The Impact of the Equity Risk Premium and Population Aging on The Canadian Retirement Savings System

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Abstract

Increasing longevity will impact retirement savings adversely. For defined benefit social insurance and private pension plans, its primary impact will be to increase costs. For accumulation-type savings arrangements, either group or individual, increasing longevity will lead to less adequate benefits than anticipated.

A critical component with respect to funded or partially funded retirement savings programs will be the rate of investment earnings achieved. Most private retirement plans and certain partially funded social insurance plans, such as the Canada Pension Plan, invest in equities. Accordingly, the return achieved on equity markets will be an important determinate of the level of benefits delivered and the costs associated with the retirement savings system. With increasing longevity of the population, the resultant savings gain or loss to the retirement system of the equity risk premium being greater or less than its forecast level will be magnified.

This paper reviews current research with respect to the equity risk premium. It uses an estimate of the equity risk premium derived from such research, combined with data regarding projected increases in mortality, and applies this information to the Canadian retirement income system. Based on the estimates of the equity risk premium and the current actuarial assumptions used to model the Canada Pension Plan, it shows the projected impact on that plan. It presents a similar analysis for other Canadian retirement savings. The paper concludes that if the lower estimates of the equity risk premium materialize, when combined with the increasing longevity of the Canadian population, the retirement savings system faces significant challenges.

Introduction

In this paper, an attempt is made to gather information regarding all components of the Canadian retirement income system, including government-sponsored pension plans such as the Canada Pension Plan (CPP) and Quebec Pension Plan (QPP), defined benefit pension plans and individual retirement savings.[1] An attempt is made to quantify the impact on the components of the system of unanticipated mortality improvements, particularly at age 65 and over, and of lower-than-expected equity returns.

In gathering the information, many sources have been referenced. Unfortunately, information from various sources is not available at a common date, so it is impossible to determine the financial impact at a particular time. Moreover, the information provided in public reports often does not provide sufficient detail or aggregates data, so that estimates and approximations are required. Also, much of the published information precedes the few years ending in 2003 when equity returns were poor and the equity risk premium was non-existent.

Nonetheless, the information gathered is sufficiently reliable to indicate that those not covered by defined benefit pension plans are in danger of having inadequate retirement income if they continue with their current savings patterns. The situation will worsen if mortality improves beyond age 65 and if lower-than-expected equity returns are achieved.

Items to be Considered

Mortality Improvement

Various sources document mortality improvement that is occurring, especially among older lives. At the first "Living to 100 and Beyond" symposium, Doray [2] presented a paper that developed expectations for life at older ages, based on Canadian experience for those born before 1892. For the oldest ages, his values for life expectancy are higher than the current table commonly used for pension plan valuation, the Uninsured Pensioners 1994 Table (UP94), which has been updated to allow for mortality improvement. See the following comparison, which shows that at the high ages, the life expectancy decreases less rapidly on Doray's values than for UP94, and at the very high ages, Doray has longer life expectancies than UP94 (as shown in bold).

TABLE 1

Age	Comparison of Doray's Expectancy of Life to UP 94			
	Male		Female	
	Doray	UP94	Doray	UP94
85	5.04	5.90	6.25	7.22
90	3.83	4.19	4.62	5.09
95	2.94	2.99	3.42	3.57
96	2.79	2.81	3.22	3.32
97	2.65	2.65	3.04	3.10
98	**2.53**	2.50	2.87	2.89
99	**2.41**	2.37	**2.72**	2.70

In a paper entitled "Mortality in the next millennium," [3] Willets states:
"There are two aspects to the idea of the ageing of mortality improvement, namely:

1. The ages showing the greatest rates of mortality improvement are increasing over time.
2. The pace at which mortality is improving at 'older ages' is accelerating over time (and the definition of 'old' is also moving upwards)."

A September 2004 announcement [4] by Statistics Canada indicates that life expectancy is rising among seniors. Based on 2002 mortality rates, the life expectancy at age 65 for Canadian men is 17.2 years and for their female counterparts is 20.6 years. Since 1979, life expectancy among men at 65 has increased by 2.6 years, while that of women at 65 has increased by 1.6 years.

In this paper, I examine the impact on the Canadian retirement system of mortality improvement at older ages for those retiring near age 65, and I attempt to quantify the impact.

Equity Risk Premium

Rational investors expect to receive a higher return for investing in equities than in long-term Government of Canada bonds, because of the additional risks taken. The expected additional return premium is referred to as the equity risk premium (ERP), i.e., the ERP is the reward in excess of the risk-free return. In the context of a Canadian pension plan, which typically has a very long investment horizon, the "risk-free" investment is a portfolio of long-term Government of Canada bonds selected to exactly match the liabilities. Where investment is not in equities, but is in other than Government of Canada bonds, there will normally be a return premium to compensate for excess risk, a similar concept to the ERP.

The ERP to be realized in the future is the subject of much conjecture. In a paper entitled "An Examination of the Equity Risk Premium Assumed by Canadian Pension Plan Sponsors," [5] I report on a range of forecasts for the ERP. A survey by Aon Consulting of investment managers as at January 1, 2004, indicates that over a 10-year horizon, the median manager expects the implicit ERP to be 2.2 percent for Canadian and U.S. equities and 4.0 percent for international equities. Applying these ERP forecasts to the average asset mix of the Canadian pension fund suggests an average ERP of about 1.4 percent. The paper also cites research by Robert D. Arnott and Peter L. Bernstein [6] that suggests very different results, namely that a negative ERP may be expected over the next 10 years.

The amount by which the Canadian Common Stock Index return exceeded the Canada Long Bond return for the 50-year period, 1954-2003, was 3.17 percent, the effective ERP. However, for the more recent 10-year periods, 1984-1993 and 1994-2003, the effective ERP was –5.60 percent and 0.10 percent respectively. [7]

Many Canadian pension plans invest in equities, as do individuals saving for retirement. In this paper, I do not attempt to determine the magnitude of the expected ERP; rather, I attempt to quantify the impact on the Canadian retirement system if the ERP is less than commonly expected, perhaps in the 1 percent range.

Government-Sponsored Pension Plans

Canada Pension Plan

The Canada Pension Plan has been established by the federal government, in consultation with the provinces, to provide pension plan coverage to employees in all Canadian jurisdictions outside Quebec. It is financed by contributions from workers and their employer, on earnings up to approximately $40,000. It provides a maximum pension at age 65, after 35 years of service, of approximately $10,000. The total contribution rate is 9.9 percent of covered wages, and this rate is expected to remain level. The steady-state rate is estimated to be 9.8 percent. The excess of the contributions over the benefits paid is invested by an independent board, the Canada Pension Plan Investment Board (CPPIB).

A panel of actuaries was appointed to review the Eighteenth Actuarial Report on the Canada Pension Plan (AR18) [8] and express an opinion regarding the appropriateness of the assumptions.

With respect to the mortality assumption, AR18 starts from the 1990-92 Life Tables for Canada and Quebec, prepared by Statistics Canada, updated for actual mortality improvements to 1996. These mortality rates were projected to adjust for assumed improvements in mortality using assumed improvement rates adopted for the 2000 trustees' report on the U.S. Social Security OASDI program, modified to reflect historical differences between mortality in Canada and the United States. At ages 55 and older, the AR18 assumed rates of improvement for males are 0.60 percent to age 79 and then 0.55 percent. For females, the assumed rates of improvement are 0.50 percent for ages 55 and older.

Sensitivity tests assuming mortality reductions of 200 percent from the assumed rates resulted in an increase in the pay-go rate in 2075 of 0.86 percent of contributory earnings; i.e., the 2075 rate increases by 7.5 percent, or an increase in the steady-state rate of 0.2 percent from 9.8 percent to 10 percent. Hence, although mortality improvement would affect Canada Pension Plan funding, requiring an increase in expected contributions, such an increase is affordable.

With respect to investment, the CPPIB now invests the funds in public and private investments. Previously, the funds were loaned to the provinces. AR18 has assumed that the real rate of return earned by CPPIB on future investments after 2001 will be 3.80 percent for bonds, 4.50 percent for Canadian equities and 5.00 percent for foreign equities, on the best-estimate basis. This assumption results in an equity risk

premium of 1.5 percent for Canadian equities and 2.0 percent for foreign equities. [9] (It also assumes an excess risk premium for bonds of 0.8 percent.)

Sensitivity tests, in which the total asset mix was assumed to earn 1.0 percent less than the best-estimate assumption, which is approximately equivalent to assuming that the ERP would be -0.5 percent for Canadian equities and 0 percent for foreign equities, produced an increase in the steady-state rate of 9.8 percent to 10.2 percent.

Again, although a reduced ERP would affect Canada Pension Plan funding, requiring an increase in expected contributions, such an increase would be manageable. As an aside, the CPP has, and is expected to have for many years, a low funded ratio. If it were "better" funded, the expected steady-state rate would be commensurately lower, as more of benefits would come from investment yields. In that set of circumstances, reducing the ERP would be far less manageable!

Quebec Pension Plan

Quebec maintains its own pension plan for employees in Quebec. The plan is similar to the Canada Pension Plan. The plan reserve, which is developing and which stood at $18 billion at December 31, 2000, is managed by the Caisse de dépôt et placement du Quebec (Caisse). The most recent actuarial report available is as at December 31, 2000. The steady-state rate is estimated to be 9.90 percent.

That report [10] notes a significant aging of the Quebec population, attributable to two main causes: a large drop in birth rates and a large reduction in age-specific mortality rates. With respect to the latter cause, the report shows the increases in life expectancy at age 65, as shown in the table below. Accordingly, the report projects that mortality rates will drop continually over the entire projection period, and life expectancy will reach the values shown in the table.

TABLE 2

Quebec Pension Plan Life Expectancy at Age 65					
Gender	**1966**	**1998**	**Percent Increase from 1966**	**2050**	**Percent Increase from 1998**
Males	13.2 years	15.6 years	18%	18.8 years	20%
Females	15.8 years	19.9 years	26%	22.1 years	11%

The report includes a sensitivity test regarding future mortality improvement greater than assumed in the projection shown above. If the life expectancy assumed to be attained in 2050 is attained by 2036, life expectancy would continue to increase, reaching 81.7 years for men and 85.6 years for women in 2050. The cost impact of this further mortality improvement would be to increase the steady-state contribution rate in 2050 by 0.07 percent to 9.97 percent. Certainly this is a manageable change.

The real rate of return assumed in all years subsequent to 2001 is 4.7 percent per annum. The asset mix employed by the Caisse is not specified. The Caisse has invested in equities for many years, and this level of real return implies some investment in equities. A reduction of 0.5 percent in the real rate of return results in an increase in the contribution rate for 2050 from 9.9 percent to 10.10 percent. Once again, the increased level of contribution rate resulting from a shortfall in investment income is manageable.

Canadian Defined Benefit Pension Plans

A report by the Certified General Accountants Association of Canada [11] attempts to estimate the funded status of Canadian defined benefit plans at December 31, 2003. The report excludes the pension plans for the federal public employees and the Quebec public employees.

The following subsections provide information on the impact of mortality improvements and a shortfall in ERP on the two pension plans excluded in the CGA's report: Pension Plan for the Public Service of Canada (PPPSC), which is for federal employees, and on the Régime de retraite des employés du gouvernement et des organismes publics (RREGOP), which is for Quebec public employees. Thereafter the findings of the CGA report are reviewed.

PPPSC

According to the Actuarial Report on the Pension Plan for the Public Service of Canada as at 31 March, 2002, [12] the mortality improvement assumption was based on a 25-year select period with an ultimate mortality improvement of 0.5 percent at all ages, after making an initial improvement in mortality to reflect the mortality improvement of the 1995-1997 Life Table Canada relative to the 1985-1987 Table. Mortality rates for the 2003 plan year were assumed to be 500 per 1,000 people for ages 105 on, reaching 1,000 per 1,000 people at age 115. It is interesting to note the number of pensioners living at 100 or above.

TABLE 3

Age Last Birthday	Number of				
	Male Pensioners	Female Pensioners	Male Disabled Pensioners	Female Disabled Pensioners	Surviving Spouses
100 – 104	5	29	0	1	0
105 – 109	1	2	0	0	0

Given the allowances made for mortality improvement and the results of the sensitivity tests from CPP, the impact on the normal cost is estimated to be less than 0.25 percent, or about $33.5 million. This is an affordable, although undesirable, increase in costs.

Most of the assets of PPPSC are notional and are credited with interest as though they were invested in 20-year Government of Canada bonds. However, from 2000, a separate Pension Fund has been established to receive contributions and to invest in financial markets. The long-term return assumption, net of investment expenses, is 4.3 percent per annum, producing an implied ERP on the total portfolio of 1.3 percent. The effect of reducing the ERP by 1 percent is to increase the deficit for the Pension Fund by $950 million, from $219 million to $1,169 million. This is a very significant change in the financial position of the Pension Fund. However, given the relatively small portion the Pension Fund represents of "total assets" of the plan and the security afforded by having the federal government as sponsor, such a change in position is not much of a cause for concern.

RREGOP

The most recent actuarial valuation report [13] on the RREGOP is as at December 31, 1999. The rates of mortality are based on the UP94 Table with mortality improvement five years beyond the valuation date using the improvement scale AA. The author estimates that additional unanticipated mortality improvement might increase the value of the obligations by approximately 5 percent, which would have the impact of increasing the 2000 contribution rate by employees by approximately 0.9 percent. Such an increase is reasonably affordable.

As at December 31, 1999, the value of the assets of the plan was $26.9 billion. The real rate of return assumed was 4.75 percent per annum for the years 2000 on. The Caisse manages the investments of this plan as well. Although the asset mix is not specified, with an expected ERP on the total portfolio of approximately 1.75 percent, it undoubtedly includes equities. A reduction in the ERP resulting in a reduction of 0.5 percent in the real return achieved would result in an increase in the 2000 contribution rate for employees of approximately 1.85 percent. This is a more significant, but still affordable, increase.

Taking the estimated mortality impact and the ERP impact together would increase the 2000 contribution rate, before expenses, from 1.38 percent to 4.13 percent. It is interesting to note that the contribution rate was 4.63 percent as determined by the actuarial report as at December 31, 1993. The extremely strong equity markets from 1993 forward served to reduce the rate. The lower-than-expected equity returns of the future may serve to raise the contribution rate.

Private Sector Pension Plans

Information on private sector pension plans is also difficult to gather in a useable form. However, actuarial valuations of such plans typically assume limited mortality improvements.

Aon Consulting has studied the impact on solvency liabilities for active members for an all-male group when the current standard table for Canadian solvency valuations, the 1983 Group Annuity Mortality Table, is replaced by the UP94 Table with mortality improvements projected to 2015. Excluding the interest rate impact, the studies show about a 9 percent increase in liability due to mortality improvements. Calculations of a 20 percent improvement in mortality from age 65 using the UP94 Table, which is becoming an increasingly common table for valuation, shows costs may increase by about 6 percent to 8 percent, depending on the male-female mix of the group. Using the information from the CGA report, [14] this suggests that for the total Canadian marketplace, plans may be about $45 billion less well-funded than they estimate.

The CGA report [15] indicates that at December 31, 2003, the average pension fund was invested 56 percent in equities, 37 percent in various types of bonds, 2 percent in real estate and 5 percent in other instruments. The expected return on assets by the median fund was in the range of 7.50 percent to 7.99 percent.

This suggests an implied ERP of 2.5 percent or higher. If we assume that any reduction in ERP will result in assets being less adequate than anticipated, then using the data from the report to estimate the impact if the actual ERP is 1 percent less than expected indicates that the Canadian plans would be approximately $45 billion worse off than they anticipate.

It is interesting to note that the impact from the lower ERP and assumed mortality improvements is approximately the same, due to the current funded status of the plans. The CGA report estimates the net deficiency for all private sector plans at December 31, 2003, to be $160 billion. [16] Hence, realization of a lower ERP and mortality improvements greater than expected implies that the pension plans in aggregate face a $250 billion deficit. Not all plans have the same funding ratio, nor are all plan sponsors backing the plans equally well-capitalized. An increase in the overall unfunded position of $90 billion would likely result in some benefit promises not being fulfilled, through plan failures, terminations or benefit reductions. [17]

Other Canadian Savers

To this point, we have focused on the retirement system constituted by the government-sponsored pension plans, CPP and QPP, and by defined benefit pension plans. However, according to a study [18] of 11.2 million tax filers in 1996 who were defined as employees, only 4.1 million participated in a Registered Pension Plan (RPP), less than 37 percent. The remaining 63 percent of tax filer employees did not have access to an employer-sponsored pension plan and must save for retirement on their own.

The Registered Retirement Savings Plan (RRSP) is a cost-effective method of saving for retirement for many of those workers not participating in an RPP. Contributions, subject to certain limits, are tax deductible. The contributed funds and investment earnings, of any type, are not taxable during the accumulation. Funds withdrawn are fully taxable. The case can be made that for low-income earners, who may qualify for income support payments in retirement through public programs such as the Guaranteed Income Supplement, it is not cost-effective to save for retirement through an RRSP. This is due to the "effective tax rate" faced by these lower-income earners as they lose dollars of income support because they have dollars of retirement savings available to them.

The study [19] showed:

- Approximately 8.5 million of the 11.2 million taxpayers were excluded from making an RRSP contribution because their income came from ineligible sources, such as investment income, government transfers, etc..

- The average RRSP contribution by the self-employed or by employees with no RPP coverage was greater than for employees in contributory RPPs.

- Income earners earning below $40,000 made smaller-than-average RRSP contributions.

- The 1996 RRSP participation rate was considerably higher among employees with an RPP than among taxpayers without such coverage.

The results sound alarm bells that those with lower earnings who are not covered by an RPP are saving very little for retirement. A 1999 study [20] showed that approximately 24 percent of family units had only RRSP assets, i.e., no RPP, with an

average value of $15,000. Even more disturbing, 29 percent of all family units did not have any private pension assets in 1999.

One might hypothesize that younger family units, with many years to retirement, are the ones without pension savings. However, this is not the case. The study showed that 43 percent of family units without pension assets had a major income recipient 45 or older. Moreover, the study showed that 34 percent of the family units with a major income recipient 65 or older had no pension assets.

How much income does a family require in retirement? The study [21] acknowledges that it is not necessary to have the same gross income after retirement in order to have the same net income, because certain work-related expenses cease. Moreover, a similar standard of living after retirement is possible with less net income, due to changes in expenditure patterns. Nonetheless, the study concludes that 33 percent of family units with a major income recipient 45 to 64 may not, given their current asset situation, generate an income in retirement above the low-income cutoff. [22]

The study indicates that those receiving retirement income between 65 to 74 and 75 and up are living on an annual income of 17 percent of total assets. Approximately 35 percent of this income comes from public plans, such as CPP. Since total assets include principal residence, I have assumed that not all assets will be converted to income. On this basis, I estimate that for single retirees, with average or less than the average amount of assets, their assets will provide a livable income for approximately nine years from age 65. This suggests that such Canadians will experience, on average, approximately two years of inadequate income (assuming they live adequately until the assets other than public program assets expire). If we assume mortality improvements of 20 percent for the years after age 65, this adds approximately one additional year, on average, with inadequate income.

The situation is even bleaker for family units where both spouses are living on average or lower-than-average assets. While the first spouse may only experience two years of inadequate income, the other spouse faces 3.5 years of inadequate income. Again, allowing for 20 percent mortality improvement from age 65 increases the average number of years of inadequate income by one year. The use of averages hides the likely societal impact. Those dying before age 75 may live adequately, whereas those living at ages 80 and beyond may experience lengthy periods of hardship.

These calculations assume that the assets generate a real return of 5 percent. This is highly unlikely, given the non-investment nature of many of the assets. However,

faced with the prospects of inadequate income, family units may be tempted to invest in equities or other high-risk investments in order to generate a higher return.

If we assume that only a 3 percent real return is achieved, combined with an assumed 20 percent improvement in mortality after age 65, the period of inadequate income increases to four years or five years for a single retiree or the first spouse to die of the family unit. For a couple, the longer-living spouse faces six years of inadequate income or seven years, assuming a 20 percent improvement in mortality after age 65. In this situation with relatively little investable assets, the mortality improvement is a significant consideration.

Some such as Brown have suggested that accumulation–type savings through vehicles such as defined contribution pension plans and RRSPs should have to be annuitized, to ensure that individuals do not outlive their savings. [23] Milevsky has developed a model to help assess the optimal time to annuitize. [24] While Brown is correct that forced annuitization would ensure that income continues for life, with the relatively small amounts that Canadians who do not participate in RPPs are saving, the lifetime income payments would be small. Under mandatory annuitization, even those savers who died earlier than their expectancy of life might be forced to have extensive periods of inadequate income.

Conclusions

The evidence is mounting that rates of mortality will continue to improve, especially for older individuals. There is considerable debate regarding the level of ERP to be achieved in the future, but there is a significant possibility that the ERP achieved will be lower than that anticipated. The net impact of both of these factors is to increase the costs of defined benefit pension plans that invest in equities and to increase the accumulated savings necessary for an individual to have adequate income in retirement.

Based on a review of reports available with respect to the various sources of retirement income plans, I have reached the following conclusions:

- For government–sponsored plans, specifically the CPP and QPP, significant provisions have been made for mortality improvement and, at present, equity investment plays a limited role in the investment of these plans. If unanticipated mortality improvements occur and the ERP is less than expected, the contribution rates will rise in the distant future, but the increases are modest and manageable.

- For defined benefit plans covering federal public employees and Quebec public employees, some allowance for mortality improvement has been made. The expected return for these plans is dependent on achieving an ERP on the total investment portfolio in excess of 1.25 percent. These plans will likely experience more sizable increases in contribution rates if mortality improvements are greater than anticipated and the ERP is less than expected. However, given the backing of the respective governments, there is little concern that pension benefits will not be delivered as promised.

- For other defined benefit pension plans, limited, if any, assumptions regarding mortality improvement would seem to be common. Moreover, these plans rely heavily on equity investments to generate an attractive investment return. In aggregate, at December 31, 2003, these plans were underfunded by approximately $160 billion. Mortality improvements and lower-than-expected ERP will worsen the financial position of these plans, requiring contribution increases. Given the financial status of these plans, there is a significant likelihood that some benefit promises will not be honoured, due to benefit cutbacks, plan terminations or plan failures. This is a cause of concern.

- With respect to employees not covered by defined benefit pension plans, the data suggests that many are not saving sufficiently or at all and will have an inadequate income in retirement. Mortality improvement will extend the period during which individuals are forced to live on an inadequate income. It will also increase the numbers of individuals unlikely to have an inadequate income.

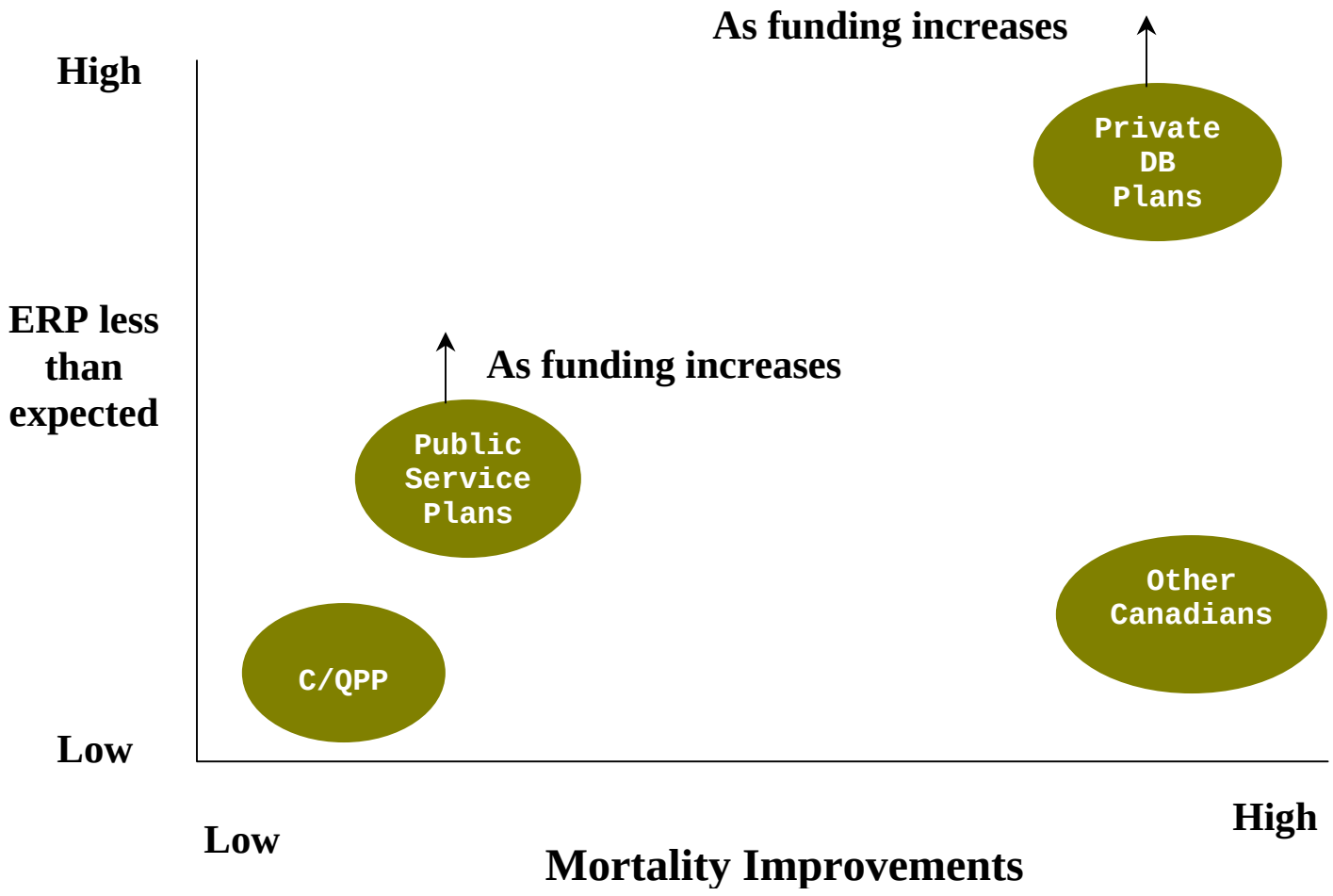
  Many of these individuals have a limited portion of their assets invested in financial instruments. On the one hand, a reduction in the ERP may have a limited impact. On the other hand, faced with the prospects of having an inadequate income, individuals may turn to equity investments as a panacea to their problem. In the latter situation, a lower-than-expected ERP will exacerbate, rather than assuage, their retirement income needs.

  A further situation that may develop, which has significant implications for Canadian society, is that the remaining member of a couple (family unit) will have, on average, six or more years to live with a very inadequate income, most of the family unit's assets having been consumed while the other member of the couple was alive.

The risk map below, labeled "Chart 1 – Riskiness Of Unanticipated Changes," shows the relative impact of lower-than-expected ERP and mortality improvements on the various components of the retirement savings system.

Overall, the formal retirement income system constituted by government-sponsored pension plans and registered defined benefit pension plans, is, of the most part, able to withstand the increased cost implications of unanticipated mortality improvements and lower-than-expected ERP. Unfortunately, more than 63 percent of Canadians are not covered by defined benefit pension plans. A large number of these Canadians are not saving sufficiently for retirement. Unanticipated mortality improvements and lower-than-expected ERP will make the situation worse. Efforts to warn Canadians about the need to increase their savings for retirement and to provide margins in setting their savings objectives to allow for mortality improvement and lower-than-expected ERP are to be encouraged.

CHART 1
Riskiness Of Unanticipated Changes



End Notes

1 The paper does not include an examination of Old Age Security (OAS) and Guaranteed Income Supplement (GIS) programs. Neither of these government-provided programs are prefunded. OAS is a demogrant to all Canadians age 65 and up who apply and meet certain residency requirements. It provides an annual benefit of less than $6,000 per year and is income-tested and reduced when income exceeds approximately $60,800. GIS is a support program for low-income and welfare recipients. Although these income sources may represent a significant portion of total income for low-income recipients and deliver significant social benefits, the author does not consider these sources to be an important foundation for individual retirement planning.

2 Doray, Louis G. "Living to 100 in Canada in 2000," p. 19.

3 Willets, Richard. "Mortality in the next millennium," p. 26.

4 Statistics Canada. 2004. Announcement regarding "Deaths, 2002."

5 Andrews, D. "An Examination of the Equity Risk Premium Assumed by Canadian Pension Plan Sponsors."

6 See, for example, Peter L. Bernstein, "Determining the Equity Risk Premium," AIMR *Equity Research and Valuation Techniques* (2002), or Robert D. Arnott and Peter L. Bernstein, "What Risk Premium is 'Normal'?" *Financial Analysts Journal* (March /April 2002).

7 Information derived from CIA Canadian Economic Statistics 1924-2003, Tables 2A and 2B.

8 See AR18 and review of AR18 by the CPP Actuarial Review Panel.

9 Review of AR18 by the CPP Actuarial Review Panel, p. 50.

10 Actuarial Report of the Quebec Pension Plan as at 31 December 2000, p. 17.

11 Certified General Accountants Association of Canada 2004. "Addressing The Pension Dilemma in Canada."

12 See PPPSC actuarial report.

13 See RREGOP actuarial report.

14 Certified General Accountants Association of Canada 2004. op.cit., p. 32-33.

15 Ibid, p. 41.

16 Ibid, p. 33.

17 Unlike the United States, which has a Pension Benefits Guarantee Corporation to provide insurance in the event of insolvency of the pension plan sponsor, only one Canadian province, Ontario, has such an insurance fund, called the Pension Benefits Guarantee Fund (PBGF). The PBGF only applies in respect of plans involving Ontario members. Consequently, in the event of insolvency of the pension sponsor, if the pension plan is not fully funded, it is likely that certain promised benefits will be reduced.

[18] Akyeampong, Ernest B. "Saving for retirement: RRSPs and RPPs." Statistics Canada *Perspectives* (Summer 1999), p. 23.

[19] Akyeampong, Ernest B., op.cit.

[20] Maser, Karen and Dufour, Thomas. "Private pension savings, 1999." Statistics Canada *Perspectives* (Spring 2002), p. 41.

[21] Ibid, p. 43.

[22] The low-income cutoff is the income threshold, determined by analyzing family expenditure data, where low-income families will devote a larger share of income to the necessities of food, shelter and clothing than the average family would.

[23] Brown, Jeffrey R. "How Should We Insure Longevity Risk in Pensions and Social Security?".

[24] Milevsky, Moshe Arye. "Optimal Asset Allocation Towards The End of the Life Cycle: To Annuitize or Not to Annuitize?".

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