Population Dependency Ratios Versus Fiscal Dependency Ratios

by

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POPULATION DEPENDENCY RATIOS VERSUS FISCAL DEPENDENCY RATIOS

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I. INTRODUCTION

Population aging is creating major concerns about fiscal sustainability and inter-generational equity in many countries. According to the OECD [2001], population aging will have serious impacts on the fiscal systems of OECD countries. It will depress revenue growth because it will lower employment growth while raising spending pressures on governments. In Canada, the federal government has used the projected increase in the elderly dependency ratio as a primary justification for a policy of debt repayment [Finance 2004].

Although population aging tends to be associated with rising dependency ratios, and these ratios are widely used by social scientists as indicators of the long-term financial sustainability of pension plans and of the fiscal pressures on governments, by themselves they provide no information on present and future fiscal conditions. Dependency ratios are statistics that relate a subset of the population, which is considered to be economically "dependent", to the other subset of the population upon which they are assumed to depend. They are expressed as ratios which often have the "dependent" population at the numerator and the "supporting" population at the denominator.

Dependency ratios cannot be used directly as indicators of fiscal sustainability or inter-generational equity because they are ratios involving subsets of the population without regard for their net fiscal contributions (positive or negative). Fiscal sustainability and inter-generational equity, on the other hand, have no meaning outside a fiscal framework. In order for dependency ratios to serve as indicators of fiscal health and equity they must be transformed from population-

based statistics into fiscal-based indicators. An approach to this transformation from a population dependency ratio to a fiscal dependency ratio is developed in this paper.

This paper serves two purposes. First, it introduces a new methodological tool for measuring the fiscal implications of population aging. Called fiscal dependency ratio, this tool is derived as the product of the population dependency ratio and a fiscal factor that relates the fiscal burden generated by the dependent population to the capacity of the supporting population to bear it. Second, it derives estimates of the fiscal dimensions of population aging in Canada over the period from 2004 to 2026 that challenge widely held views about the fiscal impact of population aging.

The results show that the population dependency ratio would lead to misdirected fiscal policy in Canada. The population dependency ratio will fall over the next seven years, but will then rise again, and in 2026 will end up 28 percent higher than it was in 2004. This increase in the population dependency ratio is more than offset by the projected decline in the fiscal factor, even when the total net fiscal contributions of the "supporting" age group (15-64) are kept constant as a ratio to GDP. The fiscal dependency ratio is projected to decline at an even faster rate when this constraint is eliminated and the fiscal structure is allowed to interact freely with the projected growth in GDP.

II. METHODOLOGY

The transformation of dependency ratios from population-based statistics into fiscal dependency

ratios suitable for evaluating the future fiscal pressures is performed in three stages. The first stage develops a model that generates the required transformation. To determine the fiscal sustainability and equity implications of changing dependency ratios, the net fiscal benefits of the "dependent" population (the numerator of the ratio) are related to the fiscal capacity of the "supporting" population (the denominator). The second stage involves the selection of the approach for allocating net fiscal benefits (positive or negative) to the "dependent" and "productive" population. The third stage, which applies only when dealing with future development, provides the projections of government revenues and expenditures that form the basis for the calculation of the net fiscal benefits by selected age group. These three stages are explained in detail in the appendix. This section highlights the main properties of the formulas derived in the appendix.

II-A. Approach to Fiscal Dependency Ratios

The first stage in the development of fiscal dependency ratios contains two steps: (a) developing a formula for the fiscal burden of an aging population, and (b) transforming this formula into a fiscal dependency ratio by relating the fiscal burden of the dependent population to the fiscal capacity of the supporting population.

As shown in the appendix, the fiscal burden ratio (FBR) can be expressed as:

$$(1)\ FBR_t = (F^*)*(PDR)_t$$

where F^* is the index of the fiscal burden factor and PDR is the population dependency ratio.

The fiscal dependency ratio can be derived as the ratio of (1) and the per capita contribution by the supporting group (C). Specifically:

$$(2)\ FDR(U)^{*}_{t} = [FF(U)^{*}]*(PDR)_{t}$$

where the index of the fiscal factor $FF(U)^{*}$ is equal to F (the per capita net fiscal benefit) divided by C(U) (the per capita net contribution), expressed as an index, which takes the value of one in the initial year, and U indicates that no constraints were imposed on the calculation of FDR.

The actual value of FDR in (2) based on a given set of fiscal projections serves as an indicator of fiscal sustainability. If it rises over time, it means that the change in the fiscal factor is insufficient to offset the rise in the dependency ratio, and population aging imposes a rising fiscal burden on the fiscal capacity of the supporting population.

The fiscal dependency ratio in (2) can be transformed into an indicator of inter-generational equity by selecting an equity criterion. A suitable criterion is the maintenance of a constant share of total contributions by the supporting age group to their income. Under this criterion, inter-generational equity is said to hold when the supporting group contributes a constant share of its income. This criterion is similar to the one used to evaluate inter-generational equity in models of generational accounting, which holds constant the share of income going to taxes [Oreopoulos and Vaillancourt 1998]. In our calculations, we used a broader concept of income, namely, Gross Domestic Product (GDP) in order to incorporate the macro-economic variable that determines the overall fiscal capacity of a given fiscal structure. By maintaining constant the net fiscal contribution by the supporting group relative to nominal GDP, we can ask the following

question: will a constant relative contribution by the supporting population be able to finance the increased net fiscal burden generated by an population aging? In this case, the fiscal dependency ratio can be expressed as:

$$(3)\ FDR(L)_t = [FF(L)^*]*(PDR)_t$$

where FF(L) is F divided by the value of C (L) determined by the equity criterion, expressed as an index, and L indicates that constraints were imposed on the calculation of FDR.

According to (3), a given fiscal system has a built-in inter-generational inequity in favour of current generations if, for given economic trends, it generates values of the fiscal dependency ratio that increase over time. If these values decline over time, the fiscal system is inter-generationally inequitable in favour of future generations.

II-B. Economic Projections

For real GDP, we started with the data contained in the November 2004 *Economic and Fiscal Update*. For the period from 2003-04 to 2009-2010, we derived the value of real GDP from table 3.6 [Department of Finance 2004: 77]. Starting with the above value in 2009-2010, we applied the growth rate in the Conference Board [February 2004] up to 2014-15 and the Conference Board [August 2004] for the period up to 2019-20. Noting that the average annual growth rates for each of the three sub-periods declined over time, we assumed a further small decline for the remaining six years of the projection period. The same approach was used for projecting nominal GDP.

II-C. Fiscal Projections

Data and Adjustments. The base-year data used for our projections are found in CANSIM Table 3850001, which contains data on consolidated federal, provincial/territorial and local government revenues and expenditures, and Table 3840009, which contains data on total government transfers to persons. We adjusted the data found in CANSIM Table 3850001 by eliminating three self-financing programs, thus focusing the analysis on the fiscal structure: (a) Canada/Quebec Pension Plan benefits and contributions, (b) contributions to and payments from public service pension plans, and (c) Workers' Compensation benefits and contributions.

We also excluded from our calculations the servicing charges on the public debt. These payments do not deliver direct benefits to any age group. Those who hold government bonds receive interest, but they could receive the same interest by purchasing other financial assets. Yet, taxpayers in a given year must pay higher taxes in order to finance debt servicing charges, and these extra tax payments are included in the list of government revenues to be allocated to the selected age groups. In our calculations we excluded interest payment from the expenditure side, thus concentrating exclusively on program spending from which individuals receive benefits directly or indirectly. Accordingly, we also eliminated the tax revenues needed to finance them.

As a first step in this adjustment, we excluded from the revenue sources investment income, except for royalties and remittances from government enterprises. We then assumed that the remaining balance of debt charges would be financed from general revenues. Therefore, this excess was allocated proportionately to all sources of government revenues. In our view, this

approach is internally consistent, as it focuses on program spending and the revenues that finance it, and prevents potential double-counting of benefits.

In order to determine the proportional adjustment to tax revenues, we had to project these interest payments on the public debt. We assumed that the public debt will remain constant throughout the projection period for two reasons: (a) it will not decline because there is no debt repayment since all revenue is assumed to be spent, and (b) there is no increase in the debt because the existing fiscal structure of all governments combined is capable of generating budget surpluses throughout the entire period [Ruggeri 2001, Conference Board 2004]. If interest rates remain at the current level, on average over the entire period, we can approximate debt servicing charges by maintaining their level as it existed in 2003-04.

Expenditures. We used two approaches to project government expenditures, which were applied separately to different categories of public spending. For certain spending categories, we projected per capita expenditures and then multiplied the results by the population to derive the projection of total spending. For other spending categories, we projected total expenditures directly. Combined expenditures by federal, provincial/territorial, and local governments were divided into the categories found in CANSIM Table 3850001. In the case of Social Services we used a finer breakdown based on CANSIM Table 3840009, which provides a disaggregation of transfers to persons.

Revenues. Two approaches were also used to project government revenues, based on the

disaggregation found in CANSIM Table 3850001. For selected revenue sources, the projections were based on their assumed relationship with the growth of Gross Domestic Product. For the remaining revenue sources, average annual growth rates of revenues were based on the demographic and economic factors affecting a specific revenue source.

II-D. Allocation of Revenues and Expenditures among the Three Age Groups

The Treatment of the Youth Group. Adjusted revenues and expenditures were allocated to three age groups: 0-14, 15-64, and 65+. We used this age breakdown in order to maintain consistency with the traditional measurement of the population dependency ratio, which forms the foundation of our fiscal dependency ratio. In future research, different age grouping may be used, as long as they are applied consistently to both population and fiscal dependency ratios.

The arguments for changing the age threshold for the elderly group are not compelling. Past trends towards early retirement would suggest an earlier age threshold, such as 60. Pressures on labour force growth due to population aging, which have prompted the elimination of mandatory retirement at 65 in several Canadian provinces, may reverse this trend, in which case the 65 years threshold may remain meaningful. A stronger case can be made for changing the age threshold for the youth group. Treating those in the 15-17 age range as "independent" may be unwarranted and in future research it may be preferable to identify the youth group with the age range 0-17. This shift, however, would have little effect on our results. The population dependency ratio would rise, but the fiscal factor would fall as the per capita net fiscal benefits received by the dependent population would change little while the per capita net fiscal contributions by the supporting population would rise.

In the case of those in the age group 15-64, the allocation is straightforward, as these adults pay taxes and receive benefits from government spending directly and not as dependants. The allocation of net fiscal benefits is also straightforward, though not always simple, for the population 65 and over because seniors have income of their own, pay taxes directly, and do not need intermediaries such as parents to receive the benefits of government spending. This is not true for children in the age group 0-14. They rarely have income of their own, do not pay taxes directly, and some of the public spending benefits they receive are part of the benefits received by the family to which they belong. Therefore, in many cases, the calculations of net fiscal benefits involve imputations. The general principle used in our imputations is that we should include in benefits and costs any changes in taxation or spending that are associated with the presence of children in that age group.

Expenditures. For allocation purposes, government expenditures were divided into four categories, as shown in Table II-1. The first category includes what are called "public good equivalents". These are expenditures which cannot be allocated to specific age groups because they are general in nature and in many cases cannot be divided in a manner where their consumption by one group would prevent consumption by another group. Therefore, they were allocated on an equal per capita basis, not because each person actually consumes an equal amount of the good and service in a given year, but because they are available to everyone in equal amounts and free of direct charge. The second category includes what economists call "transfers in kind". They are private goods which are either publicly delivered (education) or

Table II-I. Components of Allocated Government Revenues and Expenditures, 2003-04 and 2025-26, Millions of 2004 Dollars.

	2003-04	2025-26
Spending		
A. Equivalent to Public Goods (Per Capita Allocation)		
General Government Services	15,952	20,318
Foreign Affairs and International Assistance	4,793	6,105
Protection of Persons and Property	37,275	60,136
Resource Conservation and Industrial Development	19,152	24,394
Environment	11,220	14,291
Recreation and Culture	12,048	15,345
Subtotal	100,440	140,589
B. Transfers in Kind (Specific Allocation)		
Health Care	89,643	203,769
Education	68,579	86,612
Subtotal	158,222	290,381
C. Cash Transfers (Specific Allocation)		
Subtotal (includes Employment Insurance Benefits)		
Social Assistance, Family Benefits, Old Age Pensions and Veterans Benefits	74,663	105,020
D. Other Expenditures (Various Allocations)		
Other Social Services Expenditures	18,945	22,014
Transportation and Communications	20,081	25,999
Other Expenditures	13,696	24,345
Subtotal	52,722	72,357
Total	386,047	608,348
Revenues		
A. Tax Revenues	164,501	346,050
Income Taxes	88,155	137,533
Consumption Taxes	23,424	34,011
Payroll Taxes	39,161	58,872
Property Taxes	9,589	14,866
Other Taxes	324,831	591,332
Subtotal		
B. Non-Tax Revenues		
Sale of Goods and Services	32,845	37,531
Investment Income	20,044	30,047
Other Revenue	6,280	6,763
Subtotal	59,169	74,341
Total	384,000	665,673

publicly funded (health care). The third category includes direct cash transfers to persons. Its major components are, in order of magnitude, Old Age Security pensions, Employment Insurance benefits and welfare payments. The final category contains a variety of items that were allocated in different ways depending on the age groups that are expected to benefit.

Revenues. Government revenues were grouped into two major categories: tax and non-tax revenues. The first category is the dominant one, accounting for four-fifths of total allocated revenue. Income taxes are the major revenue source for all governments combined, followed by consumption taxes. All other revenue sources individually make moderate contributions to government revenues.

III. RESULTS

III-A. The Population Dependency Ratio

The underpinning of the concerns about population aging, fiscal sustainability and inter-generational equity is the projected increase in the senior and total dependency ratios. Estimates of these ratios, based on Projection 2 in Statistics Canada [2001] are shown in Table III-1. The third column indicates a steady upward trend in the elderly dependency ratio (the ratio of the population 65+ to the population 15-64). The increase is moderate from 2004 to 2014, but accelerates in the following twelve years. By 2026, the elderly dependency ratio is projected to rise to 33.6 percent, which represents an increase of 78 percent from its value in 2004. The youth

dependency ratio (the other component of the total dependency ratio) is projected to follow a shallow U-shape pattern, first declining up to 2016 and then rising again. By 2026, however, this dependency ratio is 9 percent lower than in 2004. The combination of these two ratios leads also to a U-shaped pattern of the overall dependency ratio, first falling up to 2011 and then rising again. Compared to 2004, the value of this ratio is only marginally higher in 2014, but 28 percent higher in 2026.

Table III-1. Projected Dependency Ratios in Canada, 2004-2026.

Year	Youth Ratio	Elderly Ratio	Total Ratio
2004	25.8	18.9	44.7
2005	25.2	19.0	44.2
2006	24.7	19.0	43.7
2007	24.2	19.4	43.6
2008	23.8	19.8	43.6
2009	23.4	20.1	43.5
2010	23.0	20.5	43.5
2011	22.5	20.8	43.3
2012	22.5	21.5	44.0
2013	22.5	22.2	44.7
2014	22.4	22.9	45.3
2015	22.4	23.6	46.0
2016	22.3	24.3	46.6
2017	22.5	25.1	47.6
2018	22.5	26.0	48.5
2019	22.6	26.8	49.4
2020	22.7	27.7	50.4
2021	22.8	28.5	51.3
2022	22.9	29.5	52.4
2023	23.0	30.6	53.6
2024	23.1	31.6	54.7
2025	23.2	32.6	55.8
2026	23.4	33.6	57.0
Changes:			
2004 to 2014	-3.4	4.0	0.6
2014 to 2026	1.0	10.7	11.7
2004 to 2026	-2.4	14.7	12.3

III-B. The Fiscal Burden Ratio

Projections of the fiscal burden that this rising dependency ratio would impose on the "supporting population", based on the existing fiscal structure, are presented in two steps. The first step (Table III-2) shows the projected values of the per capita real net fiscal benefits for the

youth (B_y) and senior groups (B_o), which serve as the basis for the calculation of the factor that transforms the population dependency ratio into the fiscal burden ratio. As discussed in the appendix, the values of "B_y" can also be viewed as the standard per capita real net benefits, which are common to both "dependent" age groups. The per capita real net benefits of the senior group can then be measured as the standard benefits adjusted by the factor "a". The second step (Table III-3) shows the projections of the fiscal burden ratio and its components.

Per capita benefits received by the youth and elderly groups, as well as the contributions by the supporting group that will be shown later, are expressed in real terms because they serve as the basis for the calculation of the fiscal burden to be borne by the supporting group, which in our view should be free of inflationary components. In theory, the deflation process should involve the use of different price indices. For example, for taxes and cash transfers the most appropriate price index is the consumer price index (CPI), but for government purchases the GDP deflator for the government sector would be more appropriate. Since we are dealing with projections, we used the CPI to deflate both revenues and expenditures because our economic projections do not include the GDP deflator for government purchases. It may be worth noting that from 1981 to 2004, the CPI and the GDP deflator for current government purchases increased at the same rate.

Table III-2 shows that per capita real net benefits are higher for seniors than for youth, which means that replacing a youth with a senior will raise the average per capita net fiscal benefit. This difference is projected to fall over time from $3,018 in 2004 to $2,117 in 2026 for the following reasons. Real per capital expenditures are projected to grow at the same rate for both

dependent groups although they benefit from different spending programs. For the elderly group, the higher growth of per capita spending in health care is offset by the slower growth in transfer payments (which are indexed to the CPI). The combination of these two opposing forces leads to a growth rate of per capita spending similar to that of education, which dominates public spending for the youth group. Revenues are projected to grow at a faster rate for the elderly group, primarily because of the income tax they will pay on their projected higher incomes over time.

The net result is a decline in the ratio of the two net fiscal benefits, "a", from 1.18 in 2004 to 1.21 in 2026. The decline in "a" indicates how inappropriate it is to focus our attention on the spending pressures arising from population aging, without consideration for the revenue side. In determining the fiscal burden generated by population aging, what matters is not the growth of public spending for the senior population, but the growth of the benefits they receive, namely, the difference between the expenditures and revenues assigned to them, compared to the net benefits received by the youth group.

The effect of differential fiscal pressures between the elderly and the youth groups is captured by "A", which measures the ratio of the dependent population adjusted by the factor "a" (P_d') and the unadjusted dependent population (P_d). As shown in the last column of Table III-2, the value of A is projected to decline slightly over time indicating that, within the dependent population, the increase in the elderly group relative to the youth group is more than offset by the decline in their per capita net fiscal benefits relative to the youth group.

Table III-2. Projections of the Per Capita Net Benefits Assigned to the Youth and Senior Groups: 2004 to 2026, Constant 2004 Dollars.

Year	B_y	B_o	$a=B_o/B_y$	$A=P'_d/P_d$
2004	9215.1	12233.1	1.33	1.14
2005	9455.8	12439.6	1.32	1.14
2006	9580.8	12593.6	1.31	1.14
2007	9705.8	12665.4	1.30	1.14
2008	9839.5	12784.4	1.30	1.14
2009	9977.0	12913.6	1.29	1.14
2010	10090.0	13031.2	1.29	1.14
2011	10245.1	13123.8	1.28	1.13
2012	10354.6	13117.8	1.27	1.13
2013	10464.5	13112.9	1.25	1.13
2014	10558.0	13093.2	1.24	1.12
2015	10653.4	13073.4	1.23	1.12
2016	10753.6	13083.1	1.22	1.11
2017	10814.6	13089.8	1.21	1.11
2018	10876.6	13096.0	1.20	1.11
2019	10938.3	13106.8	1.20	1.11
2020	11015.3	13117.1	1.19	1.10
2021	11100.8	13159.7	1.19	1.10
2022	11183.5	13253.0	1.19	1.10
2023	11267.1	13347.5	1.18	1.11
2024	11352.6	13445.7	1.18	1.11
2025	11438.9	13543.3	1.18	1.11
2026	11525.6	13642.6	1.18	1.11
Annual Average Growth Rate	1.02	0.50	-0.52	-0.12

In columns 2 to 4 of Table III-3, the components of the factor that transforms the population dependency ratio into a fiscal burden ratio (FBR) are shown in index form to facilitate the comparison. The associated FBR values are shown in columns 5 and 6. This table shows that the time path of the fiscal burden factor (the product of B^*_y and A^*) is determined almost entirely by the standard real net per capita benefits (B^*_y). The age adjustment (A^*) has practically no influence because the relative increase in the senior population is offset by the decline in the ratio

of net fiscal benefits between the senior and youth groups. The fiscal burden ratio increases steadily throughout the entire projection period despite a U-shape pattern of the population dependency ratio. This is because the increase in the fiscal burden factor dominates the pattern of the population dependency ratio.

Table III-3. Projections of the Fiscal Burden Ratio and Its Components in Canada, 2004 to 2026.

Year	Fiscal Burden			Population Dependency Ratio, Percent	Fiscal Burden Ratio (FBR), Percent
	B^*_y	A^*	$(B^*_y * A^*)$		
2004	1.000	1.000	1.000	44.7	44.7
2005	1.026	0.997	1.023	44.2	45.2
2006	1.040	0.999	1.039	43.7	45.4
2007	1.053	0.998	1.051	43.6	45.9
2008	1.068	0.998	1.065	43.6	46.4
2009	1.083	0.998	1.081	43.5	47.0
2010	1.095	0.999	1.094	43.4	47.5
2011	1.112	0.997	1.109	43.4	48.1
2012	1.124	0.993	1.116	44.0	49.1
2013	1.136	0.989	1.123	44.7	50.2
2014	1.146	0.985	1.129	45.3	51.2
2015	1.156	0.981	1.134	46.0	52.1
2016	1.167	0.978	1.141	46.6	53.2
2017	1.174	0.976	1.146	47.6	54.5
2018	1.180	0.975	1.150	48.5	55.8
2019	1.187	0.973	1.155	49.5	57.1
2020	1.195	0.971	1.160	50.4	58.5
2021	1.205	0.969	1.167	51.4	60.0
2022	1.214	0.970	1.177	52.5	61.8
2023	1.223	0.971	1.187	53.6	63.6
2024	1.232	0.972	1.198	54.7	65.5
2025	1.241	0.973	1.208	55.8	67.4
2026	1.251	0.974	1.218	57.0	69.4
Annual Average Growth Rate	1.02	-0.12	0.90	1.11	2.02

Note: products involving indices are based on values with a lower degree of rounding than those shown in the table.

The information contained in Table III-3 indicates that the population dependency ratio underestimates the increase in the fiscal pressures that will have to be borne by the population 15-64. Focusing on the burden side alone, however, would be misleading and would serve as a poor guide to public policy because the per capita fiscal capacity of the supporting group will also rise over time. To gain a better understanding of the fiscal pressures from population aging we need to relate the fiscal burden that would be imposed on the supporting population to their capacity to bear that burden. We call that relationship the fiscal dependency ratio (FDR) and we measure it as the product of the fiscal factor (FF), expressed as an index, and the population dependency ratio. The fiscal factor in turn, is measured by the ratio of the fiscal burden factor (F) and the per capita net fiscal contribution by the "supporting" group (C).

Two measures of FDR are developed in this paper. One measure is based on the unconstrained value of C that would be generated by the existing fiscal system interacting with the projected growth of the economy and called C(U). The other measure imposes the condition that the total net fiscal contribution by the "supporting" group remains a constant proportion of nominal GDP and corresponding per capita value is called C(L). This measure may be given an inter-generational equity interpretation because it indicates whether the fiscal pressures from population aging can be met without raising the fiscal burden on future workers (approximated by the population 15-64).

The second column of Table III-4 shows that the unconstrained per capita real net fiscal contribution of the "supporting" group is projected to grow at a much faster rate than that of the

standard net per capita benefit of the "dependent" group (3.48 percent versus 1.02 percent). As a result, the ratio of B_y to C(U) falls steadily throughout the entire projection period. Since the other component of the fiscal factor FF ("A" in the sixth column) declines slightly, the estimated value of the fiscal factor also decreases. The same pattern, but less pronounced, is found for the corresponding variables in the case where total net fiscal contributions are constrained to remain a constant share of GDP. A comparison of the second and third columns indicates that, if the projected growth of GDP materializes, the unconstrained net fiscal contribution by the supporting group will represent an increasing share of GDP because C(U) exceeds C(L) for most of the projection period and the ratio of the two increases over time.

The last two columns show that the fiscal factor is projected to decline under both approaches to the estimation of per capita real net fiscal contributions, indicating that the fiscal side will moderate the potential effects of the demographic side. Moreover, the rate of decline is considerably higher in the unconstrained than in the constrained scenario (-2.50 versus -1.23 percent). The question of which pattern of net fiscal contribution is required to satisfy the fiscal pressures of population aging depends on the relationship between the fiscal factor and the population dependency ratio, a relationship which is shown explicitly in Table III-5.

Table III-4. Calculation of the Fiscal Factor, 2004 to 2026: Contributions in Constant 2004 Dollars.

Year	C(U)	C(L)	$B_y/C(U)$	$B_y/C(L)$	A	FF(U)	FF(L)
2004	4592.0	4592.0	2.01	2.01	1.14	2.28	2.28
2005	4681.1	4732.4	2.02	2.00	1.14	2.29	2.27
2006	4807.7	4841.4	1.99	1.98	1.14	2.27	2.25
2007	5008.4	4938.0	1.94	1.97	1.14	2.20	2.23
2008	5196.9	5033.4	1.89	1.95	1.14	2.15	2.22
2009	5393.7	5126.3	1.85	1.95	1.14	2.10	2.21
2010	5592.9	5216.7	1.80	1.93	1.14	2.05	2.20
2011	5765.6	5299.5	1.78	1.93	1.13	2.02	2.19
2012	5993.4	5414.6	1.73	1.91	1.13	1.95	2.16
2013	6227.1	5532.2	1.68	1.89	1.13	1.89	2.13
2014	6483.8	5652.2	1.63	1.87	1.12	1.83	2.09
2015	6745.9	5775.1	1.58	1.84	1.12	1.76	2.06
2016	6985.9	5889.4	1.54	1.83	1.11	1.71	2.03
2017	7246.8	6018.9	1.49	1.80	1.11	1.66	2.00
2018	7513.5	6157.3	1.45	1.77	1.11	1.61	1.96
2019	7786.3	6294.7	1.40	1.74	1.11	1.56	1.92
2020	8068.3	6436.1	1.37	1.71	1.10	1.51	1.89
2021	8321.7	6567.7	1.33	1.69	1.10	1.47	1.86
2022	8595.5	6715.0	1.30	1.67	1.10	1.44	1.84
2023	8876.2	6865.6	1.27	1.64	1.11	1.40	1.81
2024	9162.3	7019.8	1.24	1.62	1.11	1.37	1.79
2025	9455.7	7177.2	1.21	1.59	1.11	1.34	1.76
2026	9755.6	7338.3	1.18	1.57	1.11	1.31	1.74
Annual Average Growth Rate	3.48	2.15	-2.38	-1.11	-0.12	-2.50	-1.23

The fourth and last columns of Table III-5 indicate that the projected increase in the fiscal capacity of the "supporting" group is more than sufficient to handle the pressures of population aging under both approaches because the fiscal factor declines at a faster rate than the increase in the population dependency ratio. Under the first approach, which captures the effects of the existing fiscal structure, the fiscal dependency ratio falls steadily throughout the entire projection period. Under the second approach, FDR follows a shallow U-shape pattern, first declining until

2016 and then slowly rising again. However, by 2026, this value is still 2.9 percent lower than it was in 2004.

These results provide some indications on how public policy may be mis-directed when it is based on misleading indicators. As shown in Figure III-1, if the economic projections hold, the projected fiscal pressures from population aging can be met by a fiscal structure that maintains the total contributions by the supporting group as a constant proportion of GDP. The current fiscal structure goes far beyond that requirement because the fiscal dependency ratio associated with it declines much faster than that constrained by a constant ratio to GDP. This overshooting of future fiscal pressures is consistent with a policy that would be based on a simple demographic indicator rather than the more appropriate fiscal indicator.

Table III-5. Fiscal Dependency Ratios, 2004 to 2026.

			Fiscal Dependency Ratios		
Year	Population Dependency Ratio, Percent	Fiscal Factor, FF(U)*, index	FDR(U) Percent	Fiscal Factor, FF(L)*, index	FDR(L) Percent
2004	44.7	1.00	44.7	1.00	44.7
2005	44.2	1.00	44.4	0.99	43.9
2006	43.7	0.99	43.4	0.99	43.1
2007	43.6	0.96	42.0	0.98	42.6
2008	43.6	0.94	41.0	0.97	42.4
2009	43.5	0.92	40.0	0.97	42.1
2010	43.4	0.90	39.0	0.96	41.8
2011	43.4	0.88	38.3	0.96	41.7
2012	44.0	0.86	37.6	0.95	41.7
2013	44.7	0.83	37.0	0.93	41.7
2014	45.3	0.80	36.2	0.92	41.6
2015	46.0	0.77	35.5	0.90	41.5
2016	46.6	0.75	35.0	0.89	41.5
2017	47.6	0.73	34.5	0.87	41.6
2018	48.5	0.70	34.1	0.86	41.6
2019	49.5	0.68	33.7	0.84	41.7

2020	50.4	0.66	33.3	0.83	41.7
2021	51.4	0.64	33.1	0.82	41.9
2022	52.5	0.63	33.0	0.81	42.2
2023	53.6	0.61	32.9	0.79	42.6
2024	54.7	0.60	32.8	0.78	42.9
2025	55.8	0.59	32.7	0.77	43.1
2026	57.0	0.57	32.7	0.76	43.4
Annual Average Growth Rate	1.11	-2.50	-1.41	-1.23	-0.13

IV. CONCLUSIONS

This paper challenged the conventional wisdom that population aging will impose unbearable burdens on Canada's fiscal system. Pointing out that the population dependency ratio cannot be used directly as a fiscal indicator, because it is simply a ratio of different age groups, we developed a methodological approach for transforming the population dependency ratio into a fiscal dependency ratio that serves as a guide to budgetary policy for maintaining fiscal sustainability and inter-generational equity over time. We then applied this methodology to develop projections of the associated indicator for Canada over the period from 2004 to 2026.

The results show that the population dependency ratio would lead to mis-directed fiscal policy in Canada. The population dependency ratio will fall over the next seven years, but will then rise again, and in 2026 will end 28 percent higher than it was in 2004. This increase in the population dependency ratio is more than offset by the projected decline in the fiscal factor, which transforms the population dependency ratio into a fiscal dependency ratio, even when the total net fiscal contributions of the "supporting" age group (15-64) are kept constant as a ratio to GDP.

The fiscal dependency ratio is projected to decline at an even faster rate when this constraint is eliminated and the fiscal structure is allowed to interact freely with the projected growth in GDP.

The results of this study undermine that pessimistic view of population aging by providing evidence that the projected fiscal pressures associated with population aging are quite manageable with the existing fiscal system as long as the economy grows even at a moderate rate. They also undermine the fiscal sustainability and inter-generational equity rationales for maintaining a structurally unbalanced fiscal system, which has a built-in tendency to generate budget surpluses or increasing magnitude over time, and for using part of this surplus for debt repayment.

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APPENDIX. METHODOLOGY

A. From Population to Fiscal Dependency Ratios

In order to determine the fiscal sustainability and equity implications of changing dependency ratios we need to relate the net fiscal benefits of the "dependent" population (the numerator of the ratio) to the fiscal capacity of the "supporting" population (the denominator). Net fiscal benefits for a given year measure the difference between government expenditures and the government revenues assigned to the "dependent" population. They can be expressed as:

$$(1)\ N_{d,t} = [B_y(P_y) + B_o(P_o)]_t$$

where N is total net fiscal benefits, B is per capita net fiscal benefits, P is population, y refers to

the 0-14 age group, o refers to the population 65+, "d" refers to the combination of the two "dependent" age groups, and "t" identifies a given year.

When the net per capita benefits received by the two dependent groups are not equal, we can express the net benefits received by the population 65+ as a proportion (greater or smaller than one) of the net benefits received by the population 0-14. Given this relationship, expression (1) may be re-written as:

$$(2)\ N_{d,t} = [B_y(P_y + aP_o)]_t = (B_y P'_d)_t$$

where "a" is equal to B_o/B_y and P'_d measures the dependent population adjusted by the factor "a" that relates the per capita net benefits of the senior population to those of the youth population. In this case, "B_y" may be viewed as the standard per capita benefit which applies to both "dependent" age groups, and "a" the adjustment for the age factor.

These net benefits must be financed either by borrowing or by the supporting group (P_s). In the latter case, we can define the fiscal burden ratio (FBR) as:

$$(3)\ FBR^*_t = [(B_y^*)*(P'_d/P_s)]_t.$$

where the superscript indicates that the standard net benefit is expressed as an index.

If we multiply the right-end side of (3) by $P_{d,t}/P_{d,t}$ and rearrange terms, we can calculate the fiscal burden ratio as:

$$(4)\ FBR^*_t = \{[(B_y^*)*(A^*)]*(PDR)\}_t$$

where A^* is the ratio of P'_d to P_d, expressed as an index.

Expression (4) shows how the population dependency ratio must be adjusted in order to transform it into a fiscal burden ratio. Expression (4), however, measures one part of the fiscal dependency ratio, namely, the burden side. This burden must be related to the fiscal capacity of the supporting group in order to determine how this burden will change over time. Since on the fiscal burden side the population dependency ratio, corrected for differences in per capita net benefits for the youth and senior groups when necessary, is adjusted by the standard per capita benefit (assigned to the youth group) or its index, the fiscal capacity of the supporting group is also expressed on a per capita basis and will be represented by C(U).

The fiscal dependency ratio (FDR) can be expressed as:

$$(5)\ FDR\ (U)^*_t = \{[(R(U)^*)*(A^*)]*(PDR)\}_t$$

where $R(U)^*$ is $B_y/C(U)$ expressed as an index, and:

Expression (5) shows that, when per capita net benefits differ between the youth and the senior group, the fiscal dependency ratio is derived as the product of three factors: (a) the population dependency ratio (PDR), (b) the benefit-to-contribution ratio ($R(U)^*$ when expressed as an index), e.g., the ratio of the standard per capita net fiscal benefits to the net per capita contribution by the "supporting" population, and (c) the aging factor (A^*), e.g., the ratio of the adjusted to the unadjusted population of the "dependent" age groups, expressed as an index. The standard dependency ratio is a meaningful indicator of the fiscal pressures arising from population dynamics only in the special cases where both $R(U)^*$ and A^* remain constant over time or they move in opposite directions in a manner that leaves their product constant.

The term in the square bracket can be viewed as the "fiscal factor" used for the transformation of the dependency ratio into a fiscally meaningful indicator. This "fiscal factor" captures two separate effects. The first term inside the square bracket measures the per capita benefit-to-contribution ratio in the case where per capita benefits are equal for the youth and the senior group (the value of the factor "a" is equal to one through the entire period). The second term measures the "aging effect" when the factor "a" differs from one and changes over time.

For the purpose of our study, which focuses on the fiscal sustainability and equity aspects of population aging, two measures of FDR will be used. The first measure uses projected values of all the variables that determine the fiscal dependency ratio. The second measure is based on the assumptions that the total contributions by the supporting group (C times P_s) remains constant as a proportion of nominal GDP and is called C(L). By maintaining constant the net fiscal burden on the supporting group relative to its earnings (approximated by nominal GDP) we can ask the following question: will a constant relative burden on the supporting population be able to finance the increased net fiscal benefits associated with population aging? In this case, the fiscal dependency ratio (FDR) can be expressed as:

$$(6)\ FDR\ (L)^*_t = \{[(R(L)^*)*(A^*)]*(PDR)\}_t$$

where $R(L)^*$ is $B_y/C(L)$ expressed as an index, and (L) indicates that a limit has been imposed on the calculation of FDR.

Expression (6) indicates that only when FDR^* increases over time will population aging raise the fiscal burden of the supporting population because it will require per capita contributions to represent an increasing share of nominal GDP.

The fiscal burden ratio in (4) and the fiscal dependency ratios in (5) and (6) will be estimated for Canada over the period from 2004 to 2026 to determine how valid are the concerns about the spending pressures arising from population aging and the combined capacity of the economy and the revenue structure to finance them.

B. Fiscal Projections

B-1. Data Sources and Adjustments

The base-year data used for our projections are found in CANSIM Tables 3850001 and 3840009. We adjusted the data found in CANSIM Table 3850001 by eliminating three of self-financing programs, thus focusing the analysis on the fiscal structure.

CPP/QPP Benefits and Contributions. This component of the fiscal system is separate from budgetary revenues and expenditures. These pensions are equivalent to deferred labour compensation, especially after the 1997 reform which introduced a balance between pay-as-you-go and pre-funding. They are similar in nature to private annuities. In Canada, payment of these pensions does not impose a burden on government finances, therefore, this item should not be included in our calculations.

Public Sector Pensions. A similar argument can be made for pensions paid by government department and agencies to their retired employees. These pension schemes are not different from those offered by private sector employers. Any financial pressures that may arise from population aging would be handled by adjustments to the structure of these programs without requiring budgetary decisions.

Workers' Compensation. The above argument about pensions can be extended to the Workers' Compensation program. This is also a separate fund which collects revenues from a payroll tax on employers and pays benefits to workers who are injured.

We also excluded from our calculations the changers on the public debt for the reasons explained in the text.

B-2. Expenditure Projections

We used two approaches to project government expenditures. In the first approach, we projected per capita expenditures and then multiplied the results by the population to derive the projection of total spending. In the second approach, we projected total expenditures directly.

Per Capita Growth Approach

Items not Related to Population Aging. Various components of government spending are projected to grow at rates that are affected by population growth, but not by population aging. For these spending components we assumed that per capita expenditures will grow at the rate of inflation plus half a percentage point to capture other cost pressures. Adding population growth will result in an average annual growth rate in excess of 3 percent. The spending categories projected with this approach are: general government services; labour, employment and immigration; housing; foreign affairs and international assistance; regional planning and development; transportation and communications; resource conservation and industrial development; environment; recreation and culture; and research establishments.

Protection of Persons and Property (Other than National Defence). For this spending item we assumed per capita growth equal to inflation (2.0 percent) plus adjusted productivity growth (1.4 percent) on the premise that real wages will track labour productivity growth. The adjustment to labour productivity growth is made in order to account for the slightly higher projection of consumer inflation over producer inflation.

Health Care. Health care expenditures were divided into nine age groups and seven categories of services based on Health Canada [2001]. The age groups are: 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, 85+. The services categories include: hospitals, other institutions, physicians, drugs, home care, other services, and administration. We started with per capita expenditures by age group and type of service contained in Health Canada [2001] and adjusted them proportionally to ensure that total expenditures in 2000-01 matched those in CANSIM Table 3850001. The per capita cost of all services was assumed to increase by 3.4 percent per year (inflation plus adjusted labour productivity). Additional growth factors were assigned to selected types of services, based on cost pressures: 0.5 percent for hospitals and 0.6 percent for physicians because of potential labour supply pressures; 3.0 percent for drugs because of the introductions of new drugs, and 0.5 percent for other expenditures to capture additional costs from new equipment. The projected per capita expenditures by type of service and age group were aggregated to yield the projection of total health expenditures by all levels of government combined.

Education. Education expenditures include: (a) primary and secondary education, (b) post-

secondary education, and (c) other expenditures, including re-training. The first category also includes three components: wages for educators, wages for non-teaching staff, and other spending. We projected the total number of full-time equivalent (FTE) educators and non-teaching staff based on projected enrollment and applied a growth rate of 3.4 percent to wages per FTE. Other expenditures were assumed to track inflation. The same wage growth per FTE was assumed for post-secondary education; however, following the results from the Conference Board [2004] we projected stable post-secondary education enrollment and FTE staff. Other education expenditures were projected to increase at the rate of inflation.

Government expenditures on **Social Assistance (Welfare), Other Social Assistance (Excluding Old Age Security Benefits, Employment Insurance Benefits, Veteran Benefits, GST Credits and Child Tax Benefits)** expenditures were projected to increase by inflation plus half of adjusted productivity growth, implying real increases in social assistance rates over time but less than increases in real wages. The same approach was used for **Other Social Services.**

Old Age Security expenditures include three items: (a) Old Age Security (OAS) benefits, (b) the Guaranteed Income Supplement (GIS), and the Allowance. Since OAS benefits are indexed for inflation, we assumed that benefits per senior will increase at the rate of inflation (thus discounting the income-testing at the high end of the income scale). For the other two components we used a growth rate of benefits per beneficiary of 1.5 percent to take into account that these programs are income-tested.

Motor vehicle Accident Compensation expenditures per person over 15 were projected to increase at the inflation rate.

Expenditures Projected at the Aggregate Level

Spending on **National Defence** was projected to grow at an average annual rate of 2.5 percent.

Employment Insurance Benefits. We started with the values from CANSIM Table 3840009 and applied an average annual growth rate of 3.2%, which is the combination of inflation and employment growth rate.

Veterans Benefits were projected to increase at a rate of 1.5 percent per year, based on past trends.

Goods and Services Tax Credit. The cost of this credit was projected to increase at the combined rate of inflation and population growth.

Child Tax Benefit. Spending on these programs was projected to increase at the combined rate of inflation and the population in the age group 0-17.

Other Spending. We assumed a basic growth rate of 2.5 percent per year. We also added $1 extra billion per year, cumulatively, for ten years to incorporate electoral promises with respect to a national daycare program and extra spending on infrastructure.

B-3. Revenue Projections

Personal Income Taxes. We started with the revenue recorded in table 3850001 for 2003-04. For the period up to 2009-10 we raised it by the increase in the federal personal income tax shown in the *Economic and Fiscal Update* [Finance 2004] times the provincial share based on historical trends. For the remained for the period, we assumed that personal income tax revenues grow on average at an annual rate 25 percent higher than that of nominal GDP. This implicit "elasticity" of 1.25 takes into consideration the re-indexing of the personal income tax.

Corporate Income Taxes. For the period from 2004-05 to 2009-10 we started with the projections contained in Finance [2004] for federal revenues and multiplied them by the ratio of total revenues to federal revenues that existed during the past ten years. For the rest of the projection period, we assumed that corporate income tax revenues will grow at the same rate as nominal GDP. An elasticity of 1.0 was assumed also for mining and logging taxes, natural resource taxes and licences, and provincial payroll taxes.

General Sales Tax revenues (which include the Goods and Services tax, the Harmonized Sales Tax, and provincial Sales Taxes) were assumed to grow at a rate slightly lower than nominal GDP (an implicit elasticity of 0.95) to take into account exemptions, deductions and the tax-free status of exports. A similar assumption was made for amusement taxes, other consumption taxes, and miscellaneous taxes.

Customs Duties and Corporate Capital Tax revenues were kept constant at their 2003-04 level to take into account the trend towards further reductions in these taxes at the federal level.

Revenues from taxes on **Alcoholic Beverages and Tobacco Products** were projected to increase at a rate of 1.5 percent per year (0.5 percent less than inflation) because of anti-smoking policies and population aging.

Remitted Gaming Profits and Real Property Taxes. Revenues from these sources were projected to increase at a rate of 3.0 percent per year (inflation plus extra growth factor for increases in property values) plus the growth of the population 15+.

Revenues from **Motor vehicle Licenses and Liquor Profits** were projected to increase at the combined rate of inflation and population growth (15+).

Fuel Taxes were divided into two parts: the transportation of goods and the transportation of people. The first part was projected to increase at the rate of real GDP plus one percentage point, under the assumption that fuel inflation is partly offset by technological advances. The second part was projected to increase at a rate of 2.0 percent per year because population aging and technological changes are expected to reduce the demand for fuel.

Health Insurance Premiums were assigned a growth rate of inflation plus population growth.

Employment Insurance Contributions for the period from 2004-05 to 2009-10, we used the values recorded in the *Economic and Fiscal Update* [Finance 2004]. For the remained of the period the increase in contributions matched the increase in benefits.

Sales of Goods and Services include two components: tuition, and other sales. We assumed annual growth rates of 3.0 percent for the first components and 2.0 percent for the other.

Investment Income contains three sub-categories: (a) royalties, (b) remittances from government enterprises, and (c) interest and other investment income. The value for the last category was adjusted in 2003-04 to ensure consistency in the treatment of contribution by and pensions for public service employees (which were both excluded from our calculations or revenues and expenditures). Component (b) was projected to grow in line with nominal GDP. The other two components were projected to increase at the rate of 3.0 percent per year.

Income Taxes on Non-Residents were placed in a separate category and included in non-tax revenues because they are government revenues, but do not impose a burden on Canadian taxpayers. They were assumed to grow at the rate of inflation.

C. Allocation

C-1. Expenditures

Protection of Persons and Property. This spending component comprises two major items: (a)

national defence and (b) other. The latter includes the police, the court system, the penitentiaries, and all the associated administrative costs. In theory, the two components serve a similar purpose: they protect the lives and property of the residents of a country. Accordingly, fiscal incidence studies generally allocate government spending on protection of persons and property among individuals in different economic conditions either on an equal per capita basis or in proportion to their income [see, for example Ruggeri, Van Wart and Howard 1997]. When the distribution is based on age, it may be more meaningful to separate the two spending components. National defence can still be allocated on a per capita basis because its ultimate purpose is to protect the territorial integrity of a country and the lives of its citizens. For the other component, it is important to acknowledge that the vast majority of crimes are property-related. Therefore, this component should be more properly allocated to wealth. Children benefit from this wealth and its protection, therefore, a certain portion of the second component of this category of spending should be assigned to children. Because detailed information on wealth, especially for children, is not available, we approximated wealth with consumption. We allocated half of the second component of this category of spending on a per capita basis, reflecting the protection of person component, and the other half on the basis of consumption, using the GST allocation as a proxy (explained in the revenue sub-section).

Health Care. We projected health care expenditures for nine age groups and seven categories of services. The age groups are: 0-14, 15-24, 25-34, 35-44, 45-54,55-64,65-74,75-84, and 85+. The services are: hospitals, other institutions, physicians, drugs, home care, other services, and administration. We started with the per capita expenditures by age group and type of service

contained in Health Canada [2001] and adjusted them proportionally to ensure that total expenditures in 2000-01 matched those in CANSIM Table 3850001. We then applied the following growth factors to each per capita expenditure by type of service: 3.4 percent for home care, other institutions and administration (reflecting a combination of inflation and nation-wide productivity growth), 3.9 percent for other expenditures and spending on hospitals, 4.0 percent for physicians, and 6.4 percent for drugs. The higher growth rates for the last four service components reflect pressures from selective labour shortages and special costs pressures in the case of drugs. The projected per capita values were finally aggregated to yield the total value of government expenditures on health care.

Education. Total education expenditures were divided into two categories: (a) elementary and secondary, and (b) post-secondary and other. The first category was allocated to the age group 0-18. A portion of this total was allocated to the age group 0-14, based on enrollment statistics and the assumption of equal per pupil expenditures in the entire age group. Data on enrollment are from Statistics Canada [2000]. Post-secondary education and other education expenditures were allocated entirely to the age group 15-64.

General Government Services. Expenditures on general government are those for central agencies that are not involved directly in the delivery of programs, but are involved in the decision-making process leading to policies and associated legislation. These services do not benefit any individual directly, but serve as the basis for the overall functioning of our civic institutions. Therefore, it seems appropriate to allocate these expenditures on an equal per capita basis.

Environment. Reducing the degree of environmental degradation generated by economic activity affects each member of society. Although in a given year the effects may differ among individuals depending on where they live and even their existing health conditions - people with respiratory problems will receive relatively greater benefits from programs that improve air quality - it would be extremely difficult to measure these potential differences. Therefore, government spending on the environment has been allocated on an equal per capita basis.

Housing plus Transportation and Communications. These expenditures benefit all age groups. Deriving a very detailed allocation is very difficult because it involves imputations and unavailable information. As a proxy we used the GST allocation because it is based on adult equivalents, which make a clear distinction between adults and children.

Research Establishments. Expenditures on this item were allocated entirely to the population 15-64.

Other Expenditures. This residual category includes resource conservation and industrial development, recreation and culture, foreign affairs and international assistance, regional planning and development, and other expenditures. In 2000-01, they represented 9.7 percent of allocated expenditures. These expenditures are general in scope and affect the entire population in a manner that cannot be easily separated by age group. Therefore, we allocated these expenditures on a an equal per capita basis.

Social Services. This category of government spending contains four separate components: (a) social assistance, (b) veterans' benefits, (c) motor vehicle accident compensation, and (d) other social services expenditures. In turn, social assistance can be broken down into a number of separate components.

Income Maintenance (welfare) was allocated on the basis of information contained in national Council on Welfare (1998).

Old Age Security Payments, including the Guaranteed Income Supplement (GIS) and the Allowance, were allocated entirely to the 65+ age group.

Employment Insurance benefits were allocated entirely to the age group 15-64.

The GST credit was allocated on the basis of information contained in Revenue Canada's *Taxation Statistics.* To the age group 0-14 we allocated the amount based on the credits for the 0-18 age group and the ratio of the population 0-14 to the population 0-18.

The Child tax Benefit is paid to families with dependent children, but the amount of the benefit varies with age, therefore a straight per capita allocation would not be accurate. We adjusted the population 0-17 in accordance with the benefit rates and calculated the ratio of this adjusted population between the 0-14 and 0-17 age group. This ratio was applied to total benefits to estimate the amount to be allocated to the 0-14 age group. A small remaining amount of family

and youth allowances was allocated to the age group 0-14 on the basis of its share to the age group 0-15.

Other Social Assistance expenditures are largely in the form of administrative costs. Half of this expenditure was allocated on the same basis as income maintenance. The other half was allocated on the basis of the share by age group of the total social assistance net of income maintenance.

C-2. Revenues

Personal Income Taxes (PIT). For those 65 years of age and over, the allocation of income taxes presents no problems, because they receive income on which they pay income taxes and the taxes they pay incorporate the special tax preferences delivered by the PIT. Moreover, accurate figures on these payments are available because Revenue Canada publishes annually detailed data on income tax payments by individuals by age. Children in the age range 0-14, rarely have taxable income, therefore, we should assign zero to them for this revenue item. One may argue that, since these children are dependent on their parents and raise their level of spending, parents may have to earn additional income for each additional child in order to maintain the desired standard of living for the average member of the family. In this case, the tax that would be paid on this extra income should be allocated to the children, for the purpose of estimating net fiscal benefits, because it is due to a change in the behaviour of parents due to chid-rearing. Estimating this effect would require a separate study. In this report, we rely exclusively on the record of who actually pays income taxes and assign zero to those in the age group 0-14 the tax payments recorded in the taxation statistics publications, but we acknowledge that this approach may lead to an overestimation of the net fiscal benefits accruing to this age group.

General Sales Taxes. These taxes include the federal Goods and Services Tax (GST), the combined federal-provincial harmonized Sales Tax (HST) in New Brunswick, Nova Scotia and Newfoundland, and provincial sales taxes in all other provinces except Alberta. These are broad-based taxes and their bases can be approximated by total consumer expenditures, as is often done in tax incidence studies. As in the case of personal income taxes, no issues arise in the allocation to seniors. For children 0-14, the spending is done by their parents. Therefore, it is necessary to impute to them a portion of the family's expenditures. We used the following imputation procedure. We started with the number of unattached individuals and families by number of parents, number of dependent children and age (senior and non-senior families). We then developed an adult equivalent number of people by assigning a value of one to a single individuals and the first person in a family, 0.4 to the second person and 0.3 to the third and successive members. Finally, we calculated the shares of the total adult equivalents for each of three selected age groups and applied these percentages to the total GST revenues.

Corporate Taxes. These taxes include corporate income and capital taxes plus mining and logging taxes. There is no consensus in the literature on the incidence of corporate taxes. Approaches vary from total allocation to capital income to total allocation to consumption. We used a middle of the road approach by assigning 50 percent to capital income and 50 percent to consumption. As approximations, we allocated the first component on the basis of the shares of realized capital gains, as recorded in Revenue Canada's *Taxation Statistics,* and the second component according to the GST allocation.

Alcoholic Beverages, Liquor Profits and Tobacco Taxes are assigned to two population groups only, 15-64 and 65+, using data from Statistics Canada's *Survey of Family Expenditures (FAMEX).* We recognized that there is some consumption of alcoholic beverages and tobacco products by the age group 0-14, but we did not find a reliable and consistent data set to make a meaningful allocation to this group over the entire period.

Gasoline and Motive Fuel Taxes are allocated by first using Statistics Canada's *Survey of Family Expenditures (FAMEX)*, and then the adult-equivalent population. We used the variable Gasoline and Motive Fuel from FAMEX to separate the share of the expenditure spent by senior members and non-senior members' respectively. We further disaggregated the non-senior groups between youth group and non-youth group using adult-equivalent population by assigning 0-14 age group with an adult-equivalent ratio of 0.2 while 15-64 age group with an adult-equivalent ratio equal to 1.

Remitted Gaming Profits are totally assigned to non-youth age groups, i.e. 15+. And we used the Gambling expenditure from Statistics Canada's *Survey of Family Expenditures (FAMEX)* to calculate the share of 65+ and 15-64.

Payroll Taxes and EI Contributions are levies related to employment, therefore, they are assigned entirely to the 15-64 age group.

Real Property Taxes (except for capital taxes, which were included in the corporate tax

category). These taxes are paid by businesses in the industrial and commercial sector and on residential properties, both rental units and owner-occupied homes. There is no agreement in the literature on tax incidence on who bears the burden of these taxes. At one extreme they are considered as capital taxes and assigned to owners of capital. At the other extreme, they are treated as excise taxes effectively applied to the services provided by the real property. We used the excise tax approach as allocated these revenues in the same manner as GST revenues.

Miscellaneous Taxes include several small revenue sources, which were allocated in the same manner as general sales taxes.

Sales of Goods and Services include a variety of items. We divided this spending category into two items: (a) university and college tuition, and (b) other sales. The first item was assigned entirely to the age group 15-64. The second item was assigned in the same manner as GST revenues.

Investment Income was divided into three categories: (a) royalties, (b) remittances from government enterprises, and (c) interest and other investment income. Royalties were allocated entirely to the group 15-64 on the assumption that natural resource prices are set internationally, therefore, domestic levies on producers are shifted backwards. Remittances were allocated in the same manner as corporate taxes. Interest and other investment income were not allocated because it was used as a partial offset to the exclusion of debt changes on the spending side.

Figure III-1. Population Dependency Ratios and Fiscal Dependency Ratios: 2004 to 2026.

