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AGING AND INTER-GENERATIONAL FAIRNESS – A CANADIAN ANALYSIS

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IARIW Session 2D: Aging and Demographic Change
Aging and Inter-Generational Fairness – A Canadian Analysis

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“To portray America as riven by generational warfare, young against old, is therefore an exaggeration. Worse, it obscures a deeper divide, of class rather than age. ...The big problem of the American welfare state is not that the old get too much, but that the rich do.” (Economist, January 11, 1997)

Introduction

Population aging is increasingly recognized as a world-wide phenomenon. And the pace of aging over the past few decades, especially in the richest countries, is unprecedented in human history. While there are many reasons that increased longevity and modest family sizes should be welcomed, population aging is more often a source of concern. The essential fear is that future cohorts of elderly, in particular the post WW II baby boom, will be placing an intolerable financial burden on future working age generations. A phrase capturing this concern is that the baby boom generation is the first in history where they cannot expect their children to be better off than they are.

In this paper, we examine these questions for Canada, looking decade by decade at the financial circumstances of successive birth cohorts born during the twentieth century. More specifically, for each decadal birth cohort, we have estimated the total amount of income and payroll taxes they pay over their lifetimes, and the corresponding amounts of income transfers, especially old age pensions, and transfers in kind they receive in the forms of education and health care services.

It takes the better part of a lifetime to accrue a pension or to save adequately for retirement. As a result, a widely accepted criterion for good public policy in this area is that the rules underpinning public pensions and other major age-sensitive programs are reasonably stable and predictable. Such stability enables individuals to plan better their own private savings over their life course. On the other hand, this kind of stability in public sector rules is very difficult to achieve because the future is inherently unknowable. Still, by indexing and other provisions, governments have *de facto* indicated what the responses will be in future to at least some unknown vicissitudes – for example, in the case of the indexing of benefit levels and income tax thresholds, to future and as yet unknown rates of inflation.

It would be reassuring for future public pensions, health care, and income tax policy – the three largest government programs most sensitive to population aging – to be based on a set of rules or principles (to the extent possible) that individuals could count on for their long term financial planning. In turn, this means that these rules or principles would be unlikely to be amended in future, by whatever democratic coalitions might emerge. In a phrase, this entails (as a necessary, but not sufficient condition) that the rules and principles should be designed in such a way that they are currently, and will continue to be, broadly perceived as inter-generationally fair. (It is also important that the rules be fair within generations, a point to which we return later.)

This is a challenging objective for at least two fundamental reasons. First, there is no widely agreed concept of inter-generational fairness. Second, the future is inherently unknowable, so that even with an agreed concept of inter-generational fairness, it is extraordinarily difficult, if not impossible, to apply such a criterion for all possible eventualities. In other words, it is impossible to assess the inter-generational fairness of a given system or rules or principles under all possible future scenarios.

However, it is possible to make a reasoned effort, and to consider a few of the most important areas of uncertainty. In this spirit, the following analysis provides a series of birth cohort-specific quantitative reconstructions of their histories, and projections of the interactions of successive birth cohorts with

Canada's major tax and cash and in kind transfer programs. The essential objective is to provide the information to support judgments as to the inter-generational fairness of these major public programs.¹

In addition to a "baseline" or *status quo* scenario for the future evolution of these programs, two further policy-related scenarios will be examined. Neither represents a specific policy option currently under discussion in Canada. Rather they represent two stylized and simplified versions of policy options either under discussion or implemented in some other country (refs – Sweden, US, de-indexing in some continental countries, etc QQQ.). The first policy alternative essentially raises the age of entitlement to public pensions from age 65 to age 70. The second shifts a range of tax and cash transfer program indexing provisions from the *status quo* CPI (consumer price index) to AW (the average wage).

Since a fundamental objective of this analysis is to assess the likely inter-generational fairness of major age-sensitive public programs to the unknown vicissitudes of the future, we have also posited several alternative scenarios for the socio-economic milieu within which future program structures would apply. Again, we rely on a few highly stylized scenarios. In general, we can distill two main axes of uncertainty from the literature on public pensions and inter-generational equity – whither longevity, and whither the economy.² More concretely, we have therefore constructed four (2 x 2) "exogenous" socio-economic scenarios within which to embed our examination of the inter-generational patterns of public policy – high and low projections of future mortality rate improvements, and high and low future levels of employment.³

The vast majority of published literature on inter-generational fairness and the inter-generational impacts of public programs has been extremely simplified. In particular, it has typically involved just one or maybe two (a male and a female) representative (or average) individual for each birth cohort (e.g. Kotlikoff, 1993; QQQ etc.). This is an extremely restrictive assumption, and one that we will show yields seriously misleading results. This analysis eschews such representative agents, and instead is fully *microanalytic*. It is based on Statistics Canada's LifePaths microsimulation model (ref QQQ). LifePaths is much more than a casual extension of some sort of spreadsheet analysis. Rather, it is an "industrial strength" policy-oriented microsimulation model that has been developed over more than a decade in partnership with a number of central policy ministries of the Canadian Government.

In the following section, we review some of the main concepts of inter-generational fairness. Then we briefly outline the LifePaths model. The main part of the analysis describes the scenarios – both policy and exogenous – in greater detail and then moves onto the key results.

¹ Of course, inter-generational transfers occur in many ways, from unrequited payments among family members of different generations, to broader investments (or dis-investments) in the productive capacity of the economy and the quality of the environment. The latter are beyond the scope of this analysis, even though they may enter into policy debates about the inter-generational fairness of the taxes and transfers being examined here.

² A third major axis, which is beyond the scope of this analysis, is the future health of the population. This has been treated in Wolfson and Rowe (2004).

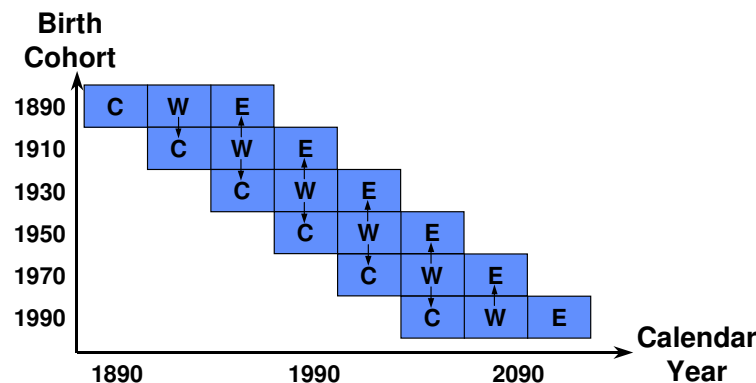
³ Employment is only one of several ways to measure the strength of the economy. Another would be per capita economic growth rates, in turn usually linked to productivity growth. Similarly, there is considerable interest in the role of immigration (as well as life expectancy) among demographic factors. Alternative scenarios of this sort are easily feasible with LifePaths. The focus here on life expectancy and employment is simply for the convenience of a manageable range of scenarios for this initial exploratory analysis.

Judging Inter-generational Fairness and Sustainability

There is no widely agreed approach to judging whether a society's tax / transfer system is inter-generationally fair or sustainable.⁴ Still, there are several norms which appear commendable:

- inter-generational golden rule (e.g. Canada, 1980, Summary, p54) – One generation, when it becomes old and frail, should not expect to be treated any better by its children (in working age at that future time) than it treated its parents' generation in their old age (when they themselves were of working age).⁵
- sustainability (Canada, 1980, Summary, p54; House of Commons, 1983, p15) – The world that parents bequeath to their children should be at least as good (e.g. economically productive) as the one they in their turn had inherited.
- neutrality – Each generation should pay for its own pensions, i.e. there should be no intergenerational transfers at all.
- Musgrave (1981) – Per capita transfers to the elderly should be a fixed proportion of per capita wages less taxes of the working age population.
- House of Commons (1983, p17) – Public pensions (as well as income tax thresholds for retirement saving incentives) should be indexed in such a manner that they are higher when
 - real average wage growth is higher,
 - labour force participation is higher,
 - unemployment is lower, and
 - the old-age dependency ratio is lower,
 and would be lower in the opposite circumstances.
- a process norm – “If a retirement income system is not, and is seen not to be fair in its treatment of successive generations, it will be changed sooner or later.” (Canada, Summary, 1980, p54) In other words, a tax/transfer system is sustainable and fair if it is the outcome of a continuing democratic consensus.

Figure 1 – Basic Generational Accounting Framework



⁴ A widely agreed norm for *intra*-generational fairness is progressivity, i.e. that the tax/transfer system is generally redistributive from those with higher to those with lower (more often contemporaneous than *lifetime*) income.

⁵ “(t)hose now working could build up a moral claim on future pension entitlements by making transfers to the current elderly of at least the same magnitude as they would expect to receive when their time came. This would set in motion a kind of intergenerational golden rule.” (House of Commons, 1983)

Figure 1 (Wolfson, et.al., 1998) provides a convenient schema for illustrating these norms. Birth year is shown on the vertical axis, and calendar time along the horizontal. Each horizontal bar represents one generation or birth cohort born at time b . In turn, their lifetimes have been divided into three broad phases: childhood (C_b), working (W_b), and elderly (E_b). Intergenerational transfers then arise, in this analysis, only from government tax/transfer activities (both cash and in kind), and generally speaking involve either $W_b \rightarrow C_{b+1}$ or $W_b \rightarrow E_{b-1}$ flows, as indicated by the short vertical arrows in the diagram.

There are several challenges for assessing inter-generational fairness in terms of Figure 1. The first is that the boxes in Figure 1 (along the vertical axis), in reality, should not all be shown as the same size. Some birth cohorts are larger than others. Second, the state of the economy varies significantly from one time period to the next along the horizontal axis. The arrows in Figure 1 focus on the sequence of contemporaneous (i.e. point-in-time) transfers occurring across generations. But the diagram also has no representation of savings and investment (or dis-saving and dis-investment), in the sense for example of the future productivity (or increased environmental degradation) of the society. How much wealth and income a society is able to generate in future years is a crucial aspect of assessments of inter-generational fairness, and is implicit in the first two norms.

Nevertheless, the diagram is still helpful in thinking about the various norms for inter-generational fairness just outlined. The first norm implies that the public pensions and health care services expected by the current working age generation, when it becomes elderly in the future, should not be any larger, relative to the size of the economy, than the transfers it is financing for the current elderly. In terms of Figure 1, this norm implies that the sequence of transfers indicated by the vertical arrows from W_b to E_{b-1} should be non-increasing over time.

The second norm suggests that it is unfair to bequeath to future generations any kind of substantial liability, such as a large public debt, or a degraded physical, human, environmental or other kind of capital stock. This norm is consistent with lifetime consumption or disposable income that rises from one generation to the next. In other words, each generation of parents is sacrificing at least somewhat so their children can have a better life. This norm encompasses much more than income taxes and cash and in kind transfers made through the public sector. Still, if each generation (e.g. E_b which had been W_b earlier during its working years) succeeded in leaving its successors (W_{b+1}) a wealthier and more productive economy, then it should be possible for W_{b+1} to transfer to E_b an amount that is higher than the amount W_b had transferred to E_{b-1} in its turn. In terms of Figure 1, this means that transfers from those of working age to elderly should be increasing from one generation to the next.

The third norm takes a different approach, basically saying that the fairest system is one in which there are no intergenerational transfers at all. However, there exists no “extra planetary banker” who can initially loan funds to children while they are growing up, take savings from them when working first to pay down their educational loans and then to accumulate for their retirement, and finally gradually disburse their accumulated saving after they have retired. Instead, the savings and dis-savings of each generation during its life course inevitably involve *de facto* contemporaneous inter-generational transfers. Still, this norm is (in our view, naively) involved in analyses that compare, for example, the internal rates of return to different generations for their Social Security contributions and benefits, and implicitly raises concerns when they are not all the same. (ref QQQ to come)

The fourth norm (Musgrave, 1981), in a more precise and focused way, provides a kind of balance point between the first and second norms. According to this norm, the sequence of transfers W_b to E_{b-1} are in some sense constant. But in more detail, this norm also adjusts automatically in the event of population aging by reducing net transfers to the elderly, and it adjust for higher than anticipated per capita economic growth by raising net transfers.

The fifth norm was developed by a Special Parliamentary Committee formed in 1983 to review the results of what at the time was referred to as the “great pension reform debate”. After much discussion amongst the members of this all party committee, these Members of Parliament agreed on recommending this sort of indexing for old age pension benefits. It is, in fact, a specific articulation of the both of the first two norms, and is more precise and fully in the spirit of the Musgrave notion.

Interpreting the sixth norm in the context of Figure 1 is difficult. The main reason is that the population of eligible voters at any point in time includes not only members of different generations, but also individuals within a generation who are in widely different circumstances. In a word, each generation is *heterogeneous*. It could be, for example, that a tax/transfer system is progressive in a way that lower and middle income individuals from several adjacent generations (all of whom are of voting age at a given point in time) have more in common than those with high and low incomes within a given generation. Thus, “block voting” by generation, or generational politics, may not be in many individuals’ self-interest. As a result, the democratic process norm need not be consistent with any of the other norms.

The implication of the first five norms is that any assessment of inter-generational fairness requires specific data on each of a sequence of overlapping birth cohorts. The sixth norm reminds us that while this is analytically necessary, it is by no means sufficient. We need an analytical framework that can also unpack and reflect the great heterogeneity of individuals’ life course experiences within any given generation.

An Overview of the LifePaths Microsimulation Model

In order to assess Canada’s tax/transfer system in the light of the norms just outlined, we draw on Statistics Canada’s LifePaths model. LifePaths is a computer simulation model designed explicitly to encompass both inter- and intra-generational analyses simultaneously. Each LifePaths simulation run generates a representative microcosm of the Canadian population. In other words, LifePaths is microanalytic. The basic units of observation are individuals, and the focus is on micro level dynamics – how individuals move among various mixtures of socioeconomic states over their life courses. And empirically, LifePaths is *metasynthetic* – drawing upon multiple data sets, covering diverse subject matters, and using each in order to assemble the best possible overall estimate of the information of interest.⁶

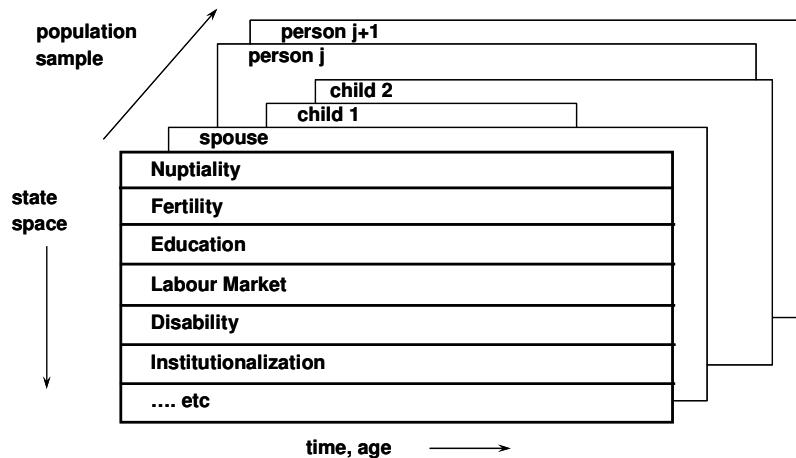


Figure 2 – State Space and Longitudinal Micro Data Sample Generated by a LifePaths Simulation

The basic unit of analysis in LifePaths is an individual life history or stylized biography, as shown in Figure 2. The “state space” of attributes or individual characteristics is shown along the vertical axis, with age and calendar time coincident along the horizontal. The third axis indicates a representative sample of individuals in the population of interest. These are not all unrelated individuals; rather, they are juxtaposed to show that family structure is also included.

⁶ The term “metasynthesis” is used in contrast to the epidemiological term “meta-analysis,” which refers to the combination of results from a number of data sets, all of which pertain to the same question. Metasynthesis, in contrast, refers to the combination of results from data sets covering diverse subject matters.

Given these micro level life histories as the basic building blocks, LifePaths assembles large representative samples of individuals (grouped into nuclear families) in a sequence of overlapping birth cohorts (Figure 3). Each “layer” in the diagram represents one birth cohort, while the sequence of layers represents successive birth cohorts. A typical population pyramid showing age structure by sex at a point in time corresponds to a vertical slice through the overlapping birth cohorts along the line for “today.”⁷

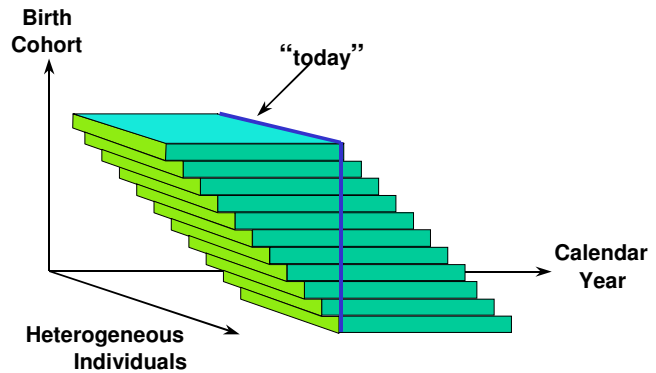


Figure 3 – Overlapping Birth Cohorts with Heterogeneous Members

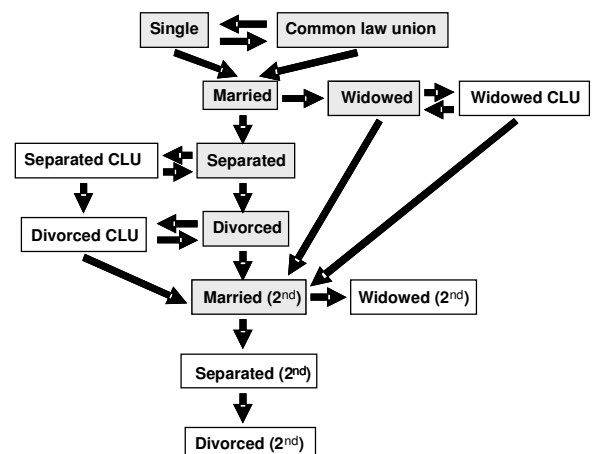
LifePaths essentially creates a large sample of representative individual life histories, where the individuals have been born throughout the 20th century in accord with historical population data. The historical reconstruction and subsequent projection processes proceed by data synthesis using longitudinal microsimulation: each individual’s life history is synthesized, starting at birth and then recursively generating the suite of events and characteristics shown along the vertical axis of Figure 2 over time until death. Then another family of individuals is synthetically generated, and again, and again, until a very large sample (e.g. 1,000,000s) is generated.

The result is our “fitted” population microcosm (for years prior to “today”), plus micro level extrapolations of each life history beyond “today” (if still alive) over coming decades. The result is a very large longitudinal sample of synthesized individuals that – when appropriately cross-tabulated or otherwise examined – reproduces a diversity of observed data, such as population characteristics from censuses, mortality and fertility rates dating back to about 1900, age- and sex-specific employment/population ratios since the 1970s, and aggregate wages and income taxes back to the 1920s.

Underlying any LifePaths simulation is a detailed set of empirically based state transition dynamics. As a result, dynamics are represented by transition probabilities (more precisely, by transition probability functions of a range of time-varying covariates / co-evolving characteristics).

Figure 4 – Nuptiality States and Transitions

For example, the nuptiality transitions explicitly modeled are shown in Figure 4. The different states are given by the boxes, while the arrows indicate the possible transitions. For each arrow, there is an empirically estimated transition probability function of time-varying covariates. The transition probability functions have been estimated initially from survey data and then (where possible) adjusted so that LifePaths as a whole reproduces the distribution of families by marital status observed in Canada’s 1996 population census.



Some added detail on LifePaths is given in the Appendix, and further information is available at www.statcan.ca/english/spsd/LifePaths.htm.

⁷ Although the diagram implies that time is discrete, LifePaths represents and models all events in continuous time.

Exogenous Scenarios

Given this background discussion, we turn to the heart of this analysis. First, in order to assess the impact of exogenous changes on the projected intergenerational profiles of major government programs on Canadian birth cohorts, a series of four scenarios characterizing the socio-economic milieu have been constructed – high and low mortality, and high and low economic circumstances.

Mortality: As noted above, the mortality process is simulated in terms of hazard rates differentiated by birth year, age, sex, and institutional status. Up to 2004, observed data are used.

Under the high mortality / lower life expectancy scenario, Statistics Canada’s “high mortality” scenario in the official demographic projections (Statistics Canada, 2005) is used up to 2051, the end of that projection period. For those members of birth cohorts who survive beyond 2051 in these simulations, mortality rates remain constant at their 2051 levels.

For the lower mortality / higher life expectancy scenario, the low age-sex specific mortality hazards from the demographic projections were used from 2005 to 2051. For years after 2051, mortality hazard rates (differentiated by age and sex) were assumed to continue improving at the constant rate embodied in the demographic projections for the interval from 2050 to 2051.⁸

These two scenarios result in considerable divergence in life expectancy, as shown in Table 1 below. Life expectancies for each sex differ by about 3 years for the cohort born in the 1990s, and by almost 5 years for those born in the 2002 to 2011 interval.⁹

Table 1 – High and Low Life Expectancy Scenarios

Simulated Life Expectancies			
Cohort	Scenario	Females	Males
Born in 1992-2001			
	Low Life Expectancy	87.1	82.2
	High Life Expectancy	89.9	85.2
	Difference	2.9	3.0
Born after 2001			
	Low Life Expectancy	87.6	83.1
	High Life Expectancy	92.2	88.0
	Difference	4.6	4.9

Strength of the Economy: The other major axis of exogenous uncertainty that will be considered is the strength of the economy. This can be conceptualized in a variety of ways, but for this analysis we focus on employment. A “strong” economy is defined as one where employment levels are higher; while a weak economy is one where employment is lower.

In order to implement these alternative employment scenarios, advantage was taken of the fact that the employment dynamics module in LifePaths is conditional on calendar year dummy variables for each of the years from 1976 to 2004, as well as a range of other factors (age, sex, educational attainment, duration in

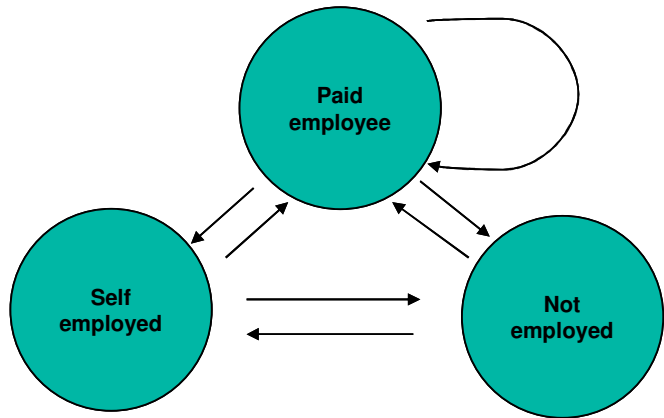
⁸ Since the mortality rates underlying the demographic projections are based on a smooth mathematical function, using the rate of change over the last single year is reasonable for extrapolating the underlying trend.

⁹ The Chief Actuary’s projections in his most recent report (OSFI, 2005b) are 80.7 and 84.1 for males and females respectively. Note that Chief Actuary’s are period life expectancies in 2050, rather than cohort life expectancies used here, based on mortality projections extending to the end of the 21st century.

employment state, province of residence, presence of a spouse and spouse’s employment status). The year dummy variables appear both on their own, and as interaction terms respectively with age (linear and quadratic terms, age 65, age 65+), presence of pre-school children, low education level (<High School), and presence of pre-school children X low education level.

Figure 5 – Employment States and Transition Possibilities

Given this detailed and richly specified structure for the employment dynamics module, the “high employment” scenario is based simply on the assumption that the most recent business cycle peak year, 2004, will apply for the years 2005 and on in evaluating the set of employment state transition probability functions as a “fixed effect” for all future periods.

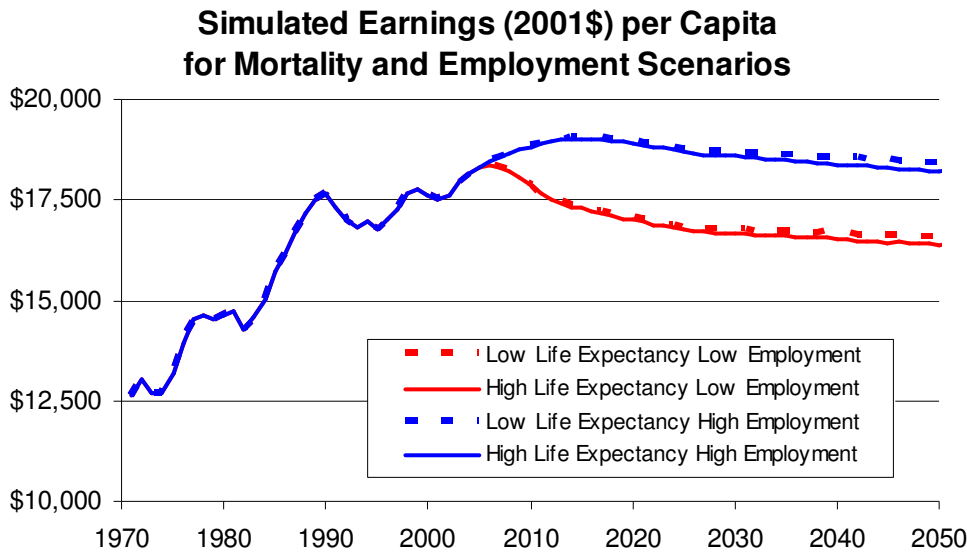


The “low employment” scenario makes an analogous assumption, but in this case uses the year of the most recent business cycle trough, 1993, as a fixed effect for all future periods after 2011. Actual transition hazards for 1994 to 2004 are still used. From, the 2004 business cycle peak, a smooth transition has been assumed for the dummy variables to the 1993 business cycle trough over the interval 2005-2011. After that, the dummies remain constant at their 1993 levels.

Figure 6 below shows the effects of these two employment scenarios on per capita earnings. For most of the projection period, the divergence in employment transition dynamics, between those of the 2004 peak and the 1993 trough business cycle years, amounts to over \$2,000 (in 2001 dollars) or over 10% of per capita earnings.

Figure 6 also shows the effects on earnings of the two life expectancy scenarios. Since most of the variation in mortality rates arises after prime working ages, and the differences do not affect the total population that greatly (even though they change life expectancy by as much as almost 5 years), there is no appreciable difference in per capita earnings as a result of differences in life expectancy.

Figure 6 –



Provision for Retirement in the Canadian System

In addition to incorporating a wide variety of socio-economic characteristics, this LifePaths analysis must also realistically model Canada's major tax and transfer programs. In this section, we first give a brief overview of Canada's current public pension system, and then describe the taxes and in kind transfers that have also been explicitly modeled.

Canada's public pension system is often described as having three tiers. The first tier is a pair of cash transfers to the elderly (generally age 65+) based only on their current income, and financed out of general taxation. One is a taxable "demogrant" called the Old Age Security (OAS) pension. It started in 1952 paying monthly benefits to those over age 70. This entitlement age was subsequently lowered to 65, and currently benefits are \$5,684 per year (subject to a sufficient period of prior residency).

The other basic cash transfer is an income-tested benefit, the Guaranteed Income Supplement (GIS) program, starting in 1967, and an extension, the Spouse's Allowance (SPA) program, starting in 1976. They provide non-taxable monthly benefits to Canadians age 65 and over (or age 60-64 with a spouse age 65 or over in the case of SPA). Together, these major programs provide basic income guarantees of \$10,420 and \$16,900 for Canada's senior individuals and couples in 1996 (QQQ update). As a result of a number of *ad hoc* increases over the years, their combined benefit levels have become such that very few of Canada's elderly have incomes below the "low income line".

The next tier is the Canada and Quebec Pension Plans (C/QPP), an earnings-related public pension plan that pays out a retirement pension essentially equal to 25% of average (updated) pre-retirement earnings. (While there are two plans, one for Quebec and one for the rest of Canada, they have virtually identical provisions and are completely integrated from the viewpoint of individuals moving between them.) The maximum pension is based on the year's maximum pensionable earnings (YMPE). This is equal to the average annual wage in Canada, and was \$38,300 in 2001.¹⁰

The plans are financed by a payroll tax. Until recently, the rate was set so as to assure a reserve equal to the payout of about two years of benefits. Recently, the payroll tax rate has been increased so that accumulated funds are projected to rise to about 4.4 times benefits in 2010, and about 6.3 times in 2050 (OSFI 2005b). Still, overall, the plans remain funded essentially on a pay-as-you-go basis.

The third tier of Canada's public pension system is a set of tax incentives for private saving for retirement, either via individual accounts called Registered Retirement Savings Plans (RRSPs) or employer-sponsored plans (Registered Pension Plans or RPPs). The tax expenditure (foregone income tax revenue) in respect to these provisions amounted to about \$19 billion in 2005, while the total cost of OAS/GIS was about \$30 billion in the same year (OSFI, 2005a), and C/QPP also paid out about \$30 billion (for retirement and survivor pensions, based on OSFI 2005b). Thus, income tax incentives are a significant component of the public system, and they are used disproportionately by those in upper income brackets.

Beyond the public system, and the significant volume of private saving accumulated under registered plans for retirement purposes, home ownership is a significant form of *de facto* saving for retirement. However, about half of all Canadians enter retirement without owning a house, and with relatively little in the way of accumulated savings of any form. They are therefore highly dependent on the public pension system.¹¹

Beyond public pensions and other provisions for retirement, this analysis also takes explicit account of personal income taxes (both federal and provincial), payroll taxes, (un)employment insurance transfers, and

¹⁰ The C/QPP also provide pre-and post-retirement survivor pensions, orphan and disability pensions, and a lump sum death benefit. However, in this analysis we consider only the retirement pension and the post-retirement survivor pension. These comprise about three-quarters of the total benefits provided by the plans.

¹¹ Note that while private tax-assisted employer-sponsored pension plan saving (RPPs) is explicitly modeled in LifePaths, private tax-assisted retirement savings via RRSPs and home ownership are not.

in kind education and health care benefits. In the latter two cases, benefits are imputed based on highly simplified formulae. Health care in kind service benefits are assumed to vary only by age and sex, while education in kind service benefits vary only by the type of educational institution attended (Cameron and Wolfson, 1994). These unit costs are projected simply in line with the growth in average wages. It is, of course, well known that non-demographic factors are typically far more important in determining the trends in these unit costs (Evans et. al., 2001). However, consideration of these factors is beyond the scope of this analysis.¹²

Policy Scenarios

As noted earlier, the core of this analysis is the simulation of the impacts of Canada's major age-sensitive tax/transfer programs on inter-generational fairness according to several basic norms. The four scenarios to test the robustness of the policy scenarios to unknown future uncertainties (high and low life expectancy and high and low employment) were outlined above. From the policy perspective, we consider two stylized alternative policy scenarios in addition to the *status quo* scenario, as follows.

Extended Work: One approach to the aging of the population is to redefine retirement, essentially by raising the age of entitlement to public pensions. At the time Bismark first set an age for pensions in the late 19th century at age 65, fewer than 10% of the population even survived to that age (QQQ check). In 1983, the U.S. amended the law so that the normal age of entitlement for Social Security would begin rising gradually 20 years hence, in 198X until it reached age 67, which occurred in 199X QQQ. More recently, Mankiw (2006) for example has called for further change in this direction. In Canada, the Lazar Report (Canada, 1980) considered whether the age of entitlement to public pensions (both C/QPP and OAS) should be raised gradually¹³, but concluded that the uncertainties were such that instead, some sort of trigger criteria for considering this kind of change, with a 10 year lead time, would be more appropriate. The criteria could include dependency ratios, taxpayer burdens, or labour force participation rates (Canada, 1980, p328). More recently, the Swedes reformed their public pension system in a way that implicitly indexes pensions benefits to life expectancy – by requiring that the benefit about to come into pay be based on an actuarial annuity calculation, in turn based on whatever mortality rates are then current. (ref QQQ)

In order to reflect this broad class of possible options for responding to concerns about the costs of public pensions, we have defined an “extended work” scenario. This is implemented in the model by 'delayed aging' of persons for purposes of employment transitions and for public pension (C/QPP, OAS, and GIS/SA) eligibility and take-up. This delayed aging occurs not only in future, but also in the past. It is as if the policy of increasing of the age of entitlement to public pensions in Canada had started in 1976, and proceeded at a very gradual rate until 2005 when everyone's entitlement would be at age 70.

More specifically, delayed aging is implemented by creating an artificial alternative age variable to be used by all the appropriate simulation modules, including both those governing behavioural dynamics and those determining program eligibility and participation. This alternative age variable kicks in at age 55 and remains fixed at age 55 for as long as 5 years. The onset age of 55 was chosen because it is an age where employment rates are high. In effect, by starting the 'delayed aging' process at age 55, the decline in age-specific employment to population ratios observed after age 55 could be reasonably attenuated and thereby generate a more realistic scenario in line with the likely behavioural impacts of increasingly delayed entitlement to public pensions.

The general intention was to implement delayed aging gradually: first, delaying the aging of the cohort that turned 55 in 1976 by 2 months; then, delaying the aging of the cohort that turned 55 in 1977 by 4 months, and so on - gradually implementing the full 5 year delay over a period of 30 years (1976-2005). However,

¹² Future versions of this analysis could build on the EUs projection approaches which explicitly model improvements in health status and hence declining age-specific health care costs, for example. See DG ECFIN, 2005.

¹³ The report strongly recommended against any lowering of this age.

many of the relevant modules in the LifePaths model are not sensitive to fractional ages. As a result, the gradual 30 year phase-in was implemented by: first, delaying the aging of only a (randomly chosen) 1/6th of the cohort that turned 55 in 1976 by 1 year; then, delaying the aging of only a (randomly chosen) 2/6^{ths} of the cohort that turned 55 in 1977 by 1 year; ...; delaying the aging of all of the cohort that turned 55 in 1981 by 1 year; delaying the aging of all of the cohort that turned 55 in 1982 by 1 year and further delaying the aging of a (randomly chosen) 1/6th of that cohort by an additional 1 year; ... and so on. All members of cohorts that turn 55 on or after 2005 experience delayed aging of a full 5 years.¹⁴

Relative Indexing: Another broad set of approaches to concerns about growing public pension costs in the face of population aging is to change the way the dollar value of pensions is updated from one year to the next, i.e. the indexing provisions. For example, both the Musgrave (1981) and the House of Commons (1983) norms for intergenerational fairness described above reflect forms of indexing.

Canada has a somewhat complex and unusual system of indexing provisions. For the major earnings-related public pension, C/QPP, benefits are implicitly indexed to AW during working years. Then, after retirement when the pension comes into pay, it is indexed by the CPI. However, in Canada the earnings-related pension constitutes less than half of all the publicly provided old age cash benefits. The other major programs, OAS and GIS/SA, are indexed to the CPI. Moreover, the OAS is now subject to a degree of income testing, and the threshold where the income testing begins is itself indexed to the CPI. (QQQ check) As a result, any real average wage growth results in these public pensions declining relative to the size of the economy.

In contrast, the U.S. public pension system, for example, which is dominated by Social Security, is much closer to being fully wage indexed (even though, as with Canada's C/QPP, pensions in pay are indexed to the CPI). Similarly, in many European countries, retirement pensions were substantially wage indexed, though over the last decade a number have moved away from pure AW indexing and closer to CPI indexing. (QQQ check)

On the one hand, CPI rather than AW indexing means that in future, pension costs will be lower. On the other hand, CPI compared to wage indexing means that for pensioners, their incomes will be lower, and more likely to fall below a low income line.

The importance of indexing provisions has been well known to the economically informed for decades. For example as early as the 1980s, officials in the IMF (Heller et. al., 1986) projected that Canada was relatively unique in *not* facing a pension affordability problem – essentially because of the CPI indexing of the OAS and GIS. However, there have been virtually no analyses showing the counterpart implication of falling individual income levels among the future elderly (with the exception of Murphy and Wolfson 1991, and Wolfson and Murphy, 1997).

Given the importance of indexing scenarios from these earlier analyses, the second stylized and illustrative policy scenario explores wage indexing as an alternative to the current price indexing of major government programs – including not only public pensions but also the income tax system and its associated set of refundable income tax credits which *de facto* are very much like cash transfers. The shift to wage indexing is assumed to occur in 2001.

Simulation Results

In this section we present the main results from the LifePaths simulations. In all cases, the focus is on the net balance between income and payroll taxes paid, and cash transfers plus in kind health and education

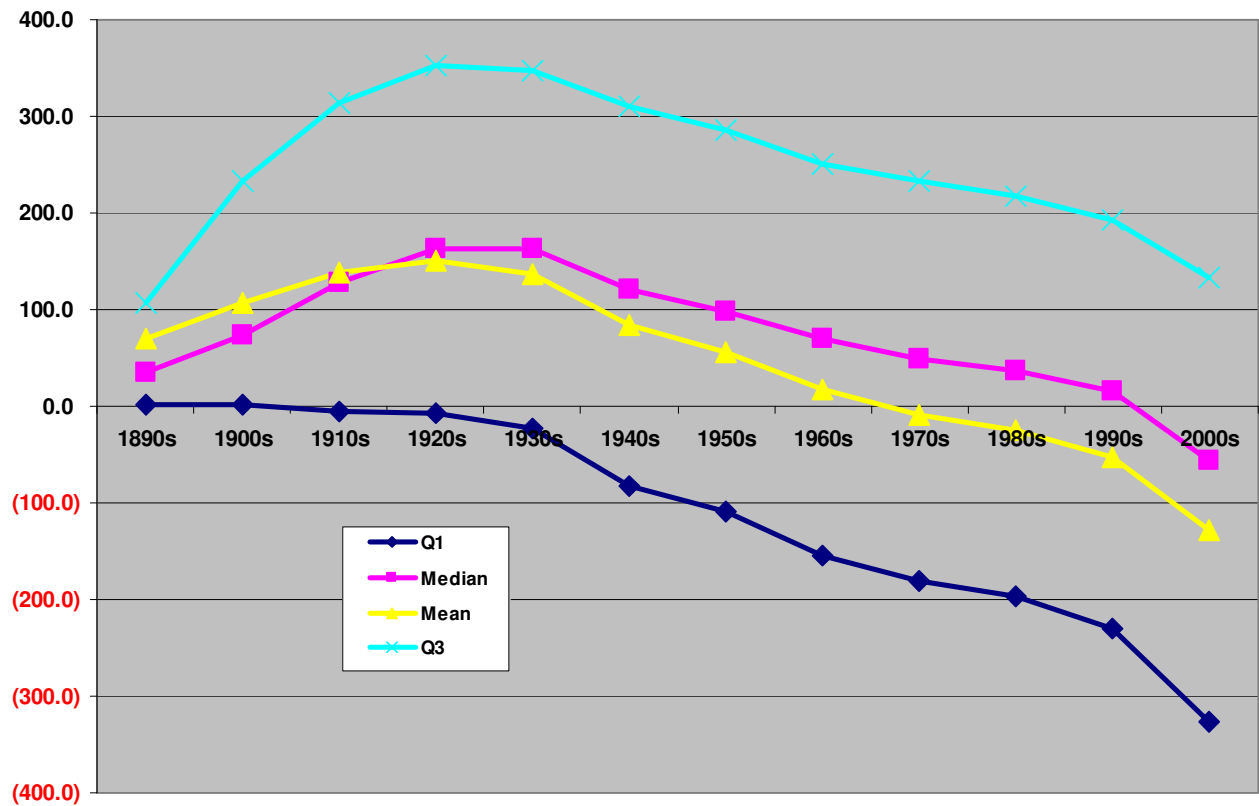
¹⁴ It should be noted that this scenario increases income and payroll tax revenues, as a result of greater employment in the 55 to 70 age range, and reduces payouts of public pensions in the 65 to 70 age range. Consequently, the government's fiscal balance improves. Notwithstanding, no adjustments are made to income or payroll taxes or to any other aspect of cash transfers. While this is likely an unrealistic scenario, it is simpler and aids interpretation of results.

benefits received. These are lifetime net balances, summed over representative samples of individuals in each decadal birth cohort.

The sums are net present discounted values, where the discount rate is the same as the growth rate of average wages. This growth rate, in turn, is assumed at 1% per annum – slightly lower than the 1.1% and 1.2% assumed by the Chief Actuary in his previous two actuarial reports on the CPP (OSFI, 2005b).¹⁵

Graph 1 shows these lifetime NPVs (2001 \$000s) on the vertical axis, for each decadal birth cohort along the horizontal axis. The different curves correspond to four different points in the NPV distributions for each birth cohort – the first quartile (Q1), the median, the mean, and the third quartile (Q3). In this case, we have shown the “base” policy scenario, and the low life expectancy and low employment exogenous scenarios.¹⁶

1. Net Present Values of Lifetime [Transfers - Taxes]; Scenario = le emp base



¹⁵ The results are sensitive to the choice of discount rate. For this kind of analysis, from a social and inter-generational perspective, as contrasted for example to an individual perspective on a short or medium term investment choice, it is arguable that the growth rate in per capita wages is the most appropriate discount rate.

¹⁶ Even though the LifePaths simulations cover everyone in Canada, these graphs cover only persons who survived to at least age 15 and were born in a province west of Newfoundland. The reason, simply, is that immigrants receive no transfers and pay no taxes until they arrive in Canada, and Newfoundlanders receive no transfers and pay no taxes until after Confederation 1949. These two cases create anomalous spikes in the frequency distribution of transfers minus taxes at zero.

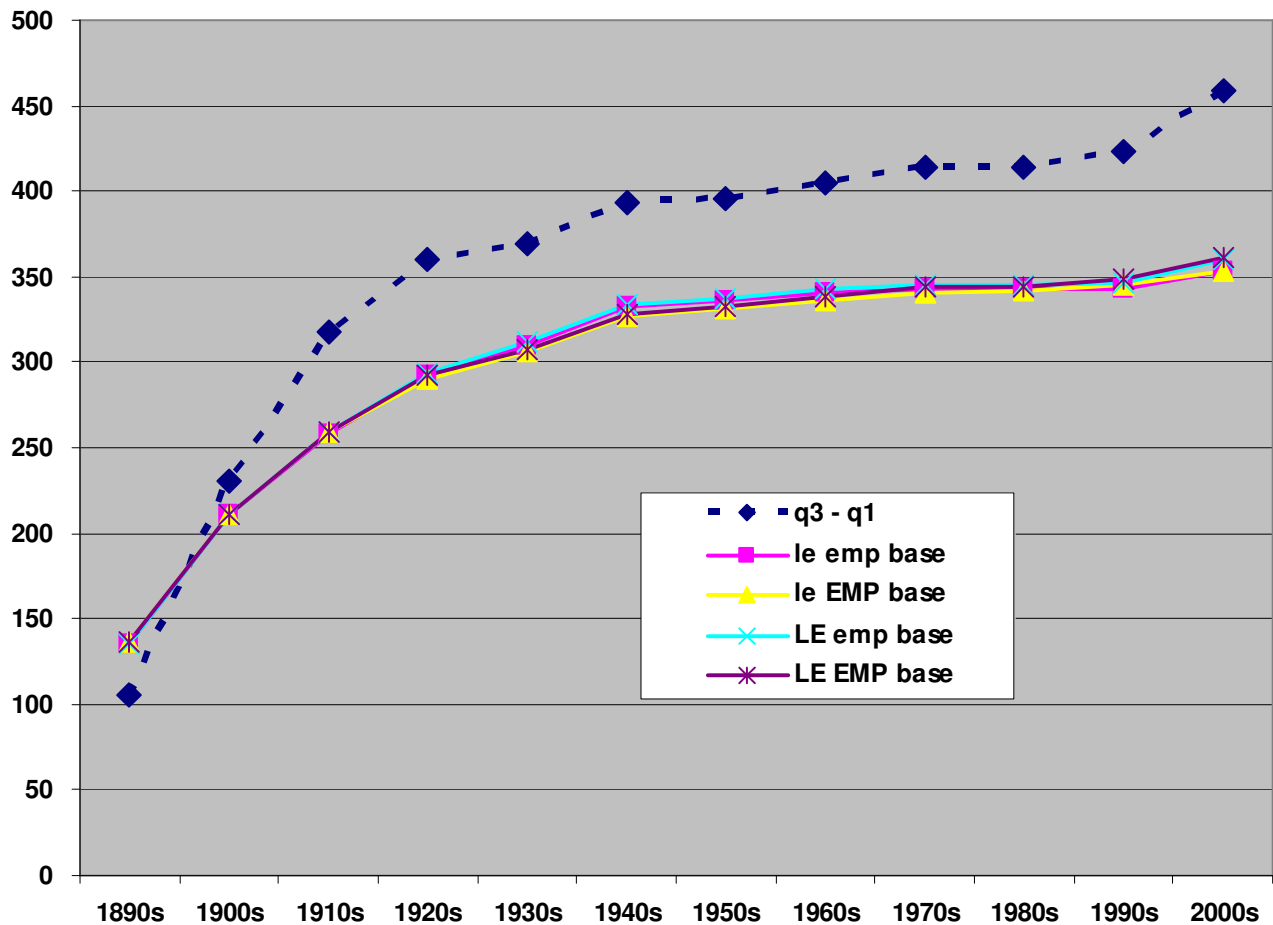
To begin with the middle of the distribution of lifetime NPVs, the median curve peaks with the 1920s and 1930s birth cohorts at over \$150,000. These are the birth cohorts who experienced the first benefits from the fully phased in C/QPP (introduced in 1966 and fully phased in by 1976), after having made minimal payroll tax “contributions”, as well as being the first generation to benefit from improvements to the OAS and the introduction of the GIS. But after this point, median lifetime NPVs tail off, and become slightly negative for the cohort being born in this decade.

From this perspective, the current system (under the specific “low – low” exogenous life expectancy and employment scenario) is not balancing the first two fairness norms outlined above – successive birth cohorts after the 1920s are receiving declining net transfers.

But this graph also indicates dramatic differences across individuals within each birth cohort. The mean NPV is generally lower than the median. This reflects a negative skewness in the NPV distribution, and in turn the fact that taxes are unbounded above, while cash and in kind transfers are bounded below at zero.

More importantly, the curves in Graph1 for the first and third quartiles show a very wide dispersion in NPVs, on the order of \$400,000. This is an extraordinarily clear support of the old adage, “beware of the mean”. The usual analyses of inter-generational fairness (e.g. Kotlikoff, 1993), which are based on representative agents, completely ignore these tremendous variations *within* generations.

2. Inter-Quartile Range of NPV of Tax - Tran and Standard Deviation of NPVs by Exogenous Scenario, Base Policy Scenario



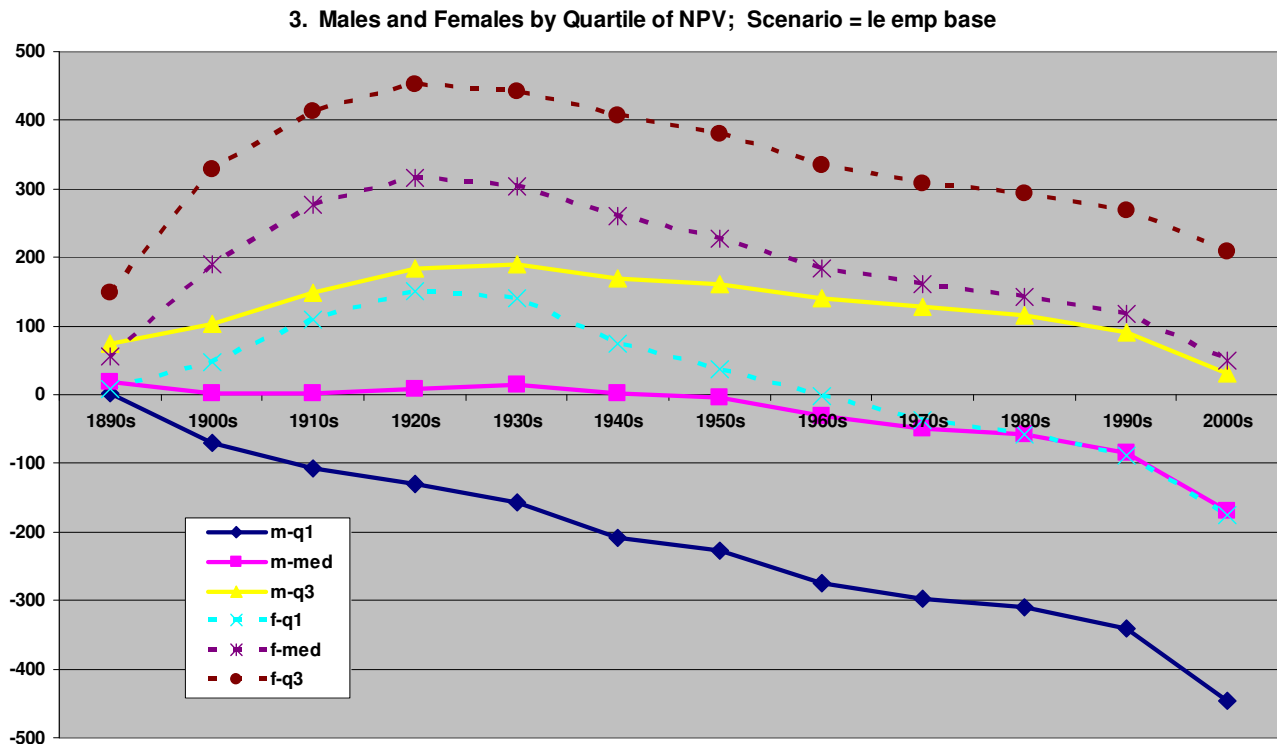
Graph 2 reinforces this point by showing two measures of dispersion, the inter-quartile range for the same low – low scenario as in Graph 1, and the standard deviation of NPVs, for each birth cohort. Additionally, for the standard deviations, four different curves are plotted, one for each of the exogenous scenarios.¹⁷

Two key messages arise. The first is that both indicators of dispersion give similar results – there is a great deal of heterogeneity in individual circumstances within each birth cohort. Indeed, that variation within birth cohorts is far larger than that between birth cohorts shown in Graph 1.

Second, the extent of this variation is essentially unaffected by which of the exogenous scenarios is chosen. Whether life expectancy is high or low, and whether employment is high or low, has virtually no effect on the dispersion of lifetime NPVs.

(QQQ add something on the trends...)

However, Graph 3 shows that sex does make a big difference. In this case, we are looking at the same scenario set as in Graph 1 – the *status quo* policy scenario, and the low-low exogenous scenario.



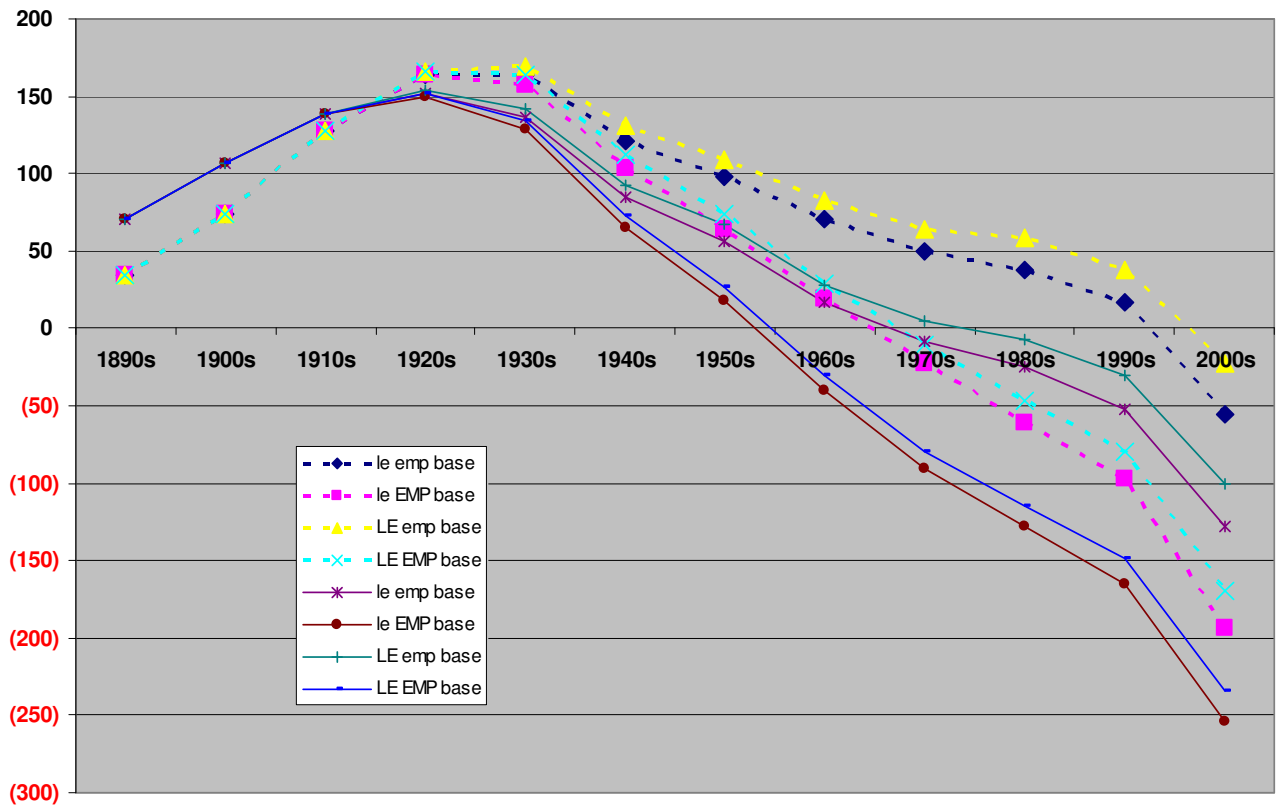
The dashed lines for females are almost everywhere above the solid lines for males. The median NPVs for females in the 1920s and 1930s birth cohorts are on the order of \$300,000 higher than those of their male counterparts, though this declines to about \$200,000 for the current decadal birth cohort.

¹⁷ Note that this dispersion does not include the further effects of differential mortality by income. This is well known, for example Wolfson et. al. (198X). More recently, the Chief Actuary (OSFI, 2006) has estimated that life expectancy at age 65 in 2001 varies by 4.5 years for males and 3.6 years for females between those with low incomes (roughly under \$10,000) and those with high incomes (roughly over \$50,000). (QQQ needs refining to get at bias due to omission of mortality – income inverse correlation)

First quartile males (those with high incomes so therefore paying more income tax and receiving less transfers) end up with NPVs of -\$300,000 or lower for 1970s and successive birth cohorts, while the corresponding birth cohorts of females have NPVs about \$200,000 higher.

Even though the exogenous scenarios had virtually no effect on the dispersion in lifetime NPVs (Graph 2 above), they do have an impact on the typical net present value of taxes minus transfer for successive birth cohorts. Graph 4 shows the impacts on the mean (solid lines) and the median (dashed lines) NPVs of the high and low life expectancy scenarios ("LE" and "le" respectively) and high and low employment scenarios ("EMP" and "emp" respectively) for the *status quo* ("base") policy scenario.

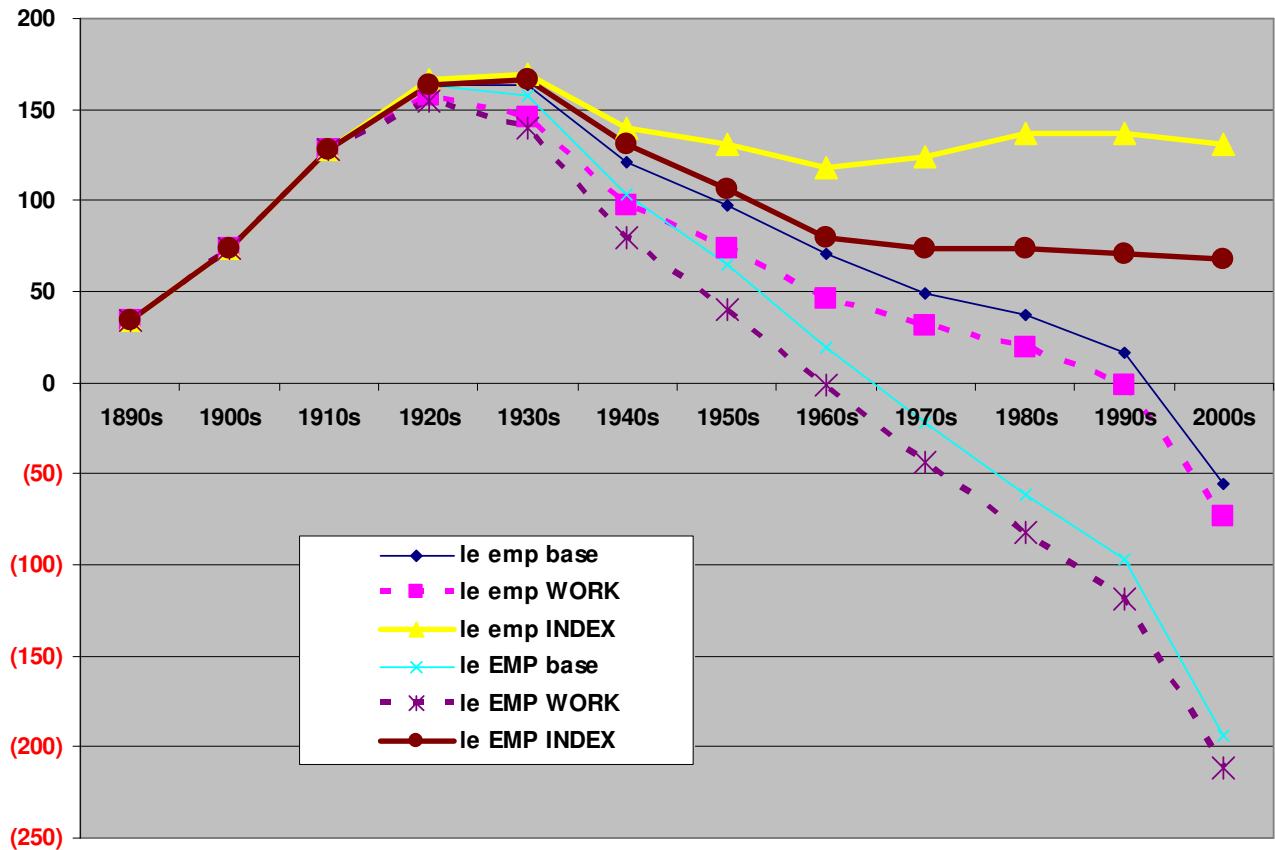
4. Medians and Means by Exogenous Scenario



The main result here is that the strength of the economy has a much larger impact than the pace of improvement in life expectancy. Not surprisingly, higher life expectancy increases the NPVs of transfers minus taxes, as individuals living longer have more years of entitlement to public pension benefits and use more health care services, but are not paying correspondingly more income and payroll taxes over their longer lifetimes. On the other hand, a stronger economy reduces NPVs as income taxes in particular are higher, while the demogrant (OAS) and income tested (GIS) portions of the public pension system are relatively unaffected.

In quantitative terms, for the baby boom and subsequent birth cohorts, a change in life expectancy of as much as 5 years has impacts on lifetime NPVs that are only about one fifth as large as an improvement in employment with the effect of raising per capita wages by about 10%.

5. Lifetime NPVs for Three Policy and Two Employment Scenarios



Finally, Graph 5 shows how the two stylized policy alternatives compare. Since the low and high employment scenarios had a much larger impact than the high and low life expectancy scenarios, we focus on only those two exogenous scenarios (both assuming low life expectancy change). The light lines show the *status quo* (“base”) scenarios; the dashed lines show the scenario where individuals work longer and the age of entitlement to pensions rises gradually from age 65 to age 70 over the period 1976 to 2005; and the heavy lines show the scenario where indexing has been shifted from a price index basis to an index of average wages, while leaving the age of entitlement at age 65.

The most dramatic result here is the relative impacts of the working longer / delayed retirement scenarios compared to the wage indexing scenarios. The shift to delayed retirement (from light solid to dashed lines) is much smaller than the shift from price to wage indexing (from light to heavy solid lines) – on the order of a reduction of \$20,000 compared to an increase well over \$100,000 in lifetime NPVs of transfers minus taxes.

As shown earlier, an improvement in the economy (from “emp” to “EMP”) is important, and tends to shift all the curves up on the order of \$100,000. Thus, a stronger economy (of the order posited in the exogenous scenarios simulated here) turns out roughly to offset the shift from price to wage indexing.

Finally, in terms of the basic focus of this analysis, on intergenerational fairness, the shift from price to wage indexing has the effect of leveling out the curves of NPVs across generations. (Recall that these NPVs are discounted, based on the growth rate of average wages.) In terms of the norms of intergenerational fairness outlined above, these wage indexed scenarios appear most in accord.

Concluding Comments

Population aging is more often a source of concern for public policy than cause for celebration. One reason is the expectation that future cohorts of the elderly, particularly the post WW II baby boom generation, will place intolerable burdens on future working age generations in their retirement years in order to finance their public pensions and insured health care services. However, this analysis suggests the opposite. Under current program rules, and a range of scenarios for future economic growth and longevity, birth cohorts after those born in the 1920s and 1930s will experience successively smaller lifetime net transfers (both cash, and in kind for health and education).

The main factor underlying this (perhaps) unexpected result is the index broadly used to update cash transfer benefit levels and income tax thresholds and other related parameters. This index is the CPI (consumer price index). However, if history is any guide at all, average wages (AW) and the economy more generally will most likely grow faster than inflation. In other words, we can likely expect real per capita economic growth. In this range of scenarios, CPI-indexed benefits will gradually shrink relative to the average incomes of those of working age, and CPI-indexed tax brackets will result in taxpayers gradually finding themselves in ever higher tax brackets, hence paying a larger proportion of their incomes in income tax.

While there is great concern about the effects of increasing longevity on pension costs and hence on inter-generational fairness, our simulations suggest that for quite a wide range of life expectancy scenarios, this has a much smaller impact than the strength of the economy – judged by the range of employment over the most recent business cycle – specifically the 1993 trough and the 2004 peak.

While the focus of this analysis is on widely expressed concerns about *inter*-generational fairness, our results show that differences *within* generations are far larger than those between generations. Women's net lifetime transfers minus taxes are hundreds of thousands of dollars greater than those for men, while the differences between the poor and the rich within any given generation are larger still.

Finally, one of the most widely discussed responses to population aging, in the context of public pensions, is raising the age of entitlement. One of the least discussed issues, on the other hand, is the nature of the indexing of pensions as well as income taxes. That these government programs should be indexed to the CPI is largely taken for granted. However, our analysis suggests that the impact of the indexing provisions is far larger than delaying the age of entitlement from age 65 to 70.

Continuing with CPI indexing results in a continuing fall from one generation to the next in the net lifetime value of transfers minus taxes. Moving to wage indexing results in a leveling off of these net values. Still, cohorts born after the 1930s never receive the net transfers minus taxes that the 1920s and 1930s birth cohorts do.

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Appendix -- Data and Methods

This analysis draws on extensions to the LifePaths (Wolfson, 1996) family of models being developed at Statistics Canada. These are dynamic monte carlo microsimulation models which generate representative population cohorts. The cohorts are built up as longitudinal samples of thousands of synthetic but highly realistic individual biographies or life paths – particularly in respect to their educational participation and attainment, employment, earnings, fertility, nuptiality, government taxes and transfers, and mortality trajectories over their lifetimes – hence their LifePaths.

The analysis starts with the cohort born in the 1890s, and extends for two centuries, to the ultimate demise of the children being born in the 2002 - 2011 decade. A major effort has been made to ground the analysis using quantitative data. However, the combination of an absence of detailed historical data, with the need to make long run projections, means that relatively stylized representations of the main socio-demographic processes and components of Canada's tax/transfer system have had to be used.

LifePaths is in a constant state of development and refinement. The most recent version was employed in the analysis reported here. However, a reasonably up-to-date description of most of the components dealing with demography, education, employment, and earnings can be found on the Statistics Canada website at www.statcan.ca/english/spsd/LifePaths.htm.

Components of the model employed for this study that are not described on the website include Income Taxes and Cash Transfers, Other Sources of Income, and In Kind Transfers. The following provides a brief description of these:

Income Taxes and Cash Transfers – Federal income taxes have been implemented explicitly using historical tax regulations. Structural changes through time and legislated changes have been implemented, as have surtaxes and surtax reduction) from 1917 to present. Income taxes are calculated at year end using the simulated detail on each individual's income: including income from working (both employment and self-employment), pension income (CPP/QPP Retirement Benefits, CPP/QPP Survivors Benefits, CPP/QPP Death Benefits, RPP Benefits, OAS Benefits, and Unemployment / Employment Insurance (UI/EI) Benefits). Net Income is determined after repayment of social benefits (Family Allowances, OAS Benefits, UI/EI Benefits). Deductions and exemptions accounted for include, basic personal amount, age amount, pension income amount, married and equivalent to married amount, dependent amount, education amount, CPP / QPP contributions, and UI / EI Premiums. Tax credits that have been taken into account explicitly include: Child Tax Credit, Federal Sales Tax Credit, and Goods and Services Tax Credit. Major sources of provincial transfer income have been included: Provincial Family Allowances, Quebec Newborn Allowance, and Quebec Child Supplements. However, provincial income taxes have been modeled simply as a weighted proportion of basic federal income taxes. The main programs that are currently not implemented are Provincial GIS top-ups and Provincial Child Tax Benefit Programs. Current CPI or CPI - 3% partial indexing is assumed to continue into the future, under one of the scenarios to be considered. This is a critical assumption, as shown in Wolfson and Murphy (1997).

Other Sources of Income – Selected special sources of income are imputed at year end just before the year's income tax calculation takes place. These include components of income that are otherwise difficult to model: provincial Social Assistance ("welfare"), workers compensation, veterans benefits, investment and dividend income, and alimony. The imputation equations were estimated from census microdata, and take account of sex, age, immigration status, student and employment status, education level, marital status and number of children at home, as well as weeks worked and earnings in the previous 12 months. The imputation was carried out for three separate source groups: Other Transfer Income, Investment Income, and Other Miscellaneous Income. In each case, imputation was carried out in two steps: First, it was determined whether the imputed value was to be non-zero using a logistic regression equation. Then, if it was to be non-zero, a random value was imputed from an appropriate distribution using three quartile regression equations to reflect the location, dispersion and asymmetry of the empirical distribution. The last step in the imputation process involved rescaling the imputed values to values more appropriate to the simulated calendar year of imputation. For that purpose, Other Transfer Income was rescaled by the consumer price index, Investment Income was rescaled by the bank rate and Other Miscellaneous Income was rescaled by the average industrial wage.

In Kind Transfers – The major in kind government transfers are health care and education. These are modeled based on unit costs by age, and sex in the case of health care, and unit costs based on the kind of educational institution attended (elementary-secondary, community college, university; Cameron and Wolfson, 1994).