037,117	102,675	114,300	-11,625	40,176	28,551	612,435	6.88	5.09
2030	11.09	9.90	1,085,137	107,429	120,341	-12,912	42,137	29,225	641,659	6.88	5.07
2031	11.14	9.90	1,135,710	112,435	126,563	-14,128	44,144	30,016	671,675	6.88	5.05
2032	11.18	9.90	1,189,146	117,725	132,922	-15,197	46,205	31,008	702,683	6.88	5.04
2033	11.20	9.90	1,244,895	123,245	139,430	-16,185	48,334	32,149	734,832	6.88	5.03
2034	11.21	9.90	1,304,012	129,097	146,138	-17,041	50,543	33,502	768,334	6.88	5.02
2035	11.21	9.90	1,365,842	135,218	153,096	-17,878	52,845	34,967	803,301	6.88	5.01
2036	11.21	9.90	1,430,601	141,630	160,331	-18,702	55,248	36,546	839,847	6.88	5.01
2037	11.19	9.90	1,498,993	148,400	167,797	-19,397	57,759	38,362	878,209	6.88	5.00
2038	11.17	9.90	1,570,438	155,473	175,474	-20,001	60,396	40,396	918,605	6.88	5.01
2039	11.15	9.90	1,644,836	162,839	183,424	-20,585	63,175	42,590	961,195	6.88	5.01
2040	11.12	9.90	1,723,263	170,603	191,704	-21,101	66,105	45,004	1,006,199	6.88	5.02
2041	11.11	9.90	1,804,247	178,620	200,367	-21,747	69,202	47,455	1,053,654	6.88	5.03
2042	11.08	9.90	1,889,517	187,062	209,396	-22,334	72,468	50,134	1,103,789	6.88	5.04
2043	11.06	9.90	1,978,432	195,865	218,804	-22,939	75,920	52,980	1,156,769	6.88	5.06
2044	11.04	9.90	2,070,475	204,977	228,646	-23,669	79,568	55,899	1,212,668	6.88	5.07
2045	11.03	9.90	2,166,730	214,506	238,980	-24,474	83,418	58,944	1,271,612	6.88	5.09
2046	11.02	9.90	2,266,912	224,424	249,835	-25,411	87,477	62,067	1,333,679	6.88	5.11
2047	11.01	9.90	2,371,940	234,822	261,177	-26,355	91,752	65,397	1,399,076	6.88	5.12
2048	11.00	9.90	2,481,166	245,635	273,011	-27,376	96,257	68,882	1,467,958	6.88	5.14
2049	11.00	9.90	2,594,977	256,903	285,433	-28,530	101,003	72,473	1,540,431	6.88	5.16
2050	11.00	9.90	2,713,442	268,631	298,525	-29,894	105,997	76,102	1,616,534	6.88	5.18

Table VII.C.2   Projected Financial Results - Annually - 1998 to 2100
            (Continued)

Year	Paygo Rate %	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expenditures Ratio
2051	11.01	9.90	2,837,229	280,886	312,286	-31,400	111,240	79,839	1,696,373	6.88	5.19
2052	11.01	9.90	2,966,397	293,673	326,673	-33,000	116,740	83,740	1,780,113	6.88	5.21
2053	11.02	9.90	3,101,377	307,036	341,656	-34,620	122,509	87,889	1,868,003	6.88	5.23
2054	11.02	9.90	3,242,899	321,047	357,294	-36,247	128,565	92,318	1,960,321	6.88	5.25
2055	11.02	9.90	3,391,204	335,729	373,672	-37,943	134,927	96,984	2,057,305	6.88	5.26
2056	11.02	9.90	3,546,897	351,143	390,760	-39,617	141,610	101,993	2,159,299	6.88	5.28
2057	11.02	9.90	3,708,935	367,185	408,572	-41,387	148,640	107,253	2,266,552	6.88	5.31
2058	11.01	9.90	3,878,958	384,017	427,192	-43,175	156,033	112,858	2,379,410	6.88	5.33
2059	11.01	9.90	4,057,331	401,676	446,599	-44,923	163,814	118,891	2,498,300	6.88	5.35
2060	11.00	9.90	4,243,739	420,130	466,852	-46,722	172,011	125,290	2,623,590	6.89	5.38
2061	10.99	9.90	4,438,987	439,460	487,983	-48,523	180,652	132,128	2,755,718	6.89	5.40
2062	10.98	9.90	4,643,833	459,739	510,052	-50,313	189,765	139,452	2,895,171	6.89	5.43
2063	10.98	9.90	4,857,972	480,939	533,190	-52,251	199,385	147,134	3,042,305	6.89	5.46
2064	10.97	9.90	5,081,643	503,083	557,397	-54,314	209,536	155,221	3,197,526	6.89	5.49
2065	10.96	9.90	5,316,259	526,310	582,715	-56,405	220,246	163,840	3,361,366	6.89	5.52
2066	10.95	9.90	5,561,431	550,582	609,202	-58,620	231,552	172,931	3,534,298	6.89	5.55
2067	10.95	9.90	5,817,399	575,923	636,926	-61,004	243,487	182,483	3,716,781	6.89	5.58
2068	10.94	9.90	6,085,020	602,417	665,959	-63,542	256,083	192,541	3,909,322	6.89	5.61
2069	10.94	9.90	6,365,152	630,150	696,375	-66,225	269,374	203,149	4,112,471	6.89	5.65
2070	10.94	9.90	6,657,443	659,087	728,245	-69,158	283,399	214,241	4,326,712	6.89	5.68
2071	10.94	9.90	6,962,171	689,255	761,643	-72,388	298,192	225,804	4,552,516	6.89	5.71
2072	10.94	9.90	7,280,865	720,806	796,651	-75,845	313,784	237,938	4,790,454	6.89	5.75
2073	10.95	9.90	7,613,822	753,768	833,359	-79,591	330,214	250,624	5,041,078	6.89	5.78
2074	10.95	9.90	7,960,752	788,114	871,851	-83,737	347,523	263,786	5,304,864	6.89	5.82
2075	10.96	9.90	8,323,300	824,007	912,216	-88,209	365,740	277,531	5,582,395	6.89	5.85
2076	10.97	9.90	8,701,909	861,489	954,532	-93,043	384,908	291,865	5,874,260	6.89	5.88
2077	10.98	9.90	9,096,394	900,543	998,881	-98,338	405,067	306,729	6,180,989	6.90	5.91
2078	10.99	9.90	9,509,179	941,409	1,045,355	-103,946	426,253	322,307	6,503,296	6.90	5.94
2079	11.01	9.90	9,939,516	984,012	1,094,039	-110,027	448,517	338,490	6,841,786	6.90	5.98
2080	11.02	9.90	10,389,314	1,028,542	1,145,019	-116,477	471,898	355,421	7,197,207	6.90	6.01
2081	11.04	9.90	10,859,225	1,075,063	1,198,379	-123,316	496,450	373,134	7,570,341	6.90	6.04
2082	11.05	9.90	11,350,532	1,123,703	1,254,210	-130,507	522,227	391,719	7,962,060	6.90	6.07
2083	11.06	9.90	11,863,887	1,174,525	1,312,613	-138,088	549,288	411,200	8,373,260	6.90	6.10
2084	11.08	9.90	12,400,017	1,227,602	1,373,696	-146,094	577,697	431,603	8,804,862	6.90	6.12
2085	11.09	9.90	12,961,032	1,283,142	1,437,567	-154,425	607,517	453,092	9,257,954	6.90	6.15
2086	11.10	9.90	13,547,714	1,341,224	1,504,332	-163,108	638,823	475,714	9,733,668	6.90	6.18
2087	11.12	9.90	14,160,859	1,401,925	1,574,116	-172,191	671,694	499,503	10,233,171	6.90	6.21
2088	11.13	9.90	14,802,592	1,465,457	1,647,060	-181,603	706,211	524,607	10,757,778	6.90	6.24
2089	11.14	9.90	15,473,099	1,531,837	1,723,313	-191,476	742,464	550,988	11,308,766	6.90	6.27
2090	11.15	9.90	16,175,266	1,601,351	1,803,028	-201,677	780,544	578,867	11,887,633	6.90	6.30
2091	11.16	9.90	16,908,562	1,673,948	1,886,358	-212,410	820,552	608,142	12,495,775	6.90	6.33
2092	11.16	9.90	17,675,954	1,749,919	1,973,479	-223,560	862,587	639,027	13,134,802	6.90	6.36
2093	11.17	9.90	18,477,674	1,829,290	2,064,575	-235,285	906,759	671,474	13,806,276	6.90	6.39
2094	11.18	9.90	19,316,024	1,912,286	2,159,841	-247,555	953,177	705,622	14,511,898	6.90	6.42
2095	11.19	9.90	20,192,664	1,999,074	2,259,486	-260,412	1,001,958	741,546	15,253,444	6.90	6.45
2096	11.20	9.90	21,109,290	2,089,820	2,363,726	-273,906	1,053,227	779,320	16,032,764	6.90	6.48
2097	11.21	9.90	22,066,914	2,184,625	2,472,792	-288,168	1,107,110	818,942	16,851,706	6.91	6.51
2098	11.21	9.90	23,067,326	2,283,665	2,586,915	-303,250	1,163,735	860,485	17,712,192	6.91	6.54
2099	11.22	9.90	24,113,060	2,387,193	2,706,341	-319,148	1,223,236	904,088	18,616,280	6.91	6.58
2100	11.23	9.90	25,206,020	2,495,396	2,831,335	-335,939	1,285,755	949,816	19,566,096	6.91	6.61

Table VII.C.3   Projection of Total Expenditures - Annually - 1998 to 2100

| | | Disability | | | | Survivor | | | | | | Grand |
Year	Retirement	Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total	Orphans	Death	Expenses	Total
1998	12,217	1,262	1,285	235	2,782	339	2,223	2,563	212	238	240	18,252
1999	12,763	1,267	1,290	235	2,792	351	2,325	2,675	222	245	269	18,967
2000	13,359	1,286	1,310	239	2,835	357	2,431	2,788	232	254	303	19,770
2001	14,029	1,323	1,352	245	2,920	365	2,547	2,911	243	263	318	20,684
2002	14,780	1,378	1,415	255	3,048	374	2,672	3,046	255	272	336	21,738
2003	15,635	1,453	1,499	268	3,221	385	2,809	3,194	268	282	356	22,956
2004	16,614	1,550	1,606	285	3,440	398	2,959	3,357	282	293	378	24,365
2005	17,679	1,663	1,730	304	3,698	412	3,114	3,525	296	304	402	25,904
2006	18,834	1,786	1,865	324	3,976	427	3,271	3,698	310	315	427	27,560
2007	20,120	1,915	2,006	344	4,265	442	3,433	3,874	324	326	453	29,364
2008	21,558	2,045	2,151	363	4,559	457	3,598	4,055	338	338	480	31,328
2009	23,122	2,181	2,301	382	4,865	474	3,768	4,241	352	349	509	33,437
2010	24,803	2,323	2,460	401	5,184	491	3,941	4,431	365	360	539	35,682
2011	26,617	2,462	2,618	420	5,499	509	4,120	4,629	379	371	567	38,062
2012	28,612	2,584	2,764	438	5,787	527	4,307	4,834	394	380	596	40,603
2013	30,788	2,714	2,913	457	6,084	544	4,497	5,042	407	390	627	43,337
2014	33,110	2,853	3,073	476	6,402	563	4,694	5,256	420	399	657	46,244
2015	35,584	2,996	3,242	494	6,733	582	4,897	5,478	433	408	690	49,326
2016	38,222	3,144	3,419	513	7,076	601	5,107	5,709	445	418	723	52,592
2017	41,033	3,296	3,602	532	7,431	621	5,327	5,948	457	427	758	56,053
2018	44,043	3,448	3,787	551	7,787	642	5,556	6,198	468	437	794	59,726
2019	47,265	3,597	3,972	571	8,140	662	5,796	6,459	480	447	831	63,621
2020	50,711	3,744	4,155	591	8,490	683	6,049	6,732	492	457	869	67,751
2021	54,375	3,892	4,341	612	8,844	704	6,316	7,020	505	467	908	72,119
2022	58,251	4,033	4,524	633	9,190	726	6,599	7,324	518	478	950	76,710
2023	62,345	4,170	4,705	654	9,530	746	6,899	7,646	531	489	992	81,534
2024	66,644	4,304	4,887	677	9,868	768	7,220	7,987	546	500	1,037	86,582
2025	71,126	4,429	5,064	700	10,193	788	7,562	8,350	561	512	1,083	91,825
2026	75,755	4,547	5,238	725	10,510	809	7,926	8,735	576	524	1,133	97,233
2027	80,481	4,665	5,416	751	10,832	829	8,316	9,145	593	536	1,184	102,771
2028	85,316	4,779	5,594	778	11,151	850	8,732	9,582	610	549	1,239	108,447
2029	90,279	4,898	5,784	806	11,488	871	9,176	10,046	629	562	1,296	114,300
2030	95,361	5,031	5,994	836	11,861	892	9,648	10,540	648	574	1,356	120,341
2031	100,527	5,190	6,242	867	12,298	914	10,149	11,063	667	588	1,420	126,563
2032	105,741	5,369	6,521	899	12,788	937	10,681	11,618	688	601	1,486	132,922
2033	111,043	5,555	6,817	932	13,304	960	11,243	12,204	709	614	1,556	139,430
2034	116,495	5,744	7,123	966	13,833	986	11,836	12,822	731	627	1,630	146,138
2035	122,153	5,932	7,437	1,001	14,370	1,012	12,461	13,473	753	640	1,707	153,096
2036	128,025	6,129	7,767	1,037	14,933	1,040	13,116	14,156	776	652	1,788	160,331
2037	134,034	6,347	8,132	1,074	15,554	1,069	13,802	14,871	800	665	1,874	167,797
2038	140,174	6,581	8,526	1,112	16,220	1,099	14,519	15,618	824	676	1,963	175,474
2039	146,508	6,830	8,946	1,151	16,928	1,131	15,265	16,396	848	688	2,056	183,424
2040	153,121	7,082	9,378	1,191	17,651	1,164	16,041	17,205	873	699	2,154	191,704
2041	160,043	7,348	9,835	1,233	18,415	1,199	16,847	18,046	899	709	2,255	200,367
2042	167,237	7,633	10,328	1,275	19,237	1,235	17,681	18,916	925	719	2,362	209,396
2043	174,730	7,934	10,851	1,319	20,105	1,274	18,543	19,816	952	728	2,473	218,804
2044	182,596	8,243	11,392	1,365	20,999	1,313	19,433	20,746	979	737	2,588	228,646
2045	190,899	8,556	11,949	1,411	21,916	1,354	20,351	21,706	1,007	745	2,708	238,980
2046	199,663	8,875	12,522	1,460	22,857	1,397	21,297	22,694	1,036	752	2,834	249,835
2047	208,844	9,203	13,119	1,510	23,831	1,441	22,271	23,713	1,066	758	2,965	261,177
2048	218,460	9,536	13,731	1,562	24,828	1,487	23,274	24,761	1,096	764	3,101	273,011
2049	228,603	9,874	14,360	1,616	25,849	1,534	24,306	25,840	1,128	769	3,244	285,433
2050	239,361	10,214	15,001	1,671	26,887	1,582	25,369	26,951	1,161	774	3,392	298,525

Table VII.C.3

Table VII.C.3 Projection of Total Expenditures - Annually - 1998 to 2100 (Continued)

Year	Retirement	Flat-Rate	Disability Earnings-Related	Children	Sub-Total	Survivor Flat-Rate	Earnings-Related	Sub-Total	Orphans	Death	Expenses	Grand Total
2051	250,711	10,563	15,668	1,729	27,960	1,631	26,465	28,096	1,194	778	3,547	312,286
2052	262,573	10,935	16,380	1,790	29,105	1,681	27,595	29,276	1,229	782	3,708	326,673
2053	274,949	11,317	17,117	1,853	30,286	1,732	28,761	30,494	1,266	785	3,877	341,656
2054	287,932	11,692	17,855	1,918	31,464	1,785	29,967	31,752	1,303	788	4,054	357,294
2055	301,608	12,060	18,592	1,986	32,637	1,838	31,216	33,055	1,342	791	4,239	373,672
2056	315,882	12,442	19,365	2,057	33,863	1,893	32,512	34,405	1,382	793	4,434	390,760
2057	330,765	12,840	20,173	2,130	35,143	1,949	33,859	35,808	1,424	795	4,636	408,572
2058	346,299	13,265	21,042	2,207	36,514	2,006	35,260	37,266	1,467	798	4,849	427,192
2059	362,465	13,715	21,964	2,286	37,965	2,065	36,721	38,786	1,511	800	5,072	446,599
2060	379,317	14,189	22,943	2,369	39,500	2,126	38,245	40,371	1,557	802	5,305	466,852
2061	396,851	14,698	23,997	2,455	41,149	2,188	39,838	42,026	1,604	805	5,549	487,983
2062	415,197	15,213	25,077	2,543	42,833	2,253	41,505	43,758	1,652	807	5,805	510,052
2063	434,447	15,746	26,209	2,634	44,589	2,320	43,250	45,569	1,702	810	6,072	533,190
2064	454,579	16,304	27,401	2,729	46,434	2,389	45,078	47,467	1,754	813	6,352	557,397
2065	475,622	16,888	28,657	2,827	48,372	2,460	46,994	49,455	1,806	816	6,645	582,715
2066	497,628	17,497	29,980	2,928	50,404	2,535	49,004	51,539	1,860	819	6,952	609,202
2067	520,659	18,132	31,370	3,032	52,534	2,612	51,111	53,723	1,915	822	7,272	636,926
2068	544,778	18,793	32,832	3,139	54,765	2,691	53,320	56,012	1,972	826	7,606	665,959
2069	570,047	19,482	34,368	3,250	57,101	2,774	55,637	58,411	2,030	830	7,956	696,375
2070	596,532	20,199	35,981	3,364	59,544	2,859	58,064	60,923	2,090	834	8,322	728,245
2071	624,301	20,942	37,671	3,483	62,096	2,948	60,606	63,554	2,151	838	8,703	761,643
2072	653,430	21,712	39,438	3,604	64,755	3,039	63,268	66,307	2,214	842	9,101	796,651
2073	684,007	22,508	41,284	3,730	67,522	3,134	66,053	69,187	2,279	847	9,517	833,359
2074	716,110	23,329	43,208	3,860	70,397	3,232	68,965	72,197	2,345	851	9,951	871,851
2075	749,819	24,175	45,212	3,995	73,382	3,332	72,009	75,341	2,413	856	10,404	912,216
2076	785,209	25,046	47,298	4,134	76,478	3,436	75,188	78,625	2,483	860	10,877	954,532
2077	822,354	25,941	49,466	4,278	79,686	3,543	78,508	82,051	2,555	865	11,370	998,881
2078	861,333	26,863	51,722	4,427	83,011	3,653	81,973	85,626	2,629	869	11,886	1,045,355
2079	902,227	27,809	54,064	4,581	86,454	3,766	85,588	89,354	2,706	874	12,424	1,094,039
2080	945,110	28,782	56,496	4,741	90,019	3,882	89,358	93,240	2,785	878	12,987	1,145,019
2081	990,051	29,782	59,025	4,906	93,713	4,001	93,291	97,292	2,866	882	13,574	1,198,379
2082	1,037,123	30,812	61,657	5,078	97,547	4,123	97,392	101,515	2,950	887	14,188	1,254,210
2083	1,086,410	31,875	64,398	5,256	101,529	4,249	101,669	105,918	3,036	891	14,830	1,312,613
2084	1,138,000	32,972	67,256	5,440	105,668	4,378	106,130	110,508	3,125	895	15,500	1,373,696
2085	1,191,978	34,106	70,241	5,632	109,978	4,510	110,783	115,294	3,217	899	16,201	1,437,567
2086	1,248,426	35,281	73,361	5,830	114,472	4,646	115,639	120,285	3,311	903	16,935	1,504,332
2087	1,307,451	36,498	76,624	6,035	119,157	4,786	120,705	125,491	3,409	907	17,701	1,574,116
2088	1,369,172	37,758	80,035	6,248	124,041	4,929	125,994	130,924	3,509	911	18,503	1,647,060
2089	1,433,715	39,065	83,603	6,469	129,136	5,077	131,516	136,593	3,612	915	19,341	1,723,313
2090	1,501,200	40,421	87,341	6,697	134,459	5,230	137,282	142,512	3,719	919	20,219	1,803,028
2091	1,571,756	41,830	91,259	6,934	140,023	5,386	143,305	148,692	3,828	924	21,136	1,886,358
2092	1,645,530	43,294	95,367	7,179	145,839	5,548	149,598	155,146	3,941	928	22,095	1,973,479
2093	1,722,683	44,814	99,673	7,432	151,919	5,715	156,173	161,888	4,057	932	23,097	2,064,575
2094	1,803,382	46,392	104,185	7,694	158,271	5,887	163,044	168,930	4,177	936	24,145	2,159,841
2095	1,887,808	48,031	108,913	7,965	164,909	6,064	170,224	176,288	4,299	941	25,241	2,259,486
2096	1,976,151	49,732	113,866	8,245	171,843	6,247	177,728	183,974	4,425	945	26,387	2,363,726
2097	2,068,613	51,497	119,053	8,535	179,085	6,435	185,570	192,005	4,555	950	27,584	2,472,792
2098	2,165,395	53,327	124,485	8,835	186,647	6,630	193,765	200,396	4,688	955	28,834	2,586,915
2099	2,266,714	55,225	130,170	9,145	194,540	6,831	202,329	209,161	4,825	959	30,141	2,706,341
2100	2,372,808	57,191	136,117	9,465	202,773	7,039	211,278	218,316	4,966	964	31,508	2,831,335

Table VII.C.4   Projection of PAYGO Rates - Annually - 1998 to 2100

Year	Retirement	Disability				Survivor			Orphans	Death	Expenses	Grand Total
		Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total				
1998	5.49	0.57	0.58	0.11	1.25	0.15	1.00	1.15	0.10	0.11	0.11	8.21
1999	5.51	0.55	0.56	0.10	1.21	0.15	1.00	1.16	0.10	0.11	0.12	8.19
2000	5.52	0.53	0.54	0.10	1.17	0.15	1.00	1.15	0.10	0.10	0.13	8.16
2001	5.51	0.52	0.53	0.10	1.15	0.14	1.00	1.14	0.10	0.10	0.12	8.13
2002	5.50	0.51	0.53	0.09	1.13	0.14	0.99	1.13	0.09	0.10	0.13	8.09
2003	5.49	0.51	0.53	0.09	1.13	0.14	0.99	1.12	0.09	0.10	0.13	8.06
2004	5.49	0.51	0.53	0.09	1.14	0.13	0.98	1.11	0.09	0.10	0.12	8.05
2005	5.50	0.52	0.54	0.09	1.15	0.13	0.97	1.10	0.09	0.09	0.12	8.05
2006	5.51	0.52	0.55	0.09	1.16	0.12	0.96	1.08	0.09	0.09	0.12	8.07
2007	5.55	0.53	0.55	0.09	1.18	0.12	0.95	1.07	0.09	0.09	0.12	8.10
2008	5.61	0.53	0.56	0.09	1.19	0.12	0.94	1.06	0.09	0.09	0.12	8.15
2009	5.68	0.54	0.56	0.09	1.19	0.12	0.92	1.04	0.09	0.09	0.12	8.21
2010	5.75	0.54	0.57	0.09	1.20	0.11	0.91	1.03	0.08	0.08	0.12	8.27
2011	5.87	0.54	0.58	0.09	1.21	0.11	0.91	1.02	0.08	0.08	0.13	8.39
2012	6.00	0.54	0.58	0.09	1.21	0.11	0.90	1.01	0.08	0.08	0.12	8.51
2013	6.14	0.54	0.58	0.09	1.21	0.11	0.90	1.01	0.08	0.08	0.13	8.65
2014	6.30	0.54	0.58	0.09	1.22	0.11	0.89	1.00	0.08	0.08	0.12	8.79
2015	6.45	0.54	0.59	0.09	1.22	0.11	0.89	0.99	0.08	0.07	0.13	8.94
2016	6.61	0.54	0.59	0.09	1.22	0.10	0.88	0.99	0.08	0.07	0.13	9.09
2017	6.77	0.54	0.59	0.09	1.23	0.10	0.88	0.98	0.08	0.07	0.13	9.25
2018	6.94	0.54	0.60	0.09	1.23	0.10	0.88	0.98	0.07	0.07	0.13	9.41
2019	7.11	0.54	0.60	0.09	1.22	0.10	0.87	0.97	0.07	0.07	0.13	9.57
2020	7.30	0.54	0.60	0.09	1.22	0.10	0.87	0.97	0.07	0.07	0.13	9.75
2021	7.48	0.54	0.60	0.08	1.22	0.10	0.87	0.97	0.07	0.06	0.12	9.93
2022	7.67	0.53	0.60	0.08	1.21	0.10	0.87	0.96	0.07	0.06	0.13	10.10
2023	7.85	0.53	0.59	0.08	1.20	0.09	0.87	0.96	0.07	0.06	0.12	10.27
2024	8.04	0.52	0.59	0.08	1.19	0.09	0.87	0.96	0.07	0.06	0.13	10.44
2025	8.21	0.51	0.58	0.08	1.18	0.09	0.87	0.96	0.06	0.06	0.12	10.59
2026	8.36	0.50	0.58	0.08	1.16	0.09	0.87	0.96	0.06	0.06	0.13	10.73
2027	8.49	0.49	0.57	0.08	1.14	0.09	0.88	0.97	0.06	0.06	0.12	10.85
2028	8.61	0.48	0.56	0.08	1.12	0.09	0.88	0.97	0.06	0.06	0.12	10.94
2029	8.70	0.47	0.56	0.08	1.11	0.08	0.88	0.97	0.06	0.05	0.12	11.02
2030	8.79	0.46	0.55	0.08	1.09	0.08	0.89	0.97	0.06	0.05	0.12	11.09
2031	8.85	0.46	0.55	0.08	1.08	0.08	0.89	0.97	0.06	0.05	0.13	11.14
2032	8.89	0.45	0.55	0.08	1.08	0.08	0.90	0.98	0.06	0.05	0.12	11.18
2033	8.92	0.45	0.55	0.07	1.07	0.08	0.90	0.98	0.06	0.05	0.12	11.20
2034	8.93	0.44	0.55	0.07	1.06	0.08	0.91	0.98	0.06	0.05	0.12	11.21
2035	8.94	0.43	0.54	0.07	1.05	0.07	0.91	0.99	0.06	0.05	0.12	11.21
2036	8.95	0.43	0.54	0.07	1.04	0.07	0.92	0.99	0.05	0.05	0.12	11.21
2037	8.94	0.42	0.54	0.07	1.04	0.07	0.92	0.99	0.05	0.04	0.13	11.19
2038	8.93	0.42	0.54	0.07	1.03	0.07	0.92	0.99	0.05	0.04	0.12	11.17
2039	8.91	0.42	0.54	0.07	1.03	0.07	0.93	1.00	0.05	0.04	0.12	11.15
2040	8.89	0.41	0.54	0.07	1.02	0.07	0.93	1.00	0.05	0.04	0.12	11.12
2041	8.87	0.41	0.55	0.07	1.02	0.07	0.93	1.00	0.05	0.04	0.12	11.11
2042	8.85	0.40	0.55	0.07	1.02	0.07	0.94	1.00	0.05	0.04	0.13	11.08
2043	8.83	0.40	0.55	0.07	1.02	0.06	0.94	1.00	0.05	0.04	0.12	11.06
2044	8.82	0.40	0.55	0.07	1.01	0.06	0.94	1.00	0.05	0.04	0.12	11.04
2045	8.81	0.39	0.55	0.07	1.01	0.06	0.94	1.00	0.05	0.03	0.12	11.03
2046	8.81	0.39	0.55	0.06	1.01	0.06	0.94	1.00	0.05	0.03	0.13	11.02
2047	8.80	0.39	0.55	0.06	1.00	0.06	0.94	1.00	0.04	0.03	0.13	11.01
2048	8.80	0.38	0.55	0.06	1.00	0.06	0.94	1.00	0.04	0.03	0.12	11.00
2049	8.81	0.38	0.55	0.06	1.00	0.06	0.94	1.00	0.04	0.03	0.13	11.00
2050	8.82	0.38	0.55	0.06	0.99	0.06	0.93	0.99	0.04	0.03	0.13	11.00

Table VII.C.4 Projection of PAYGO Rates - Annually - 1998 to 2100 (Continued)

Year	Retirement	Disability				Survivor			Orphans	Death	Expenses	Grand Total
		Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total				
2051	8.84	0.37	0.55	0.06	0.99	0.06	0.93	0.99	0.04	0.03	0.13	11.01
2052	8.85	0.37	0.55	0.06	0.98	0.06	0.93	0.99	0.04	0.03	0.13	11.01
2053	8.87	0.36	0.55	0.06	0.98	0.06	0.93	0.98	0.04	0.03	0.13	11.02
2054	8.88	0.36	0.55	0.06	0.97	0.06	0.92	0.98	0.04	0.02	0.13	11.02
2055	8.89	0.36	0.55	0.06	0.96	0.05	0.92	0.97	0.04	0.02	0.12	11.02
2056	8.91	0.35	0.55	0.06	0.95	0.05	0.92	0.97	0.04	0.02	0.13	11.02
2057	8.92	0.35	0.54	0.06	0.95	0.05	0.91	0.97	0.04	0.02	0.12	11.02
2058	8.93	0.34	0.54	0.06	0.94	0.05	0.91	0.96	0.04	0.02	0.13	11.01
2059	8.93	0.34	0.54	0.06	0.94	0.05	0.91	0.96	0.04	0.02	0.13	11.01
2060	8.94	0.33	0.54	0.06	0.93	0.05	0.90	0.95	0.04	0.02	0.13	11.00
2061	8.94	0.33	0.54	0.06	0.93	0.05	0.90	0.95	0.04	0.02	0.13	10.99
2062	8.94	0.33	0.54	0.05	0.92	0.05	0.89	0.94	0.04	0.02	0.13	10.98
2063	8.94	0.32	0.54	0.05	0.92	0.05	0.89	0.94	0.04	0.02	0.12	10.98
2064	8.95	0.32	0.54	0.05	0.91	0.05	0.89	0.93	0.03	0.02	0.12	10.97
2065	8.95	0.32	0.54	0.05	0.91	0.05	0.88	0.93	0.03	0.02	0.12	10.96
2066	8.95	0.31	0.54	0.05	0.91	0.05	0.88	0.93	0.03	0.01	0.13	10.95
2067	8.95	0.31	0.54	0.05	0.90	0.04	0.88	0.92	0.03	0.01	0.13	10.95
2068	8.95	0.31	0.54	0.05	0.90	0.04	0.88	0.92	0.03	0.01	0.12	10.94
2069	8.96	0.31	0.54	0.05	0.90	0.04	0.87	0.92	0.03	0.01	0.12	10.94
2070	8.96	0.30	0.54	0.05	0.89	0.04	0.87	0.92	0.03	0.01	0.13	10.94
2071	8.97	0.30	0.54	0.05	0.89	0.04	0.87	0.91	0.03	0.01	0.13	10.94
2072	8.97	0.30	0.54	0.05	0.89	0.04	0.87	0.91	0.03	0.01	0.12	10.94
2073	8.98	0.30	0.54	0.05	0.89	0.04	0.87	0.91	0.03	0.01	0.12	10.95
2074	9.00	0.29	0.54	0.05	0.88	0.04	0.87	0.91	0.03	0.01	0.13	10.95
2075	9.01	0.29	0.54	0.05	0.88	0.04	0.87	0.91	0.03	0.01	0.12	10.96
2076	9.02	0.29	0.54	0.05	0.88	0.04	0.86	0.90	0.03	0.01	0.12	10.97
2077	9.04	0.29	0.54	0.05	0.88	0.04	0.86	0.90	0.03	0.01	0.12	10.98
2078	9.06	0.28	0.54	0.05	0.87	0.04	0.86	0.90	0.03	0.01	0.12	10.99
2079	9.08	0.28	0.54	0.05	0.87	0.04	0.86	0.90	0.03	0.01	0.12	11.01
2080	9.10	0.28	0.54	0.05	0.87	0.04	0.86	0.90	0.03	0.01	0.13	11.02
2081	9.12	0.27	0.54	0.05	0.86	0.04	0.86	0.90	0.03	0.01	0.12	11.04
2082	9.14	0.27	0.54	0.04	0.86	0.04	0.86	0.89	0.03	0.01	0.12	11.05
2083	9.16	0.27	0.54	0.04	0.86	0.04	0.86	0.89	0.03	0.01	0.13	11.06
2084	9.18	0.27	0.54	0.04	0.85	0.04	0.86	0.89	0.03	0.01	0.12	11.08
2085	9.20	0.26	0.54	0.04	0.85	0.03	0.85	0.89	0.02	0.01	0.12	11.09
2086	9.22	0.26	0.54	0.04	0.84	0.03	0.85	0.89	0.02	0.01	0.13	11.10
2087	9.23	0.26	0.54	0.04	0.84	0.03	0.85	0.89	0.02	0.01	0.12	11.12
2088	9.25	0.26	0.54	0.04	0.84	0.03	0.85	0.88	0.02	0.01	0.12	11.13
2089	9.27	0.25	0.54	0.04	0.83	0.03	0.85	0.88	0.02	0.01	0.12	11.14
2090	9.28	0.25	0.54	0.04	0.83	0.03	0.85	0.88	0.02	0.01	0.12	11.15
2091	9.30	0.25	0.54	0.04	0.83	0.03	0.85	0.88	0.02	0.01	0.13	11.16
2092	9.31	0.24	0.54	0.04	0.83	0.03	0.85	0.88	0.02	0.01	0.13	11.16
2093	9.32	0.24	0.54	0.04	0.82	0.03	0.85	0.88	0.02	0.01	0.12	11.17
2094	9.34	0.24	0.54	0.04	0.82	0.03	0.84	0.87	0.02	0.00	0.12	11.18
2095	9.35	0.24	0.54	0.04	0.82	0.03	0.84	0.87	0.02	0.00	0.13	11.19
2096	9.36	0.24	0.54	0.04	0.81	0.03	0.84	0.87	0.02	0.00	0.13	11.20
2097	9.37	0.23	0.54	0.04	0.81	0.03	0.84	0.87	0.02	0.00	0.13	11.21
2098	9.39	0.23	0.54	0.04	0.81	0.03	0.84	0.87	0.02	0.00	0.12	11.21
2099	9.40	0.23	0.54	0.04	0.81	0.03	0.84	0.87	0.02	0.00	0.12	11.22
2100	9.41	0.23	0.54	0.04	0.80	0.03	0.84	0.87	0.02	0.00	0.13	11.23

Table VII.C.5   Projection of Total Expenditures - Differences from Report 16

Year	Retirement	Disability Flat-Rate	Disability Earnings-Related	Disability Children	Disability Sub-Total	Survivor Flat-Rate	Survivor Earnings-Related	Survivor Sub-Total	Orphans	Death	Expenses	Grand Total
1998	22	-423	-545	-112	-1,081	-14	10	-3	-15	19	-4	-1,061
1999	-155	-527	-669	-131	-1,328	-12	-18	-31	-16	18	11	-1,500
2000	-367	-631	-791	-147	-1,569	-19	-56	-75	-19	19	30	-1,983
2001	-617	-735	-910	-164	-1,809	-27	-100	-128	-23	19	29	-2,529
2002	-854	-835	-1,023	-179	-2,036	-35	-150	-185	-26	19	32	-3,049
2003	-1,058	-926	-1,129	-190	-2,244	-42	-194	-236	-27	20	35	-3,510
2004	-1,229	-1,006	-1,227	-199	-2,433	-47	-232	-279	-28	22	39	-3,907
2005	-1,407	-1,083	-1,325	-206	-2,613	-53	-271	-325	-28	24	45	-4,303
2006	-1,602	-1,161	-1,425	-212	-2,797	-58	-314	-372	-28	26	52	-4,721
2007	-1,824	-1,242	-1,535	-218	-2,995	-63	-360	-424	-26	28	57	-5,183
2008	-2,082	-1,327	-1,651	-223	-3,201	-69	-410	-480	-23	30	63	-5,693
2009	-2,375	-1,416	-1,773	-228	-3,416	-74	-463	-538	-20	31	71	-6,248
2010	-2,695	-1,510	-1,903	-234	-3,647	-80	-520	-601	-17	32	78	-6,851
2011	-3,046	-1,604	-2,040	-241	-3,885	-86	-580	-666	-14	33	82	-7,495
2012	-3,447	-1,689	-2,166	-249	-4,102	-93	-642	-735	-9	33	87	-8,173
2013	-3,907	-1,774	-2,297	-256	-4,327	-100	-712	-811	-5	33	93	-8,926
2014	-4,397	-1,866	-2,439	-263	-4,568	-107	-786	-893	-2	31	97	-9,731
2015	-4,920	-1,963	-2,588	-272	-4,822	-114	-866	-980	2	30	102	-10,588
2016	-5,483	-2,062	-2,742	-280	-5,085	-122	-952	-1,073	5	30	106	-11,501
2017	-6,101	-2,164	-2,902	-289	-5,353	-130	-1,044	-1,174	7	29	112	-12,482
2018	-6,788	-2,263	-3,062	-298	-5,622	-137	-1,143	-1,281	9	28	117	-13,538
2019	-7,540	-2,358	-3,217	-307	-5,883	-146	-1,251	-1,395	10	27	122	-14,659
2020	-8,357	-2,450	-3,371	-317	-6,138	-154	-1,365	-1,519	12	26	127	-15,849
2021	-9,238	-2,540	-3,525	-326	-6,392	-162	-1,488	-1,649	13	25	130	-17,110
2022	-10,196	-2,615	-3,662	-337	-6,614	-169	-1,619	-1,789	14	25	137	-18,425
2023	-11,239	-2,683	-3,792	-349	-6,824	-178	-1,762	-1,939	14	24	142	-19,821
2024	-12,332	-2,748	-3,922	-362	-7,031	-185	-1,913	-2,099	14	23	148	-21,278
2025	-13,474	-2,808	-4,047	-376	-7,231	-194	-2,075	-2,269	14	23	152	-22,785
2026	-14,664	-2,864	-4,170	-390	-7,424	-202	-2,250	-2,452	12	23	158	-24,346
2027	-15,893	-2,921	-4,300	-406	-7,628	-211	-2,435	-2,646	12	23	164	-25,968
2028	-17,157	-2,981	-4,438	-424	-7,843	-219	-2,633	-2,852	10	24	171	-27,646
2029	-18,453	-3,046	-4,586	-444	-8,076	-227	-2,843	-3,071	9	25	177	-29,390
2030	-19,778	-3,124	-4,764	-465	-8,353	-236	-3,067	-3,303	7	24	183	-31,219
2031	-21,137	-3,223	-4,974	-488	-8,686	-244	-3,305	-3,549	4	26	191	-33,152
2032	-22,510	-3,333	-5,200	-511	-9,046	-252	-3,555	-3,808	2	26	197	-35,139
2033	-23,890	-3,457	-5,448	-537	-9,442	-262	-3,821	-4,082	-2	27	203	-37,185
2034	-25,307	-3,587	-5,710	-564	-9,862	-270	-4,101	-4,371	-5	27	210	-39,308
2035	-26,785	-3,718	-5,977	-592	-10,288	-280	-4,396	-4,677	-9	28	217	-41,513
2036	-28,360	-3,850	-6,253	-622	-10,725	-290	-4,708	-4,998	-14	28	224	-43,844
2037	-29,943	-4,023	-6,595	-653	-11,270	-301	-5,036	-5,337	-18	30	230	-46,309
2038	-31,486	-4,217	-6,973	-686	-11,875	-313	-5,380	-5,693	-23	30	239	-48,809
2039	-33,094	-4,427	-7,385	-720	-12,531	-325	-5,741	-6,067	-30	31	244	-51,447
2040	-34,783	-4,646	-7,816	-755	-13,217	-339	-6,120	-6,459	-36	32	251	-54,211
2041	-36,583	-4,877	-8,275	-791	-13,944	-354	-6,515	-6,868	-43	33	257	-57,148
2042	-38,468	-5,135	-8,787	-829	-14,750	-370	-6,928	-7,297	-50	34	265	-60,267
2043	-40,435	-5,413	-9,339	-867	-15,618	-386	-7,359	-7,746	-58	35	270	-63,552
2044	-42,538	-5,701	-9,922	-906	-16,529	-405	-7,809	-8,214	-67	36	276	-67,036
2045	-44,803	-5,998	-10,528	-948	-17,474	-425	-8,277	-8,702	-77	37	280	-70,739
2046	-47,246	-6,303	-11,161	-989	-18,453	-446	-8,765	-9,211	-86	38	287	-74,672
2047	-49,905	-6,616	-11,819	-1,032	-19,467	-469	-9,272	-9,740	-96	39	292	-78,878
2048	-52,760	-6,937	-12,506	-1,076	-20,520	-493	-9,799	-10,292	-107	40	297	-83,342
2049	-55,792	-7,269	-13,223	-1,122	-21,615	-519	-10,348	-10,867	-118	41	303	-88,048
2050	-59,060	-7,611	-13,973	-1,171	-22,755	-547	-10,918	-11,465	-129	42	309	-93,058

		Disability				Survivor					Grand
Year	Retirement	Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total	Orphans	Death	Expenses	Total
2051	-62,607	-7,965	-14,756	-1,221	-23,943	-576	-11,511	-12,087	-141	43	313	-98,422
2052	-66,524	-8,331	-15,577	-1,272	-25,180	-606	-12,128	-12,734	-153	45	318	-104,227
2053	-70,760	-8,725	-16,463	-1,326	-26,514	-638	-12,769	-13,407	-165	47	323	-110,477
2054	-75,224	-9,127	-17,377	-1,383	-27,887	-671	-13,437	-14,108	-178	49	327	-117,021
2055	-80,136	-9,517	-18,287	-1,441	-29,247	-707	-14,133	-14,839	-192	51	333	-124,028
2056	-85,554	-9,913	-19,223	-1,503	-30,640	-743	-14,858	-15,601	-206	53	339	-131,608
2057	-91,501	-10,280	-20,128	-1,567	-31,975	-780	-15,615	-16,395	-220	54	343	-139,693
2058	-97,843	-10,702	-21,147	-1,635	-33,484	-819	-16,407	-17,226	-235	57	349	-148,382
2059	-104,453	-11,142	-22,222	-1,706	-35,070	-859	-17,235	-18,094	-251	59	355	-157,454
2060	-111,566	-11,590	-23,334	-1,780	-36,705	-900	-18,105	-19,005	-267	61	360	-167,122
2061	-119,238	-12,037	-24,467	-1,857	-38,362	-943	-19,017	-19,960	-285	64	364	-177,418
2062	-127,378	-12,515	-25,677	-1,939	-40,130	-986	-19,976	-20,963	-304	66	368	-188,341
2063	-135,925	-13,015	-26,950	-2,025	-41,990	-1,031	-20,987	-22,019	-323	69	372	-199,815
2064	-144,947	-13,537	-28,289	-2,114	-43,940	-1,078	-22,052	-23,130	-343	71	374	-211,916
2065	-154,477	-14,080	-29,697	-2,207	-45,984	-1,127	-23,176	-24,302	-365	73	376	-224,680
2066	-164,514	-14,653	-31,188	-2,304	-48,146	-1,176	-24,363	-25,539	-388	74	377	-238,136
2067	-175,049	-15,264	-32,781	-2,405	-50,450	-1,228	-25,619	-26,847	-412	76	375	-252,308
2068	-186,107	-15,914	-34,482	-2,511	-52,906	-1,283	-26,948	-28,230	-438	78	373	-267,231
2069	-197,736	-16,603	-36,296	-2,620	-55,518	-1,339	-28,354	-29,693	-465	80	368	-282,964
2070	-209,981	-17,332	-38,225	-2,734	-58,291	-1,399	-29,843	-31,242	-493	82	364	-299,562
2071	-222,886	-18,103	-40,277	-2,851	-61,231	-1,460	-31,420	-32,880	-523	83	356	-317,081
2072	-236,505	-18,912	-42,448	-2,975	-64,333	-1,526	-33,090	-34,616	-554	84	346	-335,575
2073	-250,894	-19,757	-44,735	-3,101	-67,593	-1,593	-34,859	-36,452	-586	86	335	-355,103
2074	-266,113	-20,638	-47,142	-3,233	-71,013	-1,664	-36,731	-38,395	-621	87	322	-375,733
2075	-282,214	-21,555	-49,671	-3,369	-74,595	-1,739	-38,712	-40,452	-657	88	307	-397,522
2076	-299,255	-22,509	-52,326	-3,511	-78,347	-1,817	-40,809	-42,625	-695	89	288	-420,545
2077	-317,307	-23,499	-55,109	-3,659	-82,266	-1,898	-43,026	-44,924	-734	91	267	-444,873
2078	-336,441	-24,521	-58,015	-3,812	-86,349	-1,983	-45,368	-47,351	-776	91	246	-470,578
2079	-356,714	-25,580	-61,057	-3,972	-90,608	-2,072	-47,842	-49,914	-818	93	221	-497,740
2080	-378,175	-26,674	-64,238	-4,138	-95,050	-2,164	-50,454	-52,618	-863	94	194	-526,419
2081	-400,897	-27,807	-67,562	-4,312	-99,681	-2,261	-53,209	-55,469	-909	94	162	-556,699
2082	-424,956	-28,976	-71,032	-4,493	-104,500	-2,361	-56,114	-58,475	-958	96	127	-588,665
2083	-450,422	-30,180	-74,651	-4,681	-109,512	-2,465	-59,176	-61,641	-1,008	97	91	-622,397
2084	-477,364	-31,425	-78,431	-4,879	-114,735	-2,573	-62,401	-64,974	-1,061	98	48	-657,988
2085	-505,838	-32,713	-82,383	-5,084	-120,182	-2,686	-65,798	-68,483	-1,116	99	4	-695,515
2086	-535,913	-34,049	-86,522	-5,299	-125,870	-2,802	-69,372	-72,175	-1,174	100	-45	-735,076
2087	-567,648	-35,435	-90,861	-5,524	-131,820	-2,923	-73,135	-76,058	-1,233	102	-100	-776,758
2088	-601,111	-36,876	-95,413	-5,758	-138,046	-3,049	-77,093	-80,141	-1,296	103	-159	-820,650
2089	-636,404	-38,371	-100,187	-6,002	-144,561	-3,179	-81,256	-84,436	-1,362	105	-224	-866,881
2090	-673,620	-39,929	-105,203	-6,258	-151,390	-3,314	-85,636	-88,950	-1,430	106	-294	-915,577
2091	-712,837	-41,554	-110,485	-6,524	-158,563	-3,455	-90,242	-93,696	-1,501	109	-371	-966,861
2092	-754,135	-43,254	-116,053	-6,802	-166,111	-3,600	-95,087	-98,687	-1,576	110	-456	-1,020,854
2093	-797,606	-45,033	-121,927	-7,093	-174,052	-3,751	-100,183	-103,934	-1,653	112	-549	-1,077,684
2094	-843,389	-46,892	-128,118	-7,395	-182,405	-3,908	-105,545	-109,455	-1,734	113	-650	-1,137,519
2095	-891,619	-48,837	-134,648	-7,710	-191,195	-4,073	-111,188	-115,260	-1,820	116	-759	-1,200,537
2096	-942,428	-50,874	-141,544	-8,038	-200,456	-4,243	-117,125	-121,369	-1,909	117	-877	-1,266,921
2097	-995,978	-53,008	-148,828	-8,379	-210,214	-4,421	-123,374	-127,796	-2,001	120	-1,007	-1,336,876
2098	-1,052,445	-55,243	-156,516	-8,734	-220,492	-4,606	-129,951	-134,557	-2,099	122	-1,149	-1,410,619
2099	-1,112,019	-57,578	-164,622	-9,103	-231,303	-4,799	-136,874	-141,672	-2,200	124	-1,299	-1,488,368
2100	-1,174,893	-60,019	-173,166	-9,487	-242,672	-4,999	-144,160	-149,160	-2,306	126	-1,462	-1,570,366

Table VII.C.6 Projection of PAYGO Rates - Differences from Report 16

Year	Retirement	Disability				Survivor			Orphans	Death	Expenses	Grand Total
		Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total				
1998	0.548	-0.116	-0.164	-0.035	-0.316	0.009	0.102	0.112	0.003	0.018	0.009	0.376
1999	0.567	-0.139	-0.193	-0.039	-0.371	0.013	0.107	0.119	0.005	0.019	0.017	0.357
2000	0.591	-0.157	-0.213	-0.040	-0.409	0.013	0.111	0.124	0.006	0.021	0.027	0.359
2001	0.560	-0.176	-0.234	-0.042	-0.452	0.011	0.106	0.116	0.006	0.021	0.027	0.278
2002	0.518	-0.193	-0.251	-0.043	-0.486	0.009	0.095	0.104	0.005	0.021	0.028	0.190
2003	0.478	-0.204	-0.263	-0.043	-0.510	0.007	0.085	0.092	0.006	0.020	0.029	0.114
2004	0.438	-0.211	-0.271	-0.043	-0.526	0.006	0.074	0.080	0.005	0.020	0.029	0.047
2005	0.395	-0.217	-0.279	-0.042	-0.537	0.004	0.063	0.067	0.005	0.020	0.030	-0.020
2006	0.352	-0.222	-0.285	-0.041	-0.547	0.002	0.052	0.055	0.005	0.019	0.030	-0.086
2007	0.314	-0.225	-0.292	-0.039	-0.556	0.001	0.042	0.043	0.006	0.019	0.030	-0.144
2008	0.275	-0.229	-0.298	-0.038	-0.565	0.000	0.032	0.032	0.006	0.018	0.031	-0.203
2009	0.231	-0.233	-0.305	-0.036	-0.574	-0.001	0.021	0.020	0.007	0.018	0.031	-0.267
2010	0.194	-0.236	-0.311	-0.035	-0.583	-0.002	0.012	0.011	0.007	0.017	0.032	-0.322
2011	0.189	-0.236	-0.315	-0.034	-0.585	-0.002	0.008	0.007	0.008	0.017	0.032	-0.331
2012	0.174	-0.235	-0.316	-0.033	-0.583	-0.002	0.004	0.002	0.009	0.017	0.032	-0.349
2013	0.156	-0.233	-0.318	-0.032	-0.582	-0.003	-0.002	-0.004	0.010	0.016	0.033	-0.371
2014	0.152	-0.231	-0.319	-0.031	-0.580	-0.003	-0.005	-0.008	0.011	0.016	0.033	-0.376
2015	0.146	-0.229	-0.320	-0.030	-0.578	-0.003	-0.009	-0.012	0.011	0.015	0.034	-0.384
2016	0.145	-0.226	-0.320	-0.029	-0.575	-0.003	-0.013	-0.016	0.012	0.015	0.034	-0.386
2017	0.136	-0.225	-0.321	-0.028	-0.573	-0.003	-0.018	-0.021	0.012	0.014	0.034	-0.398
2018	0.129	-0.222	-0.321	-0.027	-0.569	-0.003	-0.022	-0.025	0.012	0.014	0.034	-0.405
2019	0.125	-0.218	-0.319	-0.026	-0.563	-0.003	-0.026	-0.029	0.012	0.014	0.035	-0.407
2020	0.119	-0.214	-0.317	-0.025	-0.556	-0.003	-0.031	-0.034	0.012	0.013	0.035	-0.410
2021	0.120	-0.209	-0.313	-0.024	-0.547	-0.003	-0.034	-0.037	0.013	0.013	0.035	-0.403
2022	0.112	-0.203	-0.308	-0.024	-0.535	-0.003	-0.039	-0.042	0.013	0.013	0.035	-0.404
2023	0.110	-0.196	-0.302	-0.023	-0.521	-0.003	-0.042	-0.046	0.012	0.013	0.036	-0.395
2024	0.108	-0.189	-0.295	-0.023	-0.507	-0.003	-0.046	-0.049	0.012	0.012	0.036	-0.388
2025	0.107	-0.182	-0.288	-0.022	-0.492	-0.003	-0.050	-0.053	0.012	0.012	0.036	-0.377
2026	0.107	-0.175	-0.281	-0.022	-0.477	-0.003	-0.054	-0.057	0.012	0.012	0.036	-0.367
2027	0.102	-0.168	-0.274	-0.021	-0.464	-0.003	-0.058	-0.062	0.012	0.012	0.036	-0.364
2028	0.103	-0.162	-0.268	-0.021	-0.451	-0.003	-0.062	-0.065	0.012	0.012	0.036	-0.354
2029	0.104	-0.156	-0.263	-0.021	-0.440	-0.003	-0.066	-0.069	0.012	0.012	0.036	-0.345
2030	0.112	-0.151	-0.258	-0.021	-0.430	-0.003	-0.069	-0.072	0.011	0.011	0.037	-0.330
2031	0.119	-0.147	-0.255	-0.021	-0.423	-0.003	-0.072	-0.075	0.011	0.011	0.037	-0.320
2032	0.131	-0.143	-0.252	-0.021	-0.416	-0.002	-0.074	-0.077	0.011	0.011	0.037	-0.303
2033	0.145	-0.140	-0.250	-0.021	-0.411	-0.002	-0.077	-0.079	0.011	0.011	0.037	-0.286
2034	0.159	-0.137	-0.248	-0.021	-0.405	-0.002	-0.078	-0.081	0.011	0.011	0.037	-0.268
2035	0.177	-0.134	-0.245	-0.020	-0.399	-0.002	-0.080	-0.082	0.010	0.011	0.037	-0.245
2036	0.193	-0.130	-0.242	-0.020	-0.393	-0.002	-0.081	-0.083	0.010	0.011	0.037	-0.225
2037	0.210	-0.129	-0.242	-0.020	-0.391	-0.002	-0.082	-0.084	0.010	0.011	0.037	-0.207
2038	0.230	-0.128	-0.242	-0.020	-0.390	-0.002	-0.083	-0.085	0.010	0.010	0.038	-0.188
2039	0.254	-0.127	-0.243	-0.020	-0.390	-0.001	-0.084	-0.085	0.009	0.010	0.038	-0.164
2040	0.274	-0.127	-0.244	-0.020	-0.390	-0.001	-0.085	-0.086	0.009	0.010	0.038	-0.145
2041	0.299	-0.126	-0.244	-0.020	-0.390	-0.001	-0.085	-0.086	0.009	0.010	0.038	-0.121
2042	0.318	-0.126	-0.246	-0.020	-0.392	-0.001	-0.085	-0.086	0.009	0.010	0.038	-0.103
2043	0.340	-0.126	-0.248	-0.020	-0.394	-0.001	-0.085	-0.086	0.008	0.009	0.038	-0.083
2044	0.362	-0.126	-0.250	-0.019	-0.395	-0.001	-0.085	-0.086	0.008	0.009	0.038	-0.063
2045	0.383	-0.126	-0.252	-0.019	-0.397	-0.001	-0.084	-0.085	0.008	0.009	0.038	-0.045
2046	0.402	-0.125	-0.254	-0.019	-0.398	-0.001	-0.084	-0.085	0.008	0.009	0.038	-0.026
2047	0.416	-0.125	-0.255	-0.019	-0.399	-0.001	-0.084	-0.085	0.007	0.009	0.038	-0.014
2048	0.430	-0.124	-0.257	-0.019	-0.400	-0.001	-0.083	-0.084	0.007	0.008	0.038	0.000
2049	0.441	-0.124	-0.258	-0.018	-0.400	-0.001	-0.083	-0.084	0.007	0.008	0.038	0.010
2050	0.454	-0.123	-0.260	-0.018	-0.401	-0.001	-0.082	-0.084	0.007	0.008	0.039	0.023

Table VII.C.6 Projection of PAYGO Rates - Differences from Report 16 (Continued)

		Disability				Survivor						
Year	Retirement	Flat-Rate	Earnings-Related	Children	Sub-Total	Flat-Rate	Earnings-Related	Sub-Total	Orphans	Death	Expenses	Grand Total
2051	0.464	-0.123	-0.261	-0.018	-0.401	-0.001	-0.082	-0.083	0.006	0.008	0.039	0.032
2052	0.469	-0.122	-0.262	-0.018	-0.402	-0.002	-0.082	-0.083	0.006	0.008	0.039	0.037
2053	0.471	-0.122	-0.263	-0.017	-0.403	-0.002	-0.081	-0.083	0.006	0.007	0.039	0.038
2054	0.473	-0.121	-0.265	-0.017	-0.404	-0.002	-0.081	-0.082	0.006	0.007	0.039	0.039
2055	0.470	-0.121	-0.266	-0.017	-0.403	-0.002	-0.080	-0.082	0.006	0.007	0.039	0.036
2056	0.459	-0.120	-0.266	-0.017	-0.403	-0.002	-0.080	-0.082	0.006	0.007	0.039	0.025
2057	0.446	-0.118	-0.265	-0.017	-0.399	-0.002	-0.080	-0.082	0.005	0.007	0.039	0.016
2058	0.432	-0.116	-0.265	-0.017	-0.398	-0.002	-0.079	-0.082	0.005	0.006	0.039	0.003
2059	0.419	-0.115	-0.264	-0.016	-0.396	-0.002	-0.079	-0.081	0.005	0.006	0.039	-0.009
2060	0.403	-0.114	-0.264	-0.016	-0.394	-0.003	-0.079	-0.081	0.005	0.006	0.039	-0.022
2061	0.385	-0.112	-0.263	-0.016	-0.391	-0.003	-0.078	-0.081	0.005	0.006	0.039	-0.037
2062	0.366	-0.111	-0.262	-0.016	-0.389	-0.003	-0.078	-0.081	0.005	0.006	0.039	-0.054
2063	0.349	-0.109	-0.261	-0.016	-0.387	-0.003	-0.078	-0.080	0.005	0.006	0.039	-0.069
2064	0.335	-0.108	-0.261	-0.016	-0.384	-0.003	-0.077	-0.080	0.004	0.005	0.039	-0.080
2065	0.321	-0.106	-0.260	-0.016	-0.382	-0.003	-0.077	-0.079	0.004	0.005	0.039	-0.092
2066	0.308	-0.105	-0.259	-0.016	-0.380	-0.003	-0.076	-0.079	0.004	0.005	0.039	-0.102
2067	0.298	-0.104	-0.259	-0.015	-0.378	-0.003	-0.076	-0.079	0.004	0.005	0.039	-0.110
2068	0.290	-0.103	-0.258	-0.015	-0.376	-0.003	-0.075	-0.078	0.004	0.005	0.039	-0.117
2069	0.282	-0.102	-0.258	-0.015	-0.375	-0.003	-0.075	-0.078	0.004	0.005	0.039	-0.123
2070	0.276	-0.101	-0.259	-0.015	-0.374	-0.003	-0.074	-0.077	0.004	0.004	0.039	-0.128
2071	0.272	-0.100	-0.259	-0.015	-0.374	-0.003	-0.074	-0.077	0.003	0.004	0.039	-0.131
2072	0.269	-0.099	-0.259	-0.015	-0.373	-0.003	-0.074	-0.077	0.003	0.004	0.039	-0.135
2073	0.266	-0.099	-0.260	-0.015	-0.373	-0.003	-0.073	-0.076	0.003	0.004	0.039	-0.137
2074	0.264	-0.098	-0.260	-0.015	-0.373	-0.003	-0.073	-0.076	0.003	0.004	0.039	-0.139
2075	0.262	-0.097	-0.261	-0.014	-0.373	-0.003	-0.073	-0.076	0.003	0.004	0.039	-0.141
2076	0.260	-0.096	-0.262	-0.014	-0.372	-0.003	-0.073	-0.076	0.003	0.004	0.039	-0.143
2077	0.259	-0.096	-0.262	-0.014	-0.372	-0.003	-0.073	-0.076	0.003	0.004	0.039	-0.144
2078	0.257	-0.095	-0.262	-0.014	-0.371	-0.003	-0.074	-0.077	0.003	0.003	0.039	-0.146
2079	0.256	-0.094	-0.263	-0.014	-0.371	-0.003	-0.074	-0.077	0.003	0.003	0.039	-0.147
2080	0.253	-0.094	-0.263	-0.014	-0.370	-0.003	-0.074	-0.077	0.002	0.003	0.040	-0.149
2081	0.252	-0.093	-0.263	-0.014	-0.370	-0.003	-0.075	-0.078	0.002	0.003	0.040	-0.151
2082	0.249	-0.092	-0.263	-0.013	-0.369	-0.003	-0.075	-0.078	0.002	0.003	0.040	-0.153
2083	0.247	-0.091	-0.263	-0.013	-0.368	-0.003	-0.076	-0.079	0.002	0.003	0.040	-0.155
2084	0.244	-0.090	-0.263	-0.013	-0.367	-0.003	-0.076	-0.079	0.002	0.003	0.040	-0.157
2085	0.242	-0.089	-0.263	-0.013	-0.365	-0.003	-0.077	-0.080	0.002	0.003	0.040	-0.159
2086	0.239	-0.088	-0.263	-0.013	-0.364	-0.003	-0.077	-0.080	0.002	0.003	0.040	-0.162
2087	0.236	-0.087	-0.263	-0.013	-0.363	-0.003	-0.078	-0.081	0.002	0.003	0.040	-0.164
2088	0.233	-0.086	-0.262	-0.013	-0.361	-0.003	-0.078	-0.081	0.002	0.002	0.040	-0.166
2089	0.231	-0.085	-0.262	-0.013	-0.360	-0.003	-0.079	-0.082	0.002	0.002	0.040	-0.167
2090	0.229	-0.085	-0.261	-0.013	-0.358	-0.003	-0.079	-0.082	0.002	0.002	0.040	-0.168
2091	0.228	-0.084	-0.261	-0.012	-0.357	-0.003	-0.079	-0.083	0.001	0.002	0.040	-0.169
2092	0.226	-0.083	-0.261	-0.012	-0.356	-0.003	-0.080	-0.083	0.001	0.002	0.040	-0.169
2093	0.226	-0.082	-0.260	-0.012	-0.354	-0.003	-0.080	-0.083	0.001	0.002	0.040	-0.168
2094	0.226	-0.081	-0.260	-0.012	-0.353	-0.003	-0.080	-0.084	0.001	0.002	0.040	-0.167
2095	0.227	-0.080	-0.260	-0.012	-0.352	-0.003	-0.081	-0.084	0.001	0.002	0.040	-0.166
2096	0.228	-0.079	-0.260	-0.012	-0.351	-0.003	-0.081	-0.084	0.001	0.002	0.040	-0.165
2097	0.229	-0.078	-0.260	-0.012	-0.350	-0.003	-0.081	-0.084	0.001	0.002	0.040	-0.162
2098	0.231	-0.078	-0.260	-0.012	-0.349	-0.003	-0.081	-0.084	0.001	0.002	0.040	-0.160
2099	0.233	-0.077	-0.260	-0.012	-0.349	-0.003	-0.081	-0.084	0.001	0.002	0.040	-0.158
2100	0.235	-0.076	-0.260	-0.011	-0.348	-0.003	-0.081	-0.085	0.001	0.002	0.040	-0.155

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Table VII.C.7 Projected Financial Results - 9.8% Ultimate Contribution Rate

Year	Paygo Rate %	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets at 31 Dec.	Yield %	Assets / Expenditures Ratio
1998	8.21	6.40	222,386	14,233	18,252	-4,019	3,850	-169	36,291	10.51	1.91
1999	8.19	7.00	231,677	16,217	18,967	-2,750	3,795	1,045	37,336	10.39	1.89
2000	8.16	7.80	242,196	18,891	19,770	-879	3,763	2,884	40,220	10.03	1.94
2001	8.13	8.60	254,455	21,883	20,684	1,199	3,822	5,021	45,241	9.34	2.08
2002	8.09	9.40	268,567	25,245	21,738	3,507	3,997	7,504	52,745	8.44	2.30
2003	8.06	9.80	284,703	27,901	22,956	4,945	4,307	9,252	61,997	7.73	2.54
2004	8.05	9.80	302,690	29,664	24,365	5,299	4,845	10,144	72,141	7.43	2.78
2005	8.05	9.80	321,666	31,523	25,904	5,619	5,390	11,010	83,150	7.14	3.02
2006	8.07	9.80	341,621	33,479	27,560	5,919	6,055	11,974	95,124	6.98	3.24
2007	8.10	9.80	362,505	35,525	29,364	6,161	6,799	12,961	108,085	6.88	3.45
2008	8.15	9.80	384,160	37,648	31,328	6,320	7,631	13,950	122,035	6.82	3.65
2009	8.21	9.80	407,388	39,924	33,437	6,487	8,527	15,014	137,049	6.77	3.84
2010	8.27	9.80	431,278	42,265	35,682	6,583	9,506	16,089	153,138	6.74	4.02
2011	8.39	9.80	453,439	44,437	38,062	6,375	10,520	16,895	170,033	6.70	4.19
2012	8.51	9.80	476,918	46,738	40,603	6,135	11,618	17,753	187,786	6.69	4.33
2013	8.65	9.80	501,275	49,125	43,337	5,788	12,800	18,588	206,374	6.69	4.46
2014	8.79	9.80	525,894	51,538	46,244	5,294	14,080	19,374	225,747	6.72	4.58
2015	8.94	9.80	551,896	54,086	49,326	4,760	15,407	20,166	245,914	6.74	4.68
2016	9.09	9.80	578,372	56,680	52,592	4,088	16,782	20,870	266,784	6.76	4.76
2017	9.25	9.80	606,195	59,407	56,053	3,354	18,206	21,560	288,344	6.77	4.83
2018	9.41	9.80	634,884	62,219	59,726	2,493	19,675	22,168	310,512	6.79	4.88
2019	9.57	9.80	664,512	65,122	63,621	1,501	21,196	22,698	333,210	6.81	4.92
2020	9.75	9.80	695,029	68,113	67,751	362	22,774	23,136	356,346	6.83	4.94
2021	9.93	9.80	726,538	71,201	72,119	-918	24,417	23,499	379,845	6.85	4.95
2022	10.10	9.80	759,648	74,446	76,710	-2,265	26,089	23,824	403,669	6.87	4.95
2023	10.27	9.80	793,840	77,796	81,534	-3,738	27,766	24,028	427,697	6.88	4.94
2024	10.44	9.80	829,314	81,273	86,582	-5,309	29,417	24,108	451,805	6.88	4.92
2025	10.59	9.80	866,768	84,943	91,825	-6,882	31,072	24,190	475,995	6.87	4.90
2026	10.73	9.80	906,004	88,788	97,233	-8,445	32,731	24,287	500,282	6.87	4.87
2027	10.85	9.80	947,597	92,865	102,771	-9,907	34,396	24,490	524,772	6.87	4.84
2028	10.94	9.80	991,448	97,162	108,447	-11,285	36,075	24,790	549,562	6.87	4.81
2029	11.02	9.80	1,037,117	101,637	114,300	-12,663	37,774	25,111	574,673	6.87	4.78
2030	11.09	9.80	1,085,137	106,343	120,341	-13,998	39,494	25,496	600,169	6.87	4.74
2031	11.14	9.80	1,135,710	111,300	126,563	-15,263	41,239	25,976	626,145	6.87	4.71
2032	11.18	9.80	1,189,146	116,536	132,922	-16,386	43,017	26,632	652,777	6.87	4.68
2033	11.20	9.80	1,244,895	122,000	139,430	-17,430	44,841	27,410	680,187	6.87	4.65
2034	11.21	9.80	1,304,012	127,793	146,138	-18,345	46,718	28,373	708,560	6.87	4.63
2035	11.21	9.80	1,365,842	133,853	153,096	-19,243	48,661	29,417	737,977	6.87	4.60
2036	11.21	9.80	1,430,601	140,199	160,331	-20,132	50,675	30,543	768,520	6.87	4.58
2037	11.19	9.80	1,498,993	146,901	167,797	-20,896	52,766	31,870	800,391	6.87	4.56
2038	11.17	9.80	1,570,438	153,903	175,474	-21,571	54,949	33,378	833,769	6.87	4.55
2039	11.15	9.80	1,644,836	161,194	183,424	-22,230	57,236	35,006	868,775	6.86	4.53
2040	11.12	9.80	1,723,263	168,880	191,704	-22,824	59,636	36,811	905,586	6.86	4.52
2041	11.11	9.80	1,804,247	176,816	200,367	-23,551	62,159	38,608	944,194	6.86	4.51
2042	11.08	9.80	1,889,517	185,173	209,396	-24,223	64,806	40,583	984,777	6.86	4.50
2043	11.06	9.80	1,978,432	193,886	218,804	-24,918	67,589	42,671	1,027,448	6.86	4.49
2044	11.04	9.80	2,070,475	202,907	228,646	-25,739	70,516	44,776	1,072,224	6.86	4.49
2045	11.03	9.80	2,166,730	212,340	238,980	-26,640	73,587	46,946	1,119,171	6.86	4.48
2046	11.02	9.80	2,266,912	222,157	249,835	-27,678	76,806	49,129	1,168,300	6.86	4.47
2047	11.01	9.80	2,371,940	232,450	261,177	-28,727	80,176	51,449	1,219,748	6.86	4.47
2048	11.00	9.80	2,481,166	243,154	273,011	-29,857	83,704	53,848	1,273,596	6.86	4.46
2049	11.00	9.80	2,594,977	254,308	285,433	-31,125	87,398	56,273	1,329,869	6.86	4.45
2050	11.00	9.80	2,713,442	265,917	298,525	-32,608	91,257	58,650	1,388,518	6.86	4.45

Table VII.C.7   Projected Financial Results - 9.8% Ultimate Contribution Rate (Continued)

Year	Paygo Rate %	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expenditures Ratio
2051	11.01	9.80	2,837,229	278,048	312,286	-34,238	95,279	61,041	1,449,559	6.86	4.44
2052	11.01	9.80	2,966,397	290,707	326,673	-35,966	99,463	63,497	1,513,056	6.86	4.43
2053	11.02	9.80	3,101,377	303,935	341,656	-37,721	103,815	66,094	1,579,150	6.86	4.42
2054	11.02	9.80	3,242,899	317,804	357,294	-39,490	108,346	68,856	1,648,006	6.86	4.41
2055	11.02	9.80	3,391,204	332,338	373,672	-41,334	113,065	71,731	1,719,737	6.86	4.40
2056	11.02	9.80	3,546,897	347,596	390,760	-43,164	117,981	74,817	1,794,554	6.86	4.39
2057	11.02	9.80	3,708,935	363,476	408,572	-45,096	123,108	78,012	1,872,565	6.86	4.38
2058	11.01	9.80	3,878,958	380,138	427,192	-47,054	128,454	81,400	1,953,966	6.86	4.38
2059	11.01	9.80	4,057,331	397,618	446,599	-48,981	134,033	85,052	2,039,018	6.86	4.37
2060	11.00	9.80	4,243,739	415,886	466,852	-50,966	139,862	88,896	2,127,914	6.86	4.36
2061	10.99	9.80	4,438,987	435,021	487,983	-52,962	145,954	92,992	2,220,906	6.86	4.35
2062	10.98	9.80	4,643,833	455,096	510,052	-54,956	152,328	97,372	2,318,278	6.86	4.35
2063	10.98	9.80	4,857,972	476,081	533,190	-57,109	159,002	101,894	2,420,171	6.86	4.34
2064	10.97	9.80	5,081,643	498,001	557,397	-59,396	165,986	106,590	2,526,761	6.86	4.34
2065	10.96	9.80	5,316,259	520,993	582,715	-61,722	173,292	111,570	2,638,332	6.86	4.33
2066	10.95	9.80	5,561,431	545,020	609,202	-64,182	180,939	116,758	2,755,090	6.86	4.33
2067	10.95	9.80	5,817,399	570,105	636,926	-66,821	188,942	122,121	2,877,211	6.86	4.32
2068	10.94	9.80	6,085,020	596,332	665,959	-69,627	197,313	127,686	3,004,897	6.86	4.32
2069	10.94	9.80	6,365,152	623,785	696,375	-72,590	206,064	133,474	3,138,371	6.86	4.31
2070	10.94	9.80	6,657,443	652,429	728,245	-75,816	215,212	139,397	3,277,768	6.86	4.30
2071	10.94	9.80	6,962,171	682,293	761,643	-79,350	224,766	145,415	3,423,183	6.86	4.30
2072	10.94	9.80	7,280,865	713,525	796,651	-83,126	234,730	151,604	3,574,787	6.86	4.29
2073	10.95	9.80	7,613,822	746,155	833,359	-87,204	245,118	157,913	3,732,701	6.86	4.28
2074	10.95	9.80	7,960,752	780,154	871,851	-91,697	255,936	164,239	3,896,939	6.86	4.27
2075	10.96	9.80	8,323,300	815,683	912,216	-96,533	267,186	170,653	4,067,592	6.86	4.26
2076	10.97	9.80	8,701,909	852,787	954,532	-101,745	278,872	177,127	4,244,720	6.86	4.25
2077	10.98	9.80	9,096,394	891,447	998,881	-107,434	290,999	183,565	4,428,285	6.86	4.24
2078	10.99	9.80	9,509,179	931,900	1,045,355	-113,456	303,564	190,109	4,618,393	6.85	4.22
2079	11.01	9.80	9,939,516	974,073	1,094,039	-119,966	316,573	196,607	4,815,000	6.85	4.21
2080	11.02	9.80	10,389,314	1,018,153	1,145,019	-126,866	330,023	203,157	5,018,157	6.85	4.19
2081	11.04	9.80	10,859,225	1,064,204	1,198,379	-134,175	343,916	209,741	5,227,899	6.85	4.17
2082	11.05	9.80	11,350,532	1,112,352	1,254,210	-141,858	358,256	216,398	5,444,296	6.85	4.15
2083	11.06	9.80	11,863,887	1,162,661	1,312,613	-149,952	373,045	223,093	5,667,389	6.85	4.13
2084	11.08	9.80	12,400,017	1,215,202	1,373,696	-158,494	388,286	229,792	5,897,180	6.85	4.10
2085	11.09	9.80	12,961,032	1,270,181	1,437,567	-167,386	403,979	236,593	6,133,773	6.85	4.08
2086	11.10	9.80	13,547,714	1,327,676	1,504,332	-176,656	420,130	243,474	6,377,247	6.85	4.05
2087	11.12	9.80	14,160,859	1,387,764	1,574,116	-186,352	436,744	250,392	6,627,640	6.85	4.02
2088	11.13	9.80	14,802,592	1,450,654	1,647,060	-196,406	453,823	257,417	6,885,057	6.85	4.00
2089	11.14	9.80	15,473,099	1,516,364	1,723,313	-206,949	471,374	264,424	7,149,482	6.85	3.97
2090	11.15	9.80	16,175,266	1,585,176	1,803,028	-217,852	489,394	271,542	7,421,023	6.84	3.93
2091	11.16	9.80	16,908,562	1,657,039	1,886,358	-229,319	507,889	278,570	7,699,594	6.84	3.90
2092	11.16	9.80	17,675,954	1,732,244	1,973,479	-241,236	526,854	285,618	7,985,212	6.84	3.87
2093	11.17	9.80	18,477,674	1,810,812	2,064,575	-253,763	546,288	292,525	8,277,737	6.84	3.83
2094	11.18	9.80	19,316,024	1,892,970	2,159,841	-266,871	566,179	299,308	8,577,045	6.84	3.80
2095	11.19	9.80	20,192,664	1,978,881	2,259,486	-280,605	586,519	305,914	8,882,959	6.84	3.76
2096	11.20	9.80	21,109,290	2,068,710	2,363,726	-295,016	607,293	312,277	9,195,236	6.84	3.72
2097	11.21	9.80	22,066,914	2,162,558	2,472,792	-310,235	628,482	318,248	9,513,484	6.83	3.68
2098	11.21	9.80	23,067,326	2,260,598	2,586,915	-326,317	650,059	323,742	9,837,226	6.83	3.63
2099	11.22	9.80	24,113,060	2,363,080	2,706,341	-343,261	671,988	328,727	10,165,953	6.83	3.59
2100	11.23	9.80	25,206,020	2,470,190	2,831,335	-361,145	694,232	333,087	10,499,040	6.83	3.54

Table VII.C.8   Sensitivity Test - Fertility - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,850	-169	36,291	10.51	1.91
1999	8.19	0.00	7.00	231,678	16,217	18,967	-2,750	3,795	1,045	37,336	10.39	1.89
2000	8.16	0.00	7.80	242,198	18,891	19,771	-880	3,763	2,883	40,219	10.03	1.94
2001	8.13	0.00	8.60	254,459	21,883	20,685	1,198	3,822	5,020	45,239	9.34	2.08
2002	8.09	0.00	9.40	268,573	25,246	21,738	3,508	3,997	7,504	52,744	8.44	2.30
2003	8.06	0.00	9.60	284,714	27,333	22,957	4,376	4,296	8,671	61,415	7.76	2.52
2004	8.05	0.00	9.60	302,706	29,060	24,367	4,693	4,792	9,484	70,899	7.46	2.74
2005	8.05	0.00	9.60	321,690	30,882	25,907	4,975	5,290	10,265	81,165	7.16	2.94
2006	8.07	0.00	9.60	341,655	32,799	27,564	5,235	5,902	11,137	92,301	7.00	3.14
2007	8.10	0.00	9.60	362,553	34,805	29,369	5,436	6,587	12,023	104,324	6.89	3.33
2008	8.16	0.01	9.60	384,224	36,886	31,334	5,552	7,352	12,903	117,227	6.83	3.50
2009	8.21	0.00	9.60	407,473	39,117	33,446	5,671	8,173	13,845	131,072	6.78	3.67
2010	8.27	0.00	9.60	431,389	41,413	35,693	5,720	9,070	14,790	145,862	6.74	3.83
2011	8.39	0.00	9.60	453,581	43,544	38,076	5,468	9,992	15,460	161,322	6.70	3.97
2012	8.51	0.00	9.60	477,097	45,801	40,621	5,180	10,988	16,168	177,490	6.68	4.09
2013	8.65	0.00	9.60	501,500	48,144	43,360	4,784	12,058	16,842	194,333	6.69	4.20
2014	8.79	0.00	9.60	526,172	50,513	46,272	4,241	13,215	17,456	211,788	6.71	4.29
2015	8.94	0.00	9.60	552,266	53,018	49,359	3,659	14,407	18,065	229,854	6.73	4.37
2016	9.09	0.00	9.60	578,899	55,574	52,632	2,942	15,634	18,576	248,429	6.75	4.43
2017	9.24	-0.01	9.60	606,944	58,267	56,101	2,166	16,897	19,062	267,492	6.77	4.47
2018	9.40	-0.01	9.60	635,931	61,049	59,783	1,266	18,190	19,456	286,948	6.78	4.51
2019	9.56	-0.01	9.60	665,944	63,931	63,687	244	19,522	19,765	306,714	6.80	4.52
2020	9.73	-0.02	9.60	696,945	66,907	67,827	-920	20,918	19,998	326,712	6.82	4.52
2021	9.90	-0.03	9.60	729,056	69,989	72,206	-2,217	22,342	20,125	346,837	6.84	4.52
2022	10.07	-0.03	9.60	762,904	73,239	76,810	-3,571	23,778	20,207	367,043	6.85	4.50
2023	10.23	-0.04	9.60	797,981	76,606	81,647	-5,041	25,202	20,161	387,204	6.86	4.47
2024	10.39	-0.05	9.60	834,505	80,112	86,710	-6,598	26,582	19,984	407,189	6.86	4.43
2025	10.53	-0.06	9.60	873,196	83,827	91,969	-8,142	27,948	19,806	426,994	6.86	4.38
2026	10.66	-0.07	9.60	913,870	87,732	97,395	-9,663	29,300	19,637	446,631	6.86	4.34
2027	10.76	-0.09	9.60	957,129	91,884	102,953	-11,069	30,640	19,571	466,202	6.86	4.29
2028	10.83	-0.11	9.60	1,002,905	96,279	108,651	-12,372	31,974	19,602	485,804	6.86	4.24
2029	10.90	-0.12	9.60	1,050,769	100,874	114,528	-13,654	33,309	19,655	505,460	6.85	4.19
2030	10.95	-0.14	9.60	1,101,290	105,724	120,596	-14,872	34,647	19,775	525,235	6.85	4.14
2035	10.97	-0.24	9.60	1,400,206	134,420	153,535	-19,115	41,637	22,522	630,781	6.84	3.92
2040	10.77	-0.35	9.60	1,787,433	171,594	192,466	-20,872	50,080	29,208	761,540	6.84	3.78
2045	10.56	-0.47	9.60	2,275,902	218,487	240,317	-21,830	61,359	39,528	937,176	6.84	3.73
2050	10.41	-0.59	9.60	2,889,469	277,389	300,860	-23,471	76,632	53,161	1,174,279	6.83	3.73
2055	10.30	-0.72	9.60	3,665,861	351,923	377,675	-25,752	97,110	71,358	1,491,759	6.84	3.77
2060	10.17	-0.83	9.60	4,660,259	447,385	473,848	-26,463	125,010	98,547	1,925,962	6.84	3.88
2065	10.05	-0.91	9.60	5,929,588	569,240	595,705	-26,465	163,861	137,397	2,530,455	6.85	4.06
2070	9.98	-0.96	9.60	7,537,653	723,615	752,201	-28,586	217,873	189,287	3,367,575	6.85	4.27
2075	9.98	-0.98	9.60	9,560,311	917,790	954,419	-36,629	291,701	255,072	4,505,635	6.86	4.50
2080	10.04	-0.98	9.60	12,103,810	1,161,966	1,215,594	-53,628	390,283	336,655	6,018,293	6.87	4.72
2085	10.11	-0.98	9.60	15,322,005	1,470,913	1,548,627	-77,715	520,028	442,313	8,006,571	6.87	4.93
2090	10.15	-1.00	9.60	19,410,232	1,863,382	1,969,806	-106,424	690,965	584,541	10,627,618	6.88	5.14
2095	10.18	-1.01	9.60	24,597,040	2,361,316	2,503,318	-142,002	917,484	775,481	14,101,185	6.88	5.37
2100	10.21	-1.02	9.60	31,160,972	2,991,453	3,182,097	-190,644	1,218,148	1,027,504	18,707,698	6.89	5.60

Table VII.C.9 Sensitivity Test - Fertility - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,385	14,233	18,252	-4,019	3,850	-170	36,290	10.51	1.91
1999	8.19	0.00	7.00	231,676	16,217	18,966	-2,749	3,795	1,046	37,337	10.39	1.89
2000	8.16	0.00	7.80	242,195	18,891	19,770	-879	3,763	2,884	40,221	10.03	1.94
2001	8.13	0.00	8.60	254,451	21,883	20,684	1,199	3,822	5,020	45,241	9.34	2.08
2002	8.09	0.00	9.40	268,560	25,245	21,737	3,508	3,997	7,504	52,746	8.44	2.30
2003	8.06	0.00	9.90	284,693	28,185	22,955	5,230	4,313	9,543	62,289	7.72	2.56
2004	8.05	0.00	9.90	302,673	29,965	24,363	5,602	4,872	10,473	72,762	7.42	2.81
2005	8.05	0.00	9.90	321,642	31,843	25,902	5,941	5,441	11,381	84,143	7.13	3.05
2006	8.07	0.00	9.90	341,586	33,817	27,557	6,260	6,131	12,391	96,534	6.98	3.29
2007	8.10	0.00	9.90	362,458	35,883	29,359	6,524	6,905	13,430	109,964	6.88	3.51
2008	8.15	0.00	9.90	384,096	38,026	31,321	6,705	7,770	14,475	124,439	6.82	3.72
2009	8.21	0.00	9.90	407,303	40,323	33,429	6,894	8,703	15,597	140,036	6.77	3.93
2010	8.27	0.00	9.90	431,167	42,686	35,671	7,015	9,724	16,738	156,775	6.74	4.12
2011	8.39	0.00	9.90	453,297	44,876	38,048	6,828	10,784	17,613	174,388	6.70	4.30
2012	8.51	0.00	9.90	476,738	47,197	40,585	6,612	11,932	18,545	192,932	6.69	4.45
2013	8.64	-0.01	9.90	501,050	49,604	43,314	6,290	13,170	19,460	212,392	6.70	4.60
2014	8.79	0.00	9.90	525,615	52,036	46,217	5,819	14,513	20,331	232,724	6.72	4.72
2015	8.94	0.00	9.90	551,525	54,601	49,292	5,309	15,906	21,215	253,939	6.74	4.83
2016	9.09	0.00	9.90	577,844	57,207	52,551	4,656	17,355	22,011	275,950	6.76	4.93
2017	9.25	0.00	9.90	605,445	59,939	56,005	3,934	18,860	22,794	298,744	6.78	5.01
2018	9.41	0.00	9.90	633,837	62,750	59,670	3,080	20,416	23,496	322,240	6.79	5.07
2019	9.58	0.01	9.90	663,081	65,645	63,556	2,089	22,030	24,119	346,359	6.81	5.12
2020	9.76	0.01	9.90	693,111	68,618	67,675	943	23,707	24,650	371,009	6.83	5.15
2021	9.95	0.02	9.90	724,020	71,678	72,032	-354	25,444	25,090	396,099	6.85	5.17
2022	10.13	0.03	9.90	756,394	74,883	76,611	-1,728	27,227	25,499	421,598	6.87	5.18
2023	10.31	0.04	9.90	789,703	78,181	81,421	-3,240	29,022	25,781	447,379	6.88	5.17
2024	10.49	0.05	9.90	824,129	81,589	86,454	-4,865	30,795	25,930	473,309	6.88	5.16
2025	10.66	0.07	9.90	860,348	85,174	91,681	-6,507	32,578	26,071	499,381	6.88	5.14
2026	10.81	0.08	9.90	898,143	88,916	97,071	-8,155	34,369	26,214	525,595	6.88	5.12
2027	10.94	0.09	9.90	938,065	92,868	102,590	-9,722	36,169	26,448	552,043	6.88	5.10
2028	11.05	0.11	9.90	979,998	97,020	108,244	-11,224	37,985	26,761	578,804	6.88	5.07
2029	11.15	0.13	9.90	1,023,481	101,325	114,073	-12,748	39,822	27,074	605,877	6.88	5.05
2030	11.23	0.14	9.90	1,069,007	105,832	120,087	-14,255	41,679	27,424	633,301	6.88	5.02
2035	11.46	0.25	9.90	1,331,581	131,827	152,662	-20,835	51,450	30,614	778,987	6.87	4.87
2040	11.51	0.39	9.90	1,659,503	164,291	190,950	-26,659	62,603	35,944	947,050	6.87	4.75
2045	11.54	0.51	9.90	2,058,780	203,819	237,661	-33,842	75,743	41,901	1,144,820	6.87	4.61
2050	11.66	0.66	9.90	2,540,787	251,538	296,228	-44,690	90,711	46,021	1,367,902	6.86	4.42
2055	11.83	0.81	9.90	3,124,482	309,324	369,738	-60,414	106,471	46,057	1,599,546	6.85	4.14
2060	11.97	0.97	9.90	3,843,824	380,539	459,988	-79,449	121,601	42,151	1,819,751	6.84	3.79
2065	12.04	1.08	9.90	4,734,849	468,750	570,001	-101,251	134,627	33,376	2,006,783	6.82	3.37
2070	12.08	1.14	9.90	5,834,105	577,576	704,871	-127,295	143,365	16,070	2,126,183	6.79	2.89
2075	12.13	1.17	9.90	7,182,173	711,035	871,153	-160,118	143,980	-16,138	2,117,409	6.75	2.33
2080	12.19	1.17	9.90	8,831,100	874,279	1,076,573	-202,294	130,045	-72,250	1,880,303	6.66	1.67
2085	12.26	1.17	9.90	10,848,319	1,073,984	1,330,396	-256,412	91,454	-164,959	1,258,646	6.43	0.91
2090	12.33	1.18	9.90	13,324,805	1,319,156	1,643,329	-324,173	13,110	-311,063	20,921	3.95	0.01
2095	12.39	1.20	9.90	16,369,973	1,620,627	2,028,466	-407,839	-126,844	-534,683	-2,168,107	3.00	-1.02
2100	12.45	1.22	9.90	20,114,056	1,991,292	2,503,240	-511,949	-360,324	-872,273	-5,799,315	3.00	-2.22

Table VII.C.10   Sensitivity Test - Migration - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.20	-0.01	6.40	222,520	14,241	18,252	-4,011	3,850	-161	36,299	10.51	1.91
1999	8.18	-0.01	7.00	231,958	16,237	18,968	-2,731	3,795	1,064	37,363	10.39	1.89
2000	8.15	-0.01	7.80	242,687	18,930	19,773	-843	3,764	2,921	40,284	10.02	1.95
2001	8.11	-0.02	8.60	255,229	21,950	20,689	1,261	3,826	5,087	45,372	9.32	2.09
2002	8.06	-0.03	9.40	269,714	25,353	21,745	3,608	4,006	7,614	52,986	8.43	2.31
2003	8.02	-0.04	9.50	286,330	27,201	22,968	4,233	4,308	8,541	61,527	7.76	2.52
2004	8.00	-0.05	9.50	304,920	28,967	24,383	4,584	4,795	9,380	70,907	7.46	2.73
2005	7.99	-0.06	9.50	324,639	30,841	25,931	4,910	5,287	10,197	81,104	7.16	2.94
2006	7.99	-0.08	9.50	345,430	32,816	27,597	5,219	5,895	11,114	92,218	7.00	3.14
2007	8.01	-0.09	9.50	367,251	34,889	29,414	5,475	6,580	12,054	104,272	6.89	3.32
2008	8.05	-0.10	9.50	389,945	37,045	31,393	5,652	7,348	13,000	117,272	6.83	3.50
2009	8.09	-0.12	9.50	414,338	39,362	33,521	5,841	8,178	14,019	131,291	6.77	3.67
2010	8.14	-0.13	9.50	439,513	41,754	35,788	5,966	9,088	15,053	146,344	6.74	3.83
2011	8.25	-0.14	9.50	463,037	43,989	38,194	5,795	10,030	15,825	162,169	6.70	3.98
2012	8.35	-0.16	9.50	488,020	46,362	40,764	5,598	11,053	16,651	178,820	6.68	4.11
2013	8.47	-0.18	9.50	514,023	48,832	43,532	5,300	12,159	17,459	196,279	6.68	4.22
2014	8.60	-0.19	9.50	540,425	51,340	46,479	4,861	13,361	18,223	214,502	6.71	4.32
2015	8.73	-0.21	9.50	568,379	53,996	49,605	4,391	14,608	18,999	233,501	6.73	4.41
2016	8.87	-0.22	9.50	596,965	56,712	52,923	3,789	15,903	19,692	253,193	6.75	4.49
2017	9.00	-0.25	9.50	627,094	59,574	56,443	3,131	17,246	20,377	273,570	6.76	4.55
2018	9.14	-0.27	9.50	658,281	62,537	60,183	2,354	18,634	20,987	294,557	6.78	4.59
2019	9.29	-0.28	9.50	690,611	65,608	64,153	1,455	20,074	21,529	316,086	6.80	4.62
2020	9.44	-0.31	9.50	724,045	68,784	68,369	415	21,572	21,987	338,073	6.82	4.64
2021	9.60	-0.33	9.50	758,699	72,076	72,834	-758	23,133	22,375	360,448	6.84	4.65
2022	9.75	-0.35	9.50	795,218	75,546	77,535	-1,989	24,726	22,737	383,185	6.86	4.65
2023	9.90	-0.37	9.50	833,077	79,142	82,482	-3,340	26,327	22,987	406,173	6.87	4.63
2024	10.05	-0.39	9.50	872,488	82,886	87,668	-4,782	27,904	23,123	429,295	6.87	4.61
2025	10.18	-0.41	9.50	914,188	86,848	93,067	-6,219	29,489	23,270	452,566	6.87	4.59
2026	10.30	-0.43	9.50	957,969	91,007	98,650	-7,643	31,083	23,441	476,006	6.87	4.56
2027	10.39	-0.46	9.50	1,004,447	95,422	104,385	-8,963	32,688	23,726	499,732	6.87	4.53
2028	10.47	-0.47	9.50	1,053,543	100,087	110,280	-10,193	34,312	24,119	523,851	6.86	4.50
2029	10.53	-0.49	9.50	1,104,800	104,956	116,377	-11,421	35,963	24,542	548,392	6.86	4.47
2030	10.59	-0.50	9.50	1,158,800	110,086	122,690	-12,604	37,641	25,037	573,429	6.86	4.44
2035	10.66	-0.55	9.50	1,475,928	140,213	157,335	-17,122	46,723	29,601	710,812	6.86	4.31
2040	10.57	-0.55	9.50	1,883,244	178,908	198,979	-20,071	57,849	37,779	881,627	6.85	4.23
2045	10.47	-0.56	9.50	2,394,687	227,495	250,816	-23,321	72,244	48,924	1,102,946	6.85	4.20
2050	10.45	-0.55	9.50	3,033,840	288,215	316,901	-28,686	90,755	62,069	1,386,289	6.85	4.17
2055	10.46	-0.56	9.50	3,836,566	364,474	401,211	-36,737	113,975	77,238	1,740,561	6.85	4.14
2060	10.44	-0.56	9.50	4,857,135	461,428	507,033	-45,605	143,014	97,409	2,184,854	6.85	4.11
2065	10.40	-0.56	9.50	6,154,185	584,648	640,198	-55,550	179,875	124,325	2,750,014	6.85	4.10
2070	10.38	-0.56	9.50	7,793,545	740,387	809,354	-68,967	226,876	157,909	3,469,809	6.85	4.09
2075	10.41	-0.55	9.50	9,854,150	936,144	1,025,411	-89,267	286,151	196,885	4,374,428	6.85	4.07
2080	10.46	-0.56	9.50	12,441,910	1,181,981	1,301,490	-119,509	359,277	239,769	5,486,078	6.85	4.02
2085	10.52	-0.57	9.50	15,701,830	1,491,674	1,652,116	-160,442	447,529	287,087	6,824,810	6.84	3.94
2090	10.57	-0.58	9.50	19,821,822	1,883,073	2,095,236	-212,163	552,579	340,416	8,417,641	6.84	3.83
2095	10.61	-0.58	9.50	25,027,820	2,377,643	2,655,254	-277,611	676,365	398,754	10,293,358	6.83	3.70
2100	10.65	-0.58	9.50	31,597,968	3,001,807	3,364,856	-363,049	819,848	456,799	12,463,208	6.83	3.53

Table VII.C.11   Sensitivity Test - Migration - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,206	14,221	18,251	-4,030	3,850	-180	36,280	10.51	1.91
1999	8.20	0.01	7.00	231,303	16,191	18,965	-2,774	3,794	1,020	37,300	10.39	1.89
2000	8.18	0.02	7.80	241,544	18,840	19,767	-927	3,761	2,835	40,135	10.03	1.94
2001	8.16	0.03	8.60	253,424	21,794	20,678	1,116	3,815	4,932	45,067	9.35	2.07
2002	8.14	0.05	9.40	267,041	25,102	21,727	3,375	3,984	7,359	52,426	8.46	2.29
2003	8.12	0.06	10.20	282,544	28,819	22,940	5,879	4,307	10,186	62,612	7.70	2.57
2004	8.12	0.07	10.20	299,732	30,573	24,341	6,232	4,910	11,141	73,753	7.40	2.85
2005	8.14	0.09	10.20	317,728	32,408	25,869	6,539	5,525	12,064	85,818	7.11	3.12
2006	8.17	0.10	10.20	336,586	34,332	27,511	6,821	6,263	13,084	98,901	6.97	3.38
2007	8.22	0.12	10.20	356,244	36,337	29,298	7,039	7,085	14,123	113,025	6.87	3.62
2008	8.30	0.15	10.20	376,540	38,407	31,241	7,166	7,997	15,163	128,188	6.82	3.85
2009	8.37	0.16	10.20	398,251	40,622	33,326	7,296	8,977	16,273	144,461	6.77	4.06
2010	8.45	0.18	10.20	420,471	42,888	35,542	7,346	10,044	17,390	161,850	6.75	4.27
2011	8.59	0.20	10.20	440,865	44,968	37,889	7,079	11,148	18,227	180,078	6.71	4.46
2012	8.74	0.23	10.20	462,400	47,165	40,391	6,774	12,338	19,111	199,189	6.70	4.62
2013	8.89	0.24	10.20	484,634	49,433	43,081	6,352	13,613	19,965	219,154	6.71	4.77
2014	9.06	0.27	10.20	506,961	51,710	45,937	5,773	14,989	20,762	239,916	6.73	4.90
2015	9.23	0.29	10.20	530,458	54,107	48,959	5,148	16,411	21,559	261,475	6.75	5.01
2016	9.41	0.32	10.20	554,234	56,532	52,158	4,374	17,882	22,256	283,730	6.77	5.11
2017	9.59	0.34	10.20	579,115	59,070	55,544	3,526	19,401	22,927	306,658	6.79	5.19
2018	9.78	0.37	10.20	604,625	61,672	59,130	2,542	20,964	23,506	330,163	6.80	5.25
2019	9.98	0.41	10.20	630,824	64,344	62,927	1,417	22,577	23,994	354,157	6.82	5.29
2020	10.18	0.43	10.20	657,648	67,080	66,945	135	24,246	24,381	378,538	6.84	5.32
2021	10.39	0.46	10.20	685,186	69,889	71,188	-1,299	25,977	24,678	403,215	6.86	5.33
2022	10.59	0.49	10.20	714,001	72,828	75,638	-2,810	27,731	24,921	428,137	6.87	5.33
2023	10.80	0.53	10.20	743,587	75,846	80,303	-4,457	29,486	25,028	453,165	6.88	5.32
2024	11.00	0.56	10.20	774,129	78,961	85,172	-6,211	31,207	24,997	478,162	6.88	5.30
2025	11.19	0.60	10.20	806,277	82,240	90,214	-7,974	32,926	24,952	503,114	6.88	5.27
2026	11.36	0.63	10.20	839,850	85,665	95,397	-9,732	34,640	24,907	528,021	6.88	5.24
2027	11.50	0.65	10.20	875,370	89,288	100,684	-11,396	36,350	24,953	552,974	6.88	5.21
2028	11.62	0.68	10.20	912,721	93,098	106,079	-12,981	38,062	25,081	578,055	6.88	5.18
2029	11.73	0.71	10.20	951,484	97,051	111,619	-14,568	39,783	25,215	603,270	6.88	5.14
2030	11.82	0.73	10.20	992,135	101,198	117,310	-16,112	41,512	25,400	628,671	6.88	5.11
2035	12.02	0.81	10.20	1,228,377	125,294	147,658	-22,364	50,502	28,138	762,561	6.88	4.94
2040	11.96	0.84	10.20	1,525,798	155,631	182,427	-26,796	60,854	34,059	919,487	6.87	4.84
2045	11.86	0.83	10.20	1,888,705	192,648	223,997	-31,349	73,624	42,275	1,113,797	6.87	4.77
2050	11.84	0.84	10.20	2,327,404	237,395	275,457	-38,062	89,359	51,297	1,352,118	6.87	4.71
2055	11.86	0.84	10.20	2,861,187	291,841	339,416	-47,575	108,166	60,592	1,635,734	6.87	4.62
2060	11.85	0.85	10.20	3,522,796	359,325	417,364	-58,039	130,459	72,421	1,972,925	6.87	4.54
2065	11.80	0.84	10.20	4,343,810	443,069	512,656	-69,587	157,276	87,688	2,379,678	6.86	4.45
2070	11.77	0.83	10.20	5,355,819	546,294	630,491	-84,198	189,684	105,487	2,870,815	6.86	4.37
2075	11.79	0.83	10.20	6,592,167	672,401	777,369	-104,968	228,240	123,272	3,452,287	6.86	4.26
2080	11.86	0.84	10.20	8,098,448	826,042	960,805	-134,763	272,403	137,640	4,113,680	6.85	4.10
2085	11.95	0.86	10.20	9,942,096	1,014,094	1,187,992	-173,898	320,612	146,714	4,831,468	6.84	3.90
2090	12.02	0.87	10.20	12,211,354	1,245,558	1,467,232	-221,674	370,797	149,123	5,575,428	6.83	3.64
2095	12.06	0.87	10.20	15,005,976	1,530,610	1,810,249	-279,640	420,068	140,429	6,300,838	6.82	3.34
2100	12.11	0.88	10.20	18,440,132	1,880,893	2,233,209	-352,316	463,264	110,948	6,925,671	6.80	2.97

Table VII.C.12 Sensitivity Test - Mortality - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.19	-0.02	6.40	222,328	14,229	18,213	-3,984	3,850	-134	36,326	10.51	1.92
1999	8.17	-0.02	7.00	231,584	16,211	18,918	-2,707	3,797	1,090	37,415	10.39	1.90
2000	8.14	-0.02	7.80	242,063	18,881	19,709	-828	3,767	2,939	40,355	10.02	1.96
2001	8.10	-0.03	8.60	254,274	21,868	20,607	1,261	3,830	5,091	45,446	9.32	2.10
2002	8.07	-0.02	9.40	268,332	25,223	21,641	3,582	4,010	7,592	53,038	8.43	2.32
2003	8.03	-0.03	9.50	284,406	27,019	22,836	4,183	4,309	8,492	61,530	7.76	2.54
2004	8.01	-0.04	9.50	302,321	28,720	24,218	4,502	4,793	9,296	70,826	7.46	2.75
2005	8.01	-0.04	9.50	321,217	30,516	25,725	4,791	5,279	10,070	80,895	7.16	2.96
2006	8.02	-0.05	9.50	341,082	32,403	27,345	5,058	5,877	10,935	91,830	7.00	3.15
2007	8.04	-0.06	9.50	361,869	34,378	29,107	5,271	6,549	11,819	103,650	6.89	3.34
2008	8.09	-0.06	9.50	383,417	36,425	31,025	5,400	7,300	12,699	116,349	6.83	3.52
2009	8.14	-0.07	9.50	406,528	38,620	33,082	5,538	8,108	13,646	129,995	6.78	3.69
2010	8.20	-0.07	9.50	430,292	40,878	35,269	5,609	8,991	14,600	144,595	6.74	3.85
2011	8.31	-0.08	9.50	452,320	42,970	37,586	5,384	9,901	15,286	159,880	6.70	3.99
2012	8.42	-0.09	9.50	475,656	45,187	40,057	5,130	10,886	16,017	175,897	6.68	4.12
2013	8.55	-0.10	9.50	499,858	47,487	42,714	4,773	11,947	16,719	192,616	6.68	4.23
2014	8.69	-0.10	9.50	524,314	49,810	45,537	4,273	13,097	17,370	209,986	6.71	4.33
2015	8.82	-0.12	9.50	550,135	52,263	48,526	3,737	14,284	18,020	228,006	6.73	4.41
2016	8.97	-0.12	9.50	576,419	54,760	51,692	3,068	15,509	18,577	246,583	6.75	4.48
2017	9.11	-0.14	9.50	604,035	57,383	55,044	2,339	16,774	19,113	265,697	6.76	4.53
2018	9.26	-0.15	9.50	632,502	60,088	58,599	1,489	18,073	19,561	285,258	6.78	4.57
2019	9.42	-0.15	9.50	661,892	62,880	62,364	516	19,413	19,929	305,187	6.80	4.60
2020	9.59	-0.16	9.50	692,155	65,755	66,352	-597	20,818	20,221	325,408	6.82	4.61
2021	9.75	-0.18	9.50	723,392	68,722	70,566	-1,844	22,259	20,415	345,823	6.84	4.61
2022	9.92	-0.18	9.50	756,210	71,840	74,991	-3,151	23,717	20,566	366,389	6.85	4.60
2023	10.08	-0.19	9.50	790,092	75,059	79,634	-4,575	25,167	20,592	386,981	6.87	4.58
2024	10.24	-0.20	9.50	825,233	78,397	84,485	-6,088	26,579	20,491	407,472	6.87	4.55
2025	10.38	-0.21	9.50	862,327	81,921	89,515	-7,594	27,982	20,388	427,860	6.86	4.52
2026	10.51	-0.22	9.50	901,175	85,612	94,694	-9,082	29,376	20,294	448,154	6.86	4.48
2027	10.61	-0.24	9.50	942,344	89,523	99,986	-10,463	30,764	20,300	468,454	6.86	4.44
2028	10.69	-0.25	9.50	985,737	93,645	105,396	-11,751	32,150	20,399	488,854	6.86	4.41
2029	10.76	-0.26	9.50	1,030,912	97,937	110,964	-13,027	33,544	20,516	509,370	6.86	4.36
2030	10.82	-0.27	9.50	1,078,399	102,448	116,700	-14,252	34,944	20,692	530,061	6.86	4.32
2035	10.89	-0.32	9.50	1,355,683	128,790	147,590	-18,800	42,286	23,486	640,520	6.85	4.15
2040	10.75	-0.37	9.50	1,708,085	162,268	183,655	-21,387	51,031	29,644	774,813	6.85	4.04
2045	10.61	-0.42	9.50	2,144,421	203,720	227,579	-23,859	62,310	38,451	948,612	6.85	3.99
2050	10.55	-0.45	9.50	2,681,202	254,714	282,797	-28,083	76,840	48,757	1,171,315	6.85	3.96
2055	10.53	-0.49	9.50	3,345,308	317,804	352,413	-34,609	95,020	60,411	1,448,796	6.84	3.93
2060	10.49	-0.51	9.50	4,179,101	397,015	438,461	-41,446	117,705	76,259	1,796,306	6.84	3.92
2065	10.43	-0.53	9.50	5,226,035	496,473	544,922	-48,449	146,639	98,190	2,240,932	6.84	3.94
2070	10.38	-0.56	9.50	6,532,489	620,586	677,874	-57,288	183,993	126,706	2,814,741	6.84	3.97
2075	10.37	-0.59	9.50	8,151,577	774,400	844,991	-70,591	232,009	161,418	3,550,035	6.85	4.02
2080	10.39	-0.63	9.50	10,154,972	964,722	1,055,439	-90,717	292,720	202,004	4,476,372	6.85	4.06
2085	10.43	-0.66	9.50	12,643,090	1,201,094	1,318,695	-117,602	368,345	250,743	5,628,585	6.85	4.08
2090	10.45	-0.70	9.50	15,745,780	1,495,849	1,645,979	-150,130	462,262	312,132	7,060,418	6.85	4.10
2095	10.46	-0.73	9.50	19,614,744	1,863,401	2,052,561	-189,160	579,425	390,265	8,848,049	6.85	4.12
2100	10.47	-0.76	9.50	24,431,104	2,320,955	2,559,018	-238,063	726,014	487,950	11,084,335	6.85	4.14

Table VII.C.13 Sensitivity Test - Mortality - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.22	0.01	6.40	222,440	14,236	18,291	-4,055	3,850	-205	36,255	10.51	1.91
1999	8.20	0.01	7.00	231,764	16,223	19,015	-2,792	3,793	1,001	37,256	10.40	1.88
2000	8.18	0.02	7.80	242,321	18,901	19,832	-931	3,759	2,828	40,084	10.04	1.93
2001	8.15	0.02	8.60	254,622	21,897	20,761	1,136	3,813	4,949	45,033	9.35	2.06
2002	8.12	0.03	9.40	268,783	25,266	21,833	3,433	3,983	7,416	52,449	8.46	2.27
2003	8.10	0.04	10.00	284,976	28,498	23,074	5,424	4,299	9,723	62,172	7.72	2.54
2004	8.09	0.04	10.00	303,027	30,303	24,510	5,793	4,870	10,663	72,834	7.42	2.79
2005	8.10	0.05	10.00	322,075	32,208	26,081	6,127	5,452	11,578	84,413	7.13	3.04
2006	8.12	0.05	10.00	342,110	34,211	27,772	6,439	6,156	12,595	97,008	6.97	3.28
2007	8.16	0.06	10.00	363,082	36,308	29,615	6,693	6,944	13,637	110,645	6.87	3.50
2008	8.22	0.07	10.00	384,831	38,483	31,624	6,859	7,823	14,682	125,327	6.82	3.71
2009	8.28	0.07	10.00	408,164	40,816	33,784	7,032	8,770	15,802	141,129	6.77	3.91
2010	8.35	0.08	10.00	432,166	43,217	36,084	7,133	9,804	16,936	158,065	6.74	4.10
2011	8.48	0.09	10.00	454,444	45,444	38,526	6,918	10,877	17,795	175,861	6.71	4.28
2012	8.60	0.09	10.00	478,050	47,805	41,134	6,671	12,037	18,708	194,569	6.69	4.43
2013	8.74	0.09	10.00	502,542	50,254	43,942	6,312	13,285	19,597	214,166	6.70	4.56
2014	8.90	0.11	10.00	527,307	52,731	46,931	5,800	14,635	20,435	234,601	6.73	4.68
2015	9.05	0.11	10.00	553,468	55,347	50,101	5,246	16,035	21,281	255,882	6.75	4.79
2016	9.22	0.13	10.00	580,112	58,011	53,463	4,548	17,487	22,035	277,917	6.76	4.87
2017	9.38	0.13	10.00	608,118	60,812	57,030	3,782	18,992	22,774	300,691	6.78	4.94
2018	9.55	0.14	10.00	637,003	63,700	60,817	2,883	20,544	23,428	324,119	6.79	5.00
2019	9.72	0.15	10.00	666,841	66,684	64,836	1,848	22,151	23,999	348,118	6.81	5.04
2020	9.91	0.16	10.00	697,581	69,758	69,100	658	23,818	24,476	372,593	6.83	5.06
2021	10.09	0.16	10.00	729,329	72,933	73,615	-682	25,547	24,865	397,458	6.85	5.07
2022	10.27	0.17	10.00	762,695	76,270	78,366	-2,097	27,313	25,216	422,674	6.87	5.07
2023	10.46	0.19	10.00	797,161	79,716	83,363	-3,647	29,086	25,439	448,113	6.88	5.06
2024	10.64	0.20	10.00	832,928	83,293	88,598	-5,305	30,835	25,529	473,643	6.88	5.04
2025	10.80	0.21	10.00	870,697	87,070	94,043	-6,973	32,588	25,614	499,257	6.88	5.01
2026	10.95	0.22	10.00	910,275	91,028	99,670	-8,643	34,346	25,703	524,960	6.88	4.98
2027	11.07	0.22	10.00	952,238	95,224	105,444	-10,220	36,108	25,888	550,848	6.88	4.95
2028	11.18	0.24	10.00	996,492	99,649	111,372	-11,723	37,883	26,161	577,009	6.88	4.91
2029	11.27	0.25	10.00	1,042,592	104,259	117,497	-13,238	39,677	26,439	603,448	6.87	4.87
2030	11.35	0.26	10.00	1,091,079	109,108	123,829	-14,721	41,488	26,767	630,215	6.87	4.83
2035	11.52	0.31	10.00	1,374,771	137,477	158,376	-20,899	51,024	30,125	772,894	6.87	4.65
2040	11.49	0.37	10.00	1,736,562	173,656	199,451	-25,795	62,083	36,288	940,676	6.86	4.51
2045	11.44	0.41	10.00	2,186,237	218,624	250,017	-31,393	75,548	44,155	1,145,342	6.86	4.38
2050	11.45	0.45	10.00	2,741,602	274,160	313,837	-39,677	91,735	52,059	1,390,067	6.86	4.23
2055	11.50	0.48	10.00	3,431,273	343,127	394,442	-51,315	110,434	59,119	1,671,324	6.85	4.05
2060	11.50	0.50	10.00	4,300,143	430,014	494,614	-64,600	131,584	66,984	1,990,145	6.84	3.85
2065	11.48	0.52	10.00	5,394,936	539,494	619,604	-80,110	155,459	75,349	2,350,538	6.83	3.63
2070	11.49	0.55	10.00	6,766,307	676,631	777,292	-100,661	181,809	81,147	2,746,558	6.82	3.38
2075	11.54	0.58	10.00	8,472,792	847,279	977,598	-130,319	208,969	78,650	3,149,561	6.80	3.08
2080	11.63	0.61	10.00	10,593,194	1,059,319	1,232,193	-172,874	232,896	60,022	3,495,020	6.78	2.71
2085	11.73	0.64	10.00	13,237,564	1,323,756	1,553,367	-229,611	246,736	17,126	3,677,997	6.74	2.26
2090	11.82	0.67	10.00	16,548,734	1,654,873	1,956,126	-301,253	240,538	-60,715	3,546,936	6.67	1.73
2095	11.89	0.70	10.00	20,695,132	2,069,513	2,461,138	-391,625	199,659	-191,965	2,875,984	6.51	1.12
2100	11.96	0.73	10.00	25,879,738	2,587,974	3,096,492	-508,518	101,363	-407,155	1,312,215	5.89	0.40

Table VII.C.14   Sensitivity Test - Disability - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,850	-170	36,291	10.51	1.91
1999	8.18	-0.01	7.00	231,677	16,217	18,962	-2,745	3,795	1,050	37,341	10.39	1.89
2000	8.16	0.00	7.80	242,196	18,891	19,753	-862	3,763	2,902	40,242	10.03	1.95
2001	8.11	-0.02	8.60	254,455	21,883	20,646	1,237	3,824	5,061	45,303	9.33	2.09
2002	8.07	-0.02	9.40	268,567	25,245	21,671	3,574	4,002	7,576	52,880	8.44	2.31
2003	8.03	-0.03	9.60	284,703	27,331	22,851	4,480	4,307	8,787	61,667	7.75	2.55
2004	8.00	-0.05	9.60	302,690	29,058	24,212	4,846	4,812	9,658	71,325	7.45	2.78
2005	7.99	-0.06	9.60	321,666	30,880	25,691	5,189	5,325	10,513	81,839	7.15	3.00
2006	7.99	-0.08	9.60	341,621	32,796	27,283	5,513	5,955	11,468	93,306	7.00	3.22
2007	8.01	-0.09	9.60	362,505	34,800	29,022	5,778	6,665	12,443	105,750	6.89	3.42
2008	8.05	-0.10	9.60	384,160	36,879	30,922	5,957	7,461	13,418	119,168	6.83	3.61
2009	8.09	-0.12	9.60	407,388	39,109	32,967	6,142	8,321	14,463	133,631	6.77	3.80
2010	8.15	-0.12	9.60	431,278	41,403	35,146	6,257	9,262	15,519	149,150	6.74	3.98
2011	8.26	-0.13	9.60	453,439	43,530	37,463	6,067	10,237	16,304	165,454	6.70	4.14
2012	8.38	-0.13	9.60	476,918	45,784	39,944	5,840	11,294	17,134	182,588	6.69	4.28
2013	8.50	-0.15	9.60	501,275	48,122	42,618	5,504	12,433	17,938	200,526	6.69	4.41
2014	8.65	-0.14	9.60	525,894	50,486	45,464	5,022	13,669	18,691	219,217	6.72	4.52
2015	8.78	-0.16	9.60	551,896	52,982	48,482	4,500	14,948	19,448	238,665	6.74	4.62
2016	8.94	-0.15	9.60	578,372	55,524	51,684	3,840	16,274	20,113	258,778	6.75	4.70
2017	9.09	-0.16	9.60	606,195	58,195	55,081	3,114	17,646	20,759	279,537	6.77	4.76
2018	9.24	-0.17	9.60	634,884	60,949	58,689	2,260	19,059	21,319	300,857	6.79	4.81
2019	9.41	-0.16	9.60	664,512	63,793	62,519	1,274	20,521	21,796	322,652	6.80	4.85
2020	9.58	-0.17	9.60	695,029	66,723	66,585	138	22,040	22,178	344,830	6.83	4.86
2021	9.76	-0.17	9.60	726,538	69,748	70,889	-1,141	23,618	22,476	367,307	6.85	4.87
2022	9.93	-0.17	9.60	759,648	72,926	75,418	-2,492	25,219	22,727	390,034	6.86	4.86
2023	10.10	-0.17	9.60	793,840	76,209	80,180	-3,971	26,820	22,849	412,882	6.87	4.85
2024	10.27	-0.17	9.60	829,314	79,614	85,167	-5,553	28,389	22,836	435,718	6.87	4.82
2025	10.42	-0.17	9.60	866,768	83,210	90,352	-7,142	29,955	22,813	458,531	6.87	4.79
2026	10.56	-0.17	9.60	906,004	86,976	95,702	-8,726	31,518	22,793	481,323	6.87	4.76
2027	10.68	-0.17	9.60	947,597	90,969	101,181	-10,212	33,079	22,867	504,191	6.87	4.72
2028	10.77	-0.17	9.60	991,448	95,179	106,799	-11,620	34,645	23,025	527,215	6.87	4.68
2029	10.86	-0.16	9.60	1,037,117	99,563	112,591	-13,028	36,220	23,192	550,408	6.87	4.64
2030	10.93	-0.16	9.60	1,085,137	104,173	118,567	-14,394	37,806	23,412	573,820	6.87	4.60
2035	11.05	-0.16	9.60	1,365,842	131,121	150,899	-19,778	46,117	26,339	698,375	6.86	4.42
2040	10.96	-0.16	9.60	1,723,263	165,433	188,941	-23,508	55,835	32,327	846,565	6.86	4.29
2045	10.87	-0.16	9.60	2,166,730	208,006	235,488	-27,482	67,963	40,481	1,032,065	6.85	4.19
2050	10.84	-0.16	9.60	2,713,442	260,490	294,176	-33,686	83,006	49,320	1,260,925	6.85	4.10
2055	10.86	-0.16	9.60	3,391,204	325,556	368,323	-42,767	101,017	58,250	1,533,673	6.85	3.98
2060	10.85	-0.15	9.60	4,243,739	407,399	460,315	-52,916	122,320	69,404	1,857,246	6.84	3.86
2065	10.81	-0.15	9.60	5,316,259	510,361	574,654	-64,293	147,825	83,532	2,245,774	6.84	3.74
2070	10.79	-0.15	9.60	6,657,443	639,115	718,208	-79,093	178,370	99,277	2,710,446	6.83	3.61
2075	10.81	-0.15	9.60	8,323,300	799,037	899,705	-100,668	214,088	113,420	3,250,719	6.82	3.45
2080	10.87	-0.15	9.60	10,389,314	997,374	1,129,498	-132,124	253,749	121,625	3,845,625	6.81	3.25
2085	10.94	-0.15	9.60	12,961,032	1,244,259	1,418,407	-174,148	294,696	120,549	4,454,864	6.80	3.00
2090	11.00	-0.15	9.60	16,175,266	1,552,826	1,779,399	-226,574	333,150	106,577	5,021,926	6.78	2.70
2095	11.05	-0.14	9.60	20,192,664	1,938,496	2,230,305	-291,809	363,552	71,743	5,460,981	6.75	2.34
2100	11.09	-0.14	9.60	25,206,020	2,419,778	2,795,253	-375,475	376,601	1,126	5,626,314	6.69	1.92

Table VII.C.15   Sensitivity Test - Disability - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,850	-169	36,291	10.51	1.91
1999	8.19	0.00	7.00	231,677	16,217	18,980	-2,763	3,795	1,032	37,323	10.39	1.88
2000	8.18	0.02	7.80	242,196	18,891	19,822	-931	3,762	2,832	40,154	10.03	1.93
2001	8.17	0.04	8.60	254,455	21,883	20,797	1,086	3,815	4,902	45,056	9.35	2.05
2002	8.17	0.08	9.40	268,567	25,245	21,938	3,307	3,981	7,288	52,344	8.46	2.25
2003	8.17	0.11	10.20	284,703	29,040	23,271	5,769	4,298	10,067	62,411	7.70	2.51
2004	8.20	0.15	10.20	302,690	30,874	24,826	6,048	4,890	10,938	73,349	7.41	2.76
2005	8.25	0.20	10.20	321,666	32,810	26,543	6,267	5,488	11,755	85,104	7.12	3.00
2006	8.31	0.24	10.20	341,621	34,845	28,392	6,453	6,201	12,655	97,759	6.97	3.22
2007	8.38	0.28	10.20	362,505	36,976	30,389	6,587	6,990	13,576	111,335	6.87	3.42
2008	8.47	0.32	10.20	384,160	39,184	32,546	6,638	7,861	14,499	125,834	6.82	3.61
2009	8.55	0.34	10.20	407,388	41,554	34,850	6,704	8,792	15,496	141,330	6.77	3.79
2010	8.65	0.38	10.20	431,278	43,990	37,289	6,701	9,802	16,503	157,833	6.74	3.96
2011	8.79	0.40	10.20	453,439	46,251	39,861	6,390	10,842	17,231	175,064	6.71	4.11
2012	8.93	0.42	10.20	476,918	48,646	42,583	6,063	11,960	18,022	193,087	6.69	4.24
2013	9.08	0.43	10.20	501,275	51,130	45,498	5,632	13,158	18,790	211,876	6.70	4.36
2014	9.24	0.45	10.20	525,894	53,641	48,591	5,050	14,449	19,500	231,376	6.72	4.46
2015	9.40	0.46	10.20	551,896	56,293	51,861	4,432	15,782	20,214	251,590	6.74	4.55
2016	9.56	0.47	10.20	578,372	58,994	55,319	3,675	17,157	20,832	272,422	6.76	4.62
2017	9.73	0.48	10.20	606,195	61,832	58,977	2,855	18,576	21,431	293,853	6.78	4.68
2018	9.90	0.49	10.20	634,884	64,758	62,846	1,912	20,033	21,945	315,798	6.79	4.72
2019	10.07	0.50	10.20	664,512	67,780	66,935	845	21,536	22,381	338,179	6.81	4.75
2020	10.25	0.50	10.20	695,029	70,893	71,258	-365	23,103	22,738	360,917	6.83	4.76
2021	10.44	0.51	10.20	726,538	74,107	75,819	-1,712	24,716	23,004	383,921	6.85	4.76
2022	10.61	0.51	10.20	759,648	77,484	80,600	-3,116	26,351	23,235	407,156	6.86	4.76
2023	10.78	0.51	10.20	793,840	80,972	85,610	-4,638	27,985	23,347	430,503	6.87	4.74
2024	10.95	0.51	10.20	829,314	84,590	90,843	-6,253	29,587	23,334	453,838	6.87	4.71
2025	11.11	0.52	10.20	866,768	88,410	96,265	-7,855	31,187	23,332	477,170	6.87	4.69
2026	11.24	0.51	10.20	906,004	92,412	101,849	-9,437	32,785	23,348	500,518	6.87	4.65
2027	11.35	0.50	10.20	947,597	96,655	107,565	-10,910	34,383	23,473	523,991	6.87	4.62
2028	11.44	0.50	10.20	991,448	101,128	113,419	-12,291	35,990	23,698	547,689	6.87	4.58
2029	11.52	0.50	10.20	1,037,117	105,786	119,458	-13,672	37,611	23,939	571,628	6.87	4.55
2030	11.58	0.49	10.20	1,085,137	110,684	125,700	-15,016	39,247	24,231	595,859	6.86	4.51
2035	11.70	0.49	10.20	1,365,842	139,316	159,753	-20,437	47,871	27,434	725,304	6.86	4.34
2040	11.61	0.49	10.20	1,723,263	175,773	200,059	-24,286	58,002	33,716	879,884	6.85	4.21
2045	11.52	0.49	10.20	2,166,730	221,006	249,533	-28,527	70,632	42,105	1,073,041	6.85	4.11
2050	11.49	0.49	10.20	2,713,442	276,771	311,666	-34,895	86,271	51,376	1,311,173	6.85	4.02
2055	11.50	0.48	10.20	3,391,204	345,903	389,835	-43,932	105,075	61,143	1,596,432	6.84	3.92
2060	11.47	0.47	10.20	4,243,739	432,861	486,653	-53,792	127,558	73,766	1,938,755	6.84	3.81
2065	11.42	0.46	10.20	5,316,259	542,258	607,237	-64,979	154,802	89,823	2,354,595	6.84	3.71
2070	11.40	0.46	10.20	6,657,443	679,059	758,762	-79,703	187,839	108,136	2,858,139	6.83	3.60
2075	11.42	0.46	10.20	8,323,300	848,977	950,224	-101,247	227,054	125,807	3,452,783	6.82	3.47
2080	11.47	0.45	10.20	10,389,314	1,059,710	1,192,123	-132,413	271,646	139,233	4,124,426	6.82	3.31
2085	11.54	0.45	10.20	12,961,032	1,322,025	1,495,664	-173,639	319,682	146,043	4,844,103	6.80	3.10
2090	11.59	0.44	10.20	16,175,266	1,649,877	1,874,619	-224,742	368,454	143,712	5,571,788	6.79	2.84
2095	11.63	0.44	10.20	20,192,664	2,059,652	2,347,861	-288,209	413,899	125,690	6,244,523	6.76	2.54
2100	11.67	0.44	10.20	25,206,020	2,571,014	2,940,620	-369,606	448,792	79,186	6,748,474	6.73	2.19

Table VII.C.16   Sensitivity Test - Employment - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.19	-0.02	6.40	222,724	14,254	18,252	-3,998	3,850	-148	36,312	10.51	1.91
1999	8.17	-0.02	7.00	232,203	16,254	18,967	-2,713	3,796	1,083	37,395	10.39	1.89
2000	8.14	-0.02	7.80	242,926	18,948	19,772	-824	3,766	2,942	40,338	10.02	1.95
2001	8.10	-0.03	8.60	255,408	21,965	20,686	1,279	3,830	5,109	45,446	9.32	2.09
2002	8.06	-0.03	9.40	269,768	25,358	21,740	3,618	4,011	7,629	53,075	8.42	2.31
2003	8.02	-0.04	9.70	286,180	27,759	22,959	4,800	4,325	9,125	62,200	7.73	2.55
2004	8.00	-0.05	9.70	304,475	29,534	24,369	5,165	4,853	10,019	72,219	7.43	2.79
2005	8.00	-0.05	9.70	323,789	31,408	25,910	5,498	5,390	10,888	83,107	7.14	3.01
2006	8.01	-0.06	9.70	344,113	33,379	27,567	5,812	6,047	11,859	94,966	6.98	3.23
2007	8.04	-0.06	9.70	365,399	35,444	29,373	6,071	6,783	12,854	107,820	6.88	3.44
2008	8.09	-0.06	9.70	387,488	37,586	31,340	6,246	7,608	13,854	121,674	6.82	3.64
2009	8.14	-0.07	9.70	411,192	39,886	33,452	6,434	8,497	14,931	136,605	6.77	3.83
2010	8.20	-0.07	9.70	435,593	42,253	35,700	6,553	9,471	16,024	152,628	6.74	4.01
2011	8.32	-0.07	9.70	457,975	44,424	38,084	6,340	10,481	16,820	169,449	6.70	4.17
2012	8.44	-0.07	9.70	481,690	46,724	40,631	6,093	11,573	17,666	187,115	6.69	4.31
2013	8.57	-0.08	9.70	506,290	49,110	43,371	5,739	12,748	18,488	205,602	6.69	4.44
2014	8.71	-0.08	9.70	531,156	51,522	46,285	5,237	14,022	19,259	224,861	6.72	4.55
2015	8.86	-0.08	9.70	557,417	54,069	49,375	4,694	15,340	20,034	244,896	6.74	4.65
2016	9.01	-0.08	9.70	584,158	56,663	52,651	4,012	16,706	20,718	265,614	6.76	4.73
2017	9.17	-0.08	9.70	612,260	59,389	56,123	3,266	18,119	21,385	286,999	6.77	4.80
2018	9.33	-0.08	9.70	641,236	62,200	59,809	2,391	19,576	21,967	308,966	6.79	4.85
2019	9.49	-0.08	9.70	671,160	65,103	63,718	1,385	21,083	22,467	331,433	6.81	4.88
2020	9.67	-0.08	9.70	701,983	68,092	67,864	228	22,647	22,875	354,308	6.83	4.90
2021	9.85	-0.08	9.70	733,807	71,179	72,250	-1,071	24,272	23,202	377,510	6.85	4.91
2022	10.02	-0.08	9.70	767,248	74,423	76,861	-2,438	25,924	23,486	400,996	6.86	4.91
2023	10.19	-0.08	9.70	801,783	77,773	81,706	-3,933	27,578	23,645	424,641	6.87	4.89
2024	10.36	-0.08	9.70	837,612	81,248	86,778	-5,530	29,202	23,672	448,313	6.87	4.87
2025	10.51	-0.08	9.70	875,441	84,918	92,046	-7,128	30,826	23,698	472,011	6.87	4.84
2026	10.65	-0.08	9.70	915,070	88,762	97,483	-8,721	32,451	23,730	495,741	6.87	4.81
2027	10.77	-0.08	9.70	957,079	92,837	103,052	-10,215	34,077	23,862	519,602	6.87	4.78
2028	10.86	-0.08	9.70	1,001,369	97,133	108,763	-11,630	35,711	24,081	543,684	6.87	4.74
2029	10.95	-0.07	9.70	1,047,494	101,607	114,653	-13,046	37,360	24,314	567,998	6.87	4.70
2030	11.02	-0.07	9.70	1,095,995	106,312	120,735	-14,423	39,024	24,601	592,599	6.87	4.67
2035	11.14	-0.07	9.70	1,379,508	133,812	153,744	-19,932	47,793	27,861	724,079	6.86	4.50
2040	11.07	-0.05	9.70	1,740,503	168,829	192,722	-23,893	58,086	34,193	880,912	6.86	4.37
2045	10.99	-0.04	9.70	2,188,407	212,275	240,507	-28,232	70,906	42,674	1,076,728	6.86	4.28
2050	10.97	-0.03	9.70	2,740,588	265,837	300,719	-34,882	86,754	51,872	1,317,600	6.85	4.19
2055	11.00	-0.02	9.70	3,425,129	332,238	376,697	-44,459	105,706	61,246	1,604,378	6.85	4.07
2060	10.99	-0.01	9.70	4,286,192	415,761	470,887	-55,126	128,125	72,999	1,944,701	6.85	3.95
2065	10.95	-0.01	9.70	5,369,442	520,836	588,008	-67,172	154,963	87,791	2,353,168	6.84	3.83
2070	10.93	-0.01	9.70	6,724,039	652,232	735,116	-82,884	187,068	104,184	2,841,095	6.83	3.70
2075	10.96	0.00	9.70	8,406,560	815,436	921,064	-105,628	224,562	118,935	3,407,739	6.83	3.54
2080	11.02	0.00	9.70	10,493,240	1,017,844	1,156,308	-138,464	266,202	127,739	4,032,000	6.82	3.33
2085	11.09	0.00	9.70	13,090,686	1,269,797	1,451,802	-182,005	309,340	127,335	4,673,785	6.80	3.08
2090	11.15	0.00	9.70	16,337,077	1,584,697	1,820,768	-236,072	350,228	114,156	5,277,117	6.78	2.77
2095	11.19	0.00	9.70	20,394,640	1,978,280	2,281,531	-303,251	383,333	80,082	5,756,416	6.75	2.41
2100	11.23	0.00	9.70	25,458,126	2,469,438	2,858,849	-389,411	399,298	9,888	5,964,918	6.70	1.99

Table VII.C.17   Sensitivity Test - Employment - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.22	0.01	6.40	222,047	14,211	18,252	-4,041	3,850	-191	36,269	10.51	1.91
1999	8.21	0.02	7.00	231,151	16,181	18,966	-2,785	3,794	1,008	37,277	10.40	1.89
2000	8.19	0.03	7.80	241,467	18,834	19,769	-935	3,760	2,825	40,102	10.04	1.94
2001	8.16	0.03	8.60	253,502	21,801	20,683	1,118	3,814	4,932	45,034	9.35	2.07
2002	8.13	0.04	9.40	267,366	25,132	21,735	3,397	3,983	7,380	52,414	8.46	2.28
2003	8.10	0.04	9.80	283,226	27,756	22,953	4,803	4,284	9,087	61,502	7.75	2.52
2004	8.10	0.05	9.80	300,905	29,489	24,361	5,128	4,810	9,937	71,439	7.45	2.76
2005	8.11	0.06	9.80	319,543	31,315	25,899	5,416	5,340	10,756	82,195	7.15	2.98
2006	8.12	0.05	9.80	339,129	33,235	27,553	5,682	5,986	11,668	93,863	6.99	3.20
2007	8.16	0.06	9.80	359,612	35,242	29,355	5,887	6,708	12,595	106,458	6.89	3.40
2008	8.22	0.07	9.80	380,832	37,322	31,316	6,006	7,513	13,519	119,977	6.83	3.59
2009	8.28	0.07	9.80	403,585	39,551	33,423	6,128	8,378	14,507	134,484	6.78	3.77
2010	8.35	0.08	9.80	426,965	41,843	35,663	6,180	9,321	15,500	149,984	6.75	3.94
2011	8.47	0.08	9.80	448,904	43,993	38,040	5,953	10,294	16,246	166,230	6.70	4.10
2012	8.59	0.08	9.80	472,148	46,271	40,576	5,695	11,345	17,040	183,270	6.69	4.23
2013	8.73	0.08	9.80	496,261	48,634	43,304	5,330	12,477	17,807	201,077	6.69	4.35
2014	8.87	0.08	9.80	520,635	51,022	46,204	4,818	13,703	18,521	219,598	6.72	4.46
2015	9.02	0.08	9.80	546,376	53,545	49,277	4,268	14,969	19,237	238,835	6.74	4.55
2016	9.17	0.08	9.80	572,587	56,114	52,533	3,581	16,279	19,859	258,694	6.76	4.62
2017	9.33	0.08	9.80	600,132	58,813	55,984	2,829	17,632	20,461	279,156	6.77	4.68
2018	9.49	0.08	9.80	628,534	61,596	59,644	1,952	19,024	20,977	300,133	6.79	4.72
2019	9.66	0.09	9.80	657,866	64,471	63,524	947	20,461	21,408	321,541	6.81	4.75
2020	9.83	0.08	9.80	688,077	67,432	67,638	-206	21,959	21,753	343,293	6.83	4.77
2021	10.01	0.08	9.80	719,271	70,489	71,988	-1,499	23,505	22,006	365,299	6.84	4.77
2022	10.18	0.08	9.80	752,050	73,701	76,560	-2,859	25,072	22,213	387,512	6.86	4.76
2023	10.35	0.08	9.80	785,900	77,018	81,363	-4,345	26,636	22,291	409,803	6.87	4.74
2024	10.52	0.08	9.80	821,020	80,460	86,388	-5,928	28,165	22,237	432,041	6.87	4.72
2025	10.68	0.09	9.80	858,099	84,094	91,607	-7,513	29,690	22,176	454,217	6.87	4.68
2026	10.81	0.08	9.80	896,943	87,900	96,987	-9,087	31,208	22,122	476,338	6.87	4.65
2027	10.93	0.08	9.80	938,120	91,936	102,494	-10,558	32,722	22,164	498,502	6.87	4.61
2028	11.02	0.08	9.80	981,533	96,190	108,136	-11,946	34,238	22,292	520,794	6.87	4.57
2029	11.10	0.08	9.80	1,026,744	100,621	113,953	-13,332	35,762	22,430	543,224	6.87	4.53
2030	11.17	0.08	9.80	1,074,284	105,280	119,956	-14,676	37,295	22,618	565,843	6.86	4.49
2035	11.28	0.07	9.80	1,352,182	132,514	152,466	-19,952	45,299	25,347	685,833	6.86	4.30
2040	11.18	0.06	9.80	1,706,027	167,191	190,691	-23,500	54,642	31,141	828,490	6.85	4.16
2045	11.07	0.04	9.80	2,145,058	210,216	237,450	-27,234	66,325	39,091	1,007,449	6.85	4.06
2050	11.03	0.03	9.80	2,686,301	263,258	296,350	-33,093	80,854	47,761	1,228,819	6.85	3.96
2055	11.04	0.02	9.80	3,357,283	329,014	370,696	-41,682	98,304	56,622	1,493,505	6.84	3.85
2060	11.02	0.02	9.80	4,201,289	411,726	462,907	-51,181	119,045	67,864	1,809,161	6.84	3.74
2065	10.97	0.01	9.80	5,263,085	515,782	577,598	-61,816	144,037	82,221	2,190,601	6.83	3.63
2070	10.95	0.01	9.80	6,590,851	645,903	721,684	-75,781	174,170	98,390	2,649,872	6.83	3.51
2075	10.97	0.01	9.80	8,240,048	807,525	903,865	-96,340	209,671	113,331	3,187,909	6.82	3.37
2080	11.03	0.01	9.80	10,285,395	1,007,969	1,134,428	-126,459	249,478	123,019	3,786,455	6.81	3.19
2085	11.10	0.01	9.80	12,831,395	1,257,477	1,424,139	-166,662	291,239	124,577	4,410,012	6.80	2.96
2090	11.15	0.00	9.80	16,013,480	1,569,321	1,786,030	-216,709	331,646	114,937	5,009,393	6.78	2.68
2095	11.20	0.01	9.80	19,990,684	1,959,087	2,238,022	-278,935	365,836	86,901	5,509,463	6.75	2.35
2100	11.24	0.01	9.80	24,953,888	2,445,481	2,804,291	-358,810	385,520	26,710	5,780,117	6.70	1.97

Table VII.C.18   Sensitivity Test - Real-Wage Differential - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,850	-169	36,291	10.51	1.91
1999	8.17	-0.02	7.00	232,036	16,243	18,967	-2,724	3,795	1,070	37,361	10.39	1.89
2000	8.13	-0.03	7.80	243,159	18,966	19,772	-806	3,764	2,959	40,320	10.02	1.95
2001	8.08	-0.05	8.60	256,173	22,031	20,688	1,343	3,830	5,173	45,492	9.31	2.09
2002	8.03	-0.06	9.40	270,805	25,456	21,745	3,711	4,016	7,726	53,219	8.42	2.32
2003	7.96	-0.10	9.40	288,457	27,115	22,970	4,145	4,321	8,466	61,684	7.76	2.53
2004	7.93	-0.12	9.40	307,650	28,919	24,389	4,530	4,804	9,334	71,018	7.46	2.74
2005	7.90	-0.15	9.40	328,357	30,866	25,943	4,923	5,294	10,216	81,235	7.16	2.94
2006	7.89	-0.18	9.40	350,158	32,915	27,620	5,295	5,904	11,199	92,434	7.00	3.14
2007	7.90	-0.20	9.40	373,004	35,062	29,452	5,610	6,596	12,206	104,640	6.89	3.33
2008	7.92	-0.23	9.40	397,197	37,337	31,456	5,881	7,377	13,257	117,897	6.82	3.51
2009	7.95	-0.26	9.40	422,653	39,729	33,615	6,114	8,225	14,339	132,237	6.77	3.68
2010	7.99	-0.28	9.40	449,363	42,240	35,922	6,318	9,159	15,477	147,714	6.73	3.85
2011	8.08	-0.31	9.40	474,851	44,636	38,380	6,256	10,133	16,389	164,103	6.69	4.00
2012	8.18	-0.33	9.40	501,315	47,124	41,015	6,109	11,196	17,305	181,408	6.67	4.14
2013	8.30	-0.35	9.40	528,785	49,706	43,863	5,843	12,348	18,191	199,598	6.68	4.26
2014	8.42	-0.37	9.40	557,113	52,369	46,903	5,466	13,602	19,068	218,666	6.71	4.36
2015	8.54	-0.40	9.40	586,963	55,175	50,140	5,035	14,909	19,943	238,609	6.73	4.45
2016	8.68	-0.41	9.40	617,431	58,039	53,586	4,453	16,269	20,721	259,331	6.74	4.53
2017	8.81	-0.44	9.40	649,879	61,089	57,253	3,836	17,684	21,520	280,851	6.76	4.59
2018	8.96	-0.45	9.40	682,862	64,189	61,160	3,029	19,150	22,179	303,030	6.78	4.64
2019	9.10	-0.47	9.40	717,428	67,438	65,321	2,117	20,672	22,789	325,819	6.79	4.67
2020	9.26	-0.49	9.40	753,529	70,832	69,750	1,082	22,257	23,339	349,158	6.82	4.69
2021	9.42	-0.51	9.40	790,796	74,335	74,455	-120	23,899	23,779	372,937	6.84	4.70
2022	9.57	-0.53	9.40	829,865	78,007	79,421	-1,414	25,590	24,176	397,113	6.86	4.69
2023	9.72	-0.55	9.40	870,707	81,846	84,662	-2,816	27,290	24,475	421,588	6.87	4.68
2024	9.88	-0.56	9.40	913,053	85,827	90,170	-4,343	28,970	24,627	446,215	6.87	4.65
2025	10.01	-0.58	9.40	958,134	90,065	95,918	-5,853	30,658	24,805	471,020	6.87	4.62
2026	10.13	-0.60	9.40	1,005,299	94,498	101,874	-7,376	32,357	24,981	496,001	6.87	4.59
2027	10.23	-0.62	9.40	1,055,653	99,231	108,003	-8,772	34,068	25,296	521,297	6.87	4.56
2028	10.31	-0.63	9.40	1,108,611	104,209	114,313	-10,104	35,799	25,695	546,992	6.86	4.53
2029	10.38	-0.64	9.40	1,164,244	109,439	120,850	-11,411	37,557	26,146	573,138	6.86	4.49
2030	10.44	-0.65	9.40	1,222,610	114,925	127,626	-12,701	39,345	26,644	599,783	6.86	4.45
2035	10.51	-0.70	9.40	1,568,281	147,418	164,890	-17,472	49,003	31,532	745,964	6.86	4.31
2040	10.41	-0.71	9.40	2,016,265	189,529	209,870	-20,341	60,887	40,546	928,707	6.85	4.22
2045	10.30	-0.73	9.40	2,583,664	242,864	266,236	-23,372	76,400	53,029	1,167,732	6.85	4.18
2050	10.28	-0.72	9.40	3,296,870	309,906	338,826	-28,920	96,509	67,589	1,475,874	6.85	4.15
2055	10.30	-0.72	9.40	4,198,396	394,649	432,305	-37,656	121,796	84,140	1,861,837	6.85	4.10
2060	10.28	-0.72	9.40	5,353,724	503,250	550,412	-47,162	153,424	106,262	2,346,140	6.85	4.06
2065	10.24	-0.72	9.40	6,833,930	642,389	699,933	-57,544	193,675	136,131	2,964,074	6.85	4.04
2070	10.22	-0.72	9.40	8,720,840	819,759	891,209	-71,450	245,226	173,776	3,754,834	6.85	4.01
2075	10.24	-0.72	9.40	11,111,662	1,044,496	1,137,568	-93,072	310,547	217,475	4,753,132	6.85	3.98
2080	10.30	-0.72	9.40	14,135,085	1,328,698	1,455,301	-126,603	391,245	264,642	5,980,812	6.84	3.91
2085	10.36	-0.73	9.40	17,971,290	1,689,301	1,862,264	-172,963	488,370	315,407	7,454,610	6.84	3.81
2090	10.41	-0.74	9.40	22,857,688	2,148,623	2,380,386	-231,764	603,297	371,534	9,197,831	6.83	3.68
2095	10.45	-0.74	9.40	29,082,718	2,733,776	3,039,815	-306,040	737,663	431,624	11,235,031	6.83	3.52
2100	10.49	-0.74	9.40	37,000,356	3,478,033	3,881,652	-403,619	891,778	488,159	13,566,663	6.82	3.33

Table VII.C.19   Sensitivity Test - Real-Wage Differential - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,850	-170	36,291	10.51	1.91
1999	8.19	0.00	7.00	231,574	16,210	18,966	-2,756	3,795	1,039	37,330	10.39	1.89
2000	8.17	0.01	7.80	241,879	18,867	19,770	-903	3,763	2,859	40,189	10.03	1.94
2001	8.15	0.02	8.60	253,793	21,826	20,683	1,143	3,819	4,962	45,151	9.34	2.08
2002	8.13	0.04	9.40	267,305	25,127	21,736	3,391	3,989	7,380	52,530	8.46	2.29
2003	8.13	0.07	10.20	282,386	28,803	22,951	5,852	4,312	10,165	62,695	7.70	2.57
2004	8.14	0.09	10.20	299,228	30,521	24,355	6,166	4,913	11,079	73,775	7.40	2.85
2005	8.18	0.13	10.20	316,545	32,288	25,886	6,402	5,522	11,924	85,699	7.12	3.11
2006	8.22	0.15	10.20	334,737	34,143	27,528	6,615	6,249	12,864	98,563	6.97	3.36
2007	8.29	0.19	10.20	353,752	36,083	29,310	6,773	7,054	13,827	112,390	6.87	3.60
2008	8.37	0.22	10.20	373,425	38,089	31,245	6,844	7,945	14,789	127,179	6.82	3.82
2009	8.45	0.24	10.20	394,096	40,198	33,314	6,884	8,897	15,781	142,960	6.78	4.03
2010	8.55	0.28	10.20	415,297	42,360	35,506	6,854	9,927	16,782	159,741	6.75	4.22
2011	8.69	0.30	10.20	435,196	44,390	37,822	6,568	10,989	17,557	177,299	6.71	4.40
2012	8.84	0.33	10.20	455,842	46,496	40,282	6,214	12,131	18,345	195,644	6.70	4.56
2013	9.00	0.35	10.20	476,790	48,633	42,918	5,715	13,352	19,066	214,710	6.71	4.70
2014	9.17	0.38	10.20	498,363	50,833	45,709	5,124	14,665	19,789	234,499	6.73	4.82
2015	9.34	0.40	10.20	520,724	53,114	48,654	4,460	16,018	20,478	254,977	6.75	4.93
2016	9.52	0.43	10.20	543,915	55,479	51,763	3,716	17,414	21,131	276,107	6.77	5.02
2017	9.69	0.44	10.20	567,850	57,921	55,043	2,878	18,856	21,734	297,841	6.79	5.09
2018	9.88	0.47	10.20	592,046	60,389	58,508	1,881	20,336	22,217	320,058	6.80	5.15
2019	10.07	0.50	10.20	617,044	62,938	62,165	773	21,859	22,633	342,691	6.82	5.19
2020	10.26	0.51	10.20	643,276	65,614	66,027	-413	23,447	23,034	365,725	6.84	5.22
2021	10.46	0.53	10.20	669,878	68,328	70,095	-1,767	25,085	23,318	389,043	6.86	5.23
2022	10.66	0.56	10.20	697,441	71,139	74,350	-3,211	26,746	23,535	412,577	6.87	5.24
2023	10.86	0.59	10.20	725,926	74,044	78,800	-4,756	28,404	23,649	436,226	6.88	5.23
2024	11.04	0.60	10.20	755,504	77,061	83,437	-6,376	30,031	23,655	459,882	6.88	5.21
2025	11.22	0.63	10.20	786,359	80,209	88,230	-8,021	31,657	23,636	483,517	6.88	5.19
2026	11.37	0.64	10.20	819,235	83,562	93,151	-9,589	33,280	23,691	507,208	6.88	5.17
2027	11.51	0.66	10.20	853,218	87,028	98,165	-11,137	34,907	23,770	530,979	6.88	5.14
2028	11.61	0.67	10.20	889,187	90,697	103,278	-12,581	36,538	23,958	554,936	6.88	5.11
2029	11.71	0.69	10.20	926,685	94,522	108,526	-14,004	38,183	24,178	579,114	6.88	5.08
2030	11.79	0.70	10.20	966,226	98,555	113,920	-15,365	39,841	24,476	603,591	6.88	5.05
2035	11.97	0.76	10.20	1,192,800	121,666	142,735	-21,069	48,559	27,490	733,739	6.88	4.92
2040	11.91	0.79	10.20	1,476,342	150,587	175,863	-25,276	58,715	33,438	887,729	6.87	4.85
2045	11.83	0.80	10.20	1,821,856	185,829	215,485	-29,656	71,275	41,619	1,078,836	6.87	4.81
2050	11.81	0.81	10.20	2,238,667	228,344	264,307	-35,963	86,817	50,854	1,314,393	6.87	4.77
2055	11.82	0.80	10.20	2,745,823	280,074	324,688	-44,614	105,596	60,982	1,598,132	6.87	4.72
2060	11.81	0.81	10.20	3,371,808	343,924	398,156	-54,232	128,202	73,970	1,940,551	6.87	4.68
2065	11.77	0.81	10.20	4,144,592	422,748	487,885	-65,137	155,772	90,635	2,358,982	6.87	4.64
2070	11.75	0.81	10.20	5,092,702	519,456	598,600	-79,144	189,504	110,360	2,870,342	6.87	4.60
2075	11.78	0.82	10.20	6,247,871	637,283	736,050	-98,767	230,237	131,470	3,485,434	6.87	4.54
2080	11.85	0.83	10.20	7,652,040	780,508	906,717	-126,209	278,104	151,895	4,204,683	6.86	4.45
2085	11.93	0.84	10.20	9,367,014	955,435	1,117,029	-161,594	332,699	171,106	5,022,373	6.86	4.31
2090	11.99	0.84	10.20	11,469,211	1,169,860	1,374,711	-204,852	393,527	188,675	5,931,648	6.85	4.14
2095	12.03	0.84	10.20	14,048,687	1,432,966	1,690,519	-257,553	459,678	202,125	6,917,968	6.85	3.93
2100	12.08	0.85	10.20	17,204,674	1,754,877	2,078,886	-324,009	528,833	204,824	7,942,811	6.83	3.67

Table VII.C.20　　　Sensitivity Test - Prices - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,850	-169	36,291	10.51	1.91
1999	8.18	-0.01	7.00	231,933	16,235	18,967	-2,732	3,805	1,073	37,364	10.42	1.89
2000	8.14	-0.02	7.80	243,371	18,983	19,803	-820	3,791	2,971	40,335	10.10	1.94
2001	8.09	-0.04	8.60	256,888	22,092	20,790	1,302	3,890	5,192	45,527	9.46	2.07
2002	8.04	-0.05	9.40	273,326	25,693	21,964	3,729	4,144	7,873	53,400	8.68	2.29
2003	7.99	-0.07	9.50	292,398	27,778	23,357	4,421	4,582	9,002	62,403	8.17	2.50
2004	7.96	-0.09	9.50	314,012	29,831	25,005	4,826	5,215	10,041	72,444	7.99	2.70
2005	7.94	-0.11	9.50	337,758	32,087	26,819	5,268	5,880	11,148	83,592	7.78	2.90
2006	7.94	-0.13	9.50	362,353	34,424	28,783	5,641	6,687	12,327	95,919	7.69	3.10
2007	7.97	-0.13	9.50	388,180	36,877	30,932	5,945	7,608	13,553	109,472	7.65	3.29
2008	8.00	-0.15	9.50	416,017	39,522	33,289	6,233	8,641	14,874	124,346	7.63	3.47
2009	8.05	-0.16	9.50	445,342	42,307	35,839	6,468	9,772	16,240	140,586	7.62	3.64
2010	8.10	-0.17	9.50	476,158	45,235	38,579	6,656	11,017	17,673	158,259	7.62	3.81
2011	8.20	-0.19	9.50	506,302	48,099	41,516	6,583	12,342	18,924	177,184	7.61	3.97
2012	8.31	-0.20	9.50	537,640	51,076	44,680	6,396	13,788	20,184	197,367	7.62	4.10
2013	8.43	-0.22	9.50	570,682	54,215	48,114	6,101	15,352	21,453	218,820	7.64	4.22
2014	8.57	-0.22	9.50	604,804	57,456	51,802	5,654	17,046	22,700	241,520	7.67	4.33
2015	8.70	-0.24	9.50	640,700	60,867	55,753	5,114	18,825	23,939	265,459	7.70	4.43
2016	8.84	-0.25	9.50	678,446	64,452	59,985	4,467	20,699	25,166	290,625	7.72	4.50
2017	8.99	-0.26	9.50	717,962	68,206	64,516	3,690	22,666	26,357	316,982	7.74	4.57
2018	9.14	-0.27	9.50	758,757	72,082	69,372	2,710	24,722	27,432	344,414	7.76	4.62
2019	9.30	-0.27	9.50	801,923	76,183	74,574	1,609	26,880	28,488	372,902	7.78	4.65
2020	9.46	-0.29	9.50	846,928	80,458	80,146	312	29,153	29,465	402,368	7.81	4.67
2021	9.63	-0.30	9.50	894,413	84,969	86,102	-1,133	31,551	30,419	432,786	7.84	4.68
2022	9.80	-0.30	9.50	943,565	89,639	92,433	-2,794	34,031	31,236	464,022	7.86	4.68
2023	9.96	-0.31	9.50	995,863	94,607	99,160	-4,553	36,529	31,976	495,998	7.87	4.67
2024	10.12	-0.32	9.50	1,050,590	99,806	106,284	-6,478	39,043	32,565	528,564	7.87	4.65
2025	10.26	-0.33	9.50	1,108,546	105,312	113,779	-8,467	41,602	33,135	561,699	7.87	4.62
2026	10.40	-0.33	9.50	1,169,650	111,117	121,616	-10,499	44,204	33,705	595,404	7.87	4.59
2027	10.51	-0.34	9.50	1,235,070	117,332	129,761	-12,429	46,850	34,420	629,824	7.87	4.56
2028	10.60	-0.34	9.50	1,304,225	123,901	138,228	-14,327	49,550	35,224	665,048	7.87	4.52
2029	10.68	-0.34	9.50	1,377,243	130,838	147,076	-16,238	52,313	36,075	701,123	7.86	4.48
2030	10.75	-0.34	9.50	1,454,739	138,200	156,327	-18,127	55,142	37,015	738,138	7.86	4.45
2035	10.86	-0.35	9.50	1,920,159	182,415	208,617	-26,202	70,654	44,452	943,546	7.86	4.28
2040	10.80	-0.32	9.50	2,538,440	241,152	274,153	-33,001	89,811	56,809	1,200,432	7.85	4.15
2045	10.72	-0.31	9.50	3,345,720	317,843	358,741	-40,898	114,603	73,706	1,533,704	7.85	4.05
2050	10.71	-0.29	9.50	4,390,431	417,091	470,393	-53,302	146,452	93,150	1,959,773	7.85	3.94
2055	10.75	-0.27	9.50	5,750,835	546,329	617,964	-71,635	186,086	114,452	2,487,805	7.84	3.81
2060	10.74	-0.26	9.50	7,542,184	716,508	810,211	-93,704	234,728	141,025	3,137,151	7.83	3.67
2065	10.72	-0.24	9.50	9,903,290	940,813	1,061,226	-120,413	294,762	174,349	3,940,097	7.83	3.52
2070	10.71	-0.23	9.50	12,999,589	1,234,961	1,391,638	-156,677	368,410	211,733	4,923,315	7.82	3.35
2075	10.73	-0.23	9.50	17,037,956	1,618,606	1,828,917	-210,311	456,182	245,870	6,087,950	7.81	3.15
2080	10.80	-0.22	9.50	22,296,524	2,118,170	2,408,247	-290,077	554,700	264,623	7,382,410	7.79	2.90
2085	10.88	-0.21	9.50	29,164,022	2,770,582	3,171,655	-401,073	655,411	254,338	8,689,389	7.77	2.59
2090	10.93	-0.22	9.50	38,161,456	3,625,338	4,172,882	-547,544	743,655	196,111	9,810,841	7.73	2.23
2095	10.98	-0.21	9.50	49,956,528	4,745,870	5,485,648	-739,778	794,966	55,188	10,411,738	7.68	1.80
2100	11.03	-0.20	9.50	65,392,576	6,212,295	7,211,083	-998,789	766,595	-232,194	9,901,605	7.56	1.30

Table VII.C.21   Sensitivity Test - Prices - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,850	-170	36,291	10.51	1.91
1999	8.20	0.01	7.00	231,419	16,199	18,966	-2,767	3,785	1,018	37,309	10.37	1.89
2000	8.18	0.02	7.80	241,400	18,829	19,739	-910	3,735	2,825	40,133	9.96	1.95
2001	8.15	0.02	8.60	252,412	21,707	20,580	1,127	3,757	4,884	45,018	9.21	2.09
2002	8.13	0.04	9.40	264,507	24,864	21,517	3,347	3,862	7,208	52,226	8.21	2.31
2003	8.12	0.06	10.00	277,772	27,777	22,566	5,211	4,063	9,274	61,500	7.34	2.59
2004	8.13	0.08	10.00	292,250	29,225	23,747	5,478	4,486	9,964	71,464	6.93	2.86
2005	8.15	0.10	10.00	307,064	30,706	25,028	5,678	4,893	10,572	82,036	6.54	3.11
2006	8.18	0.11	10.00	322,608	32,261	26,398	5,863	5,400	11,263	93,298	6.31	3.35
2007	8.23	0.13	10.00	338,826	33,883	27,885	5,998	5,952	11,950	105,248	6.14	3.57
2008	8.30	0.15	10.00	355,548	35,555	29,495	6,060	6,570	12,630	117,878	6.03	3.78
2009	8.37	0.16	10.00	372,661	37,266	31,209	6,057	7,225	13,282	131,160	5.95	3.97
2010	8.46	0.19	10.00	390,132	39,013	33,015	5,998	7,930	13,928	145,088	5.89	4.16
2011	8.58	0.19	10.00	406,727	40,673	34,911	5,762	8,634	14,396	159,484	5.81	4.32
2012	8.73	0.22	10.00	423,021	42,302	36,916	5,386	9,394	14,780	174,264	5.77	4.46
2013	8.88	0.23	10.00	439,936	43,994	39,054	4,940	10,208	15,148	189,411	5.76	4.59
2014	9.03	0.24	10.00	457,344	45,734	41,304	4,430	11,099	15,529	204,940	5.78	4.69
2015	9.19	0.25	10.00	474,931	47,493	43,663	3,830	12,005	15,835	220,776	5.79	4.79
2016	9.36	0.27	10.00	492,726	49,273	46,136	3,137	12,923	16,059	236,835	5.80	4.86
2017	9.53	0.28	10.00	511,112	51,111	48,728	2,383	13,857	16,240	253,075	5.82	4.92
2018	9.71	0.30	10.00	530,084	53,008	51,450	1,558	14,800	16,359	269,434	5.83	4.96
2019	9.89	0.32	10.00	549,227	54,923	54,304	619	15,754	16,373	285,807	5.84	4.99
2020	10.08	0.33	10.00	568,489	56,849	57,298	-449	16,731	16,282	302,089	5.85	5.00
2021	10.26	0.33	10.00	588,900	58,890	60,429	-1,539	17,714	16,175	318,263	5.86	5.00
2022	10.45	0.35	10.00	609,604	60,960	63,681	-2,721	18,691	15,971	334,234	5.87	4.98
2023	10.63	0.36	10.00	630,560	63,056	67,055	-3,999	19,648	15,649	349,883	5.88	4.96
2024	10.81	0.37	10.00	652,393	65,239	70,541	-5,302	20,565	15,263	365,146	5.88	4.93
2025	10.98	0.39	10.00	675,254	67,525	74,112	-6,587	21,458	14,872	380,018	5.87	4.89
2026	11.12	0.39	10.00	699,353	69,935	77,739	-7,804	22,328	14,524	394,542	5.87	4.85
2027	11.24	0.39	10.00	724,245	72,425	81,391	-8,967	23,176	14,210	408,752	5.87	4.80
2028	11.34	0.40	10.00	750,308	75,031	85,072	-10,041	24,005	13,964	422,716	5.87	4.76
2029	11.43	0.41	10.00	777,075	77,708	88,811	-11,104	24,820	13,716	436,432	5.87	4.71
2030	11.50	0.41	10.00	805,524	80,552	92,615	-12,063	25,619	13,556	449,988	5.87	4.66
2035	11.62	0.41	10.00	966,034	96,603	112,274	-15,671	29,548	13,878	517,866	5.86	4.45
2040	11.52	0.40	10.00	1,161,896	116,190	133,896	-17,706	33,800	16,094	593,200	5.86	4.28
2045	11.41	0.38	10.00	1,393,601	139,360	158,946	-19,586	38,846	19,261	683,047	5.85	4.15
2050	11.36	0.36	10.00	1,664,039	166,404	189,081	-22,677	44,795	22,118	788,135	5.85	4.02
2055	11.37	0.35	10.00	1,983,283	198,328	225,416	-27,088	51,471	24,384	905,405	5.84	3.88
2060	11.33	0.33	10.00	2,367,197	236,720	268,255	-31,535	58,855	27,320	1,035,826	5.84	3.73
2065	11.28	0.32	10.00	2,828,190	282,819	318,965	-36,146	67,185	31,039	1,183,589	5.83	3.58
2070	11.24	0.30	10.00	3,377,775	337,778	379,762	-41,985	76,573	34,588	1,349,827	5.82	3.43
2075	11.25	0.29	10.00	4,027,632	402,763	453,194	-50,431	86,781	36,350	1,529,251	5.81	3.26
2080	11.30	0.28	10.00	4,794,281	479,428	541,967	-62,539	97,026	34,487	1,707,237	5.80	3.04
2085	11.37	0.28	10.00	5,704,064	570,406	648,281	-77,875	106,078	28,204	1,862,751	5.78	2.77
2090	11.41	0.26	10.00	6,787,437	678,744	774,660	-95,916	112,509	16,593	1,971,315	5.76	2.46
2095	11.45	0.26	10.00	8,079,018	807,902	924,901	-116,999	114,495	-2,504	2,000,769	5.72	2.09
2100	11.48	0.25	10.00	9,614,942	961,494	1,104,222	-142,728	109,286	-33,442	1,901,425	5.65	1.66

Table VII.C.22   Sensitivity Test - Return on Investments - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,859	-160	36,300	10.54	1.91
1999	8.19	0.00	7.00	231,677	16,217	18,967	-2,750	3,811	1,061	37,361	10.44	1.89
2000	8.16	0.00	7.80	242,196	18,891	19,770	-879	3,804	2,925	40,286	10.13	1.95
2001	8.13	0.00	8.60	254,455	21,883	20,684	1,199	3,911	5,110	45,396	9.54	2.09
2002	8.09	0.00	9.40	268,567	25,245	21,738	3,507	4,168	7,675	53,071	8.78	2.31
2003	8.06	0.00	9.40	284,703	26,762	22,956	3,806	4,567	8,373	61,444	8.25	2.52
2004	8.05	0.00	9.40	302,690	28,453	24,365	4,088	5,145	9,233	70,677	8.05	2.73
2005	8.05	0.00	9.40	321,666	30,237	25,904	4,333	5,739	10,072	80,749	7.83	2.93
2006	8.07	0.00	9.40	341,621	32,112	27,560	4,552	6,454	11,006	91,755	7.73	3.12
2007	8.10	0.00	9.40	362,505	34,075	29,364	4,711	7,264	11,975	103,730	7.68	3.31
2008	8.15	0.00	9.40	384,160	36,111	31,328	4,783	8,163	12,946	116,676	7.66	3.49
2009	8.21	0.00	9.40	407,388	38,294	33,437	4,857	9,133	13,990	130,666	7.64	3.66
2010	8.27	0.00	9.40	431,278	40,540	35,682	4,858	10,191	15,050	145,716	7.63	3.83
2011	8.39	0.00	9.40	453,439	42,623	38,062	4,561	11,298	15,860	161,575	7.61	3.98
2012	8.51	0.00	9.40	476,918	44,830	40,603	4,227	12,493	16,720	178,296	7.61	4.11
2013	8.65	0.00	9.40	501,275	47,120	43,337	3,783	13,774	17,557	195,853	7.63	4.24
2014	8.79	0.00	9.40	525,894	49,434	46,244	3,190	15,150	18,340	214,193	7.66	4.34
2015	8.94	0.00	9.40	551,896	51,878	49,326	2,552	16,576	19,128	233,322	7.68	4.44
2016	9.09	0.00	9.40	578,372	54,367	52,592	1,775	18,060	19,835	253,156	7.71	4.52
2017	9.25	0.00	9.40	606,195	56,982	56,053	929	19,597	20,526	273,683	7.72	4.58
2018	9.41	0.00	9.40	634,884	59,679	59,726	-47	21,193	21,146	294,828	7.74	4.63
2019	9.57	0.00	9.40	664,512	62,464	63,621	-1,157	22,865	21,708	316,537	7.75	4.67
2020	9.75	0.00	9.40	695,029	65,333	67,751	-2,418	24,605	22,186	338,723	7.77	4.70
2021	9.93	0.00	9.40	726,538	68,295	72,119	-3,824	26,393	22,569	361,292	7.79	4.71
2022	10.10	0.00	9.40	759,648	71,407	76,710	-5,303	28,215	22,912	384,203	7.81	4.71
2023	10.27	0.00	9.40	793,840	74,621	81,534	-6,913	30,046	23,133	407,337	7.82	4.70
2024	10.44	0.00	9.40	829,314	77,956	86,582	-8,626	31,853	23,227	430,564	7.82	4.69
2025	10.59	0.00	9.40	866,768	81,476	91,825	-10,349	33,666	23,317	453,881	7.82	4.67
2026	10.73	0.00	9.40	906,004	85,164	97,233	-12,069	35,484	23,415	477,296	7.82	4.64
2027	10.85	0.00	9.40	947,597	89,074	102,771	-13,697	37,309	23,612	500,908	7.81	4.62
2028	10.94	0.00	9.40	991,448	93,196	108,447	-15,251	39,148	23,897	524,805	7.81	4.59
2029	11.02	0.00	9.40	1,037,117	97,489	114,300	-16,811	41,009	24,198	549,003	7.81	4.56
2030	11.09	0.00	9.40	1,085,137	102,003	120,341	-18,338	42,892	24,554	573,556	7.81	4.53
2035	11.21	0.00	9.40	1,365,842	128,389	153,096	-24,707	52,901	28,195	705,898	7.81	4.40
2040	11.12	0.00	9.40	1,723,263	161,987	191,704	-29,717	64,823	35,106	866,019	7.80	4.32
2045	11.03	0.00	9.40	2,166,730	203,673	238,980	-35,307	79,913	44,606	1,069,229	7.80	4.28
2050	11.00	0.00	9.40	2,713,442	255,064	298,525	-43,461	98,954	55,493	1,324,513	7.80	4.24
2055	11.02	0.00	9.40	3,391,204	318,773	373,672	-54,899	122,327	67,428	1,636,692	7.79	4.19
2060	11.00	0.00	9.40	4,243,739	398,911	466,852	-67,941	150,831	82,891	2,018,507	7.79	4.14
2065	10.96	0.00	9.40	5,316,259	499,728	582,715	-82,987	186,086	103,099	2,491,854	7.79	4.09
2070	10.94	0.00	9.40	6,657,443	625,800	728,245	-102,445	229,854	127,408	3,078,883	7.79	4.04
2075	10.96	0.00	9.40	8,323,300	782,390	912,216	-129,826	283,415	153,590	3,794,316	7.78	3.98
2080	11.02	0.00	9.40	10,389,314	976,596	1,145,019	-168,424	346,923	178,500	4,638,059	7.78	3.87
2085	11.09	0.00	9.40	12,961,032	1,218,337	1,437,567	-219,230	419,405	200,175	5,597,205	7.77	3.72
2090	11.15	0.00	9.40	16,175,266	1,520,475	1,803,028	-282,553	499,186	216,633	6,650,245	7.76	3.53
2095	11.19	0.00	9.40	20,192,664	1,898,110	2,259,486	-361,376	583,264	221,888	7,755,556	7.74	3.28
2100	11.23	0.00	9.40	25,206,020	2,369,366	2,831,335	-461,969	665,178	203,208	8,822,251	7.72	2.98

Table VII.C.23 Sensitivity Test - Return on Investments - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.21	0.00	6.40	222,386	14,233	18,252	-4,019	3,841	-179	36,281	10.49	1.91
1999	8.19	0.00	7.00	231,677	16,217	18,967	-2,750	3,779	1,029	37,311	10.35	1.89
2000	8.16	0.00	7.80	242,196	18,891	19,770	-879	3,723	2,844	40,155	9.93	1.94
2001	8.13	0.00	8.60	254,455	21,883	20,684	1,199	3,734	4,933	45,088	9.14	2.07
2002	8.09	0.00	9.40	268,567	25,245	21,738	3,507	3,829	7,336	52,424	8.11	2.28
2003	8.06	0.00	10.20	284,703	29,040	22,956	6,084	4,047	10,131	62,555	7.22	2.57
2004	8.05	0.00	10.20	302,690	30,874	24,365	6,509	4,527	11,036	73,591	6.81	2.84
2005	8.05	0.00	10.20	321,666	32,810	25,904	6,906	5,004	11,910	85,501	6.44	3.10
2006	8.07	0.00	10.20	341,621	34,845	27,560	7,285	5,597	12,882	98,383	6.23	3.35
2007	8.10	0.00	10.20	362,505	36,976	29,364	7,612	6,252	13,864	112,247	6.07	3.58
2008	8.15	0.00	10.20	384,160	39,184	31,328	7,856	6,991	14,847	127,095	5.98	3.80
2009	8.21	0.00	10.20	407,388	41,554	33,437	8,117	7,786	15,903	142,997	5.90	4.01
2010	8.27	0.00	10.20	431,278	43,990	35,682	8,308	8,656	16,965	159,962	5.85	4.20
2011	8.39	0.00	10.20	453,439	46,251	38,062	8,189	9,547	17,736	177,698	5.79	4.38
2012	8.51	0.00	10.20	476,918	48,646	40,603	8,043	10,514	18,557	196,255	5.76	4.53
2013	8.65	0.00	10.20	501,275	51,130	43,337	7,793	11,562	19,355	215,610	5.75	4.66
2014	8.79	0.00	10.20	525,894	53,641	46,244	7,397	12,710	20,108	235,718	5.78	4.78
2015	8.94	0.00	10.20	551,896	56,293	49,326	6,967	13,898	20,865	256,583	5.79	4.88
2016	9.09	0.00	10.20	578,372	58,994	52,592	6,402	15,123	21,525	278,108	5.81	4.96
2017	9.25	0.00	10.20	606,195	61,832	56,053	5,779	16,391	22,170	300,278	5.82	5.03
2018	9.41	0.00	10.20	634,884	64,758	59,726	5,032	17,694	22,726	323,004	5.83	5.08
2019	9.57	0.00	10.20	664,512	67,780	63,621	4,159	19,041	23,201	346,205	5.85	5.11
2020	9.75	0.00	10.20	695,029	70,893	67,751	3,142	20,438	23,580	369,785	5.87	5.13
2021	9.93	0.00	10.20	726,538	74,107	72,119	1,988	21,867	23,854	393,639	5.89	5.13
2022	10.10	0.00	10.20	759,648	77,484	76,710	774	23,314	24,088	417,727	5.92	5.12
2023	10.27	0.00	10.20	793,840	80,972	81,534	-562	24,772	24,210	441,937	5.93	5.10
2024	10.44	0.00	10.20	829,314	84,590	86,582	-1,992	26,206	24,214	466,151	5.93	5.08
2025	10.59	0.00	10.20	866,768	88,410	91,825	-3,415	27,639	24,225	490,376	5.93	5.04
2026	10.73	0.00	10.20	906,004	92,412	97,233	-4,821	29,072	24,252	514,627	5.93	5.01
2027	10.85	0.00	10.20	947,597	96,655	102,771	-6,116	30,506	24,390	539,017	5.93	4.97
2028	10.94	0.00	10.20	991,448	101,128	108,447	-7,319	31,948	24,629	563,646	5.93	4.93
2029	11.02	0.00	10.20	1,037,117	105,786	114,300	-8,514	33,403	24,889	588,535	5.93	4.89
2030	11.09	0.00	10.20	1,085,137	110,684	120,341	-9,657	34,874	25,217	613,752	5.92	4.85
2035	11.21	0.00	10.20	1,365,842	139,316	153,096	-13,780	42,668	28,888	749,400	5.92	4.67
2040	11.12	0.00	10.20	1,723,263	175,773	191,704	-15,931	51,948	36,017	913,598	5.92	4.56
2045	11.03	0.00	10.20	2,166,730	221,006	238,980	-17,974	63,696	45,723	1,122,010	5.92	4.49
2050	11.00	0.00	10.20	2,713,442	276,771	298,525	-21,754	78,494	56,740	1,383,299	5.92	4.43
2055	11.02	0.00	10.20	3,391,204	345,903	373,672	-27,769	96,622	68,853	1,702,172	5.92	4.36
2060	11.00	0.00	10.20	4,243,739	432,861	466,852	-33,991	118,731	84,740	2,092,277	5.91	4.29
2065	10.96	0.00	10.20	5,316,259	542,258	582,715	-40,457	146,126	105,670	2,576,909	5.91	4.23
2070	10.94	0.00	10.20	6,657,443	679,059	728,245	-49,186	180,245	131,059	3,179,853	5.91	4.17
2075	10.96	0.00	10.20	8,323,300	848,977	912,216	-63,239	222,205	158,965	3,918,332	5.91	4.10
2080	11.02	0.00	10.20	10,389,314	1,059,710	1,145,019	-85,309	272,429	187,120	4,797,802	5.91	4.00
2085	11.09	0.00	10.20	12,961,032	1,322,025	1,437,567	-115,542	330,861	215,320	5,817,837	5.91	3.87
2090	11.15	0.00	10.20	16,175,266	1,649,877	1,803,028	-153,151	397,579	244,428	6,981,359	5.90	3.70
2095	11.19	0.00	10.20	20,192,664	2,059,652	2,259,486	-199,834	472,697	272,863	8,289,795	5.90	3.51
2100	11.23	0.00	10.20	25,206,020	2,571,014	2,831,335	-260,321	555,372	295,051	9,724,968	5.89	3.28

Table VII.C.24   Sensitivity Test - Combined - Low Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.17	-0.04	6.40	222,802	14,259	18,213	-3,954	3,859	-95	36,365	10.54	1.92
1999	8.13	-0.06	7.00	232,752	16,293	18,915	-2,622	3,825	1,203	37,568	10.46	1.90
2000	8.06	-0.10	7.80	244,785	19,093	19,728	-635	3,844	3,209	40,777	10.18	1.97
2001	7.98	-0.15	8.10	259,118	20,989	20,682	307	3,984	4,290	45,068	9.73	2.07
2002	7.88	-0.21	8.10	276,762	22,418	21,811	607	4,187	4,794	49,862	9.22	2.15
2003	7.77	-0.29	8.10	298,089	24,145	23,150	995	4,440	5,435	55,297	8.80	2.24
2004	7.68	-0.37	8.10	321,824	26,068	24,732	1,336	4,860	6,196	61,493	8.67	2.32
2005	7.61	-0.44	8.10	348,014	28,189	26,470	1,719	5,300	7,019	68,512	8.48	2.42
2006	7.55	-0.52	8.10	375,766	30,437	28,353	2,084	5,864	7,948	76,460	8.41	2.51
2007	7.50	-0.60	8.10	405,520	32,847	30,428	2,419	6,540	8,959	85,419	8.40	2.61
2008	7.48	-0.67	8.10	437,180	35,412	32,714	2,698	7,314	10,012	95,431	8.40	2.71
2009	7.47	-0.74	8.10	471,170	38,165	35,201	2,964	8,173	11,137	106,568	8.41	2.81
2010	7.47	-0.80	8.10	507,049	41,071	37,888	3,183	9,136	12,319	118,887	8.42	2.91
2011	7.52	-0.87	8.10	542,658	43,955	40,785	3,170	10,173	13,343	132,230	8.42	3.01
2012	7.58	-0.93	8.10	579,325	46,925	43,929	2,996	11,319	14,315	146,545	8.45	3.09
2013	7.66	-0.99	8.10	618,604	50,107	47,359	2,748	12,563	15,311	161,857	8.48	3.17
2014	7.74	-1.05	8.10	659,873	53,450	51,063	2,387	13,914	16,300	178,157	8.52	3.24
2015	7.83	-1.11	8.10	703,420	56,977	55,053	1,924	15,334	17,258	195,415	8.55	3.29
2016	7.92	-1.17	8.10	749,385	60,700	59,349	1,351	16,838	18,189	213,605	8.58	3.34
2017	8.02	-1.23	8.10	797,704	64,614	63,973	641	18,417	19,058	232,663	8.61	3.37
2018	8.12	-1.29	8.10	848,958	68,766	68,960	-194	20,083	19,888	252,551	8.62	3.40
2019	8.23	-1.34	8.10	902,800	73,127	74,331	-1,204	21,851	20,646	273,197	8.65	3.41
2020	8.35	-1.40	8.10	959,763	77,741	80,118	-2,377	23,721	21,343	294,541	8.68	3.41
2021	8.46	-1.47	8.10	1,020,078	82,626	86,336	-3,710	25,670	21,961	316,501	8.71	3.40
2022	8.58	-1.52	8.10	1,084,015	87,805	92,983	-5,178	27,664	22,486	338,987	8.73	3.39
2023	8.69	-1.58	8.10	1,151,635	93,282	100,087	-6,805	29,670	22,865	361,853	8.75	3.36
2024	8.80	-1.64	8.10	1,223,322	99,089	107,650	-8,561	31,664	23,103	384,955	8.74	3.33
2025	8.90	-1.69	8.10	1,300,037	105,303	115,652	-10,349	33,674	23,325	408,281	8.74	3.29
2026	8.98	-1.75	8.10	1,382,339	111,969	124,069	-12,100	35,701	23,601	431,882	8.74	3.25
2027	9.04	-1.81	8.10	1,470,525	119,113	132,864	-13,751	37,749	23,997	455,879	8.74	3.21
2028	9.08	-1.86	8.10	1,564,633	126,735	142,063	-15,328	39,829	24,501	480,380	8.73	3.17
2029	9.11	-1.91	8.10	1,664,926	134,859	151,733	-16,874	41,951	25,077	505,456	8.73	3.12
2030	9.14	-1.95	8.10	1,772,210	143,549	161,901	-18,352	44,120	25,768	531,224	8.72	3.08
2035	9.07	-2.14	8.10	2,431,247	196,931	220,437	-23,506	56,220	32,714	678,232	8.71	2.90
2040	8.86	-2.26	8.10	3,345,727	271,004	296,371	-25,367	72,557	47,190	881,464	8.70	2.80
2045	8.66	-2.37	8.10	4,592,556	371,997	397,915	-25,918	96,849	70,931	1,184,700	8.69	2.80
2050	8.54	-2.46	8.10	6,283,999	509,004	536,760	-27,756	133,369	105,613	1,638,235	8.70	2.87
2055	8.45	-2.57	8.10	8,594,440	696,150	726,628	-30,478	187,709	157,231	2,311,584	8.71	2.99
2060	8.35	-2.65	8.10	11,775,671	953,829	982,980	-29,151	269,868	240,717	3,332,198	8.73	3.19
2065	8.25	-2.71	8.10	16,143,940	1,307,659	1,331,482	-23,823	397,032	373,209	4,910,474	8.75	3.47
2070	8.19	-2.75	8.10	22,113,244	1,791,173	1,810,547	-19,374	594,298	574,924	7,349,137	8.77	3.82
2075	8.18	-2.78	8.10	30,227,876	2,448,458	2,473,144	-24,686	896,922	872,236	11,071,227	8.79	4.20
2080	8.22	-2.80	8.10	41,254,024	3,341,576	3,390,312	-48,736	1,353,576	1,304,840	16,664,096	8.81	4.61
2085	8.26	-2.83	8.10	56,299,304	4,560,244	4,647,526	-87,283	2,036,537	1,949,255	25,015,602	8.83	5.05
2090	8.27	-2.88	8.10	76,878,408	6,227,151	6,358,786	-131,635	3,060,653	2,929,018	37,536,008	8.84	5.55
2095	8.27	-2.92	8.10	105,014,768	8,506,196	8,689,590	-183,394	4,605,176	4,421,782	56,410,088	8.86	6.10
2100	8.28	-2.95	8.10	143,404,672	11,615,778	11,875,691	-259,913	6,941,302	6,681,388	84,927,056	8.87	6.72

Table VII.C.25 Sensitivity Test - Combined - High Cost

Year	Paygo Rate %	Paygo Vs. Best Estimate	Contribution Rate %	Contributory Earnings	Contributions	Expenditures	Cash Flow	Investment Earnings	Change In Assets	Assets At 31 Dec.	Yield %	Assets / Expend. Ratio
1998	8.24	0.03	6.40	221,921	14,203	18,290	-4,087	3,841	-246	36,214	10.49	1.90
1999	8.25	0.06	7.00	230,503	16,135	19,026	-2,891	3,766	875	37,089	10.33	1.87
2000	8.28	0.12	7.80	239,826	18,706	19,846	-1,140	3,687	2,547	39,636	9.89	1.91
2001	8.32	0.19	8.60	249,569	21,463	20,759	704	3,646	4,350	43,986	9.10	2.02
2002	8.38	0.29	9.40	260,115	24,451	21,792	2,659	3,647	6,306	50,292	8.00	2.19
2003	8.46	0.40	10.20	271,527	27,696	22,963	4,733	3,706	8,439	58,731	6.98	2.42
2004	8.56	0.51	11.00	283,919	31,231	24,291	6,940	4,003	10,943	69,674	6.37	2.71
2005	8.70	0.65	11.80	296,007	34,929	25,742	9,187	4,368	13,555	83,229	5.81	3.05
2006	8.83	0.76	12.60	309,052	38,941	27,290	11,651	4,933	16,584	99,812	5.47	3.45
2007	9.00	0.90	12.70	321,750	40,862	28,944	11,918	5,615	17,533	117,345	5.25	3.82
2008	9.16	1.01	12.70	335,164	42,566	30,709	11,857	6,371	18,227	135,573	5.12	4.16
2009	9.34	1.13	12.70	348,766	44,293	32,565	11,728	7,159	18,887	154,460	5.02	4.48
2010	9.52	1.25	12.70	362,518	46,040	34,499	11,541	7,995	19,536	173,996	4.95	4.77
2011	9.73	1.34	12.70	375,119	47,640	36,504	11,136	8,819	19,955	193,951	4.88	5.03
2012	9.95	1.44	12.70	387,703	49,238	38,590	10,648	9,696	20,345	214,296	4.84	5.25
2013	10.19	1.54	12.70	400,279	50,835	40,789	10,046	10,631	20,677	234,973	4.83	5.45
2014	10.43	1.64	12.70	413,157	52,471	43,084	9,387	11,648	21,035	256,009	4.84	5.63
2015	10.67	1.73	12.70	426,011	54,103	45,469	8,634	12,680	21,314	277,323	4.86	5.78
2016	10.93	1.84	12.70	438,839	55,733	47,949	7,784	13,717	21,500	298,823	4.86	5.91
2017	11.18	1.93	12.70	452,006	57,405	50,524	6,881	14,769	21,650	320,473	4.88	6.02
2018	11.44	2.03	12.70	465,054	59,062	53,202	5,860	15,826	21,686	342,159	4.89	6.11
2019	11.71	2.14	12.70	478,022	60,709	55,982	4,727	16,889	21,616	363,775	4.90	6.18
2020	11.98	2.23	12.70	491,289	62,394	58,868	3,526	17,959	21,485	385,260	4.91	6.23
2021	12.25	2.32	12.70	504,915	64,124	61,861	2,263	19,027	21,290	406,550	4.92	6.26
2022	12.52	2.42	12.70	518,531	65,853	64,938	915	20,085	21,001	427,551	4.93	6.28
2023	12.80	2.53	12.70	532,088	67,575	68,100	-525	21,130	20,606	448,156	4.94	6.28
2024	13.07	2.63	12.70	545,703	69,304	71,338	-2,034	22,148	20,115	468,271	4.94	6.28
2025	13.32	2.73	12.70	560,369	71,167	74,621	-3,454	23,141	19,687	487,958	4.94	6.26
2026	13.55	2.82	12.70	574,950	73,019	77,921	-4,902	24,113	19,211	507,169	4.94	6.24
2027	13.76	2.91	12.70	590,332	74,972	81,215	-6,243	25,061	18,818	525,987	4.94	6.22
2028	13.93	2.99	12.70	606,403	77,013	84,500	-7,487	25,989	18,502	544,489	4.94	6.20
2029	14.10	3.08	12.70	622,730	79,087	87,808	-8,721	26,901	18,180	562,669	4.94	6.17
2030	14.26	3.17	12.70	639,293	81,190	91,149	-9,959	27,797	17,838	580,507	4.94	6.14
2035	14.74	3.53	12.70	732,957	93,086	108,011	-14,925	32,095	17,170	667,105	4.94	5.98
2040	14.94	3.82	12.70	840,936	106,799	125,623	-18,824	36,336	17,511	753,602	4.94	5.83
2045	15.08	4.05	12.70	961,436	122,102	145,015	-22,913	40,689	17,777	842,396	4.93	5.65
2050	15.30	4.30	12.70	1,092,804	138,786	167,153	-28,367	44,970	16,603	928,498	4.93	5.40
2055	15.57	4.55	12.70	1,236,962	157,094	192,557	-35,463	48,720	13,257	1,002,051	4.93	5.06
2060	15.78	4.78	12.70	1,400,738	177,894	220,975	-43,081	51,469	8,388	1,054,318	4.92	4.64
2065	15.90	4.94	12.70	1,589,444	201,859	252,723	-50,864	52,848	1,984	1,077,875	4.91	4.15
2070	15.99	5.05	12.70	1,804,540	229,177	288,584	-59,407	52,376	-7,032	1,062,118	4.90	3.58
2075	16.09	5.13	12.70	2,047,454	260,027	329,458	-69,431	49,254	-20,177	989,598	4.88	2.93
2080	16.22	5.20	12.70	2,319,366	294,560	376,114	-81,555	42,262	-39,293	834,134	4.84	2.16
2085	16.35	5.26	12.70	2,624,517	333,314	429,231	-95,917	29,729	-66,188	560,572	4.75	1.27
2090	16.48	5.33	12.70	2,969,237	377,093	489,389	-112,296	9,512	-102,784	124,157	4.20	0.25
2095	16.59	5.40	12.70	3,360,427	426,774	557,415	-130,641	-21,051	-151,691	-530,889	2.00	-0.93
2100	16.68	5.45	12.70	3,804,415	483,161	634,727	-151,566	-65,417	-216,983	-1,477,711	2.00	-2.27

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VII. Appendix D - Supplementary Actuarial Information

1. Discussion of Actuarial Funding

The CPP is a defined benefit plan, i.e., in exchange for contributions, a worker and his or her dependents become eligible for a range of benefits, the amounts of which are based on his or her participation and earnings histories. In this sense, the CPP is similar to a defined benefit pension plan that might be established by an employer for its employees.

Defined benefit pension plans that are registered under the Income Tax Act must be funded in accordance with periodic actuarial valuations. These valuations are performed with the objectives of enhancing benefit security and providing for an orderly accumulation of sufficient funds during an individual's period of employment to meet the expected cost of the benefits promised.

From a more technical perspective, an actuarial valuation would generally:

• determine the adequacy of the plan's assets to meet its liabilities, assuming the plan is wound-up immediately;

• compare the plan's assets to its liabilities, assuming continuation of the plan on a going-concern basis; and

• determine the level of contributions required in order to accumulate sufficient assets, over a reasonable period of time, to meet both wind-up and going-concern liabilities.

The CPP differs from a typical pension plan in that it is funded largely on a pay-as-you-go basis. Although the CPP assets are targeted to reach a level of about four or five years' expenditures, this is only about 20% of the funding that would be required of a registered pension plan. For the most part, therefore, the contributions made by workers in a given year are used to meet the obligations of the CPP to current beneficiaries. Such intergenerational funding is appropriate for a social insurance program. Accordingly, the contribution rates are determined through long-term projections of the financial development of the plan, such as those presented in the main body of this report.

Appendix D - Supplementary Actuarial Information

This appendix provides supplementary actuarial information regarding two of the issues mentioned above. It presents the results of a valuation performed using an actuarial method commonly applied to registered pension plans. It also provides an indication of the extent of the intergenerational transfers inherent in the CPP, through estimates of the internal rates of return to various cohorts of participants.

2.   Actuarial Valuation - Accrued Benefit Method

The accrued benefit method has been used to determine the unfunded liability of the CPP. It is the method most widely used for actuarial valuations of registered pension plans and replaces the entry age normal method that was used in previous CPP actuarial reports. This change in method had the effect of decreasing the value of the actuarial liability by about 3.5%.

Under this method, the future benefits that will be paid in respect of CPP participation on or before the valuation date of 31 December 1997 must first be projected. This projection was based on the best-estimate assumptions described in Section III, with the following exceptions:

• no new entrants to the workforce were included; and

• current plan participants who were not yet retired at the valuation date were assumed to have no contributory earnings beyond that date.

Next, these projected future expenditures were discounted at interest to determine their present value, i.e., the actuarial liability. The interest rate used for this purpose was 6.98%. This is the weighted average of the assumed ultimate rates of return of 4.5% and 7.0% on the Operating Balance and Fund, respectively, under a scenario where the CPP would be fully funded.

The actuarial balance sheet of the CPP on this valuation basis is shown in Table VII.D.1 below.

Table VII.D.1   Actuarial Position as at 31 December 1997 - Accrued Benefit Method

	Amount ($ millions)	% of Liability
Actuarial value of assets	36,460	7.8
Actuarial liability	464,512	100.0
Unfunded liability	428,052	92.2

The book value of the CPP assets as at 31 December 1997 was used as the actuarial value of assets for purposes of this valuation. In the future, as marketable assets form a growing proportion of the investments, it may become appropriate to measure assets at market value. Note that if the assets had been valued by discounting future coupons and maturities of the existing 20-year bond portfolio using an interest rate of 6.98%, the balance sheet would have shown assets of $42,321 million and an unfunded liability of $422,191 million.

The major factors that account for the changes in the unfunded liability from the amounts shown in the Fifteenth and Sixteenth Actuarial Reports are identified in the table below.

Appendix D - Supplementary Actuarial Information

Table VII.D.2   Reconciliation of Changes in Unfunded Liability
(millions of dollars)

Fifteenth Report unfunded liability as at 31 December 1993	487,500
Increase due to recalculation as at 31 December 1996	100,300
Expected unfunded liability as at 31 December 1996	587,800
Bill C-2 changes	-130,300
Sixteenth Report unfunded liability as at 31 December 1996	457,500
Increase due to recalculation as at 31 December 1997	22,300
Expected unfunded liability as at 31 December 1997	479,800
Adoption of accrued benefit method	-17,900
Improvements in methodology, experience update and changes in "other" assumptions	-19,200
Changes in key assumptions	
Fertility	-100
Migration	6,600
Mortality	7,900
Disability	-10,000
Employment	-800
Real-wage differential	-2,400
Price increases	-15,800
Seventeenth Report unfunded liability as at 31 December 1997	428,100

If the CPP were fully funded, the ratio of its assets to anticipated 1998 expenditures would be about 25.5. This ratio will vary in future years, in accordance with demographic and economic experience and any changes in assumptions.

The normal actuarial cost represents the value of future benefits earned in a year. The normal cost for 1998 was calculated as $12,876.1 million, or 5.79% of projected 1998 contributory earnings. All other things being equal, the normal cost rate will increase if the average age of CPP participants increases.

3.   Internal Rates of Return

With respect to a group of CPP participants born in a given year, i.e., a cohort, the internal rate of return has been determined as the interest rate at which:

•   the present value of past and future contributions paid, or expected to be paid, by that cohort is equal to

•   the present value of past and future benefits earned, or expected to be earned, by that cohort.

Accordingly, actual internal rates of return cannot be determined until the last member of the cohort has died. However, they can be estimated based on the historical experience, and projected future experience, of the cohort. Internal rates of return have been calculated on the basis of the best-estimate assumptions and using the currently-scheduled steady-state contribution rate of 9.9% for 2003 and thereafter.

The results, presented in Table VII.D.3 below, are net rates, in the sense that the administrative expenses associated with the cohort are not included in the value of the benefits. They are shown on two bases, as both nominal and real internal rates of return. To determine the real internal rates of return, both contributions and benefits were first adjusted to removed the impacts of price increases.

Appendix D - Supplementary Actuarial Information

Table VII.D.3   Internal Rates of Return by Cohort
                  (annual percentages)

Birth Year	Nominal	Real
1910	31.4	23.1
1920	21.3	13.6
1930	15.0	9.0
1940	10.7	6.1
1950	7.8	4.2
1960	6.2	3.1
1970	5.5	2.4
1980	5.4	2.3
1990	5.1	2.1
2000	5.1	2.0
2010	5.0	2.0
2020	5.0	1.9
2030	5.0	1.9

The higher internal rates of return of the earlier cohorts mean that they are expected to receive better "value" from the CPP than those who follow. The differences provide an indication of the degree of intergenerational transfer inherent in the plan. However, the fact that all of the rates in the table are greater than zero shows that each cohort is expected to receive more from the CPP than it contributes.