**Section 1: The Layperson's Guide                                               to Canada's Generational Accounts**

**The need for generational accounting**[The author benefitted from reading Oreopoulos [1995].]

IN RECENT YEARS, CANADA HAS INCURRED LARGE budget deficits. Deficits occur when the annual revenues that a government receives are less than the government's annual spending. The government makes up the difference caused by this overspending by borrowing funds. The amount of funds it has to borrow each year is equal to the government's annual budget deficit. The sum of past budget deficits represents Canada's debt load. This is the total amount of funds that Canada owes either to its own citizens or to foreigners.

The government must be able to pay off this debt. This repayment does not have to occur immediately, next year, or at any particular point in the future. [This is subject to Canada's borrowing agreements with its lenders.] However, in order to retain its reputation in capital markets, the country must not be seen to be acquiring debts which, in principle, are not repayable. That is, Canada cannot keep incurring additional debt indefinitely. At some time, it must begin to repay its lenders not just the interest, but the principle as well. When the level of government taxation is greater than the government's spending, the government is able to begin to repay its loans.

**The central question**
A reasonable question, then, might be to ask: Given current government policy regarding taxation and spending, will the government be able to pay off its debt? This is a difficult question. In order to answer it, one needs to be able to look at the pattern of future government spending and taxation: a pattern which depends a great deal on the size of the population and its age structure. It seems intuitive that the Canadian government will be able to collect more taxes the more working-age citizens there are in the country. Government spending will also depend on demographics. For example, the more school-aged children, the more the government will have to spend on education. The more elderly people there are in the population, the more health care and pensions the government will have to provide. Thus, population size and demographics are very important in predicting future government spending and taxation.

**How generational accounting works**
Generational accounting provides a way of looking at the Canadian government's policies regarding taxation and spending. It ties estimates regarding Canada's future demographics and population size to the level of taxation and spending on each group. The key demographic measure used by generational accounts is the number of people of a given age. Some generational accounts also look at the demographics of sex. (This study does not differentiate between males and females in their demand for government services and their contribution to the tax revenues of government. [The issue of whether or not to differentiate generational accounts on the basis of gender is important and is discussed in the technical appendix.]) By using demographics and population size, the generational accounts are able to predict the level of government expenditure and taxation in the future.

Generational accounting works under the principle that public policy must be structured so that the government is able to earn enough revenue to pay its bills. In other words, generational accounting works backwards from the assumption that in the end, all governments will have to balance their budgets. This "balanced budget" does not have to occur every year. In fact, the government can run large deficits now, as long as it runs larger surpluses later. Policy that ensures that the government is able to pay all its bills (including current government net-debt) in this latter sense is called sustainable policy.

By combining the requirement that government policy be sustainable with predictions of future levels of government expenditure and taxation, one is able to determine the total amount of net taxes (i.e. taxes paid to the government by an individual less transfers such as social security payments from government received by an individual) the government must receive from future generations to pay the government's bills. This study assumes that current government policy regarding expenditure remains unchanged indefinitely, and that policies regarding taxation and transfers remain unchanged for individuals alive in 1991. However, the study assumes, in projecting forward, that those born after 1991 face tax and transfer policies sufficiently strict to ensure that the government is able to pay all of its bills.

Generational accounts provide a vast quantity of information. They show the amount of taxes and transfers the average person of each age in 1991--each age represents a different generation--can expect to pay over the remainder of his or her lifetime. In addition, the accounts show the amount of net taxes each member of a future generation must pay in order for the government to be able to pay all of its bills. If the amount of net taxes a future generation member has to pay is greater than the amount of net taxes a 1991 newborn pays, then current Canadian government policy is unsustainable, in that future generations must be greater net contributors to the government than current generations. The greater the increase in the amount future generations have to pay compared to 1991 newborns, the more unsustainable is government policy. This section of the study will not present the generational accounts, but instead will discuss the accounts' main results. Those interested in reading the tables should refer to the discussion in section 2.

**The main results**
The single most important result presented in this study is the following: Current government fiscal policy is not sustainable. There will have to be a substantial increase in the net payments of future generations to the government over current generations if the government continues current spending programs and wants to pay off its debt. Generational accounts are useful because they quantify the increase in net payments necessary for government policy sustainability. [For this section, the study assumes the discount rate is 4 percent and the productivity growth rate is 0.6 percent. For a discussion of the discount and productivity rate assumptions and well as a presentation of generational accounts constructed under different discount and growth rate assumptions, see section 2.] In some sense, generational accounts tell us what the overall fiscal position of the Canadian government would be if all of its activities were "wound up," as when a business is sold or liquidated. Since those who would be responsible for the liabilities and those who get the benefits of the government's activities are the people of Canada, the winding up process must be seen relative to their benefits and obligations.

**Who pays and who benefits?**
Canada's generational accounts show that those aged 25 in 1991 can expect to make net payments of $219,000 each to the government over the remainder of their lifetimes. This is comprised of per capita tax payments of $376,000 less $157,000 in transfer receipts. Alternatively, 25 year olds can expect to contribute 49 percent of their remaining lifetime labour income to the government by paying 85 percent of remaining lifetime labour income as taxes and receiving 35 percent of remaining lifetime labour income as transfers. [The net tax rate figure may not equal the difference between the gross tax rate figure and the transfer figure due to rounding error.] Those aged 50 in 1991 can expect to make net payments to the government of only $28,000 over the rest of each of their lives. This is comprised of $256,000 in per capita tax payments offset by $228,000 in per capita transfer receipts. On a net tax rate basis, 50 year olds will pay an average of 10 percent of their remaining lifetime labour income to the government by paying 88 percent in taxes and receiving 79 percent in transfers over their remaining lifetime income. Better off still are those aged 65 in 1991. These citizens can expect to receive $299,000 dollars each in transfers from the government over the remainder of their lifetimes while expecting to pay only $123,000 in taxes each. Alternatively, senior citizens in 1991 will receive net transfers (transfers less taxes) from the government equal to 141 percent percent of their remaining lifetime labour income due to remaining lifetime gross tax rates of 99 percent and transfer rates of 239 percent. The general trend is for older people to receive much more in transfers than they pay in taxes.

**The burden of future generations**
It is even more interesting to compare the net payment burden on 1991 newborns with that on future generations. Recall that newborns are subject to current government tax and transfer policies, while members of future generations are responsible for ensuring that the government pays its current and future bills. In this case, newborns can expect to make a net contribution to the government of $126,000 each (or alternatively, 49 percent of all future labour income due to a gross tax rate of 86 percent and a transfer rate of 38 percent) compared with a member of the future generation who must contribute $317,000 to the government (or alternatively, 139 percent of all future labour income). Future generations must contribute much more to government net revenues than current generations are doing now.

**The future doesn't "add up"**
Essentially, this means that we have seen the future and "it doesn't add up!" It is inconceivable that future generations will be willing or able to contribute more than 100 percent of their labour income to the government. Yet, the calculation shows that that is what will be required to cover all of the government's liabilities and spending obligations. This calculation effectively demonstrates that the current posture of all-government policy in Canada is essentially unsustainable. In short, government is vastly overspending relative to the resources it can rely upon to finance its programs and transfers.

The natural question to ask, then, is by how much must government expenditure permanently decline in order for current tax and transfer policies to be sustainable? If government expenditure on goods and services such as health care, education, police protection, etc. permanently declines by 36 percent then current taxation and transfer policies can remain intact.

Another way of looking at Canada's fiscal health is to look at the country's unfunded liabilities. Canada's unfunded liabilities are equal to the sum of the excess of government spending over taxation over the long run, plus the current level of government debt. If Canadian fiscal policy is sustainable, the total unfunded liabilities should be zero. Instead, Canada's actual unfunded liabilities are estimated by the generational accounts to be $2.3 trillion, or, alternatively, $2,300 billion (or $2.3 million million, if you like). This value is over 230 percent greater than the 1991 level of Canadian Gross Domestic Product. [1991 Canadian GDP is $675,928 million according to Richardson [1991b], p. 7.]One way to interpret this is that to make the future "add up," Canada would have to have a lump of savings equal to more than three full years of the total output of the economy. This lump of savings and the interest on it would be required to pay the future obligations of the government and to pay off the accumulated debts of all Canadians who were born up to 1991. If we had such a lump of savings, current fiscal policy would be sustainable. [This statement takes liberties with complications that arise due to the interdependent nature of the elements of an economy. For a discussion of these issues, see Section 2.]

**How does Canada compare to the United States?**
How does Canada's fiscal situation compare with that of the United States? The Canadian government sector is overspending at a rate vastly greater than its U.S. counterpart. Put succinctly, future generations in Canada must increase the magnitude of their net payments to the government by 225 percent whereas future generations in the United States need only increase their burden by 33 percent. [Further details of this comparison are given in section 2.]  Compared to their northern counterparts, future generations in the United States must submit to a relatively minor increase in net payments to government.

One approach, called "freeze and growth through productivity" suggests one relatively painless solution to Canada's fiscal concerns. Freeze and growth through productivity is the policy of increasing the amount of taxes that an individual pays at a given age at the rate of productivity growth in the economy, while maintaining transfers and government expenditure that an individual receives at a given age at current levels. In general, this allows Canada's future generations to maintain the current standard of living, while increasing taxes enough to allow the government to pay its obligations. Using Canada's historic productivity growth rate, 0.6 percent per year, the net payment burden on future generations is able to remain the same as on 1991 newborns. That is, future generations need not contribute more than current 1991 newborns under this new tax policy. Freeze and growth through productivity policy appears to show great potential in making Canada solvent.

**Conclusion**
This section gives the reader a taste of the generational accounting approach to looking at Canada's fiscal situation. The news is unpleasant; Canadian fiscal policy appears highly unsustainable. Other things being equal, future generations will be forced to bear much of the burden of the government's past overspending. Compared with the United States, Canada is in much worse fiscal shape. However, changes to Canada's fiscal policy can save the country from bankruptcy. Freeze and growth through productivity is one such possibility. Overall, the generational accounting approach makes clear the true extent of Canada's fiscal troubles.

**Section 2: Canada's Generational Accounts**

**Why is generational accounting important?**[This study uses the concept and techniques of generational accounting described by Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff in their work, Generational Accounts: A Meaningful Alternative to Deficit Accounting. See the reference citation Auerbach et al [1991].]

Current government figures do not paint a thoroughly dismal picture of the Canadian government sector's financial health. In 1991 the total all-government net debt was just over $550 billion, or approximately 92 percent of Canada's gross domestic product (GDP) for that year. This may appear substantial, but to put the potential for paying off the debt in perspective, one must consider that the Canadian government managed to extract almost $247 billion in taxes in 1991. Interest on the public debt absorbed $65.3 billion dollars that same year. [See Statistics Canada's National Income and Expenditure Accounts, p.46-47.]This is about one-quarter of total taxes, implying, on the surface, that the Canadian government has some time before it fails to meet its interest obligations.

However, the Canadian government sector has many future bills to pay and generational accounting takes these future obligations into account. For example, generational accounting accommodates debt inertia--a country in debt tends to become further indebted--in government policy. Just as the government incurred large deficits for the last 20 years, so too will it incur further deficits for many more years given current policy. The Canadian government sector ran a deficit in 1991 due to government expenditure on goods and services of $150 billion, including interest payments of over $65 billion. High interest payments plus continued high government expenditure levels ensure many years of further indebtedness. In addition, pay-as-you-go plans such as the Canada Pension Plan (CPP) and the Quebec Pension Plan (QPP), which extract a fixed percentage of income from the young and guarantee the old a certain pension value, result in unfunded pension plan liabilities depending on Canada's demographics. A mainly elderly population supported by a relatively small number of young workers results in substantial pension plan deficits. These unfunded liabilities have been estimated at $525 billion by the Chief Actuary of Canada for existing generations only. [This figure is quoted in Richardson [1994a] and comes from the Office of the Chief Actuary, Government of Canada, Ottawa.] The OECD uses a generational accounting approach to measure these unfunded liabilities and estimates that the total unfunded liability is closer to 250 percent of GDP or about $1.7 trillion in 1990. The [OECD figure comes from table 2.1 on page 55 of Van den Noord & Herd [1993] and also is presented in Richardson [1994a]. The table states that the total net liabilities for Canada are 250 percent of 1990 GDP.] Similarly, government expenditure depends on the age of its citizens. For example, a young population implies more education expenditure while an elderly population implies greater health care expenditure. Changes in Canada's demographics largely determine whether current government policy exacerbates or ameliorates the country's current debt burden. These implicit liabilities must be accounted for before a reasonable analysis of the sustainability of government policy can be assessed. In order to make informed decisions regarding the evaluation and correction of the Canadian government sector's fiscal difficulties, one must analyze not only the current situation, but the expected future effects as well.

It is important for Canadians to know whether current government policy on taxation, transfers, and government expenditure (hereafter referred to under the blanket term of government policy) is sustainable. Canada's government policy must be sustainable, otherwise the country will become bankrupt. Under sustainable government policy, Canadians maintain their standard of living by paying taxes which provide for affordable levels of government expenditure on health and education and all other public goods and services, while meeting debt payments and social safety net transfers. Canadian government policy must be sustainable over the long run. If it is not, changes will occur to remedy the situation and these reforms likely will be neither benign nor painless.

Generational accounting is useful because it addresses not only the current debt problem, but it determines the effects of current government policy when applied in the future. This allows one to determine the long-term sustainability of government policy, not just for the next few years, but indefinitely. Generational accounts incorporate future government bills and future net payments to government. The greater the extent to which the net payments fall short of the combined government obligations (its goods and services bills plus the net debt), the less sustainable is Canadian government policy.

Generational accounts are important because they paint a picture of Canada's future. The accounts reveal the effects on future Canadians if current government policy does not change. They provide a basis for determining the magnitude of cutbacks on government expenditure on goods and services as well as tax increases and social safety net declines necessary to ensure that the Canadian government remains solvent in the long run. Moreover, these accounts provide an accurate estimate of the true extent of government debt; that is, not just current debt, but the expected value of all future additions to the debt caused by current policy. Lastly, the generational accounting approach provides a method to evaluate the efficacy of long-term policy approaches for dealing with the debt problem. As will be seen, these types of reforms offer the greatest hope for maximizing Canada's long-term standard of living in a sustainable policy environment. Overall, Canada's generational accounts tell Canadians how their fiscal life will be in the future, and the story is often unpleasant. [While this study focuses on the Canadian government sector as a whole, future research may focus on applying generational accounting techniques to such areas as Canadian health expenditure, education expenditure, pension plans and the like.]

**What is generational accounting?**
Generational accounts are based on a concept economists call the government intertemporal budget constraint. In its most basic form, this constraint requires that someone pay the government's bills; more government spending on current generations will require more payments to the government by future generations.

**Concepts behind the intertemporal budget constraint**
To understand generational accounting and the intertemporal budget constraint, it is necessary to introduce a concept called the time value of money. One dollar received today is not equal to one dollar received tomorrow or yesterday. This is due to the time value of money. The time value of money simply states that because money can be invested and earn interest, the value of money declines with time. A given amount of money today is worth more than the identical amount of money in the future. For example, if your money can earn interest at five percent per year then you should be indifferent about the choice between receiving one dollar today and receiving one dollar and five cents next year. Such is the logic behind the time value of money.

A related concept to the time value of money is the idea of present value. Continuing with the above example, the present value of one dollar and five cents one year from now, in current dollars, is one dollar. Thus, future receipts or expenses can be "discounted" to current dollars. The interest rate used to discount future transactions is called the discount rate. Similarly, the value of a stream of revenues or expenses occurring in the future can be discounted to current dollars; this provides the present value of revenues and expenses.

**The government's intertemporal budget constraint**
Since the government is presumed to exist indefinitely, the vast majority of the government's bills and the net taxes it receives from the public will occur in the future. The intertemporal budget constraint compares the present value of these future government expenses and receipts.

One can express the intertemporal budget constraint as a simple relationship:

The left hand side of this relationship is the government's net revenues: the money it receives in taxes less the money it pays out in transfers to the public. Note that these transfers are not government expenditure on such public goods as parks or police. Instead, transfers are expenses such as pensions, unemployment insurance, and welfare payments which are received by individuals directly and have the effect of reducing the net amount of tax actually paid by these individuals and received by government. The right hand side of the relationship is the government's bills. These bills are government expenditure on goods and services as well as the current value of the net debt. Net debt is total (gross) debt less the value of the government's financial assets. This study uses net debt in its calculations, not gross debt, because if the government were "wound up" it should be able to sell off its financial assets very quickly (without accepting much of a discount in price received for the assets as the assets are highly liquid). Another way of expressing the government intertemporal budget constraint is to say that taxes must equal transfers plus government expenditure plus government debt.

One very important characteristic of the intertemporal budget constraint is its zero-sum nature. An increase in the present value of transfers from the government requires an exactly offsetting increase in the present value of taxes to the government, or a corresponding decrease in the present value of government expenditure, in order for government policy to remain sustainable. Thus, satisfying the intertemporal budget constraint does not depend on whether the government runs a deficit or a surplus in a given year, or whether consumption or taxes or transfers differ over time; it requires only that the government be able to pay its bills in the long run. The government never escapes an obligation; it only pushes it off to the future. Taking into account the time value of money, the government cannot avoid its obligations indefinitely as the interest payments are accounted for automatically in the intertemporal constraint. Avoiding an obligation now implies a greater obligation later.

**The meaning of the intertemporal budget constraint**
By using the present value concept, the intertemporal constraint takes into account all present and future government receipts and expenses in terms of today. The intertemporal budget constraint is satisfied if the left hand side of the relationship equals the right hand side; that is, if the government's net revenues equal the government's expenses. When the intertemporal budget constraint is satisfied, government policy is sustainable. This means that in the long run the government can afford all of its expenditure and also pay off its initial debt load. If the government's net revenues are less than the its bills (the left hand side is greater than the right hand side of the relationship), then government policy is unsustainable. Put bluntly, unsustainable policy means that the Canadian government is on the path to bankruptcy. At some point in the future, Canada's government will be unable to meet its interest obligation. In particular, Canada will need to borrow funds in order to meet its interest obligation and will find no willing lenders. The final possibility is that the government's net revenues exceed its bills. In this case, government policy is sustainable, and in the future, Canada will become a net lender as opposed to its current status as net borrower. However, this is unlikely to occur because it implies that Canadians acquiesce to lending money knowing that it will not be paid back. When the government of Canada is "wound up," the people of Canada would only want to just pay off the creditors, not overpay them. Practically speaking, sustainable government policy requires that the government's intertemporal budget constraint holds exactly.

This is equivalent to stating that the government can afford its expenditure on goods and services given the amount of taxes it extracts from the population, less the amount of transfers it returns to its citizenry. This means that in the long run--the long run for a government is the infinite future--the government has the means to pay for all of its expenditures, interest obligations and initial debt. At this point, an example may be beneficial. Consider a 35 year old male, currently indebted, who has planned his consumption expenditure, tax payments, and transfer receipts accordingly so that he satisfies his intertemporal budget constraint. This means that the amount of income this person receives over the remainder of his lifetime pays for the tax obligations over the remainder of his life, as well as his consumption and interest payments over the same period. Moreover, and most importantly, at the point of his death, he will have no outstanding debts; he will have managed to pay not only his interest payments, but all of the principle on his initial debt as well. In short, the man will die obligation free. The idea of an intertemporal constraint works identically with the government except that the lifespan of the government is infinite. The infinite life of the government generally implies that the government never pays off all of its initial debt, but that the total value of the principle falls to zero with time. In effect, a government which satisfies its intertemporal budget constraint has the wherewithal to pay for all of the benefits it provides its citizens, and also has the capacity to satisfy its creditors.

**A different view of the intertemporal constraint**
Another way of looking at the government's intertemporal budget constraint is in terms of the net payments each generation must make to the government. A net payment is defined as the tax an individual pays to the government less the transfers the individual receives. Writing the intertemporal constraint in terms of generations:

The zero-sum nature of the intertemporal constraint is more explicit here. A decline in the tax burden of current generations, given the stream of government expenditure, increases the net payment burden of future generations. Similarly, holding the tax bill of existing generations fixed, while boosting current government expenditure, requires either a reduction in future consumption or an increase in the net payment burden on future generations. In this way, government debt can be thought of as an implicit tax on future generations.

In addition, the intertemporal budget constraint reveals the damaging effects of current government debt on future prosperity. The larger the current net government debt, given no change in the present value of the net payments of existing generations, the greater the net payment burden on future generations, or the less the government expenditure in the future. In effect, a higher current net debt implies a declining standard of living for future generations. Current generations receive a temporarily high standard of living at the expense of future generations who will have to pay the current generations' bills and sacrifice their own consumption.

**How generational accounting uses the intertemporal constraint**
Generational accounting estimates the government's intertemporal budget constraint. First, one estimates the present value of the stream of future government expenditure. Next, one estimates the present value of taxes from and transfers to individuals currently alive. Then, using the net debt figure, one determines the present value of net payments for future generations necessary to satisfy the intertemporal constraint. This method of calculating the generational accounts implies that the government is benevolent towards those individuals alive in the base year, in the sense that these individuals benefit from existing government policies throughout the remainder of their lives. The study assumes that the responsibility of balancing the government's intertemporal budget constraint falls on future generations; that is, people born after a base year. There are many different ways to allocate the net payment burden of individuals in order to pay the government's bills, but this method demonstrates most effectively the degree to which current government policy is unsustainable and is the standard approach in the generational accounting literature.

When completed, generational accounts present the present value net payment obligation of individuals of every generation from age 0-99 in the base year given current government policy, as well as the present value net payment burden of future generations needed to ensure that the government pays all its bills in the long run.

**A warning: sustainability does not guarantee against bankruptcy**
As a caveat, it is important to note that just because the government satisfies its intertemporal budget constraint does not imply that a financial crisis may not occur. Intertemporal constraint compliance means that the government is on a sustainable policy path; it does not imply liquidity. A large debt call can still break a government which is on a sustainable policy path. Indeed, a major underlying assumption of generational accounting is that the government is free to borrow and to lend. Constraints which hinder the ability of the government to borrow to meet debt calls will bankrupt the government. However, if lenders realize that there is no probability for default in a Canada that satisfies its intertemporal budget constraint, the probability of an early debt call is minimized.

**How is generational accounting done?**
To construct generational accounts, five data sources are needed: (1) projections of the Canadian population by age; (2) projections of the average net payments to government for each generation for each year in which at least one member of the generation is still alive; (3) a discount rate (interest rate) which is used to determine the present value of receipts and expenditures, and a productivity growth rate which represents the percentage increase in GDP from one year to the next given the same population; (4) the value of total all-government net debt; and (5) projections of future government expenditure on goods and services. The study's base year is 1991 which represents the most recent available taxation statistics in the necessary level of detail for this study.

**Step 1: Determine the changes in Canada's demographics**
The first step in calculating Canada's generational accounts is to determine the changes in Canada's future demographics. The population projections come from Statistics Canada's Population Projections Section, Demography Division, and represent the latest estimates. The study uses the medium growth projection as the most likely reality. The projections provide the total population in each age group from 1993-2041 (actual data are used for 1991 and 1992). These projections are for each age from 0-89 and the age group 90+. The study assumes the maximum lifespan is 99 years. The study breaks up the total number of people who are 90+ into separate ages--90 to 99--in a steadily declining manner, so that the number of 90 year olds is greater than the number of 91 year olds, and so on. The study extends the population projections from 2041 to 2100 by measuring the average growth rate in the number of people of each age and extending this average growth rate to 2100. When complete, one knows the percentage change in the number of members of each age from 1991 to 2100. Each age represents a different generation.

**Step 2: Determine future taxes and transfers**
The next stage in the generational accounts procedure is to determine the government's future tax receipts and transfer expenditures. The projections for age-specific taxes and transfers come from the 1991 Taxation Statistics publication from Revenue Canada. Here, the data are presented in five-year groupings (ages 20-24 to ages 70-74), as well as under 20 and over 75 categories. The study assumes that individuals aged 0-17 receive no transfers and pay no taxes. As a result, the study splits the under 20 category into ages 18 and 19 based on the number of each age. To break up the five-year groupings into single ages, one divides the total taxes or transfers to the age group by the proportion of members in each age category of the age group. To divide the 75+ category into single ages, one divides the 75+ plus category into each age from 75-99, based on the total number of people in each of these age categories. Thus, the taxation statistics provide information regarding the percentage of total personal taxes and personal transfers each generation receives. Combining these percentages with the actual total direct taxes received from persons and total transfers to persons less other current transfers reported in the national accounts, the study obtains the total amount of personal taxes paid and personal transfers received by each generation.

The study assumes that corporate taxes and transfers are divided among individuals based on the relative quantity of capital income each generation receives. The study again uses Taxation Statistics to derive capital income for each generation. One breaks the capital income into ages following the same approach as is used for the tax and transfer data. Next, one determines the percentage of total capital income received by each generation. Applying these percentages to the total corporate taxes and corporate transfers reported in the national income accounts gives the total amount of corporate taxes paid and corporate transfers received by each generation in 1991, the base year.

As an aside, some readers may wonder why the study assigns corporate taxes and transfers to individuals. Indeed, individuals do not adjust their personal income directly by government subsidies, or the corporate tax payments of their employers. However, as corporate taxes represent lost income that would normally be distributed to owners as dividends or capital gains, and as corporate subsidies represent additional income to corporate owners, corporate taxes and subsidies ultimately become personal income. Capital income is the preferred allocation method for corporate taxes and transfers because these transactions affect dividends and capital gains which enter personal income as capital income.

Lastly, the study allocates indirect taxes by factor income. Factor income is the income accruing to a factor of production. A factor of production is defined as an input into a production process, the process by which a good or service is produced. For example, the factors of production used in the production process of window washing are labour, as well as wipers, a ladder and cleansing fluid. In this case, the two main factors of production are labour and capital, with capital referring to the ladder, the wipers and the fluid. Indeed, capital and labour are the two main factors of production. The factor income for labour is the total income that the labour force receives less transfers which are just reallocations of existing income and do not represent additional production in the economy. Taxation Statistics provides the means to calculate factor income. This study uses the same allocation procedure as is used with corporate taxes.

The next step in constructing generational accounts is to take the estimates of the total taxes paid and transfers received by each age group, and to predict these values for each year in the lifespan of all individuals from age 0-99 in 1991. This is essentially an actuarial procedure, in that by using the Statistics Canada projections, it takes into account the changing demographics of the Canadian population as well as the differences in the total numbers of people of each age in any given year. Generational accounting provides for the number of members of every generation alive in the future. For example, to calculate the amount of taxes 18 year olds pay in 1992, one takes the amount of taxes 18 year olds pay in 1991 and increases this figure to take into account productivity growth over the year as well as the change in the total number of 18 year olds. This ensures that the taxes and transfers per person remain constant except for a productivity adjustment. One continues this procedure to determine the total amount of taxes and transfers for persons of every existing generation in 1991 over the remainder of their lifetimes. This value represents the first term on the left hand side of the relationship defining the second intertemporal budget constraint.

**Step 3: Predict government expenditure**
Similar to projecting taxes and transfers to the year 2100, one must predict government expenditure on goods and services as well. Health and education account for 60 percent of government expenditure. The study assumes that the remaining government expenditure is on public goods--those goods to which every member of society has equal access--such as police protection and parks. As such, each person receives the same dollar value from this expenditure regardless of income or age. Therefore, this type of government spending grows at the rate of the total population growth plus productivity. For health and education expenditures, this paper uses data from Statistics Canada's 1990 Survey of Family Expenditure. Next, using the identical approach of increasing expenditure by productivity growth and the percentage change in the population of each generation, the study derives the stream of health, education, and other government expenditures from 1991-2100. At the year 2100, one determines the present value of the remaining stream of payments--years 2101 on--using the average percentage increase in the population. Taking the present value of each of the three series provides the total present value of government expenditure on goods and services. This is the first term on the right hand side of the intertemporal budget constraint. Adding this to the net debt for 1991 renders the total government bill of costs for all periods in future history.

**Step 4: Determine the obligations of future generations**
This leaves only one term of the intertemporal budget constraint relationship unknown: the present value net payment obligations of future generations. Given that sustainable policy is the government's goal (or at least it is assumed to be so for this study's purpose), the present value net payment obligation of future generations is calculated as a residual. Because the left hand side of the intertemporal constraint must equal the right hand side in order to ensure sustainability of government policy, the present value net payment obligation of future generations is equal to the present value of government expenditure plus total current net debt less the present value net payments of current generations. This is where two working assumptions made previously come into play. By assuming that generations existing in the base year (those aged 0-99 as of 1991) face the current government policy regarding taxation and transfers, and that future generations (with an adjustment for growth) are treated equally (the per person net payment in present value terms is the same for anyone born from 1992 on, with the exception of a productivity adjustment), one needs to determine a single number only: the net payment for a person born in 1992 necessary to equate total government net revenues to total government bills. With the obligations of future generations figure calculated, the generational accounts are completed easily.

This study also presents the generational accounts based on net tax rates. These accounts are the same as the basic generational accounts with the exception that the net payments, taxes and transfers figures are divided by the present value of the individual's expected labour income stream to render the net tax rate, gross tax rate, and transfer rate, respectively for each generation. The net tax rate for a generation is the proportion of each dollar of labour income that a member of that generation can expect to pay to the government over the remainder of his or her life. High net tax rates for future generations imply how difficult it is for Canada to balance its intertemporal budget constraint. Often the values of future generations' net tax rates are greater than 100 percent. This implies that in the future, individuals must sacrifice all of their labour income to the government. This is clearly an untenable situation. However, it is important to note that individuals have sources of income other than labour income. For example, dividend and interest income represents a substantial portion of many households' total income streams. The net tax rates version of the generational accounts is simply an alternative representation of the basic generational accounts.

**A note on the discount rate and productivity growth**
At this point, it is necessary to explain the discount rate and productivity growth rate assumptions. The productivity growth rate used in this study, unless otherwise acknowledged, is 0.6 percent per year. This is the average annual increase in real GDP per capita from 1949-1992 in Canada. [These data come from Statistics Canada's Canadian Economic Observer.] That is, each person receives 0.6 percent more real income (purchasing power) per year. This study provides the generational accounts for three different discount rates: 2 percent, 4 percent and 6 percent. Recall that the discount rate is the interest rate that the study assumes the government can borrow or lend at for each year from 1991 onward.

The study includes the generational accounts under three different discount rate assumptions for two purposes. First, generational accounts are very sensitive to changes in the discount rate. By providing accounts under different discount rates for comparison, the reader can observe the sensitivity of changing discount rates on the present value net payment obligations. Second, predicting the future stream of interest rates is difficult. A historical analysis of the real interest rate--the real interest rate is the nominal interest rate less the rate of inflation--for Canada shows that it is approximately 2.3 percent. The 2 percent discount rate assumption best exemplifies Canada's historic discount rate. The 6 percent discount rate assumption best exemplifies Canada's current high real interest rates. The 4 percent assumption is halfway between current reality and the historic average, and may reflect most effectively the average long term discount rate for Canada. Regardless, using the three different discount rate assumptions provides for an effective representation of future discount rates in Canada.

**Reading the generational accounting tables**
Now that the generational accounting concept is more familiar, it is necessary to explain how to read generational accounts. The generational accounts for Canada given a discount rate of two percent, 4 percent, or 6 percent, are presented in appendices 1, 2, and 3 respectively.

**An example**
Use the basic generational accounts for a discount rate of 2 percent (appendix 1a) as an example. [The present value net payment of an individual of a given age may not equal the tax payments less the transfer receipts precisely. This is due to rounding error.]

Appendix 1a contains four columns of numbers. The first column gives the person's age in our base year of 1991. Thus, 0 means that the person was born in 1991, 1 is for people who are one year old in 1991, and so on. Given the assumption that the maximum lifespan is 99, the generational accounts go up to 99.

Ignore the second column for now. The third column gives the present value tax payments for individuals in that generation. For example, go to the first column and find those aged 22 in 1991. Follow that row over to the third column; the present value tax obligation is $612,900. This figure means that the remaining lifetime tax payments of the average 22 year old, discounted to 1991, are over six hundred thousand dollars. This figure is an average. It represents neither male nor female, neither high nor low income earner, but an average individual. Thus, $612,900 is the present value amount of taxes an average 22 year old can expect to pay to the government. In reality, less wealthy individuals will pay much less, whereas wealthy individuals will pay much more. Also, there are likely to be differences between the tax obligations of males and females.

The fourth column provides the present value of transfer receipts to individuals from the government. Continuing with our example, the average 22 year old can expect to receive transfers with a present value of $370,300 from the government over the remainder of his or her lifetime. Again, this does not mean that the average 22 year old will receive three hundred seventy thousand dollars per year, but that the sum of the transfer payments given to the 22 year old over the rest of his or her life, discounted back to 1991, is three hundred seventy thousand dollars. As with the tax column, less wealthy individuals will receive more transfers from the government, while wealthier individuals receive less. Again, there are likely to be differences between the transfer receipts of males and females.

The second column is the present value of net payments an individual of a given generation can expect to pay to the government over the remainder of his or her life. As a net payment to government is defined as the tax payment to government less the transfer payment received from the government, the second column is equal to the third column (taxes) minus the fourth column (transfers). In our example, the average 22 year old will make net payments in present value terms of $242,500 to the government over the remainder of his or her lifetime.

Another way of looking at these present value figures is in terms of lump sum transactions. That is, the present value tax obligation of an individual of a certain age is the lump sum amount that he or she could pay to the government in 1991 and never pay taxes again: that individual's lifetime tax bill is paid. Similarly, the present value transfer receipt is the lump sum payment the government can make to the individual in order to free the government from its responsibilities to the individual. The present value net payment of an individual is the equivalent lump sum amount the individual must pay to the government (given the present value net payment figure is indeed positive, implying that the individual is a net contributor to the government) in order to satisfy all obligations of the government to the individual in terms of transfers, and to satisfy all the obligations of the individual to the government in terms of taxes. Indeed, the government having received the net payment figure of $242,500 and having free access to capital markets, can borrow and lend in such a manner as to replicate the tax and transfer transactions that normally would occur with that individual had he or she not made the lump sum payment.

**Net receiver versus net contributor**
As was alluded to earlier, the generational accounts provide information about whether a given generation is a net receiver from government or a net contributor to government. A generation is a net contributor if the present value net payment figure for that generation is positive. This means that the generation, in present value terms, will pay more to the government in taxes than it will receive in transfers. For example, those aged 38 in 1991 have an average per capita present value remaining net payment obligation of $147,600 implying that those whose age is 38 in 1991 will be net contributors to the government. Conversely, a generation is a net government receiver if its present value remaining net payment obligation is negative. As a net receiver, the generation will receive over the remainder of its lifetime more transfers from the government than it will pay in taxes over the same period. One example is 83 year olds in 1991. The present value net payment obligation of this generation is $-84,300, implying that in 1991 dollars those aged 83 in 1991 will receive over eighty-four thousand dollars per capita net of taxes by the time he or she dies.

**Future generations**
The final vital information presented in the generational accounts is the value labelled "future generations." This is the present value net payment that each generation not alive in the base year will have to remit to the government in order to satisfy the government's intertemporal budget constraint.

What does this mean? To begin, recall the study's working assumptions. First, the study assumes that government expenditure on goods and services--expenditure on health and education and on public goods like general services, police protection, environment, recreation and cultural expenditure, etc.--continues on its current path; that is, government expenditure grows through time as the population grows, plus a boost for productivity. The second assumption is that the generations alive in the base year live the remainder of their lives under the same taxation and transfer policies that were in effect in 1991. That is, the taxes paid and the transfers received by the average person for every generation remain the same; they are adjusted in the future only by a productivity factor and the natural increase in members of that age cohort. In effect, those generations alive in 1991--those aged 0-99 in 1991--will live in a Canada identical to the one in 1991 in terms of government policy. Here, taxes refer to direct personal taxes, corporate taxes and indirect taxes such as sales tax. Transfers refer mainly to social security payments (direct transfers) as well as business subsidies. In addition, the study assumes that future generations must balance the intertemporal budget constraint, and that future generations are treated equally. Thus, the future generations figure means that each person in each generation born in 1992 or later will have to pay the future generation's value, plus a boost for productivity each year. As an example, with a discount rate of 2 percent, future generations must pay the equivalent of $597,900 1991 dollars; that is, people born in 1992 must pay $597,900 in present value net payment to the government, whereas people born in 1993 must pay the same amount plus a 0.6 percent increase for productivity, and so on throughout the years.

If existing generations in 1991 do pay, on average, the present value net payments specified in the generational accounts, and if future generations do pay on average the present value net payments specified by the future generations figure, then the government satisfies the intertemporal budget constraint. In this case, government policy is sustainable. There is no change in the quantity or composition of the goods and services received by all Canadians from 1991 on as the study assumes that government expenditure policy remains as it is in 1991. In terms of taxes paid and transfers received, existing generations in 1991 also will experience no change as the study assumes that tax and transfer policy for existing generations stays constant. However, as the present value net payments to government for future generations will change, so too will future tax and transfer policy. Recall that net payment means taxes less transfers. Thus, a change to the net payment figure requires only that the difference between taxes and transfers change. If the net payment figure rises, this implies that the difference between taxes paid and transfers received for future generations must rise. This can be accomplished in a number of ways. For example, taxes can remain constant while the level of transfers falls. This is comparable to maintaining the current level of taxation while eliminating much of the Canadian social safety net. Alternatively, transfers can remain constant while taxes increase. This is similar to maintaining Canada's social system, but requiring increased taxes. Any combination of tax increases and transfer decreases that allows for the difference between taxes and transfers to equal the net payment is acceptable.

**An alternate interpretation of generational accounts**
Refer to the net tax rate version of these generational accounts (appendix 1b). Instead of providing dollar values, these generational accounts look at net payment burdens in terms of percentages of labour income. For example, a newborn in 1991 can expect to make net payments to the government of 31.2 percent of her labour income over the remainder of her life. This figure stems from an expected gross tax rate on labour income of 87.5 percent and an expected transfer rate of 56.3 percent. In contrast, a 53 year old can expect to be a net receiver to the extent of 21.7 percent of his remaining lifetime labour income due to a gross tax rate of 91.1 percent and a transfer rate of 112.9 percent. [Again, recall that the net tax rate does not always equal the gross tax rate less the transfer rate due to rounding error.] Net contributors are characterized by positive net tax rates, whereas net receivers show negative net tax rates. Each member of a future generation will have to be a net contributor to the government in the amount of 68 cents for every dollar earned for the rest of their lifetime. This is how one should read the net tax rates version of the generational accounts.

**A note on the base year**
Readers may wonder whether the generational accounts are biased, given this study's use of 1991, a recession year, as the base year. The short answer is yes. In recession years, the decline in income causes taxes collected to be lower than average--"average" being the full employment (i.e. GDP equal to potential) outcome--with transfers (such as UI, welfare, etc.) being higher than usual. This is true. As such, the present value of net payments of existing generations may be biased downward. Moreover, as the right hand side of the government's intertemporal budget constraint (the present value of government liabilities) is not strongly affected one way or the other by a recession, then the obligation of future generations will be biased upwards.[ If government fiscal policy is designed to stabilize the economy around its potential output level (potential output is the level of output in an economy given capital and labour are employed at "usual" levels, not underemployed, not overemployed), then one expects higher government expenditure in a recession year (and less government expenditure in a boom year). Thus, the generational accounts will overestimate the present value of government expenditure and cause further bias in the generational accounts.] In other words, the accounts will present a pessimistic view. Concerned readers can remedy this by imagining that the net payment burden of future generations is actually lower than that presented in the accounts, while existing generations' net payments are higher than that in the accounts.

However, readers should not be concerned as the bias is minimal. Comparing per capita real tax receipts, transfer payments, and government expenditure suggests that the 1991 level is consistent with actual subsequent levels, including the adjustment for real increases at the rate of productivity growth. [All data come from the Canadian Economic Observer 1993/1994 (see References for the citation). Transfers are defined as the sum of transfer payments to persons, to business subsidies, to business capital income, and to non-residents. Transfer payments data come from table 3, p. 15. Tax receipts data come from table 3, p. 14. Tax receipts are defined as the sum of direct taxes, indirect taxes, and other current transfers from persons. Government expenditure data come from table 3, p. 15. Government expenditure is defined as current (government) expenditure on goods and services. To put dollar values in real terms, the GDP deflator is used. The GDP implicit price index (1986 = 100) is in table 11, p. 47. All dollar values presented in this paragraph are in 1986 terms. Total Canadian population figures come from table 6, p. 27.] Specifically, per capita real transfer payments from government were $3,421, $3,578 and $3,611 in 1991, 1992, and 1993, respectively. Per capita real transfer receipts to government were $7,304, $7,329 and $7,333 in 1991, 1992, and 1993, respectively. Lastly, per capita real government expenditure in 1991, 1992, and 1993 was $4,224, $4,271 and $4,273, respectively. The most noticeable pattern is that taxes, transfers, and government expenditure exhibit a positive jump from 1991 to 1992, not the expected pattern of a positive jump in taxes and a negative jump in transfers and government expenditure. Overall, the potential bias in the generational accounts from using a recession year as a base year appear to be extremely limited.

**The Results**

**Generational accounts under a two percent discount rate**
Appendix 1 presents the generational accounts given a discount rate of 2 percent. This discount rate refers to the rate, not including the inflation premium, at which the government can borrow or lend money. Canada's provinces and federal government have different actual interest rates for borrowing and lending given the riskiness that the market attributes to these individuals. Two percent is just less than the average real Treasury-Bill rate of 2.3 percent. Figure 1 presents the generational accounting data graphically. [FG refers to future generations. As described, it is the present value net payment obligation of future generations necessary to balance the government's intertemporal budget constraint. Net contributions to government are given by positive values; net receipts from government are given by negative values. r refers to the real discount rate assumed to prevail from 1991 on; g refers to the annual productivity growth rate assumed to prevail from 1991 on.]

People born in the base year (1991) can expect to be net contributors to the government to the extent of $200,500 1991 dollars each. This is the lump sum payment that each newborn in 1991 must make to the government in order to free itself of any tax obligations in the future, as well as eliminating any transfer obligations of the government to the newborn over its life. The total tax obligation for newborns in 1991 in present value terms is $561,900 each, while the expected transfer receipts are $361,400 each. In terms of net taxes, each newborn can expect to be a net contributor of 31.2 percent of his or her labour income to the government due to a lifetime gross tax rate on labour income of 87.5 percent and a transfer rate of 56.3 percent.

**The least and most fortunate generations** [The least/most fortunate terminology is used with some trepidation in this study. To state that the elderly are better off than the young is perfectly correct given that this study looks at the remaining lifetime value of receipts from and payments to government. A better description of least and most fortunate generations would have calculated the present value (in same year terms) net payment obligation of all generations over their full lifetimes. Such a task is beyond the scope of this study and is not necessary to calculate the generational accounts.]

The least fortunate generation alive in 1991, in terms of having the maximum present value remaining net payment obligation, is 20 year olds, each with a present value remaining net payment obligation of $246,500. This generation has the misfortune of a long and full life of tax obligations with none of the discounting of earlier generations, as people aged 0-17 do not pay taxes or transfers. As a result, people just entering the workforce in 1991 can expect to be net contributors to the government in the order of one quarter million dollars in present value terms. The quarter-of-a-million dollar figure comes from an expected tax obligation of $620,600, countered by $374,000 in transfers. In terms of net taxes, those aged 27 in 1991 are worst off. They can expect a net tax burden of 35.9 percent of their future labour income due to a lifetime gross tax rate on future labour income of 85.8 percent and a transfer rate of 50.0 percent. [Some readers may be confused by the apparent discrepancy in terms of exactly who is the worst-off generation. Specifically, in terms of net tax rates, 27 year-olds are worst off, while in terms of dollar value obligations, 20 year-olds are worst off. What is going on here? The difference is due to the timing and magnitude of people's labour income streams. An individual's labour income does not directly match (in terms of timing and magnitude) the stream of taxes payments, transfer receipts and government expenditure she receives throughout her lifetime. This imperfect alignment between government transactions and a person's labour income results in the apparent discrepancy between the two versions of the generational accounts. This effect also exhibits itself when the reader compares the net receiver/net contributors split between generational account types. The reader will notice (especially referring to figures 1-6) that the net payment patterns across generations are very similar with respect to both types of accounts.]

On a more positive note, the most fortunate generation in terms of being net receivers from the government is that of people aged 65 in 1991. Those in their retirement year in 1991 can expect to be net receivers of $211,200 each in present value terms from the government over the remainder of their lifetimes. Sixty-five year olds can expect to receive, on average, $359,000 in transfers from the government, while only paying $147,800 in taxes in present value terms. That 65 year olds are the greatest net receivers from the government is predictable. One would expect those just retiring to look forward to years of greatly reduced tax payments with the introduction of substantial transfer payments such as CPP/QPP benefits. [As a note, looking at the net tax rates of older generations, the reader is able to observe easily that the net tax rates fall in value. This is simply due to the combination of a decline in labour income and the increase in transfer payments as a person ages.]

**Net contributor/net receiver split**
In addition, it is interesting to observe the age split between net contributors to the government and net receivers from the government. People aged 48 or younger in 1991 can expect to be net contributors to the government. As stated previously, this means that the average person 48 years old or younger in 1991 will pay more taxes than he or she receives in transfers over the remainder of his or her life in present value terms. Conversely, people who are 49 years old or older in 1991 become net recipients of the government. These people can expect to receive more from the government in transfers than they pay in taxes. The net tax rates version of the generational accounts confirms these findings. The relatively young age at which people become net receivers as opposed to net contributors highlights the financial burden of the Canadian social system.

Much of the reason for the early age of transition from net contributor to net receiver stems from the "pay-as-you-go" nature of the pension plans. As Canada's demographic profile becomes consistently older towards the year 2016, the pension plan system becomes top-heavy in that the government makes pension payments to a relatively larger number of elderly while receiving contributions towards the pension from a relatively smaller number of young. The difference between what the pension plans receive and what the pension plans expect to pay leads to a vast amount of unfunded liabilities. The nature of generational accounting mathematics ensures that these unfunded liabilities are accounted for and that sustainability of government policy requires these liabilities to be paid.

***Future generations***
The most important information of the generational accounts is the per capita net payment obligation of future generations. Given a discount rate of 2 percent, future generations must pay $597,900 in present (1991) value net payments to the government. This is well over half a million dollars each, and most dramatically, represents a 196 percent increase in present value net payment liabilities of future generations over newborns in the base year. [To calculate the percentage change in future generations' net payment obligations over newborns' burdens, this study divides the future generations' net payment value by the newborns' net payment value increased by the rate of productivity growth (to correspond to the productivity growth assumptions used by the accounts), and subtracts 100 percent. This technique is employed for all such percentage change comparisons in this study. Readers who attempt to replicate the percentage change by dividing the future generations' value by the newborns' value and subtracting 100 percent will notice a slight discrepancy with what is reported in the study.]With respect to net tax rates, future generations are going to have to pay 68.4 percent of their future labour income to the government in order to balance the government's intertemporal budget constraint. Comparing this with the 31.2 percent net tax rate of 1991 newborns implies a necessary increase in net payments to the government of 37.2 percent given individuals' current labour income stream. The study assumes that an individual's labour income will increase at the rate of productivity growth. The reader should not confuse the necessary changes in net tax rates with required increases in labour income taxes. Higher labour income taxes will lower the after tax real wage of workers which will lower the labour supply and decrease output, and hence labour income. The later section on evaluating policy changes in a generational accounting [framework will address these issues in further detail.]

***Policy options for achieving sustainability***
If Canadians decide that the social safety net is invaluable and that the government's policy regarding transfers is sacrosanct, then the increase in net payments for future generations must be met entirely by an increase in the tax liabilities. In this case, the present value tax liability in 1991 dollars is $961,500 per person born in 1992 (growth adjusted for future generations). This represents an increase in the tax bill for future generations of newborns of 70 percent. These changes must be permanent in nature in that the higher tax rates will be required for all future time periods in order to achieve sustainability.

One of the most interesting implications of the generational accounts is what it reveals about the inevitability of tax increases. For example, let us suppose that in the spirit of the times Canadians reject increasing taxes as a solution. Furthermore, assume that they wish to preserve the core program functions of government such as defence, roads, education etc., and insist that all accommodation must be made by cutting the transfer programs. Since the present value of transfers to each newborn in 1991 is $361,400, the present value of transfers to future generations necessary to balance the government's intertemporal budget constraint is $-32,700 in present value terms. What that means is that even if all transfers were to stop--if all welfare, all unemployment insurance and all government pension plans were eliminated permanently--there would still be an unfunded liability that has to be met by a tax increase. In order to achieve a sustainable path, future generations will have to permanently increase their present value tax liability by $32,700 each. In short, all transfers must be eliminated and taxes must be increased by 5.8 percent over newborns' present value per capita tax obligation.

Another way of approaching the issue is to take the position that future generations should pay no more net taxes per capita than the current generations are going to pay. That means that in meeting the intertemporal budget constraint we have to ensure that future generations have the same present value net payments liability as newborns in 1991 (adjusted for productivity growth). In this case, the balance in the accounts is achieved by lowering the government expenditure on goods and services by enough to eliminate the shortfall which would otherwise occur.

The results are striking. Government expenditure on all goods and services (this includes health care and education) must fall by 61 percent permanently. This figure most clearly demonstrates the unsustainable path of government policy. In order to maintain current tax rates and social security, Canadians must be willing to sacrifice 61 percent of the government expenditure on health care, education, recreation and culture, police protection, transportation and communications, and so on. The sacrifice in terms of living standard will be immense. Canadians pride themselves on their free-access health care, inexpensive quality education system and general quality of life. However, the projected costs of these programs in conjunction with the transfers are unsustainable.

These two alternative paths to sustainability serve to outline the broad choices that Canadians face if they are unwilling to tolerate further increases in taxes. In order to make the future "add up," there must be a choice between various alternatives of program spending cuts and transfer program elimination. The attempt to preserve the transfers that make up the social safety net means a 61 percent cut in program spending. Complete elimination of the social transfers is insufficient to solve the funding problem; and if that route is taken, there will have to be some program spending cuts as well.

***Total government unfunded liabilities***
Another way to consider Canada's debt crisis is look at the present value of the total government unfunded liabilities. The present value of government unfunded liabilities is equal to current net debt plus the present value of all future unfunded liabilities. The present value of future unfunded liabilities is equal to the present value of government consumption less the present value of the net payments to the government. Assuming that current tax and transfer policies hold for all current and future generations, the present value debt bill of the government, under the assumption of a 2 percent discount rate, is $21.1 trillion. This value is more than 38 times total 1991 net debt, and more than 31 times 1991 GDP. Such a result plainly indicates the extent of the unsustainability of current Canadian government policy.

**Generational accounts under a four percent discount rate assumption**
Appendix 2 presents the generational accounts under the assumption of a permanent 4 percent discount rate. Figure 2 presents the generational accounts graphically. The reason for the fall in all the values is due to the nature of discounting. The greater the discount rate, the less funds in the future are worth, and as such, the lower the present value of any given transaction. However, don't rejoice that high discount rates are the key to diminished net obligations. High discount rates also imply lower present value labour incomes as future wages are discounted to a greater extent. As an additional note, four percent may be a good guess at the future stream of discount rates given today's currently high real interest rates followed by future interest rate declines.

A newborn in 1991 can expect to pay, on average, $222,800 in present value taxes, and to receive, on average, $97,400 in present value transfers. Overall, this makes newborns net contributors to the government in the magnitude of $125,500 each in present value terms. In net tax terms, a 1991 newborn can expect to be a net contributor to government of 48.6 percent of labour income over his or her lifetime due to a gross tax rate of 86.3 percent and a transfer rate of 37.7 percent.

***The least and most fortunate generations***
Under this discount rate scenario, the least fortunate generation is that aged 25 in 1991. In present value terms, these people can expect to pay $375,500 in taxes each, and to receive $156,900 in transfers each, over the remainder of their lifetimes. This makes 25 year olds net contributors to the government over the remainder of their lives of $218,600 each in present value terms. In net tax terms, the least fortune generation is that aged 26 in 1991, with each individual facing a lifetime net tax rate of 49.6 percent due to a gross tax rate of 84.7 percent and a transfer rate of 35.1 percent.

In contrast, the most fortunate generation is that aged 65 in 1991. Thus, those retiring after 1991 are the highest net receivers from the government in present value terms. As with the previous discount rate scenario, the reason for this is that these people benefit from both a limited tax burden and the large impact of transfer payments such as CPP/QPP benefits. Therefore, a 65 year old in 1991 can expect to be a net receiver of $176,100 from the government over the remainder of his or her life. This figure comes from an expected tax obligation of $123,100 offset by $299,200 in transfer receipts. As with the previous scenario, one intuitively expects those retiring to be the greatest net receivers.

The change in the least fortunate generation stems from the change in the discount rate. The higher the discount rate, the less the impact of future transactions on an individual's present value net payment obligation. Or, put another way, the higher the discount rate, the smaller the lump sum required to pay off future obligations, since the lump sum will generate larger returns. For Canada, the incidence of taxation and transfers makes it such that the generation that is the most affected rises with the discount rate. This is because the transfer payments in one's old age are discounted more than the tax payments in one's youth.

***Net contributor/net receiver split***
For the same reason as the least fortunate generation changed, the age split between net contributor and net receiver increases slightly as well. With the four percent discount rate assumption, the average person who is 51 years old or younger in 1991 is a net contributor, while the average person 52 years old or older is a net receiver. The net tax rates confirm this finding.

***Future generations***
The present value net payment obligation of future generations necessary to balance the government's intertemporal budget constraint is $316,600 for each newborn. Again, recall that this study treats does not adjust the tax or transfer policies currently in effect for people alive in 1991 for the remainder of their lives. This is not to say that the person who is 34 years old in 1991 pays the same taxes and receives the same transfers when he or she is 89. It does mean that the 34 year old can expect to be treated in the same manner (productivity adjusted) as the 89 year old in 1991 when he or she is 89. Further, recall that the study treats future generations, defined as those born after 1991, as responsible for balancing the govern-ment's intertemporal constraint. This forces newborns in 1992 to pay the equivalent of $356,600 each over their lifetimes, with future generations paying the same amount adjusted for productivity growth of 0.6 percent per year. So, if future generations each contribute $356,600 adjusted for productivity growth in present value, then the government can afford its policies indefinitely. However, this future generation's value is 151 percent greater than the net payment obligations of 1991 newborns. This implies that the government currently is spending well beyond its means. This is similar to an individual receiving income of $100 per year and spending $251 per year indefinitely. Such behaviour cannot exist for long without bankruptcy ensuing. The same logic works for the Canadian government. In net tax rate terms, future generations must be a net contributor to the government of 138.8 percent of labour income over the remainder of each of their lifetimes. That is, future generations must pay all of their labour income to the government plus a premium of an additional 38.8 percent in order to balance the government's intertemporal budget constraint. This is an increase of 90.2 percent over the net tax rate burden of 1991 newborns.

***Policy options for achieving sustainability***
As in the previous scenario, it is important to look at the necessary change in taxes and transfers given Canadian opinion regarding tax increases or transfer reductions. Canadians may decide to maintain the social safety net, and instead, to use tax increases to generate the necessary net contributions to the government. Thus, if transfer payments continue to grow by productivity and are not reduced in any way, then future generations can expect to pay taxes of $414,500 each in present value terms. This represents a permanent 85 percent increase over the present value tax obligations of newborns in 1991.

In contrast, Canadians may refuse to pay more taxes and wish to sacrifice transfer payments instead. In this case, not only must all transfers be eliminated, but the present value tax burden must increase for each newborn by an additional $92,400. This represents a permanent 41 percent increase over the present value tax burden of an average 1991 newborn.

It is even more intriguing to determine the necessary reduction in government expenditure on goods and services necessary to support current government policy regarding taxation and transfers. To satisfy the intertemporal constraint, the government must permanently decrease expenditure on health, education, and all other goods and services by 36 percent. More than one-third of current government spending must be sacrificed.

***Total government unfunded liabilities***
An examination of the present value of government unfunded liabilities under current policy, extended to the infinite future, indicates the extent of current government overspending. With a 4 percent discount rate assumption, the present value of total government debt is $2.3 trillion, which is over four times the current net debt, and just under 3.5 times 1991 GDP.

**Generational accounts under a six percent discount rate assumption**
Appendix 3 presents the generational accounts given a 6 percent discount rate. Six percent most effectively represents current high real discount rates, though for a long term rate it is rather steep. Figure 3 presents the generational accounts graphically.

***Main results from the generational accounts***
The results remain similar, though the magnitude of the figures declines. A newborn in 1991 can expect to pay in present value terms $99,200 in taxes, and to receive $31,900 in transfers, providing for an overall net payment burden of $67,200 per 1991 newborn. The net tax rate of 1991 newborns is 58.4 percent due to a gross tax rate of 86.1 percent and a transfer rate of 27.7 percent. Those who are 30 in 1991 are the least fortunate generation in terms of having the greatest net payment burden. A 30 year old in 1991 can expect to pay in present value terms $266,600 in taxes, and to receive $83,145 in transfers over the remainder of his or her life, leaving the per capita net payment burden at $183,500. In net tax rate terms, there are many generations that are most unfortunate (their net tax burden is each 58.4 percent): newborns, and those aged 1, 5, and 6 in 1991. The contrast between the most unfortunate generations in terms of net payment dollar value and net tax rate is due to the strong (6 percent) discounting applied to income flows. As expected, 65 year olds continue to be the greatest net receivers from the government, and thus are the most fortunate generation. The average 65 year old will receive $255,200 in transfers, while paying only $105,000 in taxes over the remainder of his or her lifetime. This implies that each 65 year old can expect to be a net receiver from the government of $150,200 over the remainder of his or her lifetime. In addition, the age split between net contributors and net receivers moves up a few years. With a six percent discount rate assumption, those 53 and younger are net contributors to government, while those 54 and older are net receivers. The net tax rate figures confirm this finding.

***Policy options for achieving sustainability***
Most striking, however, is the effect of the discount rate assumption on future generations. Each future generation has a net payment obligation of $227,100 in present value terms (increasing at the rate of productivity). This represents an increase of 236 percent over 1991 newborn net payment obligations. The net tax rate obligation of future generations is 351.2 percent, an increase of 292.8 percent over the newborn net tax rate obligation of 58.4 percent.

If Canadians wish to pay this increased obligation through tax increases, each member of a future generation must pay $259,200 in present value terms, increasing at the rate of productivity. This is a permanent increase by 160 percent over 1991 newborn tax obligations. Instead, if Canadians wish to decrease transfers to pay the necessary rise in net payments, each member of a future generation can expect to receive no transfers whatsoever, while paying an additional $127,300 in present value tax liabilities. Even with the permanent elimination of transfers, this represents a permanent 128 percent addition over current tax liabilities. Lastly, if Canadians continue with the present tax and transfer policies, and decide to reduce consumption, then a permanent 32 percent reduction in government expenditure on goods and services is required.

***Total government unfunded liabilities***
Lastly, the present value of government unfunded liabilities is $1.2 trillion. With the six percent discount rate assumption, the present value of government debt is over twice the 1991 net debt and is 171 percent of 1991 GDP.

**A note on immigration**
The previous results clearly demonstrate the unsustainability of Canadian government policy. One approach to combat this problem is to increase the number of young immigrants. Immigration provides an injection of tax dollars by expanding the tax base. In particular, increasing the number of young immigrants, who by their youth become net contributors to the government, increases the government's net income. [It is important to note that the generational accounts, as presented in the appendices, do not apply directly to immigrants who, in general, will face different streams of taxes, transfers and government expenditures than domestic Canadians. As a result, it is inappropriate simply to recalculate Canada's generational accounts under different immigration assumptions. For this reason, this study does not include such analysis. However, it is a most worthy future research opportunity to determine Canada's generational accounts under different immigration policies using appropriate methodology.] This lessens the present value net payment obligations of future generations, including the progeny of first generation immigrants. Ignoring the other benefits of immigration, it is clear that policies to increase the number of immigrants entering Canada is an effective method to lessen the expected net payment obligations of future generations.

**Comparison of Canadian and U.S. generational accounts**
Comparing these results with the generational accounts for the United States reveals that Canada is in much worse fiscal shape than its southern counterpart. [The United States' generational accounts come from Auerbach et al [1991]. Specifically, the study refers to table 1b, p. 78 for the male generational accounts, and table 2b, p. 82 for the female generational accounts.] See table 2 for a summary of the results. The methodology used in the present study and the U.S. work is virtually identical with the exception that the U.S. generational accounts have a base year of 1989 and are divided into male and female subsamples, while this study aggregates the two sexes and uses 1991 as its base year. [1993 U.S. generational accounts are available in Auerbach, Alan J. et al, "Restoring Generational Balance in U.S. Fiscal Policy: What Will it Take?" in Economic Review, Federal Reserve Bank of Cleveland, vol. 31, no. 1, 1995] As a result, the two studies' figures are for rough comparison only and are not perfectly comparable.

With this in mind, here are the U.S. results. With an discount rate of 6 percent and a productivity growth rate of 0.75 percent, the U.S. generational accounts report that the net payment obligation for a base year newborn male is 1989 US $74,00, and for a female is 1989 US $36,500. Future generations, in order to balance the intertemporal constraint, must pay 1989 US $49,100 for each female and 1989 US $99,400 for each male. Using the actual proportion of males and females under five years of age in 1990, [The study uses the population figure in table 12 of U.S. Department of Commerce [1992]: Total Population, by Age and Sex: 1980-1991. The study uses 1990 data.] and using the average exchange rate for 1989 [The study uses the average noon spot rate in 1989 (Cdn $1.1842/US $) reported in The Bank of Canada Review.] one converts the U.S. generational accounts into single-sex Canadian dollar accounts. The per capita present value of net payments for 1989 newborns in the United States is 1989 Cdn $65,900, while for future generations the net payment necessary is 1989 Cdn $88,600. This implies that the U.S. needs to increase the net payment obligations in the future by 33 percent. In comparison, appendix 4a gives the generational accounts for Canada under the assumption of a 6 percent discount rate and a 0.75 percent productivity growth rate. The present value net payment obligation for base year (1991) newborns is 1991 Cdn $70,700 each, while for future generations it is 1991 Cdn $231,500 each. To meet its intertemporal budget constraint, the Canadian government must raise the net payment obligations of future generations over those of base year newborns by 225 percent. [Total unfunded liabilities for the Canadian government are 1991 Cdn $1.2 trillion under these discount and growth rate assumptions.]

The generational accounts for the United States and Canada indicate that both countries' government policies are unsustainable in the long run. However, the 34 percent increase in net payments for U.S. citizens required to ensure sustainability of government policies, versus the 225 percent increase needed in Canada, highlight the severity of the Canadian situation in comparison with the United States' concerns. To be fair, the U.S. accounts with a base year of 1989, and the Canadian accounts with a base year of 1991, imply that the U.S. figures are not inflation adjusted to 1991 dollars, and are therefore, too low. In addition, comparing 1989 U.S. generational accounts with 1991 Canadian generational accounts ignores the budget deficits incurred by the U.S. government in 1990 and 1991; this also implies that the U.S. numbers are too low for comparative purposes.

Next, this study compares the United States and Canada again, this time maintaining the 6 percent discount rate assumption but adjusting the productivity growth rate upwards for both countries from 0.75 percent to 1.5 percent per year. The U.S. data show that a base year newborn has a net payment obligation of 1989 US $95,300 for males and 1989 US $46,500 for females. Future generations must pay 1989 US $124,100 for males and 1989 US $60,500 for females. Using the conversion procedure discussed above to convert these figures to 1989 Canadian dollars with a single sex, the data show that per capita net payment obligations of base year (1989) newborns is 1989 Cdn $84,600, while for future generations the figure is 1989 Cdn $110,200. In order to balance the intertemporal budget constraint of the government to provide for sustainability of government policy, future generations must pay 28 percent more than base year newborns.

As with the 0.75 percent productivity assumption, Canadian government policy under a 1.5 percent productivity assumption is much less sustainable (or much more unsustainable) than its American counterpart. Appendix 5a presents the generational accounts for Canada given a discount rate of 6 percent and productivity growth rate of 1.5 percent per annum. [Total unfunded liabilities for the Canadian government are 1991 Cdn $1.5 trillion under these discount rate and growth rate assumptions.] Here, base year newborns expect to pay 1991 Cdn $90,800 each in present value net payments, while future generations must pay each 1991 Cdn $260,000 in order to balance the intertemporal budget constraint. This represents an increase of 182 percent. Thus, while future generations may expect a 28 percent increase in net payment obligations in the United States, future Canadians must confront a 182 percent increase in net payment obligations. For comparative purposes, figure 4 presents the percentage change between base year newborn net payments and future generations' net payments for Canada and the U.S. Clearly, Canadian government policy is much more unsustainable than United States' government policy, regardless of the productivity assumption implemented.

**Freeze and growth through productivity analysis**
Until this point, this study has maintained the assumption that government expenditure on goods and services remains intact, as does government policy regarding the taxing of and transfers to existing generations as of 1991, with future generations forced to accept the burden of making Canadian policy sustainable. As explained earlier, this assumption is made to best highlight whether government policy is sustainable or not. This assumption is standard in the generational accounting literature.

However, many different assumptions can be made. One alternative is a "freeze and growth through productivity" assumption. Previously, the study assumed that taxes, transfers, and government expenditure grow not only with population changes, but with an annual productivity increase as well. Now the study assumes that for existing generations, not only do taxes continue to grow with productivity, but that government expenditure and transfers change only with changes in the population and experience no productivity increases. This is equivalent to increasing taxes for each existing member of each generation at the rate at which per capita real income increases (generally assumed at 0.6 percent per annum in this study), while freezing government expenditure and transfer payments for each member of each generation at their 1991 levels. This implies that there are only real increases in taxes, while there are no real increases in government expenditure and transfers for each existing generation member. Future generations, on the other hand, also face the freeze in government expenditure, but their net payment obligations are set in order to balance the government's intertemporal budget constraint assuming that the real level of the obligation increases at the rate of productivity growth. In calculating the total unfunded liabilities under the freeze and growth through productivity policy, the present value of net payments of future generations is calculated assuming that taxes grow while transfers are frozen. Notice that this assumption differs slightly from the one used to calculate the net payment obligation of future generations. [The reason for the difference is to maintain conformity with the earlier calculations. Total unfunded liabilities are always calculated based on the assumption that existing and future generations face the same government fiscal policies. The net payment burden of future generations is always calculated assuming that it increases at the rate of productivity growth. For further information on how these calculations are performed under the freeze and growth through productivity assumptions, see the technical appendix.] Overall, freeze and growth through productivity assumes that government expenditure for existing and future generations is frozen, transfer payments for existing generations are frozen, and that tax growth for existing and future generations is allowed. See table 3 for a summary of the generational accounting results under the freeze and growth through productivity policy.

Note that the freeze and growth through productivity policy does not suggest that per capita transfers and government expenditure remain constant in real terms at 1991 levels. Such a policy would imply, for example, that if per capita health care expenditure in 1991 is 1991 $100 then in 1992 per capita health care expenditure is 1991 $100. Such a policy will generate hardship in the future when Canada's demographics shift towards a greater proportion of elderly in the population with their correspondingly higher health care costs. [For example, The Fraser Institute estimates that the per capita cost of health care in 1991 for those aged 75 is 5.1 times that of those aged 20, using Statistics Canada's 1990 Survey of Family Expenditure.] Under the freeze and growth through productivity policy, transfers and government expenditure for each generation member remain constant at 1991 levels. For example, if the average 30 year old in 1991 receives 1991 $2,000 in health care expenditure from the government, then so, too, will the average 30 year old in 1992. Similarly, the freeze and growth through productivity policy does not increase per capita taxes at the rate of productivity growth. Instead, the policy increases the taxes for each member of each generation at the rate of productivity growth. Thus, if the per capita tax payment in 1991 of those aged 29 is 1991 $4,000, then the tax payment of a 29 year-old in 1992 will be 1991 $4,000 plus an increase for productivity growth. It is important that the reader have a careful understanding of the freeze and growth through productivity policy.

In terms of the standard of living for Canadians, this policy implies that the 1991 expenditure on education and health and all other goods and services as well as real transfer payments remains constant per generation member in real terms, but that taxes per generation member rise by 0.6 percent per year in real terms, the productivity growth rate. Since per capita incomes will rise by the same amount as the tax increases (in percentage terms) and since taxes are less than 100 percent of incomes, the standard of living of Canadians will rise as disposable income per capita rises. However, this standard of living growth will be slower than under the usual assumption of transfer and government expenditure increases at the rate of productivity. Indeed, freezing transfers and government expenditure, while raising taxes at the rate of productivity, seems a very effective way to cure Canada's fiscal crisis while minimizing the loss of living standards. With this policy, the standard of living increases on average, but at a slower rate.

In effect, the freeze and growth through productivity assumption ensures that there will be a proportionate reduction in the contribution which government spending and government transfers make to the living standard of each Canadian beyond the current generation. So, for example, while pension transfers are kept constant in real dollar terms, this implies that pensions as a fraction of income at retirement age will steadily decline. That is true because while real incomes increase with productivity enhancements, pension entitlements are fixed in real, dollar terms, and hence fall relative to income. In other words, the freeze and growth through productivity assumption, at least as far as pensions are concerned, is like the real world solution proposed for the unfunded liabilities of the Canada Pension Plan--namely, to effectively increase the age of retirement. [Since the fixed-in-real-terms pension benefits provided for in this scenario would imply a pension benefit which is actually shrinking as a percentage of income, to keep the same income replacement in retirement years a retiree would have to spend fewer years retired--i.e., would have to retire later.]

**Freeze and growth through productivity under a two percent discount rate assumption**
Appendix 6 presents the generational accounts under the assumption of a 2 percent discount rate, and a 0.6 percent productivity growth rate, which affects per capita taxes only. Total unfunded liabilities fall to $-14.8 trillion (a surplus!) compared with +$21.2 trillion without the freeze and growth through productivity assumptions. This suggests the power of freeze and growth through productivity. Figure 5 presents the generational accounts graphically. A newborn in 1991 can expect to pay $561,900 in present value taxes, as discussed previously, because the tax assumptions have not

changed. However, this same newborn now only receives, on average, $237,400 in transfers due to the assumption of fixed real transfer value. The present value of transfers, therefore, has fallen by 34 percent. This causes the expected per capita net payment obligations of a 1991 newborn to increase by 62 percent from $200,500 to $324,500. The net tax rates version of the generational accounts confirms this result. Whereas the expected per capita net tax rate of newborns in 1991 is 50.5 percent (due to a gross tax rate of 87.5 percent and a transfer rate of 37.0 percent), future generations need pay only 20.8 percent of future labour income as net contributions to government. This is a decline of 39.7 percent.

As the assumptions maintain the size of the government's total bill (the right hand side of the intertemporal budget constraint), the general increase in net payment obligations of existing base year generations implies that the current generations pay much of the government's total liabilities. Indeed, future generations need pay only $181,900 each to make government policy sustainable. This is a decline of 70 percent over the expected net payment obligation in the scenario with transfer and government expenditure growth as well. Additionally, note that the future generations' net payment obligation is lower than the 1991 newborns' net payment obligation by 44 percent. This implies that the government policy of real annual tax increases by productivity growth, combined with frozen real government expenditure and transfers, is so stringent that future generations, to balance the government's intertemporal budget constraint, benefit from permanent tax declines. Indeed, newborns in 1992--the first generation responsible for balancing the government's intertemporal budget constraint--need pay only $419,200 each in present value taxes. This represents a permanent 25 percent decline in per capita real tax burden for future generations. Thus, one can see the powerful possibilities for achieving a solution by constraining the benefits available to all citizens in the face of pervasive productivity-induced economic growth.

**Freeze and growth through productivity under a four percent discount rate assumption**
As a caveat, the efficacy of freeze and growth through productivity declines with high discount rates. Appendix 7 presents the generational accounts for Canada given a discount rate of 4 percent, with productivity growth of 0.6 percent per year affecting taxes only. Total unfunded liabilities fall to $-207.1 billion (a surplus) with the freeze and growth through productivity assumptions from $+2.3 trillion without the assumptions. Again, the benefits of this policy approach appear dramatic. Figure 6 presents the generational accounts graphically. 1991 newborns each pay on average $222,800 in present value taxes, the same amount as before. However, the freeze on the real value of transfer payments at the 1991 level implies that the present value tax burden of a newborn falls to $67,200 each, a decline of 31 percent from the situation of productivity-boosted transfers and government expenditure. This decline in the expected present value of transfers to base year newborns causes the anticipated net payment obligation for these newborns to rise by 24 percent, from $125,500 per head to $155,600 per head. As before, the rise in present value net payment obligations by all members of existing generations in 1991 leaves the needed net payment obligations of future generations at $156,500 each. This is a 51 percent decline over future generations' net payment obligation in a world where government expenditures and transfers increase in proportion to productivity. Even though burdened with the responsibility of ensuring the sustainability of government policy, future generations only need pay a 0.6 percent increase in net payment obligations over newborns in 1991, and given that the tax and transfer policies of 1991 hold into 1992, newborns in 1992 actually benefit from a 0.2 percent decline in net payment obligations over their 1991 newborn counterparts. In terms of present value tax obligations, a 1991 newborn owes $222,800, whereas a future generations' member owes $223,800. The similarity between the net payment obligations of base year newborns and future generations (who are responsible for sustaining government policy) shows that tax increases at the rate of productivity, accompanied by a real government expenditure and transfer freeze, is a sustainable government policy given a 4 percent discount rate.

The net tax rates reveal similar results. Whereas newborns can expect to be net contributors to the government to the extent of 60.3 percent of future labour income (due to a gross tax rate of 86.3 percent and a transfer rate of 26.0 percent), future generations must be net contributors of 68.7 percent of future labour income. This is an increase of 8.4 percent. As with the standard generational accounts, the net tax rates version of these accounts reveals the decline in effectiveness of the spending freeze and freeze and growth through productivity scenario under higher real interest rates.

The reason that the rise in discount rates causes a decline in the benefits of this plan is because the higher the discount rate, the less the benefits of constant growth in per capita taxes which, with the real spending freeze causes the net tax burden per capita to grow geometrically with time.

**Freeze and growth through productivity under a six percent discount rate assumption**
Lastly, the study presents a scenario involving the spending freeze and tax growth through productivity analysis under the discount rate assumption of six percent. As seen under the other discount rate assumptions, freeze and growth through productivity is a potent tool in helping Canada balance its government's intertemporal budget constraint. Here, total unfunded liabilities fall to $287.7 billion from $1.2 trillion without the freeze and productivity assumptions. Appendix 8 presents the generational accounts data, while figure 7 presents the generational accounts graphically.

As described above, the higher discount rate dampens the effect of the productivity increase on taxes in later years, which in turn will require future generations to be greater government net contributors than they would have been under lower discount rates. Newborns in the base year are net contributors to the government in present value terms of $75,800 each. This stems from a present value tax obligation of $99,200 each, less present value transfers of $23,400 thousand each.

In contrast, each member of a future generation, in order to make government policy sustainable, must pay $121,800 in present value net taxes. The change in policy from tax, transfer, and government expenditure growing at the rate of productivity to tax growth only, causes the present value net payment burden of newborns in 1991 to grow by 13 percent. As a result, future generations must pay 60 percent more in net payments to the government. While this is less than the 236 percent increase required if all government spending and transfers grow at the rate of productivity, it is much more than the 70 percent decline allowable under a two percent discount rate assumption with the same freeze and growth through productivity policy.

In terms of present value tax burdens, future generations must pay $145,200 each, which is an increase of 46 percent over 1991 newborn tax obligations. Looking at net tax rates, future generations are obliged to be net contributors to government of 188.4 percent of future labour income, while 1991 newborns can expect to be per capita net contributors to the government for 65.8 percent of future labour income (due to gross tax rate of 86.1 percent and a transfer rate of 20.3 percent). The net tax rate burden of future generations is 122.6 percent greater than current newborns. In general, the lesson to be learned is that a spending freeze in conjunction with growth in tax revenues through productivity is a very powerful tool in combating the unsustainability of current government policy. However, the effectiveness of this tool depends to a great extent on the level of real interest rates.

**The importance of the freeze and growth through productivity results**
The freeze and growth through productivity analysis provides the major finding of the paper. Amid the doom-and-gloom conjecture regarding Canada's "debt crisis," [See for instance The Bank Credit Analyst, "Canada: Case Study of a Debt Trap," July 1994, Vol. 46, No. 1, pp. 25-39.] a freeze in spending and growth through productivity policy provides a powerful beacon of hope for Canadians. The vast majority of this study discusses the severe changes required by Canadians in order to put the country back on a sustainable policy path. It has discussed doubling tax burdens, completely eliminating the social safety net, and dramatically reducing all government expenditure including health and education expenditure. However, these requirements stemmed from an assumption that existing generations of Canadians make no attempt to correct Canada's government policy. Moreover, it was assumed that not only taxes, but transfers and expenditures increased for each person at the rate of productivity growth. These scenarios assume that those Canadians currently alive accept no responsibility for sustainability in government policy, and where Canadians demand increases in all government expenditures and transfers in proportion to the growth in the economy.

In contrast, the freeze and growth through productivity policy hints at a very optimistic Canadian future. Using the four percent discount rate as the most reasonable assumption, freeze and growth through productivity implies that Canadians can receive identical per capita government expenditure and per capita transfers ad infinitum--this is equivalent to maintaining Canada as it was in 1991--so long as Canadians accept a minimal, 0.6 percent, annual increase in their inflation-adjusted tax bill. Another way of expressing this is to say that Canadians can maintain their social safety net, as well as the same level of health, education, police protection, and all other government goods and services forever, as long as they accept annual tax increases at the rate of average annual Canadian productivity.

Thus, taxes must increase for each person at the same rate as their labour income increases. However, since tax payments are less than one's labour income, this implies that the average person's after-tax disposable income will gradually increase in magnitude. Thus, freeze and growth through productivity maintains the current level of government services on a sustainable basis with the least impact on the individual. While current government policy is most definitely not sustainable--which is the other major point of this study--a freeze and growth through productivity policy provides a simple, relatively painless way for Canadians to ensure sustainable government policy with respect to government expenditure and the social safety net. While failure to implement government policy reforms will be devastating to Canada, the country's future under a freeze and growth through productivity policy looks very bright indeed.

**The requirements and implications of the freeze and growth scenario**
While the freeze and grow scenario does provide a real opportunity to solve the otherwise impossible problem of government sector debt burdens, it is important that the requirements of the policy be clearly understood. There are two basic aspects of the policy. The first is the freezing of government spending per generation member and the second is the continuous achievement of economic growth such that per capita income increases from year to year by .6 percent.

What will the government spending freeze require? At first blush it seems relatively painless to freeze the level of government spending per generation member at its present levels in real terms. Such a policy would ensure that each Canadian in every future generation would have exactly the same inflation-adjusted dollar amount of government services as the current generation. However, to some extent, this stand-pat policy assumes away the major problem which plagues the future world of our scenarios and the real world in which we live.

One manner in which a freeze of real health care expenditure for each generation member, for example, can potentially hurt citizens in the future is through the introduction of expensive medical technology. By freezing the real health care expenditure on generation members, citizens will be unable to take advantage of the new technology without incurring private health care expenditure. That is, the difference of the cost of using this new technology and the frozen allocation of health care expenditure must be made up by the household. Note that this scenario assumes that the new technology does not substitute for existing medical technology, the existence of which releases otherwise allocated health care funds which lowers the household's private health care expenditure.

Similarly, the need to achieve constant productivity improvement in order to make the policy work might suggest that there needs to be more investment in human capital. The main thrust of policy in this direction is education spending. While we need to have greater growth in productivity, the policy requires that there be no more public spending on education than at present.

The most stringent requirements of the policy can be seen in the area of government transfers. All government transfers are assumed to be frozen in real terms. For unemployment insurance and welfare, this assumes a declining replacement ratio as time goes by. Although protected from inflation, these programs would not increase as real incomes in Canada increased. The implication is that while unemployment insurance replaces 55 percent of a worker's wages at the present time, in the future, unemployment insurance protection will not keep pace with the growth in wages, and hence the replacement ratio will slowly but steadily decline, replacing smaller and smaller fractions of employment income. [To be precise, as of July 1994, claimants with dependents and insurable earnings below one-half of the maximum insurable earnings will receive 60 percent of their insured earnings; other claimants receive 55 percent of their insured earnings.]

In the case of welfare payments, the required policy would be as set out in the work of Professor Christopher Sarlo in his study, Poverty In Canada. [Christopher A. Sarlo, Poverty in Canada, The Fraser Institute, 1992.] This study shows that poverty lines appropriately constructed should be set at an absolute level in real terms and not permitted to escalate with increases in the general standard of living. A welfare payment appropriate to these poverty lines will be frozen in real terms as is required in the sustainable policy.

As has been noted earlier, the implicit assumption for pensions is that, like unemployment insurance, there will be a declining replacement ratio. A pension entitlement frozen in real terms while average wages increase with productivity implies a pension entitlement which steadily declines as a fraction of income at the age of retirement, or alternatively, provides fewer years worth of pension income at the higher income level. Just such an approach to the problems of unsustainability has been proposed in Italy where the government attempted to add five years to the standard age of retirement. Extending the retirement age reduces the number of years during which a retiree must be supported and thus reduces the total demands on the retirement income system.

This does not necessarily mean that retirement incomes in the future will be less adequate than they are at the moment. It simply means that there will have to be a shift from the public provision of pensions to more private provision. The public pension system will increasingly become a safety net program, while the private sector provides the first line of pension income for all workers.

The other part of the solution to the unsustainability problem is the required increases in productivity. The power of productivity to defeat Canada's debt ills implies the need for a shift in current economic and political thought. Current thought focuses on how to most effectively reduce government expenditure. As this study's analysis shows, while a spending freeze is required, there must also be a concentration on the role that public policy plays in affecting Canada's productivity, as well. This sort of thought revolves around issues such as the disincentive effects of the tax system on individual effort, the effect of capital gains taxation and the taxation of corporate income on capital investment, technological improvements, efficiency increases and the like.

There are also some deeper issues which need to be addressed in the pursuit of higher productivity. While 0.6 percent per year increase in per capita incomes is not a great challenge by historical standards, it is crucial to recognize that this historical record was generated by an economy with a very different structure. Two aspects have changed dramatically.

First of all, the modern economy, by comparison with the economy in the early post World War II period, is much more service intensive. Whereas 60 percent of the population were employed in goods production in 1946, currently less than 25 percent are so employed. This has led many to conclude that there will be greater difficulty sustaining the productivity gains of the past in this new world of service production. Whether that is true or not, it is certainly the case that the structure of the service sector will be a challenge to be overcome in the pursuit of significant gains.

The issue here is that the service sector is comprised very significantly of government produced services--principally health care and education. While health care is one of the fastest growing sectors of the economy, undoubtedly education is one of the most important. Since both these sectors are dominated by government services production undertaken under conditions of monopoly, the growth possibilities will not be realized to the greatest possible extent nor will the efficiencies that competition induces characterize the sectors. This is an important consideration and in the context of the freeze-growth solution acquires a paradoxical flavour.

If the growth in the economy which was historically achieved can be maintained, then there is a chance to retain the basic elements of government spending and transfer policy. The achievement of this historical growth performance may, however, require a turning back of the public sector encroachment on the key education and health care sectors. Without a freeing up of the methods of production of these two vital services, it is scarcely possible to achieve the historic growth norm from which the .6 percent per capita growth target is derived.

So, while the freeze-growth scenario certainly has much to recommend it, the policy components of such a scenario will be quite challenging. While radical may be too strong a characterization in 1995, certainly the required policy reform will be bracing and involve some courageous political leadership.

**Using generational accounting to analyze policy changes**
Clearly, generational accounting is a powerful technique in the analysis of Canada's fiscal health. It helps to determine whether a government's policies regarding taxation, transfer payments and expenditure are sustainable in the long run. In this way, generational accounting is extremely valuable: failure of the government to balance its intertemporal budget constraint means inevitable bankruptcy. As the data show, currently Canada's government fiscal policy is highly unsustainable.

This implies an obvious use for generational accounting: to indicate the effects of various fiscal policy changes on the government's intertemporal budget. In order to make government policy sustainable, there are only three fiscal policy options: (1) increase tax receipts from citizens, (2) decrease transfer payments to the citizens and (3) reduce government expenditure. However, there are many ways to implement the various options. Any approach may use one or all of the three options, each to a varying degree. Generational accounting demonstrates that the effectiveness of any given approach is highly dependent on what happens in the future. It is a useful tool to evaluate policy changes. Future research should study the effectiveness of various fiscal policy changes in balancing the government's intertemporal budget.

However, generational accounting must be used with care for two reasons. First, as this method looks at taxes, transfers, and government expenditure from now to the infinite future, the researcher's assumptions regarding growth and discount rates affect the accounts enormously. Second, the best that one can do in terms of evaluating policy with generational accounts is to determine the dollar changes necessary to satisfy the government's intertemporal budget constraint. Statements such as "a permanent 8 percent increase in labour income taxes is needed to ensure sustainability in government policy" are vacuous. Except for very special cases, changes in government policy cannot be analysed with generational accounting due to the interdependent nature of the elements of the economy. Indeed, taxes are distortionary, interest rates change daily, changes in savings rates affect economic growth, and declines in government expenditure temporarily lower output which diminishes tax receipts. Generally, research that attempts to analyse government policy without accounting for the dynamic general equilibrium nature of an economy should be ignored. Generational accounting does not account for these interdependencies. Further research should synthesize the generational accounting and general equilibrium approaches. Overall, generational accounting is a very potent technique that must be implemented and evaluated with care.

To emphasize the care in interpretation necessary to understand policy changes on a country's generational accounts, it is important to discuss two examples used in this study. First, it is proper to interpret the change in net tax rates required by future generations to balance the government's intertemporal budget constraint NOT as the necessary change in the labour income tax, but rather as follows: the change in the net tax rate represents the percentage increase in net payments to the government by future generations that is necessary, other things being equal, in order to balance the government's intertemporal budget constraint. Any other interpretation is flawed. Second, statements regarding the level of permanent decline in government expenditure that are needed to balance the government's intertemporal budget constraint must be taken literally. That is, if the government is able to decrease its expenditure by this amount, with all other tax payments and transfer receipts remaining unchanged, then the intertemporal constraint is satisfied. The statement does not imply that if the government decreases expenditure accordingly, that the constraint will be satisfied. Indeed, such an action is contractionary fiscal policy which will affect, in the short run, the level of tax revenues and transfer payments, as well as investment which will impact future growth rates. The key point is that generational accounting does not take into account the general equilibrium nature of the economy. As such, evaluating policy changes in a generational accounting framework is fraught with error and must be undertaken with care.

**Conclusion**
This study's conlusion is that Canadian government policy is highly unsustainable. In order to provide for long-term government solvency, Canadians must face substantial and permanent declines in government expenditure, permanent increases in taxation, and permanent declines in transfers. The result is a reduction in the standard of living for the average Canadian. Not only has the huge net debt which Canada has created over the past 20 years come to haunt Canadians currently in terms of a low dollar and high real interest rates, but the debt will hinder our children and cause future Canadians to accept cuts in their living standards. However, a real expenditure freeze and growth through productivity provides a highly effective method for Canada to return to sustainable government policy with a minimum of loss in standard of living for the average Canadian.

**Glossary**

**Debt:**Government debt is the total value of government borrowing. Thus, government deficits add to government debt, not vice versa.

**Deficit:**The excess of government expenditure over government net revenues in any given year is referred to as the government's deficit for that year.

**Discount Rate:** the discount rate is the interest rate used to determine the present value of future dollars.

**Freeze and Growth through Productivity Policy:** Under this policy, existing generations face transfers and government expenditure frozen per generation member at base year levels, while taxes are increased per generation member at the rate of productivity growth. Future generations continue to face frozen government expenditure, but now face a real net payment burden which grows at the rate of productivity growth.

**Future Generations:** These are people born after the base year. In this study, the base year is 1991. Future generations, therefore, are those born in 1992 or later. The future generations value in the generational accounts in this study indicates the present value net payment by all future generations, including annual productivity increases, necessary to balance the government's intertemporal budget constraint.

**Generational Accounting:** a technique which takes into account the future stream of government taxes, transfers, and expenditure, as well as changes in the country's demographics, in order to determine: (1) the present value of taxes and transfers for persons of each generation in a base year; and (2) the present value net payment obligation of future generations necessary to provide for sustainable government policy.

**Government Expenditure:** refers to expenditure by the government sector on final goods and services. This includes health, education, police protection, parks, fire protection, and the like. It does not include transfer payments such as the Canadian Pension Plan or welfare payments.

**Government Policy:** refers to the government's policies regarding taxation, transfer payments and government expenditure.

**Intertemporal Budget Constraint:** the government's intertemporal budget constraint requires that the present value of net payments (taxes less transfers) to the government be equal to the present value of government expenditure plus current government net debt.

**Net Contributor:**an individual is a net contributor to the government if the individual's present value of remaining lifetime net payment to the government is positive. That is, the individual can expect to pay more taxes to the government than he or she will receive in transfer payments from the government.

**Net Payment:** the net payment of an individual refers to the taxes the individual pays to the government less the transfer payments the individual receives from the government.

**Net Receiver:**an individual is a net receiver from the government if the present value of the individual's remaining lifetime net payments to the government is negative. That is, the person can expect to receive more money from the government than he or she gives to the government over the remainder of his or her life.

**Present Value:**refers to the discounting of future transactions to the current period by taking into account the potential for current money to be invested at a rate of interest.

**Productivity:**this study considers productivity to be the annual increase in real per capita GDP.

**Sustainable:**refers to government policy regarding taxation, transfer payments and government expenditure which satisfies the government's intertemporal budget constraint.

**Time Value of Money:**the time value of money simply indicates that money in the future is worth less than the same value of money today. This is because money can be invested at a positive rate of interest. That is, $100 one year from now is worth less than $100 this year, because $100 now can be invested at the current rate of interest for a year.

**Total Government Unfunded Liabilities:** this refers to the present value of government expenditure plus the present value of government transfer payments less the present value of taxes to the government plus current government net debt. That is, total government unfunded liabilities represent the discounted value of all future government deficits and surpluses plus current debt.

**Transfer Payment:**refers to the government's social safety net. That is, payments from the government to individuals in the form of pension plan payments, unemployment insurance, and welfare payments are all transfer payments from the government to individuals. Government expenditure on goods and services, such as health care, education, police protection, and the like, are not considered transfer payments.

**Section 3: Technical Appendix**

**The theory behind generational accounting**
IN LIEU OF LIQUIDITY CONSTRAINTS, WHETHER the government runs a surplus or a deficit in any given year is immaterial. What matters is the ability of the government to pay off not only today's consumption and debt obligations, but tomorrow's and those on into the future. Just because the government can afford a current year's consumption does not imply that it can sustain a given consumption stream or support a substantial initial debt load.

This is where generational accounting comes into play. First, abandon the confines of a single period government budget constraint, which is given in its simplest form for year t as follows:

where

T � Taxes paid to the government;

R � Transfers paid by the government;

C � Government final consumption expenditure on goods and services;

r � real interest rate on government debt for the period t-1 to t (this is equivalent to the discount rate);

Bg � gross stock of government debt in the previous period.

S � Surplus (net lending) generated by the government in period t (deficit if negative).

Governments interested in whether or not government policy is sustainable need to look at the government intertemporal budget constraint. Put succinctly by Auerbach and Kotlikoff, this budget constraint requires that "the present value of remaining net tax payments of existing generations + the present value of net tax payments of future generations = the present value of government purchases + official government net debt." [See Auerbach & Kotlikoff [1994].] That is, in present value terms, the net payments to the government must equal government expenditure plus the net debt of the government. Mathematically, the intertemporal government budget constraint for year t is given by:

where Bg refers to the stock of total all-government net debt. [The equations presented in the technical appendix follow the same notation used in Auerbach et al [1991].]

This study assumes a constant discount rate. In this case, equation (2) can be rewritten as:

where the discount rate is assumed constant over time at rate r, and Bg refers to the time t stock of total all-government net debt.

At this point it is necessary to explain why total all-government net debt, not gross debt, is used. Recall that net debt is gross debt less total financial assets. One reason why net debt is used is that it is the standard cross-country comparison figure. That is, using the generational accounts for different countries for comparison purposes requires the use of net debt. Second, net debt is of lesser value than gross debt and therefore is more conservative. The use of net debt implies that the government liquidates all of its total financial assets for the purposes of paying off its liabilities. In the long run--the time frame of the intertemporal budget constraint--the government will not hold financial assets so this logic is valid.

There are an infinite number of combinations of government policy (taxation, transfers, government expenditure) which satisfy this constraint. Any government policy which satisfies the government intertemporal budget constraint is considered sustainable. That is, in the long run, the government will collect enough net income to pay off all of its expenditure on goods and services and to meet all of its debt obligations, including payment of principle.

An alternative way of depicting the government intertemporal budget constraint is in terms of net payments from generations. The term generation refers to the members of a given age. The term net payments refers to the difference between government tax receipts of all types (such as federal, provincial and local income taxes) and government transfer payments of all types (such as CPP, QPP, Unemployment Insurance, Old Age Pension, etc.). Finally, all present values represent discounting with a real interest rate. Rewriting the government intertemporal budget constraint in terms of generations:

where
Nt,k � the present value of the net payments to the government remaining in the lifetime of the generation born in year k discounted to year t. D is the maximum length of life, assumed to be 99 in this study. The first element in the summation is Nt,t which is the present value of net payments of those born in the base year t, which is 1991 in this study. The last term in the summation of the first term is Nt,t-D which is the present value of remaining net payments of the oldest generation (those 99 years of age in 1991).

Note the zero-sum nature of intergenerational fiscal policy. Holding the right hand side of equation (4) fixed, decreasing the tax obligations of the living generations in the base year requires a corresponding increasing in the present value tax liabilities of future generations.

With this study's assumptions of a constant discount rate, equation (4) may be rewritten as:

The term Nt,k is defined in equation (4) as:

where
Ts,k = the projected average net payment to the government made in year s by a member of the generation born in year k. Define a generation's average net payment in year s as the average net payment across all members of the generation alive in year s.

Ps,k � the number of surviving members of the cohort in year s who were born in year k. For generations born during or prior to year t (1991 in this study), the summation begins in year t. For those born in year k, k>>t, the summation begins in year k. Regardless of the year of a generation's birth, the discounting is back to year t.

In terms of a constant discount rate, equation (6) may be rewritten as:

A set of generational accounts is simply a set of values of Nt,k, one for each existing generation and future generations, with the property that the combined total value adds up to the present value of government obligations (the right hand side of equation (4)).

Whenever the expected per capita present value of net payments by base year newborns to the government is less than the expected per capita present value of net payments of future generations to the government--that is, Nt,t Nt,k>>t--net payments must be increased or government expenditure decreased in order to satisfy the intertemporal budget constraint of the government.

**The methodology used to construct this study's generational accounts**
It is best for all parties involved, and a good general rule for research in general, to fully disclose the methodology behind one's work.

***Major assumptions***
The foundation of the generational accounts presented in this study stems from two major assumptions, both of which are standard in the generational accounting literature. First, the study treats future generations equally with the exception of productivity growth adjustments. This means that the future generations figure in the generational accounts, which gives the per capita present value of the net payment obligations of a newborn born after the base year, increases in real terms by productivity growth over time. That is, those born one year after the base year must pay the future generations figure in present value net payments, while those born two years after the base year pay the same value increased by the rate of productivity growth, and so on. The second major assumption is that the tax and transfer policies current in the base year extend for those living in the base year throughout the remainder of their lives. This assumption has the benefit of illustrating most clearly the need for change in government policy. This study does not assume that the actual changes in government policy that occur will follow this approach; most certainly they will not. Instead, this study adopts these assumptions because they are most illustrative of the fiscal challenges facing the Canadian economy.

***Background data sources***
First, one must determine the government sector taxes, transfers, expenditure and net debt as of 1991. This study uses the National Income and Expenditure Accounts for the tax, transfer and expenditure figures. [See table 36, Government Sector Revenue and Expenditure, p. 46-47 in Statistics Canada [1993].] Define government sector taxes as direct taxes (from persons, from corporate and government business enterprise and from non-residents) plus indirect taxes. Government sector transfers are defined as transfer payments (to persons, to business [both subsidies and capital assistance] and to non-residents) less other current transfers from persons. The study defines government expenditure on goods and services as government sector current expenditure on goods and services (which includes the capital cost allowance) less the capital cost allowance plus government sector investment in fixed capital and inventories. One removes the capital cost allowance in order to determine government sector expenditure in terms of cash flows. The net debt figure is $553.774 billion which comes from Richardson [1994b], p. 5.

Conspicuous by their absence are two major components of government transactions: interest on the public debt and government sector investment income. Interest on the public debt is not included because of the present value nature of the generational accounts. That is, the accounts discount government transactions back to the date of the net debt. At this date, liquidating government assets plus paying the present value of the future stream of net payments eliminates future government obligations including this period's interest obligation. Similarly, government investment income is not included because the study uses net debt which subtracts total financial assets from the gross debt. As the value of an investment asset is equal to the present value of its future income stream, subtracting total financial assets automatically eliminates the need to include government investment income. Also note that by subtracting total financial assets, which theoretically includes the present discounted value of the net income of the Bank of Canada, one accounts for government seigniorage revenue.

Next, the study makes use of the latest population projections provided by Statistics Canada's Population Projections division. [This study uses Population Projection 2 from the Population Projections division's four possible projections as of April, 1994. The second projection is a medium growth scenario which this study takes as the most likely case. Projection 2 assumptions are as follows. Average mortality in years is 76.2 male, 82.1 female in 2001; 78.5 male, 84.0 female in 2016. There is medium natural increase, medium immigration. Immigration is 250,000 people in 2001 and 2016. Emigration is assumed at 48,760 people in 2001, 53,970 people in 2016. There are expected to be 23,100 returning Canadians in 2001 and 25,630 in 2016. The number of non-permanent residents is assumed to be 149,600 in 2001 and 2016.] In particular, the study uses actual population estimates for 1991 and 1992 and combine them with the population projections up to 2041. The estimates are available broken into age cohorts. That is, the population projections provide detail regarding total numbers in each age bracket up to 2041. For example, one can determine the number of 40 year old males from 1991 to 2041. These population figures include returning Canadians. The study uses the five year average percentage change in the numbers of each cohort to extend these projections by cohort up to and including 2100. That is, take the number of members of each cohort in 2041 and extend this number to 2100 using the average growth in the cohort over the previous five years. At the end of this procedure, one has data on the number of people of each age from the year 1991 to 2100. As a note, the population figures on the elderly extend only by year until the age of 89 and the people 90 or over are aggregated in a 90+ category. The study assumes that the maximum lifespan is 99 years. One allocates the 90+ category in a descending fashion. [Readers may wonder why there appears to be a jump downward in the present value net payments received by 90 year olds over those received by 89 year olds. This is due to the study's assumption regarding maximum age. By using 99 as the maximum age, the study allocates those Canadians who are actually older than 99 among the 90-99 age group. This has the effect of attributing too much per capita transfers and taxes to the 90-99 age group. For this reason there is a jump downward in present value net payments. In terms of affecting the future generations' figure, the effect should be minimal. While the study may overestimate the extent to which those 90-99 are net receivers from government, the study doesn't extend the age group beyond 99. This implies that total present value payments of those aged 90-99 are understated, given that people have the potential to live past 99 years of age.>
]

In order to be able to determine the present value of government expenditure, taxes and transfers, it is necessary to allocate the 1991 government expenditure, taxes and transfers among cohorts. To do this, the study employs the Taxation Statistics (1993 addition), which analyzes the 1991 T1 tax returns. The 1991 tax return analysis was the most recent available at the time this study was commissioned. As a result, 1991 is the base year for this study. The Taxation Statistics publication summarizes the information given in the 1991 T1 forms by age-group and sex. One uses the summaries regarding all returns, not just taxable returns. A major benefit of the Taxation Statistics publication is that it categorizes many different income sources. In particular, the publication acknowledges 24 sources of income: employment income before deductions, commissions, other employment income, old age security pension, CPP or QPP benefits, other pensions or superannuation, family allowance, unemployment insurance benefits, taxable amounts of dividends, bond interest, bank interest, mortgage interest, income from trusts, annuity income, foreign investment income, net rental income, taxable capital gains, RRSP income, net business income, net professional income, net commission income, net farming income, net fishing income and other income.

A quick glance at the generational accounts in the appendices reveals that the study does not provide separate accounts for each sex. The standard generational accounting methodology differentiates on the basis of sex. This study does not for two reasons. First, the Taxation Statistics data are biased on the basis of sex due to the fact that the data are from filed tax returns, not from a micro data sample of individual income. Indeed, even the split between the income married couples receives is difficult to determine. The study assumes that while the sex differentiation is biased in Taxation Statistics, the age differentiation is not. Second, differentiating on the basis of sex ignores such trends as the increasing labour force participation of women. To attribute current taxation levels for females twenty years from now, for example, is not appropriate. For these reasons, the generational accounts are calculated for the average person, not for average males and females. [However, there is a price to be paid for neglecting differences based on sex. This occurs because men and women generally face different allocations of transfers and certain types of government expenditure (eg. health expenditure). Failure to differentiate on the basis of sex may introduce forecast error. However, such effects will only result when the proportion of males and females in each age group changes significantly in the future. This is not the case for Canada.]

An additional assumption comes into play regarding how to allocate income by age. The Taxation Statistics data are in age groups: under 20, 5-year age groups from 20-24 to 70-74 and 75+. The study assumes that those aged 0-17 do not pay tax and do not receive transfers. As such, any allocation of income in the Under 20 group occurs only for 18 and 19 year olds. In allocating income, one takes the total income of an age group and allocates this income on the members of each age in the age group on the basis of that age's proportion of the total number of people in the age group. That is, if 20-24 year olds account for 20 percent of total income, then 23 year olds account for the total number of 23 year olds divided by the total number of 20-24 year olds times 20 percent of total income.

**Step 1: Determine the Present Value of Government Expenditure**
To begin constructing the generational accounts for Canada, one applies the previous technique to government expenditure. The study splits government expenditure into three categories: health, education and other. The study uses the Public Finance publication from Statistics Canada to determine the total health and education expenditure in 1990 (the latest available data). [See the 1990/91 column of table H10, Consolidated Federal, Provincial, Territorial and Local Government Expenditure - Canada Total: Fiscal Years 1965/1966 to 1991/1992, p.164-165 of Statistics Canada [1991].] The study estimates 1991 health and education expenditure by increasing both costs by the same percentage change as total government expenditure (between 1990 and 1991). The Other category in 1991 is the residual of total expenditure less health and education expenditure.

Health expenditure is allocated by age on the basis of the 1990 Survey of Family Expenditures data from Statistics Canada. The data provide an estimate of the total percentage of health expenditure spent on each age. The study applies these figures to the total 1991 health expenditure figure and the 1991 population statistics to determine the total health expenditure on each age group in 1991. At this point, one determines the stream of health expenditure on each age group from 1991 to 2100. The study determines the present value of health expenditure from 2101 on by assuming that health expenditure grows at the average rate of total population growth from that point forward. As with all other taxation and transfer statistics, one assumes that the per capita real expenditure increases at the rate of productivity growth, defined here as the historical Canadian annual percentage change in real GDP per capita.

For education expenditure, the study also uses Statistics Canada's 1990 Survey of Family Expenditures to determine the relative proportion of each age that goes to school. The study divides the education figure into three categories: elementary, secondary and post-secondary. Using statistics from the Historical Education Finance Statistics publication (the study assumes the preliminary 1990-91 results hold for 1991), one determines the expenditure allocation between elementary-secondary and post-secondary schooling. [This study uses Chart 2 on p. 18, Expenditures on Education, by Level, Canada, 1985-86 to 1990-91, Statistics Canada. The data for 1990-91 are preliminary.] The study assumes that elementary and secondary schools split their aggregate expenditure equally between themselves. One assumes that elementary school is from kindergarten to grade 7 (ages 5-12) and secondary school is from grades 8-12 (ages 13-17). Moreover, one assumes that per capita expenses are equal among grades within the type of school (elementary and secondary). This allows for the division of total 1991 elementary-secondary education expenditure among ages 5-17. One assumes that those aged 0-4 receive no education, and that only those aged 18 and over attend post-secondary education. To divide post-secondary education, the study again uses Statistics Canada's 1990 Survey of Family Expenditures data. This allows for the allocation of education expenditure among those aged 18 and over. Using the same techniques described for health expenditure, one determines the total education expenditure on each age group from 1991 to 2100 as well as the present value of each age group's education expenditure after 2100.

This study uses a slightly different technique for the Other expenditure category. The study assumes that this portion of government expenditure is on public goods, goods which each member of society can benefit from equally. As a result, one assumes that the per capita allocation of this expenditure among all ages is identical. That is, a 54 year old receives as much of this expenditure as a 6 year old or a 98 year old, for example. This logic applies to such public goods expenditures as traffic lights, roads, parks and police protection. After allocating the expenditure equally on a per capita basis, one determines the total Other expenditure on each age for 1991. The study then adjusts this expenditure for the percentage change of each age, plus productivity growth each year, up until the year 2100. After this point, one determines the present value of the remaining infinite stream of Other expenditure by growing each age group's Other expenditure at the rate of the last 25 years' total population change plus a productivity boost. This also makes sense. In the long run, one would expect the population in each age bracket to grow equally.

This completes the government expenditure analysis. The assumptions ensure that per capita real government expenditure remains constant per generation member with the exception of annual productivity growth increases. Thus, the generational accounting analysis of this study provides for a productivity-enhanced "business as usual" approach to government expenditure. This highlights the need for changes in government fiscal policy and does not reflect the actual change to government spending patterns that will occur inevitably.

**Step 2: Determine the Government's Total Bill**
The study adds the present value streams of each type of government expenditure--health, education and other--to the government's net debt as measured nearest March 31, 1991. The study uses the total all-government debt excluding CPP/QPP unfunded liabilities for the fiscal year nearest March 31, 1991 from p.7 of Richardson [1994b]. [The study does not include CPP/QPP unfunded liabilities because the generational accounting technique automatically estimates unfunded liabilities and including the Richardson unfunded liabilities estimate in the net debt figure is redundant as well as incorrect given differences in methodology.] This is the value of the total government bill.

**Step 3: Determine the Present Value of Transfers from Government to Existing Generations**
Next, one determines the present value of transfers received by those living in the base year, 1991. Define two categories of transfers: personal transfers and business transfers. Define personal transfers as direct transfers to persons plus direct transfers to non-residents less other current transfers from persons. Define business transfers as direct transfers to business (subsidies and capital assistance). The study allocates personal transfers on the basis of the Taxation Statistics data regarding transfers. The study defines the following (using the sources of income in Taxation Statistics) as transfer income: Old Age Security pension + CPP or QPP benefits + Family Allowance + Unemployment Insurance benefits - CPP or QPP contributions - Unemployment Insurance premiums - gifts to Canada or a province - social benefits repayment. Using relative population proportions in age groups, one allocates personal transfers per age group into total personal transfers per age. One allocates business transfers on the basis of capital income. In terms of the Taxation Statistics publication, the study defines capital income as the taxable amount of dividends + bond interest + bank interest + mortgage interest + income from trusts + annuity income + foreign investment income + net rental income + taxable capital gains + RRSP income. Then using relative population proportions and the capital income data, estimate the total business transfers by age. Summing the total business transfers by age and the total personal transfers by age provides total transfers by age. One extends this series using the percentage change in each age group plus productivity growth every year.

**Step 4: Determine the Present Value of Taxes to Government from Existing Generations**
Similarly, the study categorizes taxes as direct taxes from persons, corporate taxes and indirect taxes. Direct taxes from persons, in the language of the National Income and Expenditure Accounts, refers to direct taxes from persons plus direct taxes from non-residents (withholding taxes). Corporate taxes refers to direct taxes from corporate and government business enterprise. Allocate direct taxes from persons on the basis of the "total tax payable" figures of Taxation Statistics, which measure actual personal tax payable. Using relative population proportion techniques as described above, one can determine the total direct taxes from persons paid by each age in 1991. The study allocates corporate taxes on the basis of capital income in a manner identical to the method used on business transfers. This allows for the estimation of total corporate tax paid by each age in 1991. The study allocates indirect taxes on the basis of factor income. Here, factor income refers to total income (as defined by the Taxation Statistics' Sources of Income) less transfers. Thus, the study uses the total income figures in the Taxation Statistics publication and allocates these values among each age on the basis of relative population proportion. One then subtracts the total transfers calculated previously for each age. This provides a percentage breakdown of factor income for each age. Apply these percentages to the total indirect taxes paid to the government sector in 1991 to determine the amount of indirect tax each age paid in 1991. Next, sum the three taxes--personal tax, corporate tax, indirect tax--paid by each age in 1991 to determine the total tax paid by each age in the base year. Then using identical techniques as with the transfer data, one determines the total tax paid by each age. [Auerbach et. al. [1991] give special treatment to capital income taxes to account for possible measurement error. This study does not. One potential problem with the Auerbach et al technique is that it ignores the possibility of capital inheritance from the old to the young. Interested readers are referred to Auerbach et al pp. 67-69 and appendix as well as Kotlikoff [1992] pp. 136-137.]

**Step 5: Determine the Present Value of Net Payments from Existing Generations to Government**
Unlike the government expenditure estimates which determine government expenditure from the base year to infinity, the tax and transfer estimates need only be performed to that point in the future sufficient to account for the remainder of the lifetimes of those alive in the base year. By assuming that the maximum lifespan is 99, the most anyone can live who is alive in 1991 is a person born in 1991 which allows for a maximum possible death date of 2090. Combine the tax and transfer estimates to determine the total remaining lifetime tax payments and transfer receipts for persons of each age in 1991. Taking the present value of these series provides the present value total tax bill and transfer receipts for each age. Divide these figures by the numbers of each age in 1991 to determine the expected present value tax bill and transfer receipts of each member of a particular age in 1991. These estimates make up the majority of the generational accounts. One sums the present value taxes and transfers for each age which provides the total present value net payment obligation of the existing generations in the base year.

**Step 6: Determine the Present Value Net Payment Obligations of Future Generations**
The final step in the construction of generational accounts is to determine the present value net payment obligations of future generations. Using equation (5), one determines the necessary total present value net payment burden of future generations as a residual; it is equal to the present value of government expenditure plus the government net debt less the present value net payment obligation of living generations. To complete the generational accounts, it is necessary to determine the future generations' value which gives the per capita present value net payment obligation of newborns born after the base year, in this case, 1992 on. Using an iterative procedure, one estimates the future generations value. If each newborn in 1992 is a net contributor to the gove