# Aging, Saving, Productivity Growth and Canadian Incomes to 2050: Some Sombre Sketches

Presentation to the
Office of the Chief Actuary's Seminar
*Demographic, Economic and Investment Perspectives of Canada: Years 2003 to 2050*

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18 March 2003

Summary

Growth in labour income and investment returns are critical to the outlook for publicly funded elderly benefits and the Canada and Quebec Pension Plans. Prospective slower growth and rising average age of Canada's population may lower saving rates and productivity growth in the future. The resulting slower growth of aggregate income would adversely affect returns to both labour and capital. This paper uses a simple growth-accounting framework to outline the possibilities. Our projections illustrate some possible damping effects of lower savings and productivity growth on aggregate income and shows that the increases in work effort from older workers necessary to offset the adverse effects are completely unrealistic. The paper concludes that upcoming actuarial investigations of the future costs and sustainability of elderly benefits and the CPP should adopt cautious assumptions about the robustness of both future growth in labour income and returns on investment.

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## Introduction and Overview

As a social insurance program that takes contributions from Canadians when they are working and pays benefits to them when they are retired or out of the workforce for specified other reasons, the Canada Pension Plan (CPP) and the Quebec Pension Plan (QPP) have always depended on growth in labour income for their funding base. Since the 1998 reform package that more fully funded it, the CPP's ability to pay promised benefits at the currently scheduled contribution rate has become, like that of the QPP, dependent also on rates of returns on investment.

The Old Age Security (OAS), Guaranteed Income Supplement (GIS) and other programs providing benefits to the elderly depend on the federal government's consolidated revenue fund, and therefore principally on federal tax revenues from personal income, personal consumption, and business income. Like the CPP and QPP, then, the OAS/GIS system ultimately depends on a base that is closely associated with aggregate incomes in Canada.

A population, and especially a working-age population, that grows more slowly in the future than it has in the past, and the average age of which is rising, may affect the funding base for these programs in several ways. The impact of a changing age structure on the share of the population that is working, and on the overall growth of labour income, assuming constant rates of labour productivity growth, is a familiar topic for actuaries and economists studying the long-term future of the CPP and OAS/GIS. In this paper, we discuss the possibility that demographic changes may affect saving and productivity growth as well.

Our tentative conclusions about the outlook for real income growth, and therefore for the funding base of these programs, are relatively gloomy. We close with some speculation about ways in which private behaviour and public policy may affect and, with sufficient skill and luck, improve the outlook. A quick investigation of the amount of extra work that would be required to offset the negative impacts of lower saving and productivity growth in aggregate incomes — an investigation that reveals the required effort, especially if the older population is expected to provide it, to be unrealistic — reinforces the conclusion that future investigations of the cost and sustainability of these programs ought to adopt cautious assumptions about the future growth of real aggregate incomes in Canada.

## Productivity and Canada's Standard of Living

Our focus in this paper is exclusively on real income growth in Canada. While nominal growth — that is, increases in income measured in current prices, including the effects of general price inflation — matters for some elements of the public pension system,[1] for the most part, the key question is how quickly the base for these programs will grow relative to the demands on them.

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[1] Inflation, for example, erodes the value of the Year's Basic Exemption in the C/QPP, making it helpful to the plans' financial positions.

A common framework that accounts for growth in living standards with reference to the contributions of labour, capital, and productivity is a useful aid to thinking about Canada's progress in the past, and highlights some reasons for concern about the future.

*A Simple Growth-Accounting Model*

The first factor highlighted by the standard growth-accounting framework is labour — essentially a measure of the physical and mental effort expended by people at work. A common simple index of labour inputs is persons employed; another, somewhat more sophisticated index is hours worked. Over the 26 years from 1976 to 2002,[2] rapid growth in the population of traditional working age (20 through 64), a rise in the ratio of actual employment to the population of traditional working age and a mild downward trend in the average hours of work per employed person have combined to produce a 1.6 percent annual increase in hours worked in the Canadian economy.[3]

The second factor, capital, is a measure of the accumulated wealth produced by past saving.[4] When the focus of analysis is output — gross domestic product (GDP) — the relevant measure is physical capital: the housing, plant, equipment, structures and infrastructure in the country. When the focus of analysis is income — gross national product (GNP) — the net position of an economy with respect to outsiders (its net foreign assets) also matters. Over the 25 years from 1976 to 2002, Canada's stock of physical assets minus its net foreign liability — national net worth — grew at an annual average rate of 2.6 percent in real terms.[5]

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[2] We begin in 1976 because that is the earliest date from which consistent labour-force data are available (Statistics Canada, CANSIM, Table 282-0016).

[3] More sophisticated breakdowns of labour inputs are possible. People have different skills, and some measures of labour input use changes in compensation to adjust for changes in skill levels over time. Because skills are hard to measure and productivity and compensation may not match perfectly, however, we prefer a simpler measure that allows changes in skill levels and productivity to emerge in an aggregate productivity variable. Similar arguments can be made with respect to capital, which can be classified by type of machine or structure and vintage, or translated into flows of capital services. Again, to the extent that such decompositions attribute productivity increases resulting, for example, from better organizational practices to improvements in the capital stock, they may be less illuminating than a decomposition that locates these changes in a measure of aggregate productivity.

[4] Some analysis treats human capital as a separate factor of production, but the uncertainties involved in its measurement make it much less tractable for this kind of analysis. Rather than treat it separately, we implicitly include it in our discussion of labour inputs and in the residual category of productivity.

[5] We convert nominal wealth totals to constant 1997 dollars using the GDP price index. We estimate wealth in 2002 by applying to 2001 GNP the average increase in wealth as a share of GNP from 1976 to 2001 (Statistics Canada, CANSIM, Table 378-0004).

The third factor, productivity, describes increases in output and incomes beyond what increases in labour and capital inputs can "explain". Increases in this factor arise from many sources — new ideas arising from research in Canada and elsewhere, new skills embodied in workers and managers and new technology embodied in machinery and structures. In one widely used class of growth models, the contributions of labour and capital to output are assumed to be proportional to their shares in income.[6] Applying that model to Canada from 1976 to 2002 — during which period labour compensation accounted for 64.2 percent and capital income 35.8 percent of total factor income[7] — would yield a compound average annual rate of increase in measurable inputs (a weighted index of labour and capital together) of 2.0 percent annually. Since actual increases in real income averaged 2.9 percent annually during that time, the contribution of productivity growth would be 0.8 percent annually (the missing 0.1 is due to compounding).

The growth-accounting exercise just described in summary is shown in more detail in Table 1. The top panel shows aggregate amounts; the bottom panel shows the same breakdown in terms that speak more directly to per-person living standards. With population growth of 1.1 percent annually, the per-person increases in inputs are scaled down accordingly: the weighted average of labour and capital grew 0.8 percent annually over the 26 years which, when combined with 0.8 percent annual productivity growth, yielded 1.7 percent compound annual growth in real income per person.

*A Baseline View of the Future*

The growth-accounting framework just summarized does more than shed light on past performance: it also permits informed speculation about the future. As is increasingly well known, the future outlook for Canada's labour market contrasts in important ways with past experience. The baby-boom of the 1950s and early 1960s, and the subsequent steady declines in fertility rates, means that the next three decades will see a substantial increase in the average age of the population, and slower growth in the population of traditional working age.

To quantify the implications of these changes, we use projections from a population model maintained at the C.D. Howe Institute.[8] We then project hours worked on the basis of province-

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6 These models use the Cobb-Douglas production function, which has the form $Y=L^{1-\alpha}K^{\alpha}A$, where: Y is output or, in our exposition, income; L is labour inputs; K is capital inputs; A is technology; and the exponents $1-\alpha$ and $\alpha$ are labour's and capital's shares of incomes in the economy.

7 Our measure of total factor income is wages, salaries and supplementary labour income, plus before-tax profits of private and government-owned businesses, plus interest income, plus capital consumption allowances (Statistics Canada, CANSIM, Table 380-0001).

8 The C.D. Howe model is adapted from a population projection model developed by the International Labour Organization (www.ilo.org). We develop separate projections for each province, using province-specific fertility, mortality and migration data, and aggregate them to the national total (we assume that inter-provincial migration decreases from 1992-2001 average levels to zero over a 10-year period, reducing the impact on the projections of migrations between provinces with

specific participation rates for each five-year age group and sex, and Canada-average hours-per-week data (for the age-groups 15-24, 25-54, 55-64 and 65+). These assumptions produce an annual average growth rate of labour inputs — that is aggregate hours worked — of only 0.2 percent during the next 48 years. Figure 1 shows the projection for the number of hours worked per week until 2050.

There are many reasons to think that demographic changes and the slower growth in labour inputs they imply will affect saving and productivity growth. Before turning to those subjects, however, we use our growth accounting model to project aggregate real income in Canada to 2050. We assume that labour inputs will evolve as just illustrated. We also assume, for this baseline projection, that Canadians in aggregate save the same share of their incomes (from which they finance increases in physical capital and net foreign assets) in the future as they did from 1976 to 2002.[9] Finally, we assume that productivity growth will continue at the 0.8 percent annual rate it registered from 1976 to 2002. The results of this modeling exercise are shown in Table 2.

Not surprisingly, this scenario is one in which income growth is less rapid than it has been historically. Aggregate real income grows at an average compound annual rate of 1.8 percent from 2002 to 2050 (top panel of Table 2), or 1.4 percent in per-person terms (bottom panel).

*Labour and Capital Incomes under the Baseline Scenario*

This overall figure for income growth is a reasonable approximation of the outlook for the funding base for OAS and other elderly benefits. As such, it is not especially alarming — the recent actuarial report for the OAS appears to envision overall real income growth over the 2002-2050 period that is lower than this.[10]

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different fertility and mortality rates). We assume that each province's fertility rates stay constant at 2001 levels, that their mortality rates decrease slowly in line with past experience, and that international migration levels stay constant at the 1992-2001 average level throughout the projection period, yielding a net immigration rate that decreases slowly from 0.57 percent of the population to 0.5 percent over a period of 20 years.

9 Our measure of the aggregate saving rate is the annual increase in national wealth as a share of that year's GNP, all measured in constant 1997 dollars. From 1976 to 2002, the average increase in real wealth was 8.9 percent of GNP. The projections in Table 2 assume that the aggregate saving rate registered that historical-average figure in 2002 (it was 8.8 percent in 2001) and stays there.

10 The 2002 actuarial report does not show a figure for real GDP, but it envisions a compound annual growth rate for nominal GDP of 4.2 percent from 2002 to 2050, and a compound annual increase in the consumer price index of 2.8 percent over the same period (calculated from figures in OCA 2002a, pp. 50 and 18 respectively). If the rate of GDP price inflation were to be the same as that of the consumer price index, the report envisions compound annual growth in real GDP of only 1.3 percent.

Whether it is also a reasonable indicator of the situation facing the funding base for the CPP and QPP is open to discussion, since labour compensation, which approximates the contribution base for the CPP and QPP, and returns to capital, which is logically related to the income on the funds invested in the plans, may not move in tandem. On the whole, however, we incline to see the overall income growth figure as useful for both. Over time, the shares of labour and capital income mentioned in Canada have been remarkably stable[11] — a fact that has been remarked in other countries also (which helps explain the popularity of the production function underlying our stylized model).

The straightforward implication of stable income shares is that the compound annual rate of growth of both labour and capital income from 2002 to 2050 will be very close to the rate of growth of aggregate income — 1.8 percent in real terms in our base scenario. Again, this projection is not, on its face, alarming. Recent actuarial reports on the CPP projected growth in real contributory earnings of 1.7 percent which, after allowing for the erosion of the Year's Basic Exemption by inflation, likely implies aggregate real labour income growth of around 1.6 percent. More problematic are the implications for returns on investment: it is hard to see how aggregate real growth of capital income of 1.8 percent can support real investment returns on domestic assets in the 3.8-percent to 4.5-percent range contemplated in recent reports (OCA 2002b, 11).[12]

**Possible Impact of Workforce Aging on Saving and Productivity**

Before turning to some considerations that might make the outlook more cheerful than the one just outlined, there are two further awkward possibilities to add to the mix. One is the possibility that an older population will save less. The other is adverse implications of an aging workforce for productivity.

*Aging and Saving*

Our baseline projection assumed that the aggregate national saving rate, expressed as a share of national income, would not change over the next half-century. The well-known life-cycle model of consumption and saving, however, suggests that saving rates, at least in the household sector, may be sensitive to demographic change. This model predicts that saving is minimal or even negative

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[11] The standard deviation of their annual shares over the 1976-2002 period is 1.7 percentage points, and a regression against a time trend yields an $R^2$ of 0.4 percent.

[12] We are conscious that this assumption of similar growth rates for both components of income is not consistent with a key argument made by supporters of fuller funding for the CPP and QPP (including Robson 1996), namely that returns on financial assets will likely exceed growth of contributory earnings in the future, allowing a more fully funded plan to operate at a lower contribution rate than a less fully funded one. Leaving aside the important possibility that funds invested abroad will earn higher returns, we think that, absent better understanding of the reasons for the margin of investment returns over growth rates in historical data, future projections should not assume that this margin will be very large.

during an individual's early working years, when income is low. Maximum saving occurs when workers are between fifty and sixty, when income is highest. Finally, during retirement there is dissaving, as the consumer draws down accumulated wealth to meet living expenses.

Fougère and Mérette (1999) calculate personal saving rates by age group in Canada, excluding private pension income, and find that the saving rate declines rapidly after age 54, turns negative around age 60-64 and remains negative or close to zero for older households. This pattern is consistent with the predictions of the life-cycle model. If this model applies to Canada, population aging may lower the household saving rate. Their projections call for a slight increase in the personal saving rate until about 2010, as the effect of the reduction in the share of young dissavers dominates the effect of the increase in the proportion of old dissavers. When the increasing share of old dissavers begins to dominate after 2010, however, they project that population aging will reduce the personal saving rate. Simulation results from their econometric model suggest that by 2050, the direct effect of population aging may cut the personal saving rate in half.

If we adopt that assumption (illustrated in Figure 2) in our model,[13] and assume that aggregate public sector and business sector saving rates remain the same (an issue we discuss further below), lower household-sector saving translates straightforwardly into lower aggregate saving. As noted earlier, the aggregate saving rate, defined as the yearly addition to real wealth as a share of real GNP, averaged 8.9 percent between 1976 and 2002. Saving in the household (personal and unincorporated business) sector averaged 7.9 percent of GNP over the same period, meaning that household saving accounted for almost all of aggregate saving. If we make the aggregate saving rate follow the pattern predicted by Fougère and Mérette, it increases slightly to 9.6 percent by 2010 and then slowly declines to reach 4.5 percent in 2050.[14]

Inserted into our stylized model in place of the steady saving rate in the base scenario, this trajectory for saving boosts income growth initially, then depresses it. Over the entire 2002-2050 period, compound annual growth of real income registers 1.7 percent rather than 1.8 percent as in the base scenario.

*Aging and Productivity*

The second concern arises from data on workforce age and productivity. Work by Mincer (1974) and others suggests that worker productivity, like saving rates, follows a hump-shaped pattern through

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[13] Fougère and Mérette's model uses different population projections, and has a different baseline household sector saving rate. Given the wide range of uncertainty that exists around the links between age and saving, we feel comfortable ignoring these differences in an illustrative exercise.

[14] Fougère and Mérette predict that the personal saving rate would increase by 10 percent between 1997 and 2010 and fall to half of its 1997 level by 2050. To account for the fact that our projection starts with the 2001 observed aggregate saving rate rather than in 1997, we make the aggregate saving rate increase by 8 percent until 2010 and fall to a little over half of its 2001 level by 2050.

life, rising from the 20s through middle age and into the 50s, then falling off sharply in the 60s. The relevance of this evidence for productivity on a national level gets support from the work of Feyrer (2002), whose cross-country regressions find that countries with a large proportion of workers in their teens, twenties and thirties are significantly less productive than countries with large cohorts in their forties, and in Guillemette (2003), who finds a statistical association between past changes in the age-structure of the Canadian workforce and multifactor productivity in the business sector. Both studies find that labour-force members in their sixties are markedly less productive than other workers, implying that an increasing proportion of actual and potential workers in their sixties would depress aggregate productivity.

Because the measures of productivity in these studies are less encompassing than the aggregate measure we use here, their results are not directly applicable to our future projection. Suppose, however, that — consistent with the cross-country and Canadian evidence — workers in their 60s tend to be 70 percent less productive than other workers. If that is so, the influence of the changing age structure on aggregate productivity would be negative in coming years. To illustrate, we give the 0.8 percent historical annual increase in aggregate productivity a 50 percent weight in the projection of future productivity, and give the demographically-driven multifactor productivity projection of Guillemette (2003) the other 50 percent.[15] The resulting time-profile of productivity is shown in Figure 3.

Future productivity growth along these lines, inserted in our baseline model, produces compound annual average growth in aggregate real income of 1.3 percent annually between now and 2050, implying concomitant decreases in the growth rates of its labour- and capital-income components.

*A Sombre View of the Future*

These two possibilities are troubling considered on their own, and more so when considered together, because they interact. If they both came to pass, Canadians could look forward to aggregate income growth of only 1.1 percent (as illustrated in Table 3). Applying this aggregate figure to labour and capital income separately implies a bleak outlook for the funding bases of all pensions, including publicly funded ones.

**Focus on Work, Saving and Productivity: Key Questions**

The key implication of this speculative exercise is the desirability it indicates for conservative assumptions when projecting outcomes for key programs such as publicly funded pensions.

Having said that, however, we emphasize that the gloomy scenarios sketched above are the outputs of a simple modeling exercise. There is nothing preordained in them. In the following sections, we

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[15] This method accounts for the likely effect of aging on aggregate productivity, while staying conservative and recognizing that the productivity measure used here is more inclusive than multifactor business-sector productivity, and trends upward in a stronger fashion.

discuss some of the uncertainties affecting the outlook, and some of the behavioural and policy changes that need more study.

*Potential Influences on the Supply of Labour*

To begin on the positive side, the quality of Canada's human capital — the health and education of Canadians generally, and potential workers particularly — provides room for optimism about the supply of labour in the future.

The improvements in life expectancy that give rise to concerns over the sustainability of the pension system also signal improvements in healthy life expectancy that could lead Canadians to stay in the labour market longer, and work more effectively while they are there. Rising rates of obesity and related conditions such as adult-onset diabetes among younger Canadians may be reflected in rising disability rates and, in the farther-distant future, leveling off or even reversal of the trend toward improved health for the older population. For several decades yet, however, the life-time effects of better nutrition and preventative medicine in youth and improved medical technology later in life seem likely to lead to continued improvements in the health status of the older population, and a concomitant potential for increases in its participation in the workforce — increases that previous projections for the OAS, CPP and QPP have taken into account, but which could provide further positive surprises.

At least as striking as the improvements in Canadians' health status are their improvements in educational attainment. Although the pattern is uneven across provinces, Canadian elementary and secondary schools appear to do a good job by international standards,[16] and the share of the working-age population that has at least finished high school is rising rapidly.[17] Postsecondary education in Canada has every appearance of a success story. Enrolments rates are extraordinarily high by historical and world standards, a majority of the working-age population now has postsecondary credentials,[18] and innovation in the sector promises better matches for students seeking personal and career-related development. These developments are positive in their implications for the supply of work effort in the Canadian economy. Labour force participation increases with educational attainment, and the differences in participation rates between more and less educated people are

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[16] Robson and Hepburn (2002) provide a summary of some of the TIMSS and PISA results.

[17] Between 1990 and 2002, the share of the labour force aged 25-54 with less than high-school education fell from 23 percent to 12 percent (Statistics Canada, CANSIM, Table 282-0004).

[18] Among the entire labour force aged 15 and over, the share with postsecondary credentials rose from 40 percent in 1990 to 53 percent in 2002. Among those aged 25-54, the shares were 46 percent and 60 percent (ibid).

greater among the older age cohorts.[19]

More ambiguous in its effects are the impact of rising labour incomes per person. Even in our less cheerful scenarios, labour incomes do rise relative to today's, thanks to increases in the amount of wealth per worker and in productivity. Considered alone, the relatively greater rewards of working relative to leisure — what economists often call a "substitution effect" arising from changes in relative prices — would suggest that these higher incomes will keep workers on the job longer. At the same time, however, greater personal wealth arising from higher earnings — what economists often call an "income effect" — will make leisure more affordable. Considered alone, this influence would suggest that higher incomes will encourage more vacations and earlier retirement. Our present state of knowledge makes strong claims about which of these forces will dominate in the future unwise. The trend toward earlier retirement over a period of many decades suggest that the greater affordability of leisure has been the dominant influence in the past, but people are not identical, and a healthier and better educated older workforce may not behave the same way.

Turning to negative factors, the prospect of higher returns to labour may induce even larger investments in formal education and other types of human capital investment in the future than we see currently (Scarth, 2002). Although a more educated population bodes well for workforce participation later in life and for productivity, the need to take time out from work in order to make those investments means that younger Canadians may, in the future, supply less labour in the formal economy than they do now.

Another factor that we are inclined to include under potential negatives is immigration. In view of the importance of immigration to future growth in the working-age population, this may seem odd, but the fact that our baseline projections already include an important contribution from immigration limits the potential for immigration to improve the outlook further. One difficulty is that competition for the immigrants Canada seeks will be intensifying as other developed countries age and as developing countries go through their demographic transitions to lower birth-rates. Canada competes most particularly with the United States for immigrants, furthermore, and the balance of taxes and public amenities offered by the two countries — particularly for high-productivity, high-earning workers — may not evolve in Canada's favour if the less favourable demographic trends on this side of the border result in relatively slower income growth. A second difficulty is that, as time goes by, the experience of immigrants in the Canadian labour market appears to be getting less and less happy — for a variety of reasons the convergence between the earnings of immigrant and the Canadian-born that was evident in past decades seems not to be occurring for more recent cohorts.[20]

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[19] Among those aged 25-54, labour force participation by those with postsecondary degrees is one-quarter again higher than by those with less than secondary education in 2002 (90 percent versus 72 percent); among those aged 55-64 it was almost half again higher (61 percent versus 42 percent); among those 65 and up it was more than twice as high (11 percent versus 4 percent) (ibid).

[20] Recent census data, for example, showed that immigrant earnings are no longer converging with those of the Canadian-born of the same age. In 1980, immigrants who had been in the country 10

A further key influence on the future supply of labour in the Canadian economy is the personal tax and transfer system. Here again, the difficulty of sorting out the primacy of income and substitution effects complicates the discussion.

The average tax burden may rise in the future as demographic changes increase the demand for transfer payments and health care more than they reduce the demand for child benefits and education.[21] Other things equal, a higher average tax burden will make people feel poorer — an income effect that increases the likelihood that they will work.

The pattern of marginal effective tax rates — the amount of each additional dollar earned that a person keeps after taxes and losses of means-tested benefits — is much more difficult to predict, which makes the substitution effect that will influence future workers in Canada a matter of conjecture. At the moment, income-tested supports and various income, payroll and consumption taxes create high marginal effective tax rates at modest incomes. Many low-income seniors face marginal effective tax rates of 100 percent or more.[22] The further spread of means-tested benefits — if, for example, income-tested co-payments begin to apply to a wider range of publicly funded medical services — would provide a powerful disincentive to work for those affected.

Before closing this brief survey of influences on the future supply of labour in Canada, at least two institutional factors warrant a comment.

Compensation arrangements are evolving in response to changing labour market conditions, and the interaction of employer-employee bargaining (formal and informal), new management practices and regulation will produce new arrangements in the future. The range of possibilities here is too wide for this brief survey, but to the extent that greater employee bargaining power results in improved working conditions — better crafted benefit packages, flexible hours, more ergonomic equipment, telecommuting, and so on — the likelier it is that workers will stay on the job longer. To the extent

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years were earning the same as their Canadian-born contemporaries; in 1990, immigrants who had been in the country 10 years were earning only 90 percent of what their Canadian-born contemporaries were earning; in 2000, the comparable figure was 80 percent (Statistics Canada 2003, 12).

21 Robson (forthcoming) calculates the present-value equivalent of the implicit assets and liabilities associated with deferred taxes and government pension, health, and education programs over a 50-year horizon. The net figure is an implicit liability of some $1.5 trillion, suggesting that population aging will put upward pressure on tax rates (and downward pressure on government-sector saving) over the projection period.

22 The combined impact of the federal GIS and Ontario's Guaranteed Annual Income for Seniors, for example, is a 100-percent effective marginal tax rate on low incomes, and a 125-percent effective marginal tax rate on dividend income (Shillington 1999). Provincial geared-to-income tax credits also matter, as do programs such as the Ontario Drug Benefit, and subsidies geared to family income or assets for home and long-term care (Shillington forthcoming).

that greater employee bargaining power results in higher pay, the effects on worker retention are harder to predict, because of the cross-cutting income and substitution effects already discussed. To the extent that greater employee bargaining power results in richer deferred compensation, the likelier it is that workers will leave the workforce. Public policies such as taxation and pension regulation can make a major difference in these areas.

The second institutional factor worth a note is the special challenge of public-sector employment. Earlier retirement among public-sector workers has been a pronounced trend in the workforce over the past 25 years. In the mid-1970s, the self-employed, private-sector employees and public-sector employees all had a median retirement age of about 65 years; by 2002, the median age had barely changed for the self-employed, had fallen by about three-and-a-half years — to 61.4 — for private-sector employees, and had fallen by almost seven years — to 58.1 — for public-sector employees.[23] There is more than one potential explanation for this trend, among them: cash accounting that shows current-year savings from early-retirement programs but neglects their longer-term costs; agency problems when such programs are designed by negotiators who will be among the first to take advantage of them; and chronically bad labour-management relations. The possibility that reforms to service delivery and other practices might make public-sector employment more attractive to older workers cannot be ruled out. On the whole, however, we would speculate that the future shares of private- and public-sector employment in the overall workforce is likely to be an important determinant of the propensity of older workers to stay on the job.

*Potential Influences on the Supply of Saving*

Saving — refraining from consumption today in order to invest in assets and accumulate claims abroad — is also a subject on which future trends are necessarily a matter of much speculation.

On the positive side is the prospect of increased life expectancy. A longer life means a longer period over which to average consumption: other things equal, the prospect of more years in old age ought to lead individuals to set more aside during their earning years (Scarth, 2002).

Less positive is the prospect, implicit in the scenarios sketched above and explicit in many discussions of future living standards (see, for example, Scarth 2002 and Mérette 2002), of a much higher ratio of capital to labour than has been the case historically. If labour is relatively scarce and capital is relatively abundant, returns to labour ought to be high and returns to capital ought to be low.[24] The conflicting influences of income and substitution effects matter again in this context, since it is possible that some savers will react to the prospect of lower returns by increasing their saving in order to achieve "target" levels of wealth. The normal presumption, however, would be

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[23] Statistics Canada, CANSIM, Table 282-0051.

[24] Indeed, such a prospect is strongly implied in our stylized model, which predicts much faster growth of wealth than labour inputs over the next half-century, accompanied — as we have conjectured — by unchanged shares of capital and labour income.

that lower rewards from saving will reduce people's proclivity to save (Ríos-Rull, 2001).

The issue of returns to saving brings into focus a distinction on which we have not dwelt in this paper — the possibility that saving and domestic investment can diverge. Domestic saving can finance investment in capital assets in Canada — indeed it is more likely to do so, since investors have a strong bias to invest at home, where information about the quality of investments is easier to obtain[25] — or finance the acquisition of assets abroad. Similarly, foreign investment can add to Canada's productive capacity if domestic saving is insufficient to take advantage of the opportunities offered inside Canada's borders. To the extent that returns on investment differ in Canada and abroad — because of more robust growth abroad, or because of distortions that interfere with the efficient allocation of resources in Canada, for example — outlets abroad may permit higher returns per dollar saved than domestic income growth would permit (a possibility incorporated in recent projections for the CPP — see OCA 2002b, 11). If that is true, and if public policy does not stand in the way of foreign investments, both aggregate income growth and the incentive to save would be higher.

As we noted above with respect to labour supply, tax policy adds a number of uncertainties to the outlook. On balance, current tax policy reduces the return to saving. Because the personal income tax taxes investment returns that merely compensate investors for inflation, for example, after-tax returns — even in a low-inflation environment — can be very modest, which likely discourages saving (Bernheim, 1999).[26] High personal and business tax rates reduce returns to entrepreneurial investment (Chen, Lee and Mintz 2002). The very high effective marginal tax rates that income-tested benefits impose on many seniors make saving relatively unrewarding or even futile. Whether these influences will gain or lose force in the years ahead is a matter of conjecture, as is the possibility that the response to them will change as the composition of the population changes and people become more familiar with them.[27]

Finally, we note that our projection above assumed that the net saving rate outside the household sector — the net saving of the business and government sectors considered together — would be the same in the future as it has been, on average, since the mid-1970s. To the extent that governments avoid the heavy borrowing that characterized much of the recent past, the national saving rate, and the income such saving generates, may be higher in the future. Because demographic change looks, on average, unhelpful to government budget balances, however, this is no more than a hopeful possibility.

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[25] See, for example, French and Poterba (1989) and McKenzie and Thompson (1996).

[26] Take a saver facing a 40-percent marginal tax rate who invests at 4 percent. Her after-tax return would be 2.4 percent which, with inflation of 2 percent, leaves only 0.4 percent in real terms.

[27] Shillington (forthcoming) points out that many low-income near seniors save when it makes little sense for them to do so. A better educated older population might be more able to see how the tax-transfer system will affect it, and reduce its saving accordingly.

*Potential Influences on Productivity*

In the long run, gains in output and incomes that arise from more efficient use of resources — getting more out of each unit of labour and capital supplied — are a decisive force in determining living standards. Frustratingly, however, the limits to our knowledge about the determinants of productivity growth are at least as severe as those affecting our ability to predict the supply of labour and the supply of saving.

The role of scientific and organizational research in adding to the world's stock of common knowledge gives grounds for optimism about future productivity growth. The spread of higher education and scientific endeavour around the world means that the stock of knowledge is growing at an unprecedented rate.

Productivity trends in the world's advanced economies do not, however, mirror the accelerating trend in the stock of knowledge. To the extent that any correlation can be found between national expenditure on research and development on the one hand and productivity growth on the other, it is a negative one (Robson 1998, 323-35). These facts force attention to the means by which new ideas get "embodied" in new productive processes.

It may be, for example, that high rates of investment in machinery and equipment are a critical link between the availability of ideas and their application in output of goods and services. If this is so, Canada's relative attractiveness as a place for domestic and foreign savers to invest will be an important determinant of future productivity growth. Domestic saving may be especially important here, since the "home bias" of investors suggests that Canada is likelier to have a high rate of domestic investment if its domestic saving rate is high. The key issue, however, is relative attractiveness to savers in all locations, making the outlook for productivity growth in Canada a function of the future balance of costs and benefits Canada offers relative to those of alternative locations, particularly the United States. As Mintz (2001, 39-54) has demonstrated, Canada's recent performance in this regard has not been good. Somewhat perversely, in a paper surveying future possibilities in the light of past performance, Canada's lacklustre competitive position in the past registers as a potential positive factor in thinking about the future, since improved tax policies in particular would support faster productivity growth than Canadians enjoyed between 1976 and 2002.

A third critical determinant of the level of productivity in an economy and of its growth over time is the extent to which labour and capital are deployed in more rather than less efficient enterprises and activities. Here again, contemplation of Canada's prospects in the future relative to the past yields both good and bad news.

The good news arises from the role that government subsidies and tax policies play in steering labour and capital among sectors in ways that reflect political priorities rather than underlying comparative advantage. The employment insurance program, with its regionally differentiated entry conditions and benefit schedules, and the corporate tax system, with its sectorally differentiated rates and special levies, are examples of Canadian policies that have almost certainly impeded productivity

growth in the past, and have recently become less distorting in their effects. Further moves toward more regionally and sectorally neutral policies would likely enhance productivity growth.

The bad news arises from the role of economic openness in promoting efficient allocation of resources and spurring business to sharpen its competitive edge. The correlation between openness and growth is a frequent theme in recent literature on economic development (see, for example, Dollar and Kraay, 2001). Because Canada already has an economy that is comparatively open to foreign trade and investment, it is not clear that the future offers much opportunity to improve on past performance. This may be an area in which maintaining the advantages conferred by open borders will be a more pressing task than enhancing them, limiting the boost to productivity growth it is reasonable to expect from this source.

*How Much Extra Work Would Offset the Bad News?*

A survey of uncertainties such as those in the preceding sections is bound to be unsatisfactory when it comes to framing a forecast for key social programs. What may be illuminating, however, is for us to quantify the degree of adeptness in public policy, adaptation in private behaviour, and plain good luck that would be necessary to lift our sombre projections (shown in Table 3) toward the levels of aggregate income growth in the baseline scenario (shown in Table 2), and more in line with those that the Office of the Chief Actuary has used in projecting the future of the CPP and the OAS/GIS programs in the past.

The overall gap between real income growth in our baseline and sombre scenarios is 0.7 percentage points annually over the period from 2002 to 2050. The gap entirely comes from the different saving rate and productivity growth assumptions that we used to take into account the likely economic effects of aging. But we have not changed the assumption regarding growth in labour input between the two scenarios. An interesting question therefore is: how hard do we have to push the growth in hours worked per week in the model in order to close this gap?

Table 4 shows the results of this exercise. Hours worked would have to grow at a compound annual rate of 1.1 percent instead of the 0.2 percent assumed in the baseline scenario to close the gap resulting from lower wealth and productivity. This would require labour input to reach approximately 909 millions of hours a week by 2050.

Is this a reasonable number? As discussed in the previous section, commentators have often pointed to the possibility that older workers will contribute more work effort in the future than they have in the recent past, through higher participation rates (mainly because of later retirement), and/or longer hours. Suppose, for the sake of illustration, that additional growth in hours worked were to come entirely from increased participation rates for all workers over the age of 50 and longer workweeks by workers over the age of 55. In order to keep the resulting participation rates assumptions somewhat realistic, we assume that participation rates for workers over 50 cannot surpass the 2002 participation rate of workers aged 45 to 49. Then we posit the same growth rate of participation rates

for workers above 49.[28] The remaining growth required in hours worked to close the real income gap between the two scenarios comes from a longer workweek for workers over 55.[29]

The annual compound growth rate that has to apply to both participation rates and workweek lengths for old workers between now and 2050 in order to generate 1.8 percent real income growth is 2.2 percent. The participation rates and workweek lengths that result from this growth requirement are rather startling. For example, the participation rate for women aged 60-64 in Ontario would have to rise from 32.6 percent in 2002 to 82.3 percent in 2050. Women over 65 in the same province would go from a 4.2 percent participation rate to 13.1 percent. Worse, workweek lengths for workers over 55 have to be unrestrained in order to completely close the gap. The phenomenally high required growth rate of 2.2 percent implies, for example, that in 2050 male workers between 55 and 64 would put in 117 hours a week, compared to the 41.3 they put in 2001. Males aged 65 and up would put in a comparatively relaxed 101 hours a week! Clearly, there is no way that increased work effort by older workers alone will make up for the possible adverse aging effects we have identified on saving and productivity growth.

**Final Thoughts**

In conclusion, then, we feel that the case for adopting relatively conservative projections for aggregate income growth in Canada over the next half-century is strong. If pressed, we incline to think that Canadians should attach a high probability to achieving growth rates along the lines outlined in our baseline scenario. We have identified some important down-side risks; if we were to build the potential impacts of a better-educated population into the model, we would find some counteracting up-side potential as well.

The recent experience of some countries, most notably Japan, that are further along in the aging process than Canada is, however, illustrates that slower growth in the working age population and rising average age may have important depressing effects on growth. We also note that the implications of slow growth may extend beyond its effects on labour income, but also affect returns on investment. Given the high importance that Canadians attach to their publicly funded pensions, and the key role that these payments play in retirement planning, projection exercises focused on their sustainability over time should take the less cheerful long-term possibilities into account.

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[28] Age groups 50 to 54, 55 to 59, 60 to 64 and 65+, all sex- and province-specific.

[29] Age bins 55-64 and 65+, sex-specific.

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**Table 1 Economic Growth in Canada, 1976-2002: A "Growth Accounting" Analysis**

Panel 1: Aggregates

| | Real Income | Population | Population 20-64 | Employment | Hours Worked per Week | Wealth | Inputs (Hours, Wealth) | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $bn | mn | mn | mn | mn | 1997 $bn | 1976=100 | 1976=100 |
| 1976 (level) | 499 | 23.4 | 13.1 | 9.8 | 345.3 | 1,723 | 100.0 | 100.0 |
| 2002 (level) | 1,037 | 31.4 | 19.5 | 15.4 | 525.4 | 3,399 | 166.9 | 124.5 |
| *1976-02 (% ch, AR)* | *2.9* | *1.1* | *1.6* | *1.8* | *1.6* | *2.6* | *2.0* | *0.8* |

Panel 2: Per-Person Amounts

| | Real Income | 20-64 as Share of Population | Employed as Share of 20-64 | Employed as Share of Popn. | Weekly Hours per Person | Capital per Person | Inputs per Person | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $ | % | % | % | | 1997 $ | 1976=100 | 1976=100 |
| 1976 (level) | 21,291 | 55.8 | 74.8 | 41.7 | 14.7 | 73,461 | 100.0 | 100.0 |
| 2002 (level) | 33,019 | 62.1 | 79.0 | 49.1 | 16.7 | 108,203 | 124.6 | 124.5 |
| *1976-02 (% ch, AR)* | *1.7* | *0.4* | *0.2* | *0.6* | *0.5* | *1.5* | *0.8* | *0.8* |

Sources: Statistics Canada, authors' calculations.

**Table 2 Economic Growth in Canada, 2002-2050: A Base Scenario**

Panel 1: Aggregates

| | Real Income | Population | Population 20-64 | Employment | Hours Worked per Week | Wealth | Inputs (Hours, Wealth) | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $bn | mn | mn | mn | mn | 1997 $bn | 1976=100 | 1976=100 |
| 2002 (level) | 1,037 | 31.4 | 19.5 | 15.4 | 525.4 | 3,399 | 166.9 | 124.5 |
| 2050 (level) | 2,486 | 39.2 | 21.5 | 17.2 | 578.2 | 10,640 | 267.1 | 186.4 |
| *2002-50 (% ch, AR)* | *1.8* | *0.5* | *0.2* | *0.2* | *0.2* | *2.4* | *1.0* | *0.8* |

Panel 2: Per-Person Amounts

| | Real Income | 20-64 as Share of Population | Employed as Share of 20-64 | Employed as Share of Popn. | Weekly Hours per Person | Capital per Person | Inputs per Person | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $ | % | % | % | | 1997 $ | 1976=100 | 1976=100 |
| 2002 (level) | 33,019 | 62.1 | 79.0 | 49.1 | 16.7 | 108,203 | 124.6 | 124.5 |
| 2050 (level) | 63,402 | 54.8 | 80.2 | 43.9 | 14.7 | 271,372 | 159.7 | 186.4 |
| *2002-50 (% ch, AR)* | *1.4* | *-0.3* | *0.0* | *-0.2* | *-0.3* | *1.9* | *0.5* | *0.8* |

Sources: Statistics Canada, authors' calculations.

**Figure 1: Millions of Hours Worked per Week in Canada**

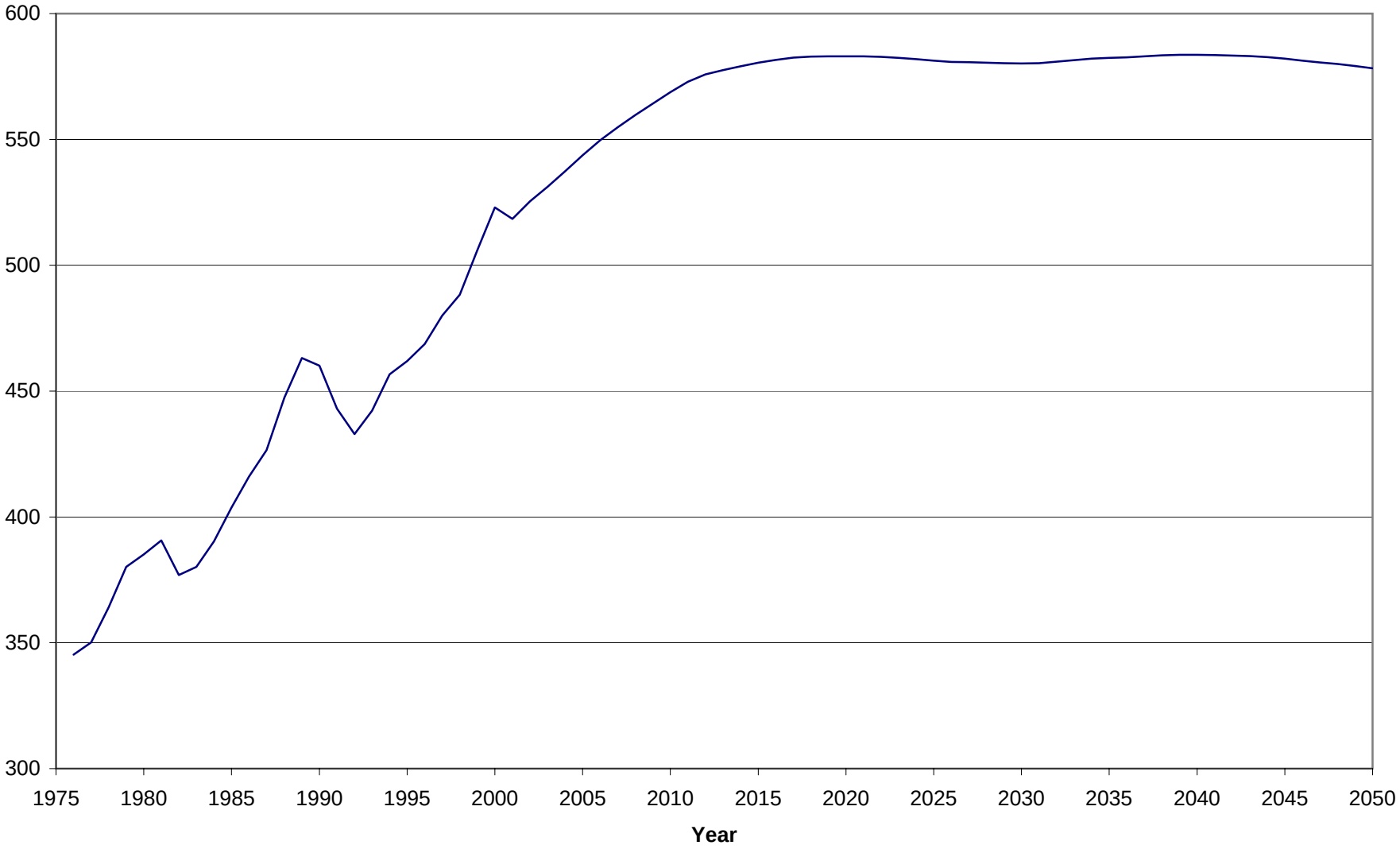

**Figure 2: Past and Projected Additions to National Net Worth Taking Into Account the Projected Fall in the Personal Saving Rate for 2003-2050**

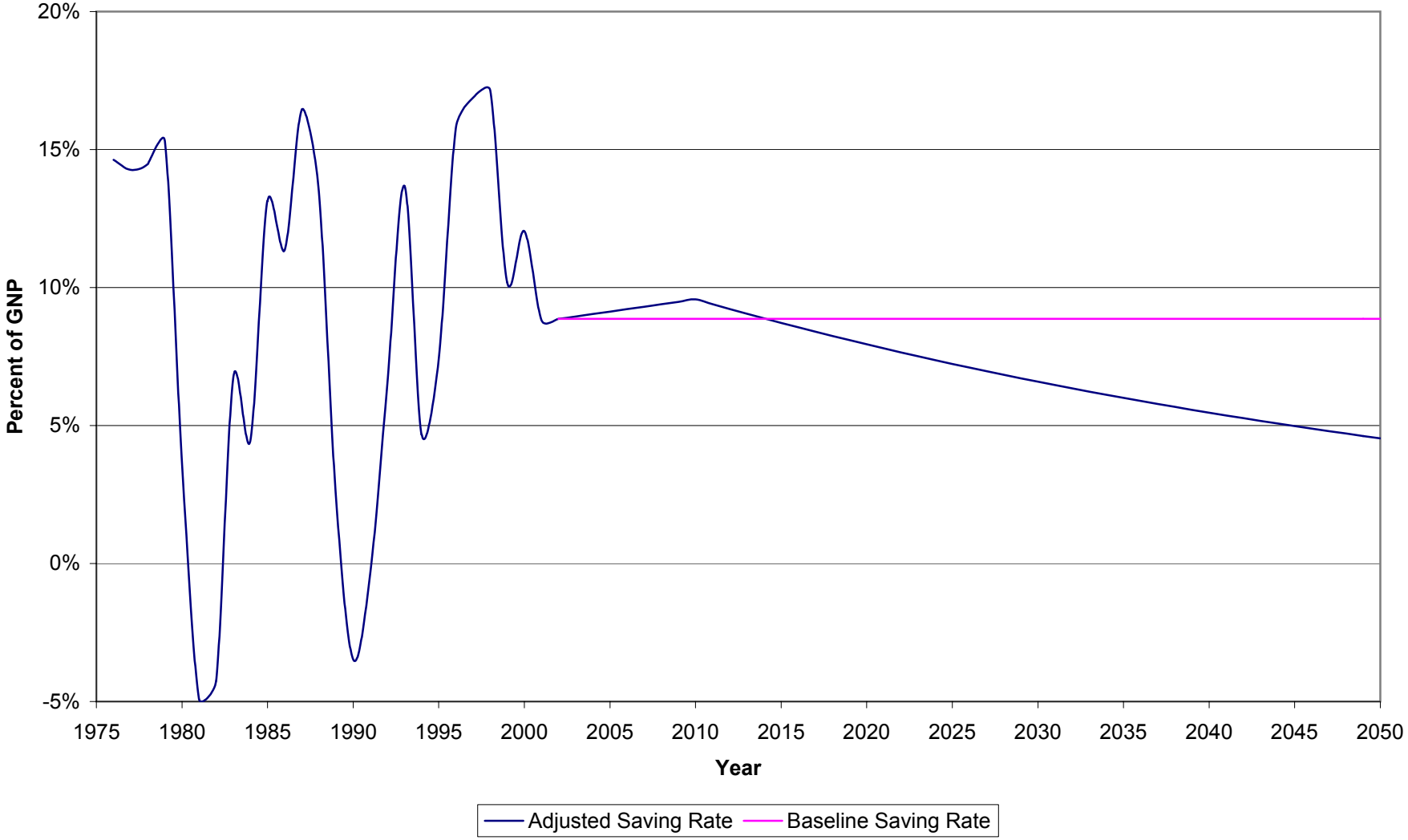

**Figure 3: Aggregate Productivity - Baseline vs Sombre Scenario 2002-2050**

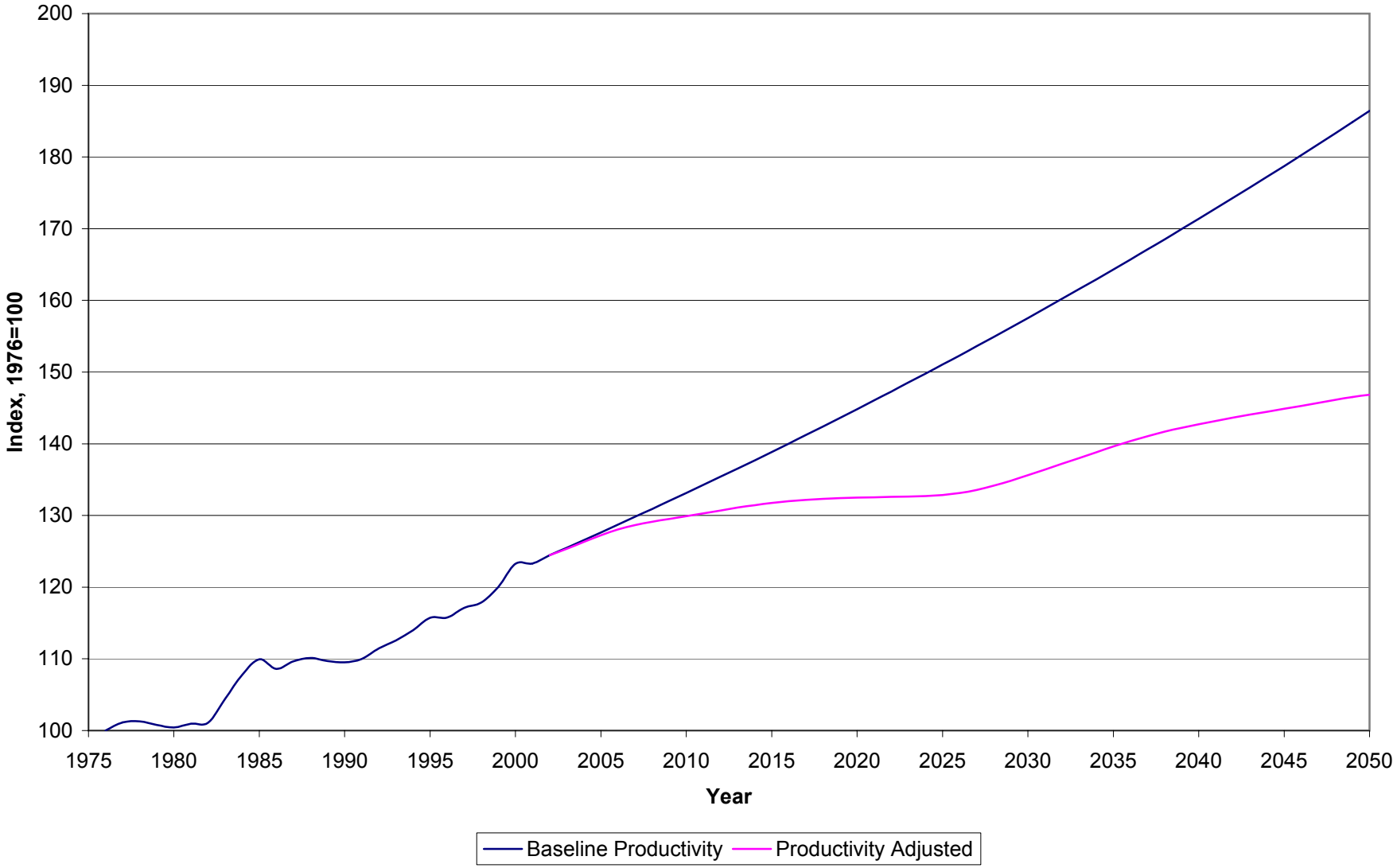

**Table 3 Economic Growth in Canada, 2002-2050: A Sombre Scenario**

Panel 1: Aggregates

| | Real Income | Population | Population 20-64 | Employment | Hours Worked per Week | Wealth | Inputs (Hours, Wealth) | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $bn | mn | mn | mn | mn | 1997 $bn | 1976=100 | 1976=100 |
| 2002 (level) | 1,037 | 31.4 | 19.5 | 15.4 | 525.4 | 3,399 | 166.9 | 124.5 |
| 2050 (level) | 1,783 | 39.2 | 21.5 | 17.2 | 578.2 | 8,196 | 243.3 | 146.8 |
| *2002-50 (% ch, AR)* | *1.1* | *0.5* | *0.2* | *0.2* | *0.2* | *1.9* | *0.8* | *0.3* |

Panel 2: Per-Person Amounts

| | Real Income | 20-64 as Share of Population | Employed as Share of 20-64 | Employed as Share of Popn. | Weekly Hours per Person | Capital per Person | Inputs per Person | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $ | % | % | % | | 1997 $ | 1976=100 | 1976=100 |
| 2002 (level) | 33,019 | 62.1 | 79.0 | 49.1 | 16.7 | 108,203 | 124.6 | 124.5 |
| 2050 (level) | 45,485 | 54.8 | 80.2 | 43.9 | 14.7 | 209,040 | 145.5 | 146.8 |
| *2002-50 (% ch, AR)* | *0.7* | *-0.3* | *0.0* | *-0.2* | *-0.3* | *1.4* | *0.3* | *0.3* |

Sources: Statistics Canada, authors' calculations.

**Table 4 Reconciling the Sombre Scenario with the Baseline Scenario Using Increased Hours and Participation from Old Workers**

Panel 1: Aggregates

| | Real Income | Population | Population 20-64 | Employment | Hours Worked per Week | Wealth | Inputs (Hours, Wealth) | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $bn | mn | mn | mn | mn | 1997 $bn | 1976=100 | 1976=100 |
| 2002 (level) | 1,037 | 31.4 | 19.5 | 15.4 | 525.4 | 3,399 | 166.9 | 124.5 |
| 2050 (level) | 2,466 | 39.2 | 21.5 | 20.3 | 909.4 | 8,994 | 336.3 | 146.8 |
| *2002-50 (% ch, AR)* | *1.8* | *0.5* | *0.2* | *0.6* | *1.1* | *2.0* | *1.5* | *0.3* |

Panel 2: Per-Person Amounts

| | Real Income | 20-64 as Share of Population | Employed as Share of 20-64 | Employed as Share of Popn. | Weekly Hours per Person | Capital per Person | Inputs per Person | Productivity |
|---|---|---|---|---|---|---|---|---|
| | 1997 $ | % | % | % | | 1997 $ | 1976=100 | 1976=100 |
| 2002 (level) | 33,019 | 62.1 | 79.0 | 49.1 | 16.7 | 108,203 | 124.6 | 124.5 |
| 2050 (level) | 62,888 | 54.8 | 94.5 | 51.7 | 23.2 | 229,379 | 201.2 | 146.8 |
| *2002-50 (% ch, AR)* | *1.4* | *-0.3* | *0.4* | *0.1* | *0.7* | *1.6* | *1.0* | *0.3* |

Sources: Statistics Canada, authors' calculations.