Canadian Retirement Security: A New Reality of Low Returns

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Abstract

Using a population micro-simulation model, we compare the financial security of Canadian seniors in three scenarios: if Canadian financial markets (1) never experienced the financial crisis of 2008 (i.e. continued on their pre-2008 path); (2) experienced the crisis and recover in five years; or (3) enter a new long-term environment of depressed stock market growth and continued low interest rates.

If recovery occurs, we project that the long-term effects of the financial crisis on retirement prospects will be the most felt by older workers now near retirement. If low interest rates continue, however, more severe repercussions await younger workers. Upper-income Canadians are affected the most by continuing low interest rates owing to their relatively greater holding of financial assets. Nevertheless, a long-term low interest rate environment will cause an additional 2.3% of Canadian seniors to experience poverty.

Our results underline the vital role of the Canadian social pension program in both protecting poorer Canadian seniors from destitution, and in also shielding the lower, middle and even upper-income Canadian elderly population from financial market risk.

Introduction

Between December 2007 and December 2008, the Toronto Stock Exchange (TSE) dropped by 35% and the yield on 1-3 years short-term Canadian securities dropped by 72% (from 3.9% to 1.1%)[1]. For retirees, depressed asset values and lower rates of return interact multiplicatively. For example, at the end of 2007 somebody with a portfolio of $1,000,000 who was expecting a return equivalent to short-term securities yields could expect an income of $39,000. At the end of 2008, after the market collapse and decline in interest rates, receiving 1.1% on a portfolio of $650,000 would imply an income of $7,150. In this example, depressed asset values and a decline in rates of return together created an 82% reduction in annual returns.

[1] Source: CansimV122558.

Although this example may be extreme (because bond portfolios diverge from equities and because the TSE has recovered[2]), the larger question remains: If financial markets have entered a new reality of low returns[3], what will this imply for the retirement prospects of Canadians? Presumably, Canadian workers could eventually adjust by changing their savings and retirement behavior – but what would the direct monetary impact be of a new reality of low financial returns?

This paper compares poverty and lifetime income continuity among Canadian seniors across three alternative financial market scenarios – no financial crisis (Scenario 'No Crisis'); a financial crisis followed by a recovery of interest rates in the next five years (Scenario 'Crisis-Recovery'); and a financial crisis followed by a new reality of long-term low financial market returns (Scenario 'No Recovery'). We investigate the consequences for Baby-Boomers born 1951-1966 (who turn 65 between 2016 and 2031) and Generation Xers/Early GenerationYers (born 1967-1990 and turning 65 between 2032 and 2055). To highlight the direct implications of financial market changes, we assume current savings and retirement behaviors do not change.

Since we want a measure of the income available for personal consumption, this paper's income concept is comprehensive – including earnings, government public pension benefits (Canada/Quebec Pension Plan benefits, Old Age Security, and Guaranteed Income Supplement), employer pension plan benefits, registered and non-registered financial wealth income flows (annuitized wealth and discretionary withdrawals), housing wealth flows, taxes, savings, as well as an adjustment for household size. To account for the realistic diversity that exists within and across the lives of Canadians, we use Statistics Canada's LifePaths model[4] – a dynamic micro-simulation model of the Canadian population, which simulates individual life-courses and models its components (birth, education, employment, income, taxes, marriage, child-bearing, retirement, etc). By simulating the behaviours of a representative sample of individual Canadians case by case, LifePaths is able to recreate the diversity of the entire Canadian population over time.

In this project, we focus exclusively on objective financial impacts in terms of financial flows.[5] We also do not explicitly model bequests – Canadian seniors who have more potential annual income available from pensions and assets than they had while they were working are highly likely to leave inheritances rather than actually increase their annual consumption, but we do not explicitly model that choice.

Section 1 reviews the literature while Section 2 describes the future financial market scenarios. Section 3 describes the three pillars of the Canadian retirement income system

[2] The TSE rose 30% in 2009 but interest rates remain low (1.1% in 2012): CANSIM V122620; V122558.
[3] See Reinhart and Rogoff (2009) and the U.S. Treasury announcement (August 9th, 2011) that interest rates will be kept near zero through 2013.
[4] This analysis is based on Statistics Canada's LifePaths Model (version 5.1.4.4). The assumptions and calculations underlying the simulation results were prepared by the authors and the responsibility for the use and interpretation of these data is entirely that of the author(s).
[5] Subjective outcomes, such as the anxiety generated by the volatility of the financial market (see Bricker et al., 2011; Deaton, 2012), are therefore not considered.

– (1) government public pension programs (universal Old Age Security (OAS), income-tested Guaranteed Income Supplement (GIS), and the Canadian/Quebec Pension Plans (C/QPP)); (2) employer pension plans; and (3) individual savings – and discusses how they interact with financial markets, particularly in a low interest rate environment. Section 4 outlines our methodology, methodological issues, and outcome measures. Section 5 analyzes and Section 6 concludes.

1 Literature review

Several U.S. studies have examined qualitative surveys to analyze the effects of the financial crisis on retirement expectations and general well-being (Bricker et al., 2011; Deaton, 2012). Actual and/or expected adjustments in retirement behavior have been examined by Coile and Levine, 2010; 2011; Goda, Shoven and Slavov, 2011; Gustman, Steinmeier, Sass, Monk and Haverstick, 2010; and Tabatabai, 2010; 2011. Changes in wealth have been the focus of Bricker et al., 2011; Gustman et al., 2010, 2011; Sass, Monk and Haverstick, 2010; and Wolff, 2011. As well, Gustman et al., (2010, 2011) have analyzed the consequences of multiple adverse effects (such as being laid off and needing to sell an undervalued home so as to relocate for new employment).

This paper most closely fits among a third approach - studies that model the impact of the financial crisis on future retirement financial security. In a similar study, Butrica et al. (2009) use large-scale micro-simulation population modeling to project the impact of the financial crisis on the retirement prospects of Americans under alternative stock market recovery scenarios. The "National Retirement Risk Index" by the Center for Retirement Research at Boston College (Munnell, Webb and Golub-Sass, 2009) and the "EBRI Retirement Security Projection Model" by the Employee Benefit Research Institute (Vanderhei, 2011) project the proportion of American households who have become at risk of insufficient retirement income as a result of the financial crisis. Vanderhei (2011) and Brady (2009) both use micro-simulation modeling to ask how much additional savings those Americans at risk need to make to make-up the shortfall created by the crisis. They conclude that the long-term effect of financial crisis will be most felt by near-retirees (since they have greater savings than their younger counterparts and will not have time to recover from their losses) and the more affluent (since they have more financial assets at stake in general)[6] but working longer and saving more can mitigate the impacts of the financial crisis.

American researchers enjoy the advantage of relative abundance of publicly available data, such as (1) the University of Michigan Health and Retirement Study (HRS), (a longitudinal panel study of more than 26,000 Americans over the age of 50 every two years) and (2) the U.S. Federal Reserve Bureau's Survey of Consumer Finances (a triennial survey of the balance sheet, pension, income, and other demographic characteristics of U.S. families (in 2007 – 2009, it collected longitudinal panel data and therefore provided an excellent data source in measuring the effects of the financial crisis). Canada does not have an HRS counterpart and the Survey of Financial Security

[6] See also Holden and Vanderhei (2002)

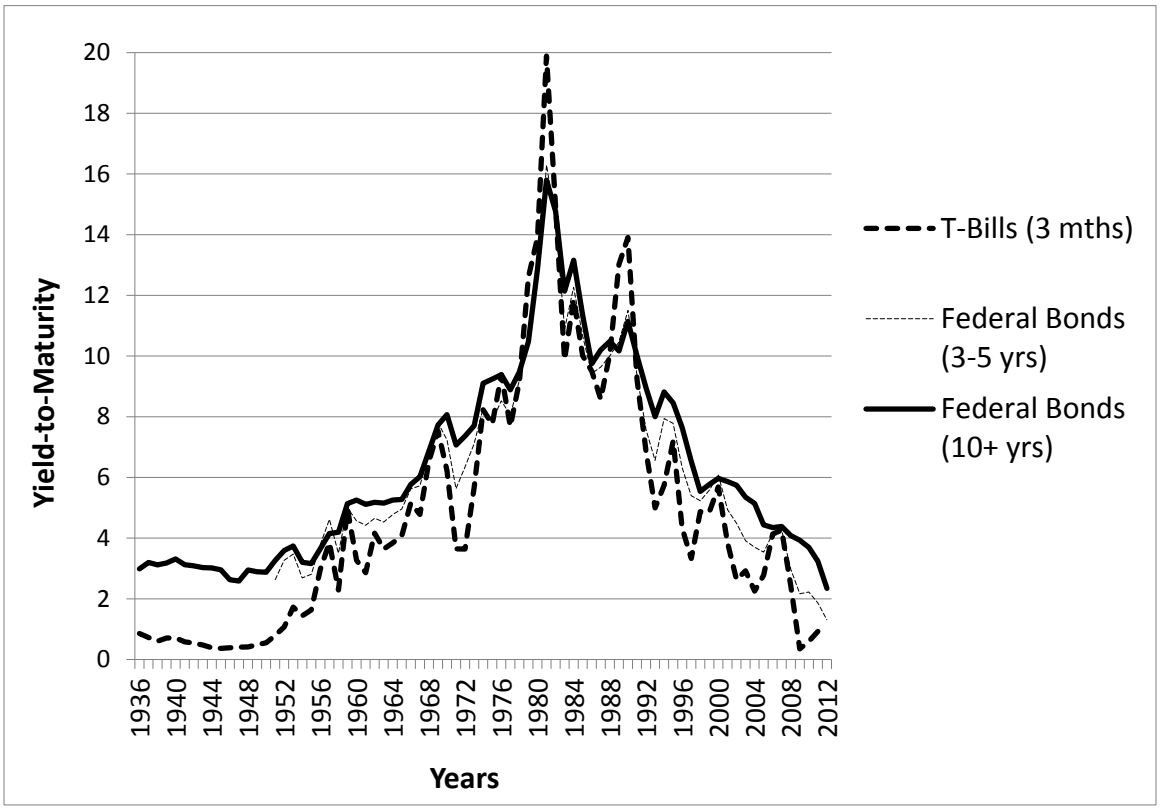
(SFS) was collected in only two years (1999 and 2005). Moreover, the 2005 survey sampled only 9,000 dwellings compared with 23,000 dwellings in the 1999 sample.[7] Without longitudinal retirement wealth data like in the U.S., Canadian researchers cannot directly compare the wealth holdings of Canadians before and after the financial crisis from any single data source as American researchers have had the capacity to do. Only through data integration and simulation modeling can a comprehensive picture of retirement wealth security in Canada be attempted – as this study attempts.
As well, Mehra and Prescott (1985) marked the beginning of a long line of research questioning why the 6% historical equity premium has been "so high" and whether it will continue. Jacquier, Kane and Marcus (2005) argued that the historical equity premium has been exaggerated and Siegel (2005) projected that the future equity premium will drop from its historical average of 6% to 2-3%. Our focus on retirement outcomes just examines one of many implications of a possible decline in rates of return to capital.

2 Financial Market Scenarios

In 2008, the Canadian common stock index TSX earned a total return of -33% and the U.S. common stock index S&P of -22.5[8]. Consequently, literature examining the impact of the financial crisis on the retirement security of seniors has predominantly asked "how the sharp decline in the stock market would affect wealth and retirement" (Gustman et al., 2011, pg. 3). Butrica et al. (2009); Sass et al. (2010); Bricker et al. (2011); Gustman et al. (2010, 2011); and Wolff (2011) have also examined the impact of wealth shocks. Much less attention has been paid to the extremely low yields on fixed securities. Figure 1 graphs the historical nominal yield-to-maturities on Canadian fixed securities year by year (calculated using the arithmetic averages of the twelve monthly yields-to-maturity (CIA, 2012)). Figure 2 graphs the historical yield-to-maturities after accounting for inflation. Beginning in 2009, the annualized average nominal yields on these securities have dropped to levels that have not been seen since the 1950s and, after accounting for inflation, to levels that have not been seen since before 1980.

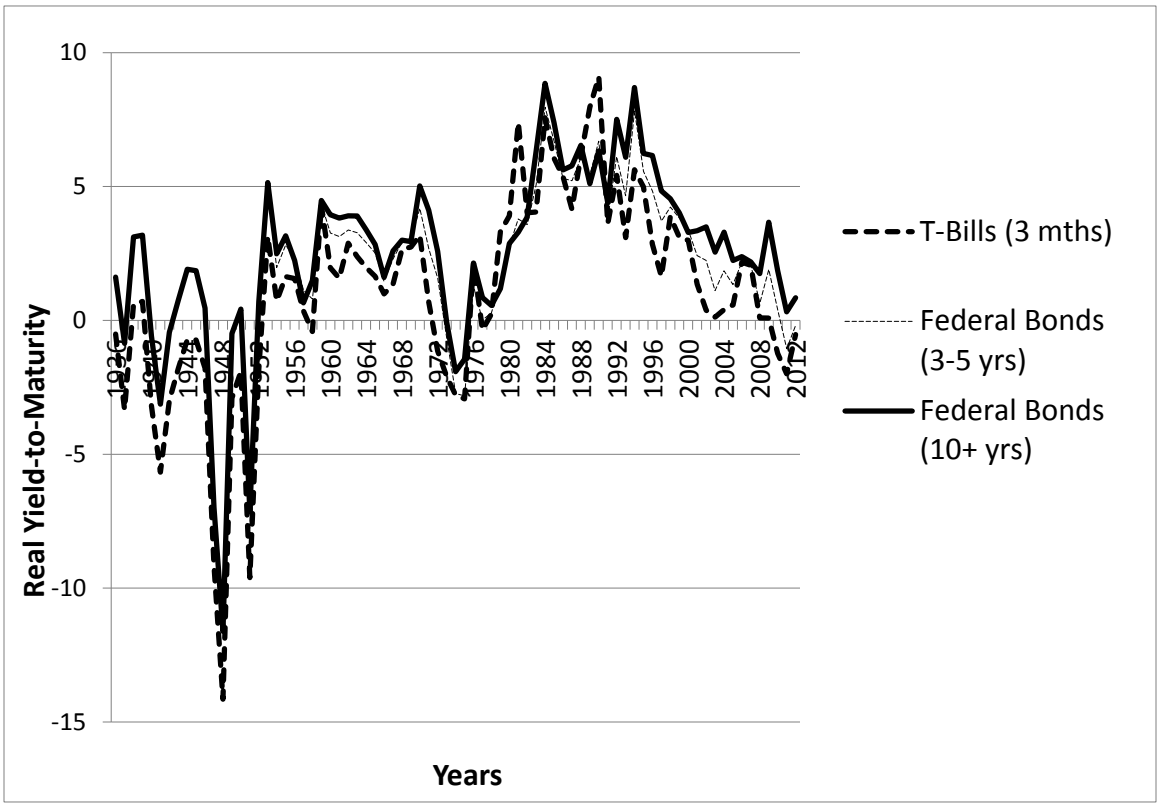
Figure 1: Historical Annualized Nominal Yield-to-Maturities on Canadian Government Fixed Securities.

[7] Statistics Canada's 2011 research paper on retirement income adequacy in Canada states: "the 1999 version is used (rather than the 2005 version) because its larger sample size makes it possible to conduct reliable analyses at the level of detail required here" (Baldwin et al., 2011, pg.9).
[8] See Appendix A for data sources.



Source: Authors' calculations from data summarized in CIA (2012).

Figure 2: Historical Annualized Real Yield-to-Maturities on Canadian Government Fixed Securities.



Source: Authors' calculations from data summarized in CIA (2012).

This project compares the projected retirement outcomes of Canadians across three scenarios:

1. the financial crisis never occurred (labeled the "No Crisis" scenario)
2. the financial crisis occurred but interest rates will recover in the next five years (2012 to 2018 – labeled the "Crisis-Recovery" scenario)
3. Canada has entered a new financial market reality of long-term low interest rates (depressed asset values at half their historical average growth rate and a continuation of 2012 low yields for fixed securities – labeled "No Recovery")

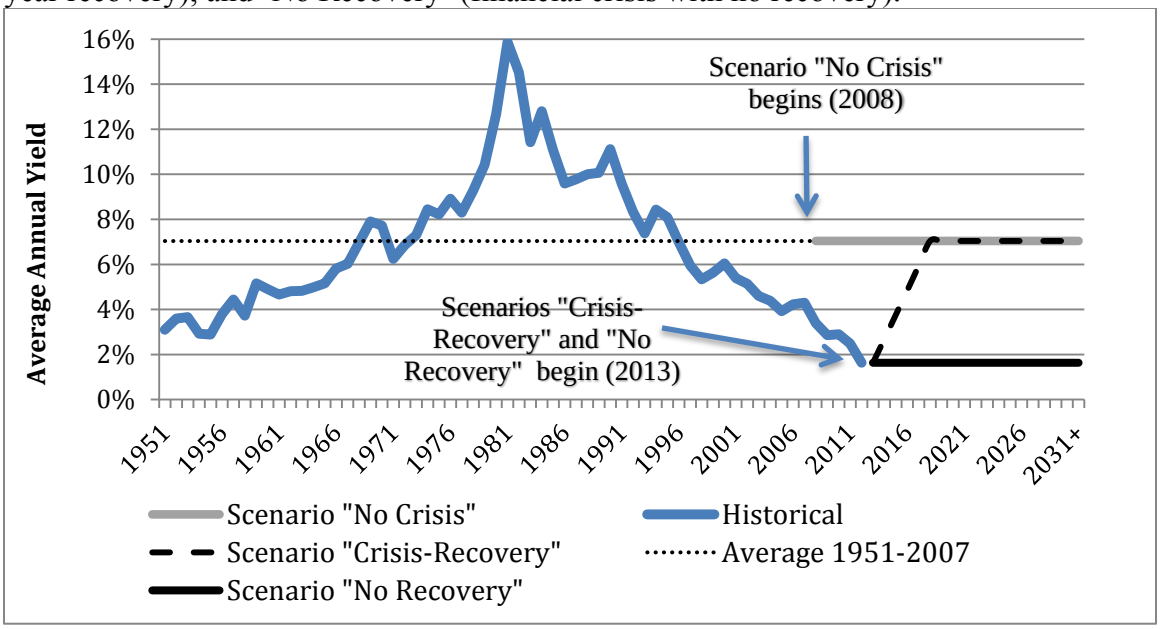
LifePaths' financial market model assumes eleven asset classes for investment, and stochastically simulates individual variability. We create scenarios by adjusting the rate of return's long-term average within each simulated asset class' interest rate model. We create our scenarios by adjusting the underlying data (additional details are given in Appendix A). Key assumptions are:

- Up until 2007, the average rates of return for each asset class' stochastic interest rate model under all three scenarios uses the actual average historical rate in that year.
- Starting in 2008, Scenario 'No Crisis' removes the financial crisis by setting the long-term average in the interest rate model for each asset class to the pre-2008 long-term average.
- Between 2008-2012, Scenarios 'Crisis-Recovery' and 'No Recovery' use the actual average historical rate in that year.
- In 2013, Scenario 'No Recovery'
    - Sets the long-term average for each fixed security's interest rate to its average 2012 value;
    - Sets the long-term average for common stock total rate of return to half its pre-2008 long-term average;
- Scenario 'Crisis-Recovery' models 2013 using the same parameter estimates as Scenario 'No Recovery', but then returns to a pre-2008 financial market by linearly interpolating between the parameter values in Scenario 'No Recovery' and 'No Crisis' up until 2018.

Figure 3 illustrates the relationship between the average rates of return in the three scenarios for government of Canada marketable bonds (5-10 years). Until 2007, all three scenarios model the average rate of return using the actual average historical rate in that year. Scenario 'No Crisis' then simulates an alternative history of no financial crisis by modeling rates of return using the pre-2008 average of 7%[9] as its long-term average. Scenarios 'Crisis-Recovery' and 'No Recovery' continue to follow the historical returns up until 2012, and then continue at 2012 levels in 2013 by using the 2012 actual return as the long-term average in its interest rate model. Thereafter, Scenario 'Crisis-Recovery' linearly returns to pre-2008 averages by 2018 (that is, the same as Scenario 'No Crisis') while Scenario 'No Recovery' continues at the 2012 level.

[9] Note that this corresponds to the log-return of 6.8% listed for this asset in Appendix A.

Figure 3: Government of Canada marketable bonds (5-10 years) average rates of return in Scenarios 'No Crisis' (no financial crisis); 'Crisis-Recovery' (financial crisis with a five-year recovery); and 'No Recovery' (financial crisis with no recovery).



In all three scenarios, we assume an annual management expense ratio of 2.2% for Canadian and U.S. stocks, 1.4% for long bonds (term greater than five years), and zero for T-Bills, GIC, and short bonds (term less than five years).

3 Three Pillars of the Canadian Retirement Income System

To understand how financial market affect the retirement income of Canadians we have to discuss the three pillars of the Canadian retirement income system and how they interact with financial markets, particularly in a low interest rate environment.

3.1 First Pillar: Government public pension programs

The Canadian public pension system consists of the universal Old Age Security (OAS), the income-tested Guaranteed Income Supplement (GIS), and the contributory Canadian/Quebec Pension Plans (C/QPP). [10]

OAS/GIS benefits protect Canadians from downside financial market risk since payouts rise in a low interest environment scenario. For example, a single senior with a 3.9% return (as in 2007) on $1,000,000 of registered savings with no other sources of income

[10] C/QPP is an earnings-related benefit aimed at replacing up to approximately 25% of the average industrial wage. OAS is a flat universal benefit for all Canadians meeting a residence requirement. As of July 2012, the maximum OAS benefit for a single was $544.98 per month which reduces at a rate of 15% for Canadians earning more than $69,562, until it is eliminated entirely for retirement income exceeding $112,966. GIS is a low-income benefit that, as of July 2012, had a maximum benefit of $738.96 per month for a single, which reduces by $0.50 for every dollar of income (excluding OAS benefits and non-registered savings) until the benefit is eliminated at an annual income of $16,512. See http://www.servicecanada.gc.ca

would have had market income of $39,000 and would not have been eligible for GIS in 2007, but would have received the maximum OAS benefit ($502.31 per month as of October 2007). After the market collapse and the decline in interest rates, the assumption of a reduced interest rate of 2% on a diminished portfolio of $500,000 in 2012 would produce income of $10,000, ensuring eligibility for a further $271.90 per month[11] in GIS benefits on top of the maximum OAS benefit.

Many Canadians may not be fully aware that the retirement income system in Canada has a stronger anti-poverty emphasis than the U.S. (where there is no GIS/OAS equivalent program), while Social Security in the U.S. replaces more of the standard of living of middle class Americans after retirement. To illustrate, OECD "Pensions at a Glance indicators"[12] show the future mandatory pension entitlements across the 34 OECD countries for workers who entered the labour market in 2008 and spent their entire working lives under the same set of rules (in Canada, these entitlements would be OAS, GIS, and C/QPP). At 50%, 100%, and 150% of the average wage that the individual is assumed to earn throughout his/her career, the net replacement rates[13] for each country were calculated as:

	0.50 of AW	1.00 of AW	1.50 of AW
Canada	88.7%	57.3%	39.7%
U.S.	63.8%	50.0%	46.6%

With less public retirement security, middle and upper income Canadians must rely more heavily on personal savings to maintain their standard of living after retirement – and hence are potentially more vulnerable to low investment returns than in the U.S.

3.2 Second Pillar: Employer pension plans

Although the percentage of employees covered by a pension plan is currently similar between Canada and the US, historical trends in both coverage rates and the types of pension plans being provided are not. Between 1987 and 2010, the percentage of Canadian employees (private and public sector) covered by an employment-sponsored pension plan has dropped from 42.6% to 38.8%[14], while the percentage of US employees has increased from 37.6% to 39.8% (Figure 19, Copeland, 2012). Table 4 presents data on private sector pension coverage, because that is where change has been greatest. It shows a strong decline in pension plan participation rates in the Canadian private sector (dropping from 31.1% to 24.4% between 1987 and 2010) while coverage rates in the U.S. remain steady. The U.S. has seen a rapid decline in Defined Benefit (DB) plan coverage and rise in Defined Contribution (DC) plans – as Table 4 shows, the share of U.S. private sector pension plan participants in a DB pension plan has dropped from 71.7% to 31.9%

[11] Based on GIS rates as of July 2012 from the Service Canada website.
[12] http://stats.oecd.org/Index.aspx?DataSetCode=ELSPENSIONS
[13] "The net replacement rate is defined as the individual net pension entitlement divided by net pre-retirement earnings, taking account of personal income taxes and social security contributions paid by workers and pensioners." (see OECD website)
[14] Source: Statistics Canada, Pension Plans in Canada and Labour Force Survey (http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labor26a-eng.htm).

between 1976 and 2007, and the share in a DC pension plan rose from 28.3% to 68.1%. Canada experienced much less decline in the share of DB pension plans (from 88.8% to 63.8%) over the same period[15].

Table 4:
Private Sector Employer sponsored DB and DC pension plan participation 1976 to 2010.

	Canada	U.S.
Pension Plan Participation Rate		
2010	**24.4%**	**39.5%**
1987	31.1%	39.8%
Defined Benefit Pension Plan Share		
2010	**63.8%**	**31.9%**
1987	88.4%	51.1%
1976	*91.1%*	*71.7%*
Defined Contribution Pension Plan Share		
2010	**36.2%**	**68.1%**
1987	11.6%	48.9%
1976	*8.9%*	*28.3%*

Notes: The U.S. and Canadian statistics both double-count workers who participate in more than one plan.
Sources:
Participation Rates: Statistics Canada, Pension Plans in Canada and Labour Force Survey, Copeland (2012; Figure 19) (note that first year given is 1987).Pension Plan Share: Table E5, U.S. Department of Labor, "Private Pension Plan Bulletin Historical Tables and Graphs" www.dol.gov/ebsa/pdf/historicaltables.pdf CANSIM, Table 280-0016. The Canadian statistics represent the share of pure DB and DC plans and classify plans that are a mix of the two designs as DB (which account for 3.1% of pension plans in 2010). 1987 DB/DC share statistics use the average between 1986 and 1988.

Our projections assume future continuation of trends to less employer pension plan coverage and continuing movement from defined-benefit to defined-contribution plans among the private sector. By 2030, for example, we assume that:

- 35.8% of Canadian employees (public and private sector) will participate in a pension plan,
- 22.6% of Canadian private sector employees will participate in a pension plan, among whom
    - 56.0% will be in a DB pension plan, and
    - 42.9% will be in a DC pension plan.
- Public employees participation rates and plan shares will remain steady.

Unlike DC pension plans where the financial market risk is the responsibility of the plan participant, DB pension plan sponsors are legally obligated to pay out vested, accumulated plan benefits regardless of financial market performance. In our scenarios, we do not model the possible effects of poor financial markets to freeze or terminate

[15] For discussions on the shift in employer pension plans in Canada, see Brown and Liu (2001); Broadbent et al. (2006); Gougeon (2009); and MacKenzie (2010).

existing employer pension plans and reduce the attraction for employers to sponsor new plans. Our model of the second pillar, therefore, only analyzes how depressed financial market returns affect DC pension plan benefits.

3.3 Third Pillar: Individual savings

Low interest rates directly impact the personal savings of Canadians in financial assets such as tax-sheltered retirement savings government programs (notably Registered Retirement Savings Plans (RRSPs)), tax-free savings accounts, and personal non-registered financial assets. A low interest rate environment also influences the price of annuities for those who wish to convert their savings (e.g. their RRSPs). For example, $1,000,000 could purchase an annual life annuity with a ten-year guarantee for a 65 year-old female that pays out $73,000 at the beginning of 2009, but at the beginning of 2012 an identical million dollar annuity purchase would have a payout of only $60,000[16].

For public policy purposes, however, the question is how many Canadians hold financial assets in retirement and how much they hold. The 2005 Canadian Survey of Financial Security (2005 SFS) reported, for example, that 60% of Canadians had RRSP accounts[17] and that the median RRSP account level was $25,000 (Pyper, 2008) – a level of private savings insufficient to finance much of the retirement years.

Tables 6 and 7 summarize the registered and non-registered financial assets and debts of Canadian seniors using the 1999 Survey of Financial Security (1999 SFS) and the 2005 Survey of Financial Security (2005 SFS)[18]. The first line of Table 6 shows the registered wealth holdings[19] in 1999 of Canadians economic families whose major income recipient is aged 65-74. The first five columns show the distribution of registered wealth of these households – for example, 41.5% of such households had no registered wealth. For the 68.5% of households holding registered wealth, the last four columns give the mean and median at the household level and at the adult-equivalent individual level (i.e. dividing the household value by the square root of the number of household members).

Tables 6 and 7 suggest that most Canadian seniors have some financial savings, but only about a third of the senior population have more than $100,000. Approximately two-thirds of all senior-led households held financial wealth of less than $100,000 (65.4% of

[16] Rounded estimates calculated from the "Payout Annuity Index" by The Individual Finance and Insurance Decisions Centre at York University (http://www.ifid.ca/payout.htm)

[17] RRSPs contributions are deductible from income taxes and the investment income accumulates tax-free - withdrawals are taxed as ordinary income. Age and income both have a strong influence on the likelihood of having RRSP investments and its value. In the 2005 SFS, 35% of households with after-tax income less than $36,500 held RRSPs with a median value of $10,000, while 89% of households with after-tax income higher than $85,000 held RRSPs with an median account level of $80,000 (ibid). Similarly, older households were more likely to hold RRSP accounts, and the median value was higher.

[18] All dollar values in 2005$. The public-use microdata files used in Tables 6 and 7 contain 15,933 dwellings in 1999 and 5,267 in 2005, which included 3,371 senior-headed dwellings in 1999, and 1,130 in 2005. Computations by the authors.

[19] These comprise of total Registered Retirement Saving Plans (RRSPs), Locked-in Retirement Accounts (LIRAs), locked-in RRSPs, Registered Retirement Income Funds (RRIFs), Life Income Funds (LIFs) and Locked-in Retirement Income Funds (LRIFs).

65-74 year olds and 69.5% of 75 years plus). These values are similar in 1999 and 2005 (67.1% and 67.9% of 65 to 74 year olds, after debt).

Table 6: Summary statistics of the financial assets and debts of Canadian seniors from the 1999 Survey of Financial Security.

	Percent households with wealth level within each range					Mean	Median	Mean	Median
	$0	$0 - $5,000	$5,000 - $50,000	$50,000 - $100,000	$100,000 +	across households holding wealth		across individuals holding wealth (adult equivalent)	
Ages 65-74									
(A) RRSP/LIRA/RRIF	41.5%	3.9%	23.9%	9.6%	21.1%	111,000	55,000	85,000	43,000
Non-Registered									
Deposits	7.3%	36.5%	41.7%	7.5%	7.0%	31,000	8,000	24,000	6,000
Mutual Funds	84.8%	1.9%	7.2%	2.5%	3.5%	78,000	35,000	61,000	25,000
Bonds	83.9%	5.3%	8.4%	0.7%	1.7%	33,000	12,000	27,000	9,000
Stocks	89.4%	2.5%	4.2%	1.4%	2.6%	131,000	28,000	101,000	21,000
Other Financial Asset	92.0%	1.7%	4.7%	0.4%	1.2%	45,000	12,000	35,000	11,000
Business Equity	90.7%	2.6%	2.5%	0.7%	3.4%	239,000	30,000	166,000	17,000
(B) All Non-Registered	5.8%	29.2%	37.5%	9.3%	18.0%	91,000	15,000	69,000	12,000
TOTAL (A+B)	4.6%	20.1%	28.4%	13.1%	33.5%	158,000	48,000	120,000	37,000
(C) Financial Debt (excluding mortgage)	68.3%	16.3%	14.3%	0.6%	0.5%	(11,000)	(5,000)	(8,000)	(4,000)
NET TOTAL (A+B+C)	2.9%	15.0%	27.3%	12.3%	32.9%	169,000	56,000	128,000	45,000
Ages 75+									
(A) RRSP/LIRA/RRIF	71.7%	2.2%	12.7%	5.6%	7.8%	85,000	44,000	68,000	35,000
Non-Registered									
Deposits	6.1%	26.1%	42.8%	11.0%	14.0%	51,000	16,000	43,000	14,000
Mutual Funds	88.3%	0.7%	5.3%	2.1%	3.6%	103,000	48,000	87,000	37,000
Bonds	80.1%	5.2%	10.2%	2.4%	2.0%	34,000	13,000	29,000	10,000
Stocks	91.6%	1.2%	2.4%	0.7%	4.1%	246,000	92,000	209,000	77,000
Other Financial Asset	94.2%	1.7%	2.4%	0.6%	1.2%	52,000	22,000	41,000	16,000
Business Equity	95.8%	0.9%	0.5%	0.3%	2.4%	234,000	121,000	168,000	109,000
(B) All Non-Registered	5.7%	22.3%	37.9%	11.3%	22.8%	106,000	25,000	88,000	22,000
TOTAL (A+B)	5.3%	19.6%	34.9%	12.3%	28.0%	131,000	35,000	108,000	30,000
(C) Financial Debt (excluding mortgage)	85.8%	9.3%	4.6%	0.3%	0.0%	(7,000)	(2,000)	(5,000)	(2,000)
NET TOTAL (A+B+C)	4.1%	16.8%	34.3%	12.3%	27.9%	135,000	38,000	112,000	33,000

Source: Author's calculations using the 1999 SFS Public Use Microdata (in 2005 constant dollars[20]).
Notes: The SFS reports assets and debts at the economic family levels. Adult-equivalent wealth is calculated by dividing household wealth by the square root of the number of household members. Age groupings are by age of the major income recipient.

[20] Consumer Price Index (annual rates, 1992=100): 1999=110.5; 2005=127.3.

Table 7: Summary statistics of the financial assets and debts of Canadian seniors from the 2005 Survey of Financial Security.

	Percent households with wealth level within each range					Mean across households holding wealth	Median across households holding wealth	Mean across individuals holding wealth (adult equivalent)	Median across individuals holding wealth (adult equivalent)
	$0	$0 - $5,000	$5,000 - $50,000	$50,000 - $100,000	$100,000 +				
Ages 65-74									
(A) RRSP/LIRA/RRIF	40.2%	5.1%	25.6%	10.0%	19.1%	118,000	50,000	90,000	40,000
Non-Registered									
Deposits	6.7%	34.9%	39.8%	8.2%	8.8%	49,000	10,000	39,000	8,000
Mutual Funds	85.1%	0.6%	6.1%	5.3%	2.9%	91,000	55,000	74,000	41,000
Bonds	88.8%	4.6%	3.7%	0.5%	2.4%	64,000	9,000	50,000	7,000
Stocks	86.3%	2.4%	4.5%	3.2%	3.6%	174,000	50,000	144,000	37,000
Other Financial Asset	94.3%	1.0%	2.8%	1.0%	0.9%	74,000	25,000	60,000	18,000
Business Equity	91.5%	2.1%	2.1%	0.5%	3.7%	261,000	53,000	177,000	37,000
(B) All Non-Registered	6.1%	25.0%	36.8%	12.0%	20.1%	124,000	22,000	97,000	19,000
TOTAL (A+B)	4.9%	17.9%	24.3%	19.3%	33.6%	196,000	62,000	152,000	50,000
(C) Financial Debt (excluding mortgage)	60.5%	11.9%	23.4%	3.7%	0.4%	(17,000)	(10,000)	(14,000)	(8,000)
NET TOTAL (A+B+C)	3.5%	12.4%	24.2%	17.0%	32.1%	211,000	66,000	164,000	51,000
Ages 75+									
(A) RRSP/LIRA/RRIF	60.9%	2.5%	17.9%	9.0%	9.7%	91,000	44,000	74,000	37,000
Non-Registered									
Deposits	7.8%	25.3%	39.9%	17.0%	9.9%	50,000	18,000	41,000	15,000
Mutual Funds	83.6%	0.4%	6.5%	3.7%	5.8%	120,000	65,000	97,000	57,000
Bonds	87.9%	3.7%	5.9%	0.7%	1.8%	40,000	11,000	34,000	7,000
Stocks	91.7%	2.3%	2.3%	1.4%	2.3%	135,000	29,000	117,000	21,000
Other Financial Asset	93.7%	2.4%	2.6%	0.5%	0.9%	70,000	7,000	56,000	5,000
Business Equity	95.6%	1.0%	0.7%	0.4%	2.3%	217,000	105,000	183,000	74,000
(B) All Non-Registered	6.7%	21.8%	33.0%	16.5%	21.7%	103,000	29,000	84,000	24,000
TOTAL (A+B)	6.4%	17.1%	29.8%	15.9%	30.5%	140,000	49,000	115,000	39,000
(C) Financial Debt (excluding mortgage)	81.4%	9.4%	7.8%	1.4%	0.0%	(13,000)	(5,000)	(10,000)	(4,000)
NET TOTAL (A+B+C)	5.0%	16.0%	27.7%	15.7%	30.4%	144,000	54,000	118,000	41,000

Source: Author's own calculations using the 2005 SFS Public Use Microdata.
Notes: see Table 6

In addition to personal financial assets, housing wealth is crucial for Canadian seniors – indeed it is the largest asset after pension savings (Baldwin et al., 2011). Over 60% of Canadian seniors own their home mortgage-free, which is higher than any other age group (Chawla and Wannell, 2004; Turcotte & Schellenberg, 2007). In 2005, nearly 70% of Canadian seniors owned a home and the median home value for these homeowners was $131,000[21].

[21] 18% owned other real estate with a median value of $63,000, and 10% had mortgage debt with a median value of $41,000 Authors' calculations from 2005 SFS.

In this study, we abstract from volatility in real estate markets and assume that housing wealth remains unchanged across financial market scenarios[22]. We include the value of homeownership in our total income measure through its imputed rent[23]. The imputed rent is determined by the value of the senior's home. Theoretically, mortgage debt could change between scenarios; however, Canadian seniors are unlikely to hold a mortgage and Bricker et al. (2011) found that debt of Americans, including mortgage debt, was only slightly changed by the financial crisis. We assume that debt levels are unaffected by changes in the financial market scenarios[24].

4 Methodology and Methodological Issues

4.1 LifePaths and Key Projection Assumptions

Statistics Canada's LifePaths is the largest micro-simulation model of its kind in Canada. By integrating and extending the large range of existing data sets within Statistics Canada, it provides a comprehensive picture of the life-courses of Canadians, while modeling the realistic complexity and diversity within life-courses and across individuals.

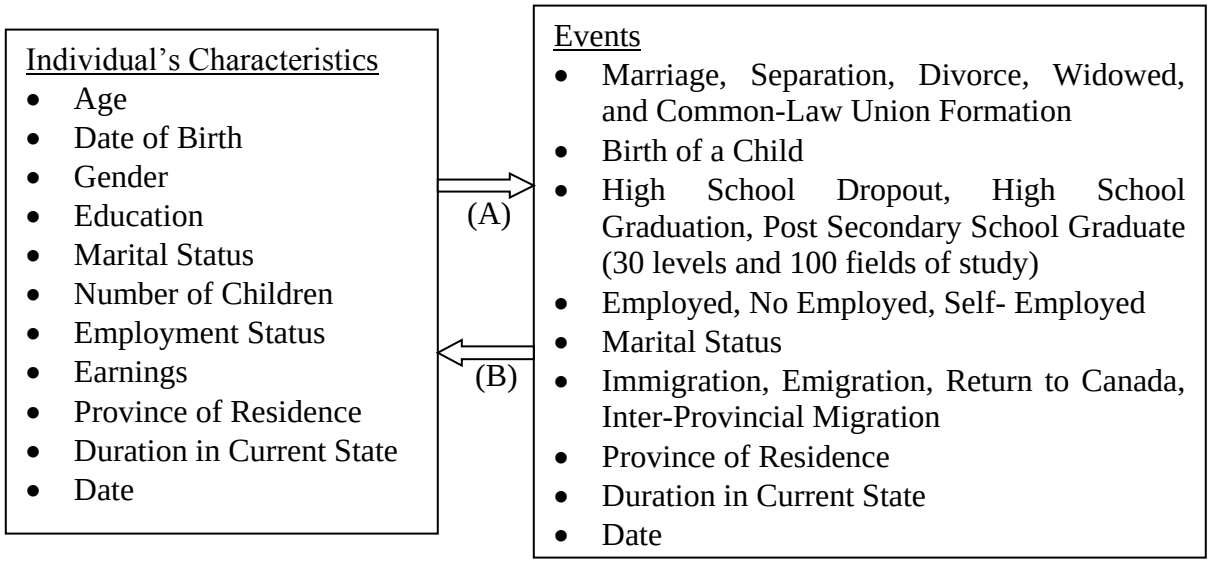
"*(LifePaths) builds an entire population by simulating the actions and interactions of individual units case by case. Figure (4) represents the evolution of a simulated life in LifePaths. This is a simplified flow chart for illustration purposes, and is not intended to convey the true complexity of LifePaths. We list only some of the components of LifePaths—marital status, fertility, education, employment, and migration. For each simulated life, LifePaths tracks the individual's relevant characteristics, such as those listed in the first box. These characteristics enter as explanatory variables to determine the times until the occurrence of each possible event (arrow A). The event with the shortest wait time "wins" and, once it occurs, the individual's characteristics are updated (arrow B). These characteristics then enter again as explanatory variables to determine the next event (arrow A). This continues until death, thus creating a complete life course with all of the necessary details for millions of simulated Canadians*." (MacDonald et al., 2010, pg.76).

[22] There is a slight feedback in LifePaths between "total income" and the house purchase decision that leads to a slight decrease in the value of purchased homes when we simulate a low interest financial markets .

[23] Venti and Wise (2004) concluded that the majority of retirees do not draw down their housing wealth to support retirement consumption, and those who do are generally owing to health shocks or the death of a spouse. In Canada, the take-up of reverse mortgages on housing equity and other such financial instruments is rare (Chiuri and Jappelli, 2010),

[24] Bricker et al. (2011) observed in the debt levels for Americans were changed very little by the financial crisis between 2007 and 2009. Moreover, financial debt is a relatively smaller concern for Canadian seniors in general according to the 1999 and 2005 SFS, where financial debt has a median level of less than $8,000 for both senior age groups in both survey years.

Figure 4: Illustration of LifePaths' simulation of a Canadian life-course.



Source: MacDonald et al. (2010) Figure 1.

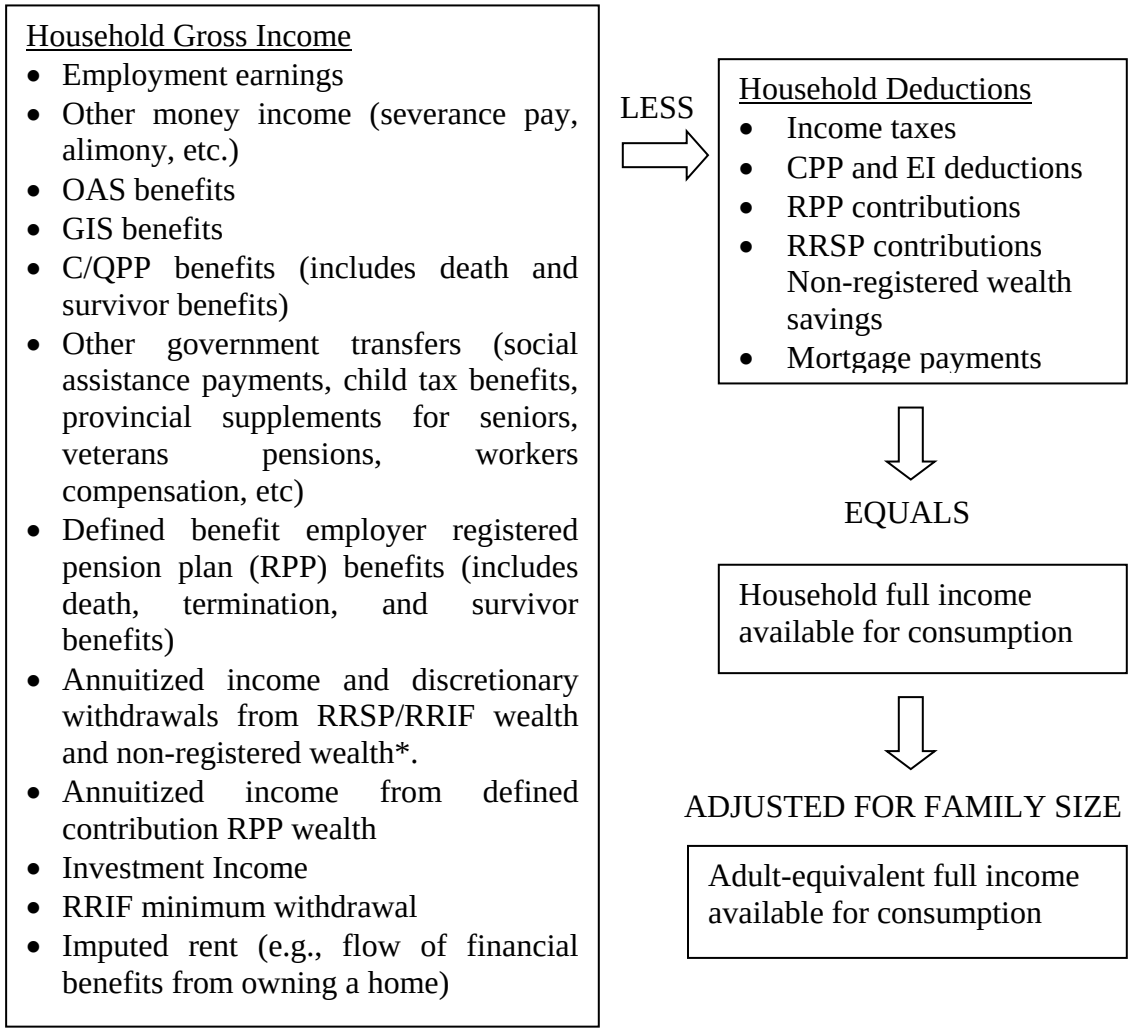
LifePaths' simulation of the past uses behavioural equations estimated from historical data to build a representative modelled population that is consistent with all available microdata on Canadians and sums to aggregate statistics. LifePath's simulation of the future, however, relies on default future projection scenarios:

- an aggregate downward trend in employer pension plan coverage and a continuing shift from defined benefit to defined contribution plans (see Section 3.2);
- an aggregate real wage growth rate of 0.3%[25] and inflation growth rate of 2.3%[26];
- a continuation into the future of historical RRSP saving behavior observed over the past decade;
- three future financial market projection scenarios as described in Section 2;
- the continuation of public pension program provisions, and payroll and income tax systems, as currently legislated;
- a modest trend away from marriage;
- a flattening out of increasing female labour participation rates and increasing post-secondary education attainment; and
- a modest trend of increasing life expectancy and fewer children across future cohorts according to the medium demographic assumptions for fertility, mortality, and migration from Statistics Canada's official population projections (Statistics Canada 2005) (these last two bullets affect mainly long-term retirees in our analysis).

A basic overview of LifePaths can be found at Statistics Canada Modeling Division (2010).

[25] Note that we lowered the LifePaths baseline scenario assumption to approximately match the average real wage growth from 1980 to 2011 (CIA, 2012).
[26] This inflation estimate matches that used by the Chief Actuary of Canada in his most recent actuarial report on the Canada Pension Plan (Office of the Chief Actuary of Canada 2010).

Figure 5: The process of measuring adult-equivalent full income available for individual consumption.



Notes: *The non-registered wealth concept used is marketable wealth (or net worth) other than primary housing – that is, "the current value of all marketable or fungible assets less the current value of debts" (Wolff, 2012: 6) other than primary housing and mortgage debt. These include the sum of non-registered financial assets (chequing accounts, GICs, trusts, etc), real estate assets (other than primary housing), and business equity, less non-mortgage debt (credit card, lines of credit, car loans, etc).

The baseline assumption in LifePaths is that DC pension plan wealth and some RRSP wealth[27] are annuitized at retirement. For the purpose of this project, this paper developed and integrated into LifePaths an annuity price calculator that realistically incorporated the relevant personal and financial market inputs akin to actual Canadian

[27] LifePaths models the choice of either converting RRSP assets to an annuity or to RRIF assets at a person's chosen conversion age of no later than age 71.

annuity providers[28]. This annuity calculator was validated using annual mid-year annuity quotes from 1985 until the present across a range of Canadian insurers (between 8 to 17 Canadian insurers each year). As well, we updated the historical returns on the eleven modeled assets listed in Appendix A (including both nominal and real returns, and yield-to-maturities and effective rates of return for fixed securities), and re-estimated the interest rate models for future projections.

We abstract, however, from labour market responses, such as delayed retirement, to compensate for poor financial performance[29].

4.3 Measuring Poverty and Income Replacement Rates

We compare each individual senior's "poverty rate" and "lifetime income continuity" across the three financial market scenarios described in Section 2. We define an individual senior's "poverty rate" as the proportion of time past age 65 that he/she spends in poverty, using Statistics Canada's 2010 after-tax Low Income Measure (LIM) updated for inflation. We measure lifetime income continuity using an individual senior's "income replacement rate", defined as the proportion of his/her working-life income that his/her retirement resources can replace[30].

$$\text{Income Replacement Rate} = \frac{\text{Retirement-Life Annual Income}}{\text{Working-Life Annual Income}}$$

Annual income is estimated to be the "adult-equivalent full income available for individual consumption" described in Figure 5. We calculate retirement-life income by averaging this variable from age 65 until death. We calculate a "representative" level of working-life income by removing the lowest and highest five years between ages 35 and 64 and averaging the remaining middle 20 years[31].

Using the 2009 after-tax LIM, we also segment the population by working-life representative income :

- < LIM: Poor
- 100-200% LIM: Near-Poor
- 200-400%: Middle Class
- >400% LIM: Affluent

[28] Thanks to Sun Life Financial, who provided substantial insight into the pricing assumptions employed by Canadian insurers.

[29] Coile and Levine (2009) and Osberg (1993) found that older workers who have been laid off are more likely to retire early when labour markets are slack.

[30] We use the term "retirement" to refer to life past age 65, although in reality people exit the workforce into "retirement" at a variety of ages in a variety of manners (some abruptly, others in stages).

[31] This calculation differs from the conventionally quoted "replacement rate", which is the ratio of gross retirement income (usually at age 65) to gross working life income (usually age 64). See Scholz and Seshadri, 2009; MacDonald and Moore, 2012 for critiques of the conventional replacement rate.

Our analysis does not include Canadians who die before reaching retirement or immigrants who arrive after age 35, as either would create missing years in the outcome measures.

5 Analysis

Table 8 begins by summarizing the changes in the mean projected retirement income flows across scenarios. The "No Crisis" baseline is clearly unrealistic, since we know the crisis did happen, but it does illustrate the future that might plausibly have been envisaged when households made financial decisions prior to 2007. Going forward, the issue is whether financial markets will recover, so the difference between "Crisis/Recovery" and "No Recovery" is of primary interest. "No Recovery" could also be called "No Recovery Ever" and is included as a lower bound to expectations of future investment returns.

Tables 8(a) and (b) list future income flows at age 70 by source for (a) the cohort born between 1951 and 1966 and (b) the 1967 – 1990 birth cohort. The first column in Table 8(a) shows income flow means (2012 family-based adult-equivalent dollars) under Scenario 'No Crisis'. The second column shows the proportional change in the Scenario 'No Crisis' means when moving to Scenario 'Crisis-Recovery'. It is not surprising that flows from registered and non-registered wealth are the most affected, reducing by 31.1% and 27.4% respectively. Unregistered wealth declines less because registered wealth is comprised only of financial assets while non-registered wealth also includes real estate assets and business equity, both of which are essentially not affected by the financial market scenarios in our simulations by assumption. Finally, income taxes reduce by 8.3% as a result of the lower income flows from the registered financial assets.

The third column in Table 8(a) shows the proportional change in income means comparing a financial market that recovers in five years (Scenario 'Crisis-Recovery') versus a long-term low interest rate environment (Scenario 'No Recovery'). Flows from registered wealth decrease by 31.1% on account of the financial crisis, but decrease an additional 45.2% if the market does not recover. The fourth column shows the aggregate impact of a long-term low interest rate environment as compared to no financial crisis by giving the proportional change in the income flows from Scenario 'No Crisis' to Scenario 'No Recovery'. For example, the aggregated effect of the financial crisis followed by a long-term low interest rate environment is a 62.3% drop in registered wealth income flow (62.3%=(1-31.1%)*(1-45.2%)-1). Note that the "No Recovery" impacts (fourth column) are approximately twice as large as "Crisis/Recovery" (second column), - i.e. a long-term low interest rate is approximately twice as harmful as the financial crisis to the average income flows of the 1951-1966 birth cohort.

Table 8(b) presents the same information as 8(a), except for the 1967-1990 birth cohort. Because this cohort is exposed for longer to the new realities, the impact of a long-term low interest rate carries much more consequences than the financial crisis alone – the impact of "no recovery" is in the range of six times as harmful than the financial crisis

alone. However, calculating impacts in terms of percentage changes in total income flows implicitly weights impacts by dollar holdings and, as we will see, these large declines are concentrated among more affluent Canadians.

Table 8: Retirement income source means at age 70 across three future financial market scenarios: Scenario 'No Crisis', Scenario 'Crisis-Recovery' and Scenario 'No Recovery' (2012 adult-equivalent family-based dollars).

(a) 1951 – 1966 birth cohort

1951-1966 Birth Cohort	**Scenario 'No Crisis'** mean (00s)	**Scenario 'Crisis-Recovery'** mean (% change from Scenario 'No Crisis')	**Scenario 'No Recovery'** mean (% change from Scenario 'Crisis-Recovery')	**Scenario 'No Recovery'** mean (% change from Scenario 'No Crisis')
Income Sources				
Earnings	$ 10,600	0.0%	0.9%	0.9%
CPP benefits	8,900	0.0%	0.0%	0.0%
Imputted Rent	3,600	0.0%	0.0%	0.0%
OAS benefits	7,000	1.4%	1.4%	2.9%
GIS benefits	1,400	0.0%	14.3%	14.3%
Other income	2,000	0.0%	0.0%	0.0%
Employer pension plan benefits	13,000	-3.8%	-4.8%	-8.5%
Flows from registered wealth	6,100	-31.1%	-45.2%	-62.3%
Flows from non-registered wealth	6,200	-27.4%	-42.2%	-58.1%
Income and payroll taxes	8,400	-8.3%	-10.4%	-17.9%
Total	50,400	-6.3%	-7.2%	-13.1%

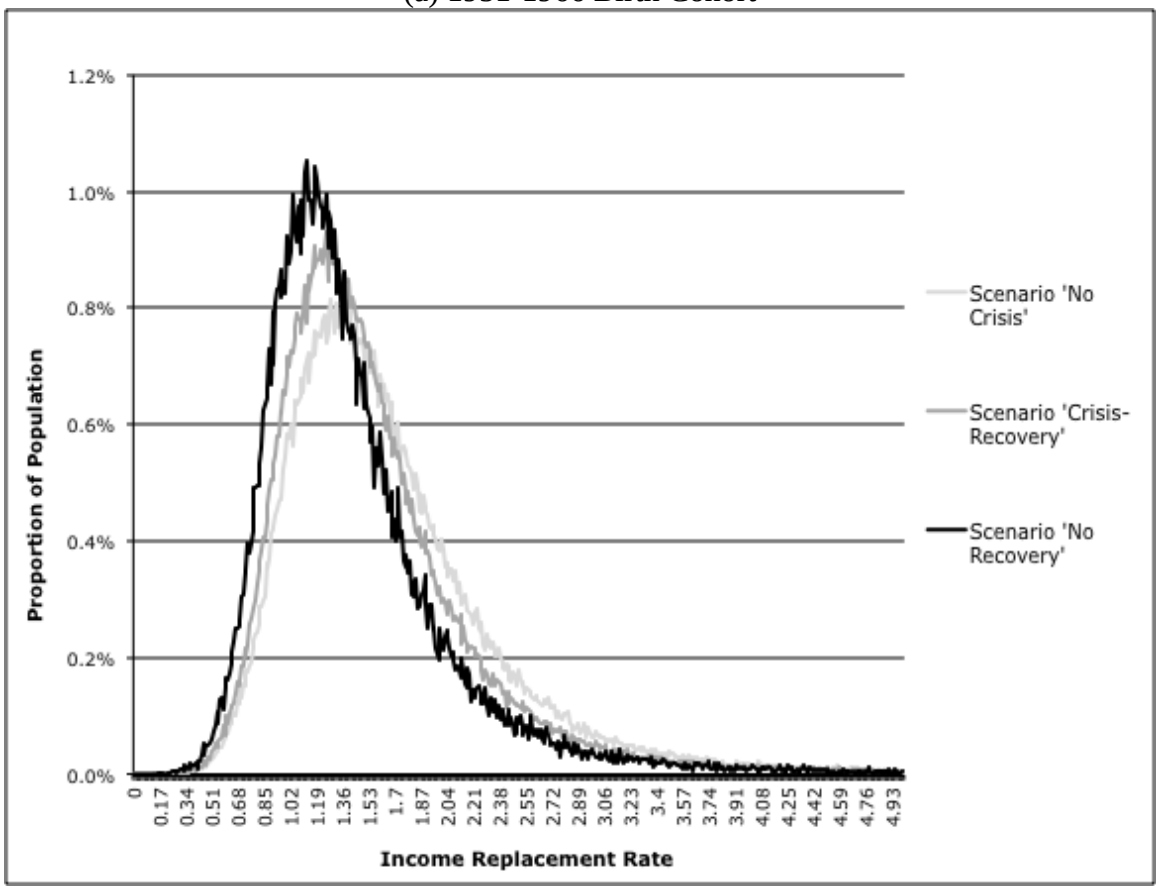
(b) 1967 - 1990 birth cohort

1967-1990 Birth Cohort	**Scenario 'No Crisis'** mean (00s)	**Scenario 'Crisis-Recovery'** mean (% change from Scenario 'No Crisis')	**Scenario 'No Recovery'** mean (% change from Scenario 'Crisis-Recovery')	**Scenario 'No Recovery'** mean (% change from Scenario 'No Crisis')
Income Sources				
Earnings	$ 13,800	0.0%	0.7%	0.7%
CPP benefits	9,200	0.0%	0.0%	0.0%
Imputted Rent	3,300	0.0%	0.0%	0.0%
OAS benefits	6,600	1.5%	3.0%	4.5%
GIS benefits	1,400	0.0%	14.3%	14.3%
Other income	2,000	0.0%	0.0%	0.0%
Employer pension plan benefits	13,600	-1.5%	-13.4%	-14.7%
Flows from registered wealth	10,200	-16.7%	-67.1%	-72.5%
Flows from non-registered wealth	5,400	-11.1%	-62.5%	-66.7%
Income and payroll taxes	11,200	-5.4%	-21.7%	-25.9%
Total	54,200	-3.1%	-14.5%	-17.2%

Figure 6 next traces the distribution of retirement income replacement rates of the 1951-1966 and 1967-1990 birth cohorts. In both Figures 6(a) and (b), the shift in the distribution of replacement rates from Scenarios 'No Crisis' to 'Crisis-Recovery' shows the impact of the financial crisis alone while the shift from 'Crisis-Recovery' to 'No Recovery' shows the additional impact if financial markets have entered a new long term low-interest rate environment. The message of Figure 6(a) is that both 'Crisis/Recovery' and 'No Recovery' have appreciable, but modest, impacts on retirement incomes for the 1951-1966 birth cohort. Figure 6(b), however, illustrates how much the 1967-1990 birth cohort has at risk in the recovery of financial returns – the 'Crisis-Recovery' scenario shows a nearly imperceptible shift in the distribution of replacement rates while the 'No Recovery' Scenario is a clear downward shift.

Replacement rates greater than one imply that individuals could, if they wished, consume at a higher level in retirement than they did while they were working. It is more likely that such individuals would leave inheritances, but we do not explicitly model bequest behavior.

Figure 6:
Distribution of retirement income replacement rates across financial market scenarios
(a) 1951-1966 Birth Cohort



(b) 1967-1990 Birth Cohort

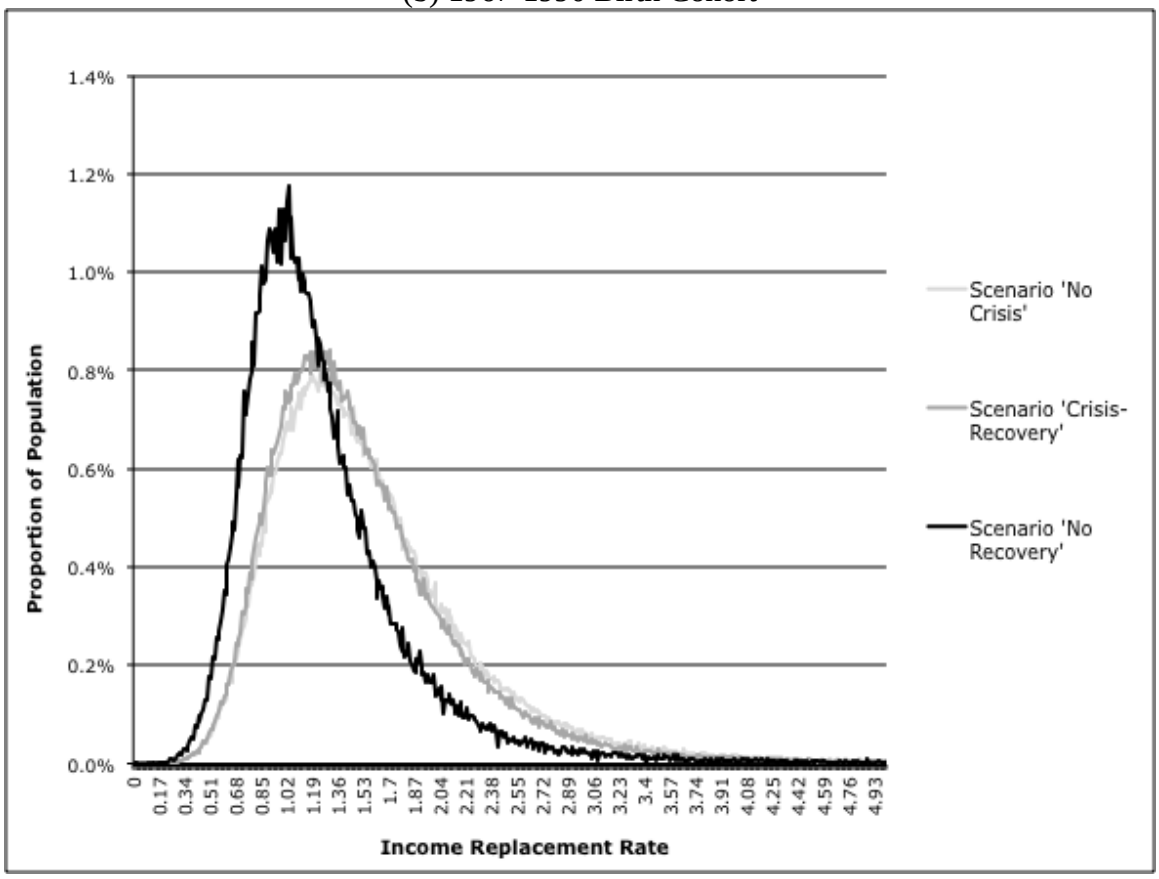


Table 9 breaks down the data by seven-year birth cohorts to show the increasing impact of a long-term low interest rate environment across birth cohorts. Even under the 'No Crisis' Scenario, income replacement rates slowly reduce over time for each consecutive birth cohort. MacDonald et al. (2011) explain this projected decline in income replacement rates as due to both an increasing denominator (growing working-life income - Schirle, 2006) and a more slowly growing numerator (inflation indexed OAS/GIS benefits lag any real-wage growth and participation in employer pension plans is declining).

Comparing 'Crisis-Recovery' and 'No Crisis' shows how much the impact of a transitory financial market shock on the distribution of income replacement rates decreases with each consecutive birth cohort. Even a decade of lower returns (i.e. 2008-2018) has fairly small impacts on the youngest birth cohort (who will not reach 65 until 2048). As one would expect, the retirement financial welfare of the oldest birth cohort (who begins to turn 65 in 2016) is significantly more affected.

If interest rates and equity returns do not recover, much bigger shifts in replacement rates are likely – whatever the point of reference. Comparing the Scenario 'No Recovery' and 'Crisis-Recovery', the additional impact of a continuation of low returns is greatest among high replacement rate groups and for younger birth cohorts.

Table 9:
Retirement income replacement rate by birth cohort under alternative return scenarios

Birth Cohort	*Income Replacement Rate*						
	<75%	*75 - 100%*	*100 - 125%*	*125 - 150%*	*150 - 175%*	*175 - 200%*	*200%+*
SCENARIO 'No Crisis'							
Early boomers (1951–1958)	2.2%	8.9%	17.9%	20.2%	16.3%	11.6%	22.9%
Late boomers (1959–1966)	3.0%	10.7%	19.2%	20.5%	16.0%	10.8%	19.8%
Early generation Xers (1967–1974)	4.2%	12.8%	20.0%	19.8%	15.0%	10.0%	18.4%
Late generation Xers (1975–1982)	4.8%	13.9%	20.0%	19.3%	14.5%	9.6%	18.0%
Early generation Yers (1983–1990)	5.5%	14.8%	20.8%	19.2%	14.2%	9.1%	16.4%
All	**3.9%**	**12.1%**	**19.5%**	**19.8%**	**15.2%**	**10.3%**	**19.2%**
SCENARIO 'Crisis-Recovery' - 'No Crisis'							
Early boomers (1951–1958)	0.6%	1.9%	2.3%	0.9%	-0.6%	-1.3%	-3.7%
Late boomers (1959–1966)	0.6%	1.8%	2.3%	0.5%	-0.6%	-1.3%	-3.4%
Early generation Xers (1967–1974)	0.6%	1.7%	1.9%	0.3%	-0.5%	-1.2%	-2.8%
Late generation Xers (1975–1982)	0.3%	1.0%	1.0%	0.2%	-0.2%	-0.4%	-2.0%
Early generation Yers (1983–1990)	0.1%	0.3%	0.4%	0.0%	-0.1%	-0.1%	-0.6%
All	0.5%	1.3%	1.6%	0.4%	-0.4%	-0.9%	-2.5%
SCENARIO 'No Recovery' - 'Crisis-Recovery'							
Early boomers (1951–1958)	1.1%	3.2%	3.0%	-0.2%	-1.8%	-1.9%	-3.4%
Late boomers (1959–1966)	2.6%	5.9%	3.7%	-1.7%	-3.2%	-2.7%	-4.5%
Early generation Xers (1967–1974)	4.9%	8.3%	2.9%	-3.0%	-4.2%	-3.3%	-5.6%
Late generation Xers (1975–1982)	6.4%	9.8%	3.5%	-3.7%	-5.0%	-3.9%	-7.2%
Early generation Yers (1983–1990)	7.3%	10.3%	3.4%	-3.8%	-5.4%	-4.1%	-7.6%
All	**4.3%**	**7.4%**	**3.3%**	**-2.4%**	**-3.9%**	**-3.2%**	**-5.6%**
SCENARIO 'No Recovery' - 'No Crisis'							
Early boomers (1951–1958)	1.7%	5.1%	5.2%	0.7%	-2.4%	-3.2%	-7.1%
Late boomers (1959–1966)	3.3%	7.7%	6.0%	-1.1%	-3.9%	-4.0%	-7.9%
Early generation Xers (1967–1974)	5.5%	10.0%	4.9%	-2.8%	-4.8%	-4.4%	-8.4%
Late generation Xers (1975–1982)	6.7%	10.7%	4.6%	-3.4%	-5.2%	-4.3%	-9.1%
Early generation Yers (1983–1990)	7.3%	10.6%	3.9%	-3.8%	-5.5%	-4.2%	-8.2%
All	**4.8%**	**8.7%**	**4.9%**	**-2.0%**	**-4.3%**	**-4.0%**	**-8.1%**

But is there a social problem? If one is worried about inadequate replacement rates, Table 9 indicates that prior to the financial crisis one could expect, summing across all birth cohorts, that 3.9% would have replacement rates less than 0.75 and that if low returns are the new reality the percentage with less than 0.75 replacement will increase to 8.7% (i.e. an increase of 4.8%, of which 0.5% is the impact of the Crisis/Recovery and 4.3% is the impact of No Recovery). At the other end of the replacement rate distribution, the percentage with more than 200% replacement will fall from 19.2% to 11.1% - but it is unclear why this should be considered a social problem.

To examine the income distributional impact of alternative financial scenarios we turn to Table 10. We label as 'poor' the 15.3% of the 1951-1966 birth cohort who have an adjusted average working-life after-tax income less than the Low Income Measure and we call 'near-poor' the 42.3% of that cohort who are under twice the LIM. (Corresponding percentages for the 1967-1990 cohort are 11.2% and 35.2%). Together they comprise about half the population and the Middle Class (200% to 400% of LIM) are another two-fifths of the population (37.8% of the 1951-1966 cohort and 43.8% of the

1967-1990 birth cohort). As Table 10 shows, their economic well-being in retirement is little affected by financial market 'Crisis/Recovery'- an understandable finding given the importance of public transfers and home equity, which are unaffected.

Table 10: Replacement rates in retirement and relative working life economic welfare

(a)

1951-1966 Birth Cohort		*Income Replacement Rate*						
Working-life representative income	*% Population*	*<75%*	*75 - 100%*	*100 - 125%*	*125 - 150%*	*150 - 175%*	*175 - 200%*	*200%+*
SCENARIO 'No Crisis'								
Poor (< LIM)	15.3%	0.0%	0.8%	7.2%	14.7%	17.5%	14.4%	45.4%
Near Poor (100 - 200% LIM)	42.0%	1.2%	9.4%	19.6%	21.7%	17.0%	11.1%	19.8%
Middle Class (200 - 400% LIM)	37.8%	3.6%	11.8%	20.0%	21.0%	15.8%	11.0%	16.7%
Affluent (> 400% LIM)	4.9%	8.0%	14.3%	18.6%	17.8%	14.4%	9.5%	17.5%
All	**100.0%**	**2.1%**	**9.0%**	**17.6%**	**20.1%**	**16.6%**	**11.6%**	**23.0%**
SCENARIO 'Crisis-Recovery' - 'No Crisis'								
Poor (< LIM)		0.0%	0.1%	0.4%	0.7%	0.2%	-0.3%	-1.1%
Near Poor (100 - 200% LIM)		0.2%	1.3%	2.4%	0.9%	-0.6%	-0.8%	-3.5%
Middle Class (200 - 400% LIM)		1.1%	3.3%	3.6%	0.6%	-1.2%	-2.3%	-4.9%
Affluent (> 400% LIM)		3.1%	4.1%	1.1%	0.5%	-2.9%	-1.5%	-4.4%
All		0.6%	1.9%	2.4%	0.7%	-0.7%	-1.3%	-3.6%
SCENARIO 'No Recovery' - 'Crisis-Recovery'								
Poor (< LIM)		0.0%	0.0%	0.6%	1.0%	0.2%	0.0%	-1.8%
Near Poor (100 - 200% LIM)		0.3%	2.4%	3.3%	0.7%	-1.3%	-1.8%	-3.6%
Middle Class (200 - 400% LIM)		2.1%	6.0%	3.9%	-1.3%	-3.7%	-2.8%	-4.2%
Affluent (> 400% LIM)		7.5%	3.3%	1.2%	-2.3%	-2.8%	-2.4%	-4.5%
All		**1.1%**	**3.3%**	**3.0%**	**-0.1%**	**-1.9%**	**-1.8%**	**-3.5%**
SCENARIO 'No Recovery' - 'No Crisis'								
Poor (< LIM)		0.0%	0.1%	1.0%	1.6%	0.5%	-0.3%	-2.9%
Near Poor (100 - 200% LIM)		0.5%	3.8%	5.8%	1.6%	-1.9%	-2.6%	-7.1%
Middle Class (200 - 400% LIM)		3.2%	9.2%	7.4%	-0.7%	-5.0%	-5.1%	-9.0%
Affluent (> 400% LIM)		10.6%	7.4%	2.4%	-1.8%	-5.7%	-3.9%	-8.9%
All		**1.7%**	**5.2%**	**5.4%**	**0.7%**	**-2.7%**	**-3.1%**	**-7.1%**

(b)

1967-1990 Birth Cohort		Income Replacement Rate						
Working-life representative income	*% Population*	*<75%*	*75 - 100%*	*100 - 125%*	*125 - 150%*	*150 - 175%*	*175 - 200%*	*200%+*
SCENARIO 'No Crisis'								
Poor (< LIM)	11.2%	0.1%	1.3%	10.0%	17.9%	16.9%	12.9%	41.1%
Near Poor (100 - 200% LIM)	35.2%	2.7%	13.9%	21.1%	18.7%	14.3%	9.8%	19.5%
Middle Class (200 - 400% LIM)	43.8%	6.4%	13.8%	19.1%	18.3%	14.5%	10.0%	18.0%
Affluent (> 400% LIM)	9.7%	7.0%	12.7%	17.0%	16.9%	14.8%	11.2%	20.5%
All	**100.0%**	**4.4%**	**12.3%**	**18.5%**	**18.3%**	**14.7%**	**10.4%**	**21.4%**
SCENARIO 'Crisis-Recovery' - 'No Crisis'								
Poor (< LIM)		0.0%	-0.1%	0.3%	0.5%	0.4%	0.1%	-1.3%
Near Poor (100 - 200% LIM)		0.1%	0.9%	1.2%	0.7%	-0.1%	-0.4%	-2.5%
Middle Class (200 - 400% LIM)		0.4%	1.6%	1.7%	0.9%	-0.2%	-0.6%	-3.7%
Affluent (> 400% LIM)		1.0%	1.7%	1.5%	1.0%	0.1%	-1.0%	-4.3%
All		0.3%	1.1%	1.3%	0.8%	-0.1%	-0.5%	-3.0%
SCENARIO 'No Recovery' - 'Crisis-Recovery'								
Poor (< LIM)		0.0%	0.2%	1.9%	1.6%	1.0%	0.1%	-4.9%
Near Poor (100 - 200% LIM)		1.4%	7.6%	6.5%	-0.1%	-3.2%	-3.6%	-8.6%
Middle Class (200 - 400% LIM)		10.0%	15.0%	4.8%	-5.4%	-7.6%	-6.1%	-10.8%
Affluent (> 400% LIM)		21.0%	15.4%	0.8%	-7.5%	-9.1%	-7.5%	-13.1%
All		**6.9%**	**10.7%**	**4.7%**	**-2.9%**	**-5.2%**	**-4.6%**	**-9.5%**
SCENARIO 'No Recovery' - 'No Crisis'								
Poor (< LIM)		0.0%	0.2%	2.2%	2.2%	1.5%	0.2%	-6.2%
Near Poor (100 - 200% LIM)		1.5%	8.5%	7.8%	0.6%	-3.3%	-4.0%	-11.1%
Middle Class (200 - 400% LIM)		10.4%	16.5%	6.4%	-4.4%	-7.8%	-6.7%	-14.5%
Affluent (> 400% LIM)		22.0%	17.1%	2.4%	-6.6%	-9.0%	-8.5%	-17.4%
All		**7.2%**	**11.8%**	**6.0%**	**-2.1%**	**-5.3%**	**-5.1%**	**-12.6%**

Note: "LIM" is updated annually by the all-items consumer price index. The population is grouped by their working-life after-tax income between ages 35 to 64 (we average the 20 middle values, dropping the top and bottom five values).

Because holdings of financial assets increase with income and the impact of low returns increases with the duration of low returns, the 'No Recovery' scenario shows bigger impacts for younger, more affluent cohorts. Among the Middle Class of the 1967-1990 cohort, the 'No Recovery' scenario shows a 10.4% (percentage point) increase in the proportion with less than 0.75 replacement – a significant increase, but given that a dramatic, permanent decline in financial returns is being simulated, some might have expected a larger impact.

Table 11 asks how many Canadian seniors will experience more years of poverty on account of the financial crisis and a long-term low interest rate environment. In the base 'No Crisis" case, about 78% will not fall into poverty and another 7.7% will spend up to 25% of their senior years in poverty. The overall impact of 'Crisis/Recovery' is small – an increase of 0.7% of seniors experiencing some poverty. Scenario 'No Recovery' results in an additional 2.3% experiencing some poverty. Although a long-term low interest rate environment will have an effect on prevalence of poverty among Canadian seniors, those at risk of poverty typically do not have enough financial assets for variations in the rate of return on financial assets to have a large impact – and part of any loss in capital income will be offset by the GIS.

Table 11: Percentage of retirement years spent in poverty by cohort.

Birth Cohort	*0%*	*1 - 25%*	*25 - 50%*	*50 - 75 %*	*75 - 99%*	*100%*
SCENARIO 'No Crisis'						
Early boomers (1951–1958)	77.6%	7.3%	3.8%	3.2%	3.7%	4.5%
Late boomers (1959–1966)	76.7%	7.9%	3.8%	3.3%	3.9%	4.5%
Early generation Xers (1967–1974)	77.6%	8.1%	3.7%	3.0%	3.6%	4.0%
Late generation Xers (1975–1982)	78.4%	7.8%	3.5%	2.9%	3.5%	3.8%
Early generation Yers (1983–1990)	78.8%	7.6%	3.5%	2.9%	3.4%	3.8%
All	**77.8%**	**7.7%**	**3.7%**	**3.1%**	**3.6%**	**4.1%**
SCENARIO 'Crisis-Recovery' - 'No Crisis'						
Early boomers (1951–1958)	-1.0%	0.3%	0.2%	0.2%	0.2%	0.1%
Late boomers (1959–1966)	-0.9%	0.2%	0.1%	0.2%	0.3%	0.2%
Early generation Xers (1967–1974)	-0.8%	0.1%	0.1%	0.1%	0.3%	0.2%
Late generation Xers (1975–1982)	-0.5%	0.1%	0.0%	0.1%	0.1%	0.1%
Early generation Yers (1983–1990)	-0.1%	0.0%	0.0%	0.0%	0.1%	0.0%
All	**-0.7%**	**0.1%**	**0.1%**	**0.1%**	**0.2%**	**0.1%**
SCENARIO 'No Recovery' - 'Crisis-Recovery'						
Early boomers (1951–1958)	-0.5%	0.3%	-0.1%	0.1%	0.1%	0.1%
Late boomers (1959–1966)	-2.1%	0.4%	0.4%	0.6%	0.6%	0.2%
Early generation Xers (1967–1974)	-2.7%	0.6%	0.3%	0.9%	0.5%	0.4%
Late generation Xers (1975–1982)	-3.0%	0.8%	0.6%	0.6%	0.5%	0.5%
Early generation Yers (1983–1990)	-3.7%	0.9%	0.4%	0.7%	1.0%	0.7%
All	**-2.3%**	**0.6%**	**0.3%**	**0.6%**	**0.5%**	**0.4%**
SCENARIO 'No Recovery' - 'No Crisis'						
Early boomers (1951–1958)	-1.5%	0.6%	0.1%	0.3%	0.3%	0.2%
Late boomers (1959–1966)	-3.0%	0.6%	0.4%	0.8%	0.8%	0.4%
Early generation Xers (1967–1974)	-3.4%	0.6%	0.4%	1.0%	0.8%	0.5%
Late generation Xers (1975–1982)	-3.4%	0.9%	0.6%	0.7%	0.6%	0.6%
Early generation Yers (1983–1990)	-3.8%	0.9%	0.4%	0.7%	1.0%	0.7%
All	**-3.0%**	**0.7%**	**0.4%**	**0.7%**	**0.7%**	**0.5%**

As noted in Section 3.1, decreased capital income flows on account of a low interest-rate environment can be partially offset by reduced clawback of OAS and GIS benefits. Under Scenario 'No Crisis', Table 12 lists income sources as a percentage of total income if the financial crisis had not occurred for the four economic welfare groups (aggregated across all 1951-1990 birth cohorts). It also shows how these income flows change in the event of a long-term low-interest rate environment (Scenario 'No Recovery'). If Canadian seniors had to rely entirely on income flows from registered and non-registered wealth, the -64% change in returns to such wealth would have dramatic effects on their retirement well-being. However, Canadian social transfers make-up 48% of the poor's total income. Because their capital income flows make up only 12% of total income, their total income falls by only 5.2% in a long-term low interest rate environment. By contrast, capital income flows are 39% of total income for the affluent, so the impact of lower returns on their wealth is an income decline of 22.1%. Regardless of the financial market, the poor receive the maximum OAS and are eligible for GIS benefits, so there is little change in their transfer income (although GIS benefits do recover 1.2% of their lost income on account of the decline in the income flows of their small wealth holdings).

On the other end of the spectrum, the affluent receive only 4% of their income from OAS benefits and none are eligible for the GIS benefits. In a long-term low interest rate environment, they continue to be ineligible for GIS benefits but less of their OAS benefits are clawed back, which helps recover 0.7% of their lost capital income. In short, the Canadian social transfer system reduces the impact of a poor financial returns across income groups, but particularly so for the poor.

Table 13: Income flows as a percentage of total income at age 70 for poor, near poor, middle class, and affluent.

Income Sources	Poor (<LIM)	Near Poor (100 - 200% LIM)	Middle Class (200 - 400% LIM)	Affluent (>400% LIM)
Scenario 'No Crisis'				
(% Total Income)				
OAS benefits	28%	19%	11%	4%
GIS benefits	20%	4%	1%	0%
Flows from registered & non-registered wealth	12%	19%	29%	39%
Total Income	100%	100%	100%	100%
Scenario 'No Recovery'				
(% Change)				
OAS benefits	0%	1%	5%	17%
GIS benefits	6%	17%	34%	30%
Flows from registered & non-registered wealth	-64%	-64%	-67%	-68%
Total Income	-5%	-10%	-17%	-22%

Conclusion

This paper has investigated the implications for Canadian retirement prospects of the financial crisis and the possible new reality of long-term low interest rates and depressed stock market returns. Using a population micro-simulation model, it compared three scenarios: if Canadian financial markets (1) never experienced the crisis of 2008 (i.e. continued on their pre-2008 path); (2) experienced the crisis and recover in five years; or (3) enter a new long-term financial market environment with depressed stock market growth and continued low interest rates.

If financial markets recover, the effects of the financial crisis on retirement prospects will be the most severe on older workers now near retirement. On the other hand, if the financial market has entered a new reality of low interest rates, more severe repercussions await younger workers. In aggregate, retirement financial security of the poor is only mildly affected by the future path of the financial market and upper-income Canadians are the most exposed to continuing low interest rates owing to their relatively greater holding of financial assets.

One way of reading our results is that they demonstrate the important role of the Canadian social pension system in not only protecting poorer Canadian seniors with no other source of income from destitution, but in also shielding middle-class Canadians from financial market risk. Our 'No Recovery' scenario represents a very large change

from the pre-2008 financial world in which Canadians now alive have made most of their financial decisions and it is remarkable how small the impacts on retirement security are – i.e. how successfully the Canadian public pension system shields Canadians from financial market risk. However, another way of reading the same data is that our results underscore the exposure of older Canadians to political risk, in the form of demands for 'reform' of that system.

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Appendix A: Financial Market Modeling

Data Sources

LifePath's financial market modeling employs financial market data from Statistics Canada socioeconomic database Cansim. The asset classes available for investment currently modeled in LifePaths are:

1. Treasury Bills (3 months)
    - Cansim V122541
2. Guaranteed Income Certificate (5 years)
    - Cansim V122526
3. Government of Canada marketable bonds (1-3 years)
    - Cansim V122558
4. Government of Canada marketable bonds (3-5 years)
    - Cansim V122485
5. Government of Canada marketable bonds (5-10 years)
    - Cansim V122486
6. Government of Canada marketable bonds (10+ years)
    - Cansim V122487
7. Long-term provincial bonds
    - Cansim V122517 (Scotia Capital Inc. - average weighted yield: long-term provincial bonds)
8. Long-term corporate bonds

- Cansim V122518 (Scotia Capital Inc. - average weighted yield: long-term all corporate bonds)

9. US Common Stock
    - Cansim V37414, V37415, V37416, V37422, V37425, V37425 (Dow-Jones industrials and Standard and Poor's (500) statistics)
10. Canadian Common Stock
    - Cansim V122618, V122619, V122620, V122628 (Toronto Stock Exchange statistics)
11. Fixed Immediate Life Annuity (single life and joint and last survivor)
    - Cannex Financial Exchanges Limited and The Individual Finance and Insurance Decisions Centre "Payout Annuity Index" http://www.ifid.ca/payout.htm (historical annuity prices)
    - North America Society of Actuaries (historical and current mortality tables and mortality improvement tables)

For assets #1-10, LifePaths financial model employs data compiled in the Canadian Institute of Actuaries 2011 report on Canadian financial statistics (CIA, 2012).

To create the financial market scenarios outlined in Section 2, we use all available data since 1951. One limitation of our study is that the fixed security data sources listed above (#1-8) are yields-to-maturity (averaged across the twelve months of each year), which is not the same as the effective rate of return that an investor would receive on a portfolio of the particular fixed security that would depend on the timing of purchase, the turnover rate, and the time to maturity for each of the bonds in the portfolio. As this these variables change from one investor to the next, we assume simply the average yield-to-maturity offered on the fixed security in the year of purchase to represent the effective rate of return earned on the asset.

Parameter Estimation

For future rates of return, LifePaths stochastically simulates each asset's total nominal annual rate of return assuming that it is independently and identically log-normally distributed with mean (μ) and standard deviation (σ). For example, asset i at time t ($A_i(t)$) with mean (μ_i) and standard deviation (σ_i) changes according to the formula:

$A_i(t+1) = A_i(t)e^{\mu_i + \sigma_i Z}$, where Z~N(0,1).

The total return on asset i between times *t* and *t+1* is therefore $A_i(t+1)/A_i(t)$.

As Section 2 explains, we create our three scenarios by adjusting the data underlying the parameter estimate values for each μ_i. Table A.1 lists the precise parameter values for μ in each scenario for each asset class. The first column lists the long-term mean values (μ_i) underlying the rates of return modeling in Scenario 'No Recovery' for years 2013 and beyond (this is contained in a dashed rectangle). Similarly, the far right column lists

in a dashed rectangle the long-term mean values underlying the rates of return modeling in Scenario 'No Crisis' for years 2008 and beyond. Finally, the larger double-lined box lists the mean long-term asset values underlying the interest rate modeling in Scenario 'No Recovery' for years 2013, 2013… 2018 and beyond. Note that Scenario 'Crisis-Recovery' shares the same values as Scenario 'No Recovery' in 2013 and the same values as Scenario 'No Crisis' in 2018 – the values in-between are a linear interpolation between the 2012 and 2018 values.

Table A.1: Log-normal rate of return model parameter value μ for each simulated asset class in Scenarios A, B, and C.

	Scenario 'Crisis-Recovery'					
	2013	2014	2015	2016	2017	2018+
Asset Classes	μ	μ	μ	μ	μ	μ
T-Bills	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
GIC	1.6%	2.7%	3.7%	4.7%	5.7%	6.8%
Federal Bonds (1-3)	1.1%	2.2%	3.2%	4.2%	5.3%	6.3%
Federal Bonds (3-5)	1.3%	2.4%	3.4%	4.5%	5.5%	6.6%
Federal Bonds (5-10)	1.6%	2.7%	3.7%	4.7%	5.8%	6.8%
Federal Bonds (10+)	2.3%	3.3%	4.2%	5.2%	6.1%	7.1%
Provincial Bonds (10+)	2.5%	3.6%	4.6%	5.6%	6.7%	7.7%
Corporate Bonds (10+)	2.9%	3.9%	4.9%	5.9%	7.0%	8.0%
Cnd Common Stock	5.1%	6.1%	7.1%	8.1%	9.1%	10.1%
US Common Stock	5.4%	6.5%	7.6%	8.7%	9.7%	10.8%
Annuity Pricing	3.2%	4.2%	5.1%	6.1%	7.0%	8.0%
	Scenario 'No Recovery' 2013+					Scenario 'No Crisis' 2008+

The standard deviation (σ) is calculated from all available data between 1951 and 2012. Rounded to the nearest percent, the standard deviation is 3% for all fixed securities, other than T-Bills in which we set to zero (this avoids negative rates of return for this risk-free asset). The standard deviation for common stock is approximately 15% in Canada and 16% in the U.S.

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