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Impacts of Cyclical Downturns on the Third Pillar of the RIS and Policy Responses

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Abstract

This paper explores impacts of recessions on private pensions and retirement savings in Canada. We estimate that the 2008-09 recession saw declines in average family wealth and retirement assets of 11% and 14% respectively. Average wealth recovered by the end of 2010, but retirement assets remained 2% lower than before the recession. Losses were higher for those more exposed to the stock market, such as older workers and retirees with DC pension plans or large RRSPs. Without the recovery the recession would have reduced expected retirement income of future retirees by averages of 3.4% and 11.0% for DB and DC plans respectively. In order to analyze unemployment and early retirement effects, the paper examines a hypothetical economy with a recession once a decade. For DB plans, unemployment caused by recessions can reduce pensions by up to 25% if it strikes late and reduces final average pay. Early retirement may reduce DB pensions up to 50%. Overall, effects tend to be smaller with DC plans, but early career unemployment or early retirement can have substantial impacts. Enhancing CPP/QPP is compared with wide adoption of Pooled RPPs (PRPPs). Expected retirement income is higher with PRPPs but so is risk.

JEL Code: D31, E21, E32, and H55

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Executive Summary

Between the second quarter of 2008 and the first quarter of 2009 Toronto Stock Exchange (S&P TSX) composite index fell 51%. Over the same period house prices fell by 6%. By themselves, these and other asset price changes over the same period reduced the average wealth of Canadian families by 11% and average retirement assets by 14%. Defined contribution (DC) plans would have lost 27% of their value, and registered retirement assets would have dropped 26%. The unemployment rate rose from 6.0% before the recession to 9% at its peak. While there has been partial recovery of asset prices since, not everyone has benefitted from that, and these changes suggest that cyclical downturns can have important impacts on the third pillar of the Retirement Income System (RIS). This paper explores such impacts in the Canadian context.

The paper begins with a review of the recent history of recessions, pensions and retirement saving. Not all cyclical downturns are the same. Recessions may or may not be accompanied by a stock market collapse (1981-82 and 2008-09), and a large fall in the stock market is also possible without there being a recession (2001-02 in Canada). A general financial crisis is rare - - the last major financial crisis prior to 2008-09 was in 1929-33. Effects of such a crisis on the third pillar are stronger than from a decline in the stock market by itself.

The fraction of the male labor force covered by employer pension plans fell from 43% in 1976 to 28% in 2010. In contrast, female coverage has *increased*, from about 28% in the 1970s to 32% in 2010. Both men and women have seen a shift from DB to DC plans, exposing their retirement incomes more to market risks, but this trend slowed down for women around 1990. In 2010, 21% of men with a pension plan were in DC plans while the figure for women was just 14%. Importantly, Canadian families have also become wealthier over time. Mean wealth, including pension wealth, rose from four times disposable income in 1990 to six times income in 2010. Correcting for changes in age composition there was about a 40% increase, which is of course a positive for retirement preparedness.

Assets and wealth holdings in Statistics Canada's 2005 Survey of Financial Security (SFS) are projected forward to 2008 in order to allow estimation of the impact of asset price effects of the 2008-09 recession on the level and distribution of household wealth, including pension assets.. This exercise shows that on average family wealth declined by 11% in the recession but then more than recovered, climbing 13% from the trough in 2009 to the end of 2010. However, retirement assets fell 14% and only rose 12%, so did not fully recover in this period. The reason for the difference is that housing is an important element in overall wealth, and house prices more than rebounded from their 6% fall during the recession in the subsequent year, partly due to low interest rates. Asset losses were higher for those more exposed to the stock market, such as older workers and retirees who were DC plan holders or had substantial RRSP saving. Another vulnerable group were those aged less than 45, who have higher relative debt than older groups

and whose net worth therefore can decline considerably when asset prices go down due to a leverage effect.

The results are translated into impacts of the 2008-09 recession on expected retirement incomes of families with a major earner between ages 50 and 64. Workers are assumed to continue in employment until age 65 when they retire fully and take up their CPP/QPP benefits. Average predicted initial retirement income for this group is $49,000. Of this amount, 18% is from RRSPs and other investment income, while the rest is about equally divided between RPP, CPP/QPP and OAS/GIS income. The recession is estimated to have reduced expected retirement income by an average of 3.4% for DB pensioners and 11.0% for DC plan holders. The 38% of families with no DB or DC coverage lose just 3.8% of retirement income because over 70% of that income comes from CPP/QPP and OAS/GIS which are not directly affected, and also because GIS rises when other income declines. There is significant individual variation in these results. For example, it is estimated that the decline of retirement income would be greater than 10% for 62% of DC plan holders, 7% of DB pensioners and 15% of those with no DB or DC coverage.

In order to analyze unemployment and early retirement effects of recessions on retirement incomes, the paper goes on to examine a hypothetical economy that is hit once a decade by a significant recession. For DB plans, unemployment caused by recessions can reduce pension income by up to 20 – 25% if it strikes late in the working lifetime and has a strong effect on final average pay. Early retirement has similarly large effects, ranging up to 40-50% for workers forced to retire 8 – 10 years early. Unemployment and early retirement effects on DC plans may be somewhat smaller than effects on DB pensions. However, if a DB worker's years of service exceed the required minimum and final average pay is not affected, there can even be a zero effect on pension income. In the DC case, timing also seems to matter more. Spells of unemployment early in the career tend to have a large effect. For DC plan members recessions can have a double impact through forced early retirement and reduced asset values. Putting the two effects together, pension losses of 40% or more are possible.

Finally, exploratory modeling of policy alternatives is performed, concentrating on two possibilities: enhancement of CPP/QPP, and a case where PRPPs are widely adopted. A difference between the CPP/QPP enhancement and PRPP approaches, in terms of the risk/return tradeoff, comes out. PRPP encourages more private saving and a buildup of more DC-like or RRSP-like assets. This may raise expected retirement income, but it also reduces the resilience of retirement incomes to stock market crashes or slumps. CPP/QPP enhancement does the opposite, providing a lower expected rate of return but increasing "recession-proof" retirement income directly and crowding out other savings that are recession-vulnerable.

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1. Introduction

Between the second quarter of 2008, when Canadian stocks reached their peak and the first quarter of 2009 when they hit their trough, Standard & Poor's Toronto Stock Exchange (S&P TSX) composite index fell 51.2%.[1] Over the same period house prices fell by 5.9%. In this paper it is estimated that, acting by themselves, these and other asset price changes over the same period would have reduced the average wealth of Canadian families by 10.7%, and the average retirement assets by 14.3%. Defined contribution (DC) plans would have lost 27.0% of their value due to price changes alone, and registered retirement assets would have dropped 26.3%. The unemployment rate rose from 6.0% before the recession to 8.7% at its peak. While there has been partial subsequent recovery of asset prices, not everyone has benefitted from that, and these changes suggest that cyclical downturns can have important impacts on the third pillar of the Retirement Income System (RIS). The purpose of this paper is to explore such impacts in the Canadian context.

Here we ask what are the effects of recessions and slumps (i.e. the whole period of recession and recovery) on retirement assets and expected retirement income in Canada. This is an important question because recessions arrive reasonably often. The typical worker will likely experience at least two, and probably three or more recessions over his/her career, and if he/she is unlucky perhaps also a period of secular stagnation. If a recession sets back the worker's net worth and/or pension wealth via asset price, unemployment or early retirement effects, the impact on wealth and pension income in retirement may be quite significant. Since we haven't found a way to make our economy recession-proof these are effects that should be taken into account when analyzing saving behavior and when designing pension policy.

The effects of recessions and slowdowns on wealth and retirement incomes depend on the policy environment - - for example on how public pensions and other income security programs are set up. Recently there have been policy initiatives in Canada, and serious discussion of other changes, that may affect the role and magnitude of the third pillar of the retirement income system. A new voluntary system of pooled registered pension plans (PRPPs) has been authorized by the federal government and will be phased in where the provinces agree to implement them. Quebec has already done so in its 2012 budget. An expansion of the Canada Pension Plan/Quebec Pension Plan (CPP/QPP) has also been proposed as an alternative by some, including the province of Ontario. We look at some of the possible effects of PRPPs and an enhanced CPP/QPP on the resilience of the third pillar of the RIS to recessions.

[1] All statements about price changes during recessions and recovery in the paper are calculated relative to the midpoint between the initial and changed levels. Hence if we say that a price fell 20% in a recession and rose 20% in the recovery, that means that the price has returned to its pre-recession level at the end of the recovery. If the usual calculation relative to the base period was used, a 25% increase would be needed in the recovery to reverse a 20% decline in the recession, which is somewhat confusing.

The remainder of the paper proceeds as follows. Section 2 provides a review of selected literature. The modeling approach is set out in Section 3. A review of the recent history of cyclical downturns and retirement assets in Canada, covering the last few decades, is provided in Section 4. Features of the microdata used in this study are outlined in Section 5. Section 6 provides results on the impact effects of asset price changes on the value of household assets, including pension rights, in the period 2008-2010. That analysis is translated into effects on expected retirement incomes for the subsample of older workers (those aged 50-64) in Section 7. Permanent effects of both asset price changes and unemployment rises during slumps on retirement incomes are modeled in Section 8, comparing results that allow behavioural responses vs. ones that do not. Section 9 looks at how the latter results are modified when an enhanced CPP/QPP is in place and when a PRPP system is in place prior to a recession. Finally, another perspective is provided in section 10, which examines the effects of unemployment spells over a career as well as those of early retirement caused by recession on retirement incomes. Section 11 concludes.

2. **Literature review**

There is a relatively small, but growing literature on the effects of recession and slowdowns on savings and pensions. Here we provide a selective review, highlighting relevant Canadian and U.S. studies.

There was some work in the U.S. predating the most recent recession (which began in 2007 in the U.S., more than a year before Canada entered recession). Engen et al. (2005) examined the relationship between fluctuations in the stock prices and the adequacy of households' saving for retirement. They found that most households appear to save adequately for retirement, and that there was almost no link between equity values and the adequacy of retirement saving. A simulated 40 percent decline in stocks had little effect on the adequacy of saving. The results were explained by the fact that households with significant stock holding have sizeable wealth in other forms.

The result that most households do not appear to be under-saving for retirement was also obtained by Scholz et al. (2006), in a pioneering comparison of actual savings with simulated optimal amounts. Scholz et al. applied a rich life-cycle model of saving to nationally representative U.S. microdata. Uncertain lifetime, uninsurable earnings and medical expenses, and a realistic tax/transfer system were incorporated. About 80% of households were found not to be under-saving.

At about this time there were also important studies of saving and preparation for retirement in Canada. Milligan (2005) used 1999 SFS data to investigate life-cycle patterns of household portfolios. He found evidence of asset decumulation in retirement when annuitized assets (e.g. pensions) are included, which is important since otherwise it would appear that private assets were being held to make bequests, rather than to provide for retirement consumption. Milligan also found evidence of a hump-shaped age profile of risk tolerance, which is consistent with the observation that many workers who are not far from retirement have quite risky portfolios (see also Guiso et al., 2002, Ameriks and Zeldes, 2001, and Poterba and Samwick, 2001). Alan (2006) used the 1999 SFS as well, and also the SLID panel survey for 1996-2001, to show that much household saving in Canada occurs for precautionary reasons. Behaviour is consistent with a buffer stock saving model. Precautionary savings increase when households face liquidity constraints. These results suggest that it is important to keep in mind the effects of labor income uncertainty (which may be caused e.g. by recessionary unemployment) and borrowing constraints when thinking about how families make saving decisions.

LaRochelle-Côté et al. (2008) studied income replacement rates in retirement for Canada using 20-year longitudinal administrative data to track individuals as they move from age 55 through their retirement. They found that for average workers family income falls after age 60, declines until 68, and then stabilizes at about 80% of age 55 income. Low income people had little change in income as they moved from age 55 through retirement. It was also found that income instability falls sharply in retirement, and that more recent retirees are experiencing higher income than earlier cohorts, largely because of higher private pensions.

Since about 2008 there has been a rapidly growing body of work in the U.S. analyzing the retirement implications of the 2007-2009 recession in that country. One early example is Coile et al. (2009) which studied impacts on the timing of retirement, pointing out that mass layoffs could cause early retirement but people who were not forced to might wait longer to retire than if there had not been a crash in housing and stock markets. They used 30 years of Current Population Survey data to estimate effects of fluctuations in equity, housing and labor markets on retirement. The results led to the prediction that the increase in retirement due to rising unemployment would be almost 50 % larger than the decrease caused by the stock market crash.

Gustman et al. (2010) asked what the stock market decline implied for the financial security and retirement choices of older workers using the U.S. Health and Retirement Study data. They found that those approaching retirement age (early boomers ages 53 to 58 in 2006) had only 15.2 percent of their wealth in stocks, directly or in defined contribution plans or individual retirement accounts (IRAs), which are similar to RRSPs. Vulnerability to a stock market decline was limited by the high value of Social Security wealth. Defined benefit (DB) plans represented 65% of pension wealth for this group. Simulations with a structural retirement model indicated that the stock market decline would lead older workers to voluntarily postpone their retirement by

only 1.5 months, which agrees with the results of Coile et al. (2009). The effects of the housing price drop were also weak for this group.

Important insight was provided by Bricker et al. (2011) which reported the results of re-interviews in 2009 of families that participated in the Federal Reserve Board's 2007 Survey of Consumer Finances (SCF). The objective was to gain detailed information on the effects of the recession on all types of households. It was found that most families had a decline in wealth between 2007 and 2009, but the size of the effect varied considerably both overall and within demographic groups. Unemployment spells were associated with wealth declines. Significantly, changes in families' wealth over the period appeared to reflect mainly *changes in asset values* (particularly the value of homes, stocks, and businesses) rather than changes in the level of ownership of assets. This is an important result in the present context since in this study we do not formally model changes in portfolio composition that might have been caused by recessionary asset price changes. We are somewhat reassured in this regard by the finding of Bricker et al. that changes in family net worth from 2007 to 2009 in the U.S. were mostly due to asset price changes rather than changes in holdings. The authors also found that families appeared more cautious in 2009 than in 2007, with most reporting greater desired buffer savings, and many expressing concern over future income and employment.

Gustman et al. (2011) examine how the recession of 2007-09 affected the wealth and retirement of older workers in the U.S. using the Health and Retirement Study. The retirement wealth of those aged 53 to 58 declined by only 2.8% between 2006 and 2010. The authors point out that in more normal times their wealth would have increased over those four years. Older cohorts actually saw an increase in their wealth, and poorer households suffered a smaller effect than average. Impacts were largest for those with the highest net worth in 2006. Early retirement effects were not strong, as unemployment affected part-time and younger workers more than older workers with full-time jobs.

Some recent U.S. studies point to long-term and emerging problems of retirement savings adequacy. Bosworth and Smart (2009), for example, find that prior to the financial crisis, the current baby-boom cohort of near retirees were surprisingly well-prepared for retirement compared with similarly aged households over the past quarter century. The results of studies like Gustman et al. (2011) may therefore not be a good guide to the future. The collapse of the housing market triggered a broad decline of asset prices that greatly reduced the wealth of all households. Unless there is a strong recovery of asset values in the next few years, the reassuring picture one gets from looking at those who were near to, or in retirement prior to the financial crisis will not extend to future cohorts entering this age range. Rosnick and Baker (2010) compare the wealth of the baby boomer cohorts, which include people aged 40-54 as well as some of the near retirees, just before the crash with projections of household wealth following

the crash. These projections show that the younger baby boomers will be largely dependent on their Social Security income after retirement. Poterba et al. (2011) obtain similar results.

Finally, the availability of the new Wealth and Assets (WAS) survey in the UK, conducted over the period 2006-08, allowed Banks et al. (2010) to do calculations similar to some of those performed in the present paper. They project changes in the value of asset holdings due to price changes by asset category up to the third quarter of 2009. Education is used as a proxy for permanent income or socio-economic status. Younger families with low education have relatively small effects, but mid and high education families and older low education families were predicted to lose from 4.5 to 6 % of gross wealth. Since younger people have relatively higher debt it was expected that their losses would be greater as a % of net worth.

3. Modeling Approach

This paper investigates recession impacts on the RIS by two routes: asset market impacts, and labor market effects. Asset market impacts include both asset price changes and changes in rates of return. Labor market effects consist of employment impacts and effects on the date of retirement. The relative importance of these different effects differs between recessions.

Our first endeavour, in section 5, will be to study the impact effects of the asset price changes during the 2008-09 recession and subsequent recovery of asset values, including the value of pension rights. This is an accounting approach - - behavioural responses are not modeled. It also provides only part of the story, since the modeled decrease of registered retirement savings plan (RRSP) and defined contribution RPP values in the recession was soon largely reversed for those who maintained their stock holdings, but it is an important precursor to further investigation. We go on to analyze asset price impacts on the expected retirement incomes of a subsample of older workers - - those aged 50-64. These are the people most immediately affected by changes in expected pensions. Also, if at the end of a recession/recovery period an older worker has seen a drop in RRSP or RPP value the consequences are likely to be suffered through at least part, if not the whole retirement period. In this analysis we bring in realistic individual differences in price changes within particular asset categories. So, for example, one family's stocks might decline in value by 50% during the recession but another's might go down 40% or by 60%.

In order to get a handle on the possible *permanent* effects of slumps on retirement incomes we go on to model the longlasting effects of stylized slumps of two, three and four year durations, whose characteristics are based on a review of the 1981-82, 1990-91 and 2008-09 recessions and following recovery periods. Both asset price and unemployment changes are taken into account, as well as the impact of declines in interest rates and other yields that may persist beyond the slump period, as has been the case in our most recent experience. At this stage we move beyond

an accounting approach and use the general framework of the well-established life cycle model of saving and consumption (LCM) to analyze behavioural responses. A cautionary note is sounded, in view of the accumulated evidence that some savers do not prepare for retirement with the degree of prudence and foresight assumed in the LCM. The hope is that true impacts may lie somewhere between our "no response" and "full behavioural response" cases. Readers may judge where they believe the mostly likely outcomes are in this range.

The next exercise is to introduce, alternatively, an enhanced CPP/QPP system and a PRPP system. The purpose is not to study the effects of these systems, in themselves, although some of those effects will be noted. The idea is to see what impact having these systems in place would have on the sensitivity of retirement incomes to recessions. This exercise is carried out with and without behavioural response.

Our final contribution is to study unemployment over the career and early retirement effects in a separate (non-behavioural) accounting framework. The assumption is that given that recessions are a normal recurring event the date when a worker enters the labor market, or retires, becomes significant. For example, being hit by a recession in the last few years of the career may result in early retirement. The possible size of these impacts is studied for typical RPP schemes, including both DB pensions and DC plans.

It should be pointed out that in this modeling we do not endogenize portfolio choice. We assume that families keep the same stocks, mutual funds, GICs, houses, and other assets and debts through a recession and recovery. Attempting to model changes in portfolio choice realistically in an intertemporal computational model is very challenging, and has seldom been attempted (see Haliassos and Michaelides, 2002). Household assets differ not only in risk but also in liquidity. Some, such as housing, are held for consumption as well as investment purposes. Constructing a model that takes into account these important dimensions satisfactorily is on economists' "to do list" and is not attempted here.

What do we lose by having portfolio choice exogenous in the modeling? For those who follow the common advice to "buy and hold", and not to sell out in a panic during a stock market downturn, the answer may be very little. However, there are people who sell their stocks in a trough and opt for safer investments voluntarily plus people who may be forced to do so. The latter group may include, for example, DC plan members forced into early retirement who may be required to annuitize their holdings. Clearly, selling at the bottom may lead to much larger long-term loss of retirement income than we simulate in any of our various modeling exercises. Conversely, people who buy more stocks at the bottom may even be net beneficiaries of price fluctuation touched off in a recession. The hope is that the incidence of these "extra" losses and gains is sufficiently small that the results found here are relevant for the majority of families.

4. Cyclical Downturns: Some History

Real and Financial Aspects of Cyclical Downturns

Not all recessions are the same. Some feature a stock market crash, while in others stock prices continue to increase. House prices decline in some recessions, but not in others. Of course GDP declines in all recessions by definition, but the extent and duration of the decline, and the speed of recovery vary. Unemployment rates also increase due to recessions, but they lag GDP changes and, in particular, often fall very slowly after a recession. The extent and time path of unemployment effects differs between recessions. Interest rates have risen in some recessions (e.g. 1980-81), and have fallen in others (e.g. 2008-09). It seems likely that most if not all these variations affect the impact a downturn has on retirement savings, pensions and retirement income.

Figure 1 shows the path of the overall unemployment rate and the annual % change in GDP in Canada from 1976 through 2011. These periods saw three recessions, producing a drop in GDP in 1982, 1991 and 2009. In addition there were a number of slowdowns, centred on 1986, 1996 and 2001. The last of these was associated with a stock market crash and recession in the U.S.

While our most recent recession coincided with the global financial crisis, Figure 1 shows that it was the least damaging of the last three recessions in Canada in terms of its impacts on the real side of the economy. In both the 1981-82 and 1990-91 recessions unemployment rose much more than in 2008-09 and continued to rise after the downturn was over. In 2010 unemployment had already begun to decrease in Canada. But, on the other hand, the 2009 recession had a very large impact on retirement savings, pensions and personal wealth as reflected in the time path of financial assets and net worth in Figure 5. So the relative severity of financial and real impacts can differ quite a bit across recessions.

Figure 2 shows the behaviour of the S&P Toronto Stock Exchange (TSX) composite index since 1975 using monthly data. One of the most dramatic features is the 58% decline between June 2008 and February 2009.[2] But it is also evident that the 1990-91 recession saw a relatively small stock market impact - - the TSX fell only 26% from its peak in August 1989 to its trough in October 1990. Interestingly, there was a 58% decline in the index between August 2000 and September 2002 - - when Canada continued to grow. And a similar decline, of 55%, occurred in the 1981-82 recession. So, sometimes real downturns are accompanied by large financial downturns and sometimes they aren't. And sometimes large financial downturns occur while the economy continues to grow.

[2] All % changes in asset prices during recession or recovery are computed with reference to the midpoint between the initial and changed price, except in Table 9 and the associated discussion, as is indicated.

From the viewpoint of maintaining retirement savings and pension fund integrity, either real downturns or financial downturns are both bad news. But when one occurs without the other there is a softening of the blow. For example, a real downturn increases the rate of business failure, but if the financial markets are fairly steady pension funds will remain intact. And while a decline in the stock market erodes pension funds (and retirement savings), if the economy keeps growing the rate of business failure may remain low, so that the period of under-funding will pass again without a crisis in which many workers lose on their pensions. In contrast, if the stock market goes down *and* there is a spike in business failures, as in the 2008-09 recession, then distressing cases of significant pension loss may occur.

A final note about financial downturns is that, while large declines in the stock market are not uncommon - - we seem to get about one per decade - - a general collapse of financial markets is uncommon. Prior to 2008-09 the most recent example in North America was in 1929-33. A full-blown financial crisis brings with it a collapse of credit that sharply increases the risk of business failure and the danger to pensions. The strong global policy response to the 2008-09 crisis warded off these dangers to a large extent. However, it also resulted in an increase in government deficits and debt, reducing the ability of the authorities to deal with future crises, and perhaps increasing the danger from future recessions for retirement savings and pensions. Hence, cyclical downturns may have important delayed effects. One of these that is relevant in the current context is a prolonged reduction in interest rates and other yields, extending beyond the end of the recession & recovery period.

Evolution of Pension Funds and Retirement Savings in Canada

Recent decades have seen important changes in the prevalence and composition of both retirement saving and pension funds in Canada. Figure 3 shows the percent of the labour force covered by Registered Pension Plans by sex from 1976 to 2010. We see that the fraction of male workers covered has declined fairly steadily since 1980, when it stood at 43%, to the present, with only 28% covered in 2010. In contrast, female coverage has increased. It was fairly steady at 28 – 29% in the late 1970s and early to mid 1980s, and then rose to a new plateau of 31 – 33% in the early 1990s. In 2010 32% of the female labour force was covered by RPPs.

Figure 4 shows that the DB/DC composition of RPPs has changed over the last three or four decades, for both men and women. The rate of increase has slowed down for both sexes, but that slowdown has been much more marked for women. As of 2010, 20.7% of men covered by an RPP had a DC plan, up from 18.3% in 2005. But for women only 14.4% were in a DC plan, not much changed from the figure of 13.8% in 2005.

The increased incidence, and gender difference, for DC plans is significant because they have very different risk/return characteristics than DB pension plans. Prior to the global financial crisis and associated recession of 2008-09 the opportunity for higher long-run returns in DC plans tended to be emphasized, but the large stock market decline of 2008-09 naturally brought the higher risk more to the fore.

Personal Wealth, Retirement Savings and Pension Funds

Canadian households have become considerably wealthier over the last two decades. Figure 5 shows that the net worth of the personal sector was about four times disposable income in 1990 and is now about six times disposable income. About 12 % points of this approximate 50% increase were due to changes in age composition, associated with the ageing of the population as the baby boom moves through.[3] But this leaves about a 40% increase on an age-standardized basis. There were notable dips during the stock market declines of 2000-02 and 2008, but aside from that net worth has risen fairly steadily. This is in part because non-financial assets, of which housing is the most important, rose without showing major cyclical dips or booms.

Liabilities have risen in relation to disposable income over the last two decades, from 92% of disposable income in 1990 to 149% in 2010 (again see Figure 5). While it might appear that this makes households more vulnerable, for example to cyclical downturns, this growth does not exceed very much the increase in personal assets. In relation to income, liabilities rose 62%, but assets grew by 51% and net worth by 48%.

Both retirement savings and funds in employer pension plans approximately doubled in relation to disposable income from 1990 to 2010. In 2010 RPPs equalled 119% of disposable income, and registered savings plans 77%.[4] Growth in these assets outpaced, and contributed considerably to, the general growth of personal financial assets. In 2010 RPPs accounted for 29% of personal financial assets and RSPs for 18%, making a total of 47% - - up from 37% in 1990.

[3] Assuming the relative wealth levels seen in the 2005 SFS the observed shift in age composition of the population from 1990 to 2005 would have raised overall mean net worth by 12.3%. It would be good to do the calculation assuming, alternatively, 1990 relative wealth levels across the age groups, but there was no Canadian wealth survey conducted close to 1990.

[4] These numbers are not shown in the figures. They are derived from CANSIM series v 5246305 on Employer Pension Plans (i.e. RPPs), and RSPs (v52463031), which are part of the National Balance Sheets, and v647037 for Disposable Income. Personal financial assets, mentioned below, are in series v52223666.

5. Data

Statistics Canada has conducted detailed surveys of the assets and debts of Canadian families since the late 1950s, at irregular intervals.[5] The most recent whose results are available is the 2005 Survey of Financial Security (SFS), which provides estimates of pension wealth as well as RRSPs and the full range of other assets. The public-use microdata file from the 2005 SFS provides the empirical basis for this study.

There are 5,267 families in the 2005 SFS sample. We exclude from our sample 1,036 families where the major income earner (MIE) is retired and has not worked for pay since his/her first retirement. In other words we eliminate those families where the MIE is completely retired, as explained earlier. A further 47 observations are dropped because retirement status or education level of the MIE was not indicated by the respondent. This yields a sample of 4,184 families. Of those, 1,032 are single individuals. There is a total of 1,546 families with a female MIE, and 2,638 families have a male MIE. In the population as a whole there are 4.1 million families with female MIEs and 6.8 million with male MIEs who would qualify to be in our sample.

Assets and debts are reported at the family level - - ownership is not ascribed to individuals. In general this procedure is appropriate in studies of wealth since many assets are either formally or de facto shared within marriage. However, given concerns about gender differences in pension coverage, and the fact that rights to a particular pension are not equally shared between spouses, it would be useful to have pension plan values identified for individuals. It is to be hoped that future public use SFS datafiles will provide that information.

We now describe the assets and debts of families in our sample. Table 1 shows the proportion of families of different ages holding the various kinds of assets and debts, and Table 2 gives the corresponding mean holdings for all families[6]. "Age" means the age of the MIE. Table 1 shows that deposits are the only asset type that is held by almost everyone (note that cash is not covered), and even here 14% of families have none. The incidence of direct holdings of other non-retirement financial assets is low - - 11.9% for mutual funds and 10.4% for stocks, for

[5] The "most irregular" interval was that between the 1984 SCF and the 1999 SFS surveys. Since 1999 surveys have been conducted at seven year intervals, with the 2012 survey in the field in May/June this year. In unfortunate contrast, the U.S. SCF has been conducted at regular three-year intervals since the 1980s.

[6] Medians could be shown in Table 2, along with or even instead of means. In general they are considerably smaller than the means, due to skewness. Wherever the incidence of an asset or debt is less than 50% the median is zero. Medians are not shown here, partly in view of space considerations, but also because they lose their value when one begins to look at composition. The "median portfolio" is an ill-defined concept. (To see this, note that the portfolio of the median family could conceivably consist of just one asset. This suggests some averaging of portfolios around the median, but there is no obviously correct way to do that.)

example. Of course many people hold these assets within registered accounts, or such assets are held for them in pension funds. RRSPs or locked-in retirement accounts (LIRAs) are held by 57.1% of families and registered retirement income funds (RRIFs), life income funds (LIFs) or locked-in retirement income funds (LRIFs) are fairly common, with incidence at 36.0%, among those families with MIEs aged 65-74 who qualify to be in our sample. Employer pension plans are held by 46.6% of families in the sample. Overall, 70.1% of the families hold some form of retirement asset.

Table 2 shows that the major division of assets is that between financial and non-financial. Here we emphasize, further, the division between non-retirement and retirement assets. Overall, non-financial assets, averaging $264,423, make up 64.9% of the total assets of families in our sample, which average $407,530.[7] Principal residences average $140,088 and alone account for 34.4% of total assets. But retirement assets - - which are principally in the form of registered accounts and employer pension plans - - make up an impressive $106,740 on average and are 26.2% of total assets. Compared with these totals, the contribution of non-retirement financial assets is relatively small, with a mean of $36,367 and an asset share of just 8.9%.

Among other assets, Table 1 shows that ownership rates for both vehicles (76.5%) and principal residences (60.5%) are high. On the other hand, business equity and other real estate are held by less that 20% of the families. This makes the mean amounts held in the latter forms - - $52,195 and $37,014 respectively (see Table 2) - - all the more impressive. The mean holdings among those who own these assets are $270,440 for business equity and $232,792 for other real estate. This is worth noting in the present context since some people, particularly the self-employed, may do much of their effective retirement saving in these forms. Investment in housing of course can play a similar role for a larger fraction of the population.

The fraction of families holding any given asset type increases in our sample with age up to 65. In other words household portfolios broaden as people age. The various kinds of retirement assets follow this pattern, with RRSP or LIRAs for example rising from 50.9% incidence for those aged 25-34 to ownership by 70.3% of our sample at ages 55-64. And the fraction of families with at least some employer pension plan holdings rises from 41.1% to 59.8% over the same interval.

As people age over the working lifetime, financial assets roughly double in relative importance. For those aged 25-34, for example, total financial assets are just 21.1% of the portfolio. In contrast they form 44.2% of the total for families aged 55-64. And the relative importance of

[7] Note that the share of an asset type in total assets can be computed by dividing the mean for that asset type by the mean of total assets and converting to percent.

retirement assets rises, so that in the 55-64 year old group retirement assets are 37.0% of total assets and 83.5% of all *financial* assets. There can be little doubt about the importance of the third pillar of the retirement income system in family finances regarded from a life-cycle viewpoint.

There has been considerable concern about household debt in Canada in recent years. Debts have risen significantly since 2005, but even then the incidence and absolute amount of debt might seem high. Tables 1 and 2 show that the age profiles of both the incidence and amount of debt are hump-shaped. For families aged 25-34 the incidence of debt was 79.8% and that of unsecured debt (mostly credit cards and other consumer debt) was 65.2%. Both of these ratios increase and peak at ages 35-44, when 84.3% of families have some debt. Debt then declines, most strongly for secured debt (mostly mortgages). At its peak, at ages 35-44, mean family debt was $94,581 in 2005, of which $78,979 was secured and $15,602 unsecured.

While the absolute amount of debts may seem high, in relative terms it is less alarming. Even in the 35-44 year old group, mean debt is only 23.3% of the value of total assets, and unsecured debt is relatively small. Shorrocks et al. (2010) show that Canadian household debt is also not extreme from the viewpoint of international comparisons.

Tables 3 and 4 show the incidence and holdings of assets and debts by gender and education of the MIE. Education is classified as Low if the MIE has less than a high school diploma; Middle for a high school diploma or post-secondary participation that did not yield a university certificate or degree; and High for those with a university certificate or degree. As pointed out by Banks et al. (2010) this is an appropriate way to bring in the vertical aspect of distribution since education is a key determinant of permanent or lifetime income and also of socioeconomic status. In a cross-section dataset the alternative is to use the "snapshot" provided by annual income groups, which is less attractive since annual income is subject to transitory shocks.

Families with female MIEs have mean net worth of $298,425 while those with male MIEs have $367,356 - - a difference of 18.8%. They also have a lower probability of holding any particular asset-type, other than bonds, which are held by 10.3% of families whether the MIEs are female or male. The lower incidence of each asset type likely reflects the fact that there tends to be less diversification in smaller portfolios. The same principle is exhibited in the increasing incidence of most asset-types as we go up the education ladder (see Table 3).

There are fairly large differences in retirement savings and pensions among the different family types. Families with female MIEs are less likely to have any particular type of retirement asset - - their incidence of RRSPs or LIRAs is 50.3% vs. 61.3% for families with male MIEs, and the difference is 40.6% vs. 50.2% for employer pension plans. The percentage differences in mean amounts are even larger, reflecting the fact that families with female MIEs are both less likely to

have these assets and hold smaller amounts if they do have the asset. The result is that families with female MIEs have 33.1% less, on average, in RRSPs or LIRAs and 28.4% less in employer pension plans than families with male MIEs. Families with female MIEs are also slightly more likely to hold DB than DC plans, but the difference is only between 87.7% DB in the female case and 86.3% DB in the male case.

It is important to point out that it is not specifically indicated whether a family's RPPs are in DB or DC form in the SFS datafile. Since retirees are excluded from our sample, however, we can identify families in which only DC plans are held since DC plans have the same value on a termination or going concern basis (both of which are reported) but DB pensions do not.[8] These families number 13.2% of those with RPPs. This is less than the fraction of RPP members in Canada who were in DC plans in 2005, which stood at 16.1%. Families that have only DB pensions, and those that have a mixture of DB and DC plans (which is a small number), are classified as "DB" in this study.

Differences in portfolio composition across education groups are quite striking. The highly educated group is considerably more likely to hold any given asset type than the middle educated group, except in the cases of bonds and RRIFs/LIFs/LRIFs (in the latter case because the highly educated group is younger). The same is true in the comparison of the middle and low education groups, except that in that case there is also a large difference for bonds but a relatively small difference for other real estate. In the highly educated group 71.2% have RRSPs or LIRAs and 56.8% have employer pension plans. But the corresponding figures for the low education group are just 29.7% and 27.2%. Many members of the latter group may be depending heavily on old age security and or guaranteed income supplement (OAS/GIS) benefits for retirement income.

6. Impact Effects of Asset Price Changes, 2008-2010

In order to model the impact effects of price changes on family assets we need to update the 2005 SFS to the beginning of the recession and then apply the asset price changes that were observed in the recession and recovery. In doing this we make some strong assumptions that are unfortunately unavoidable since we only know family's holdings at the asset-type level. Thus we may know that a family had $50,000 in shares, but we don't know which shares, for example. We therefore assume that all holdings of a particular type of asset identified in the SFS experience the same % change in prices over any given time period.

[8] The going concern basis takes into account expected future increases in income in determining the value of pension rights accumulated to date, in the case of DB pensions. This means that the reported value of a DB pension will be greater on a going concern than on a termination basis. For DC plans there is no such difference.

Figure 6 shows the key price indexes we deal with. By far the largest fluctuations are shown by the S&P TSX composite index, which we assume governs price changes for all direct and indirect shareholdings.[9] The index rose 39.6%[10] from 2005Q2, the quarter when the 2005 SFS was conducted, to its peak in 2008Q2 immediately prior to the recession. From 2008Q2 the index fell 51.2% to its trough in 2009Q1.[11] Subsequently it rose fairly strongly, increasing by 41.9% from 2009Q1 to 2010Q4. In other words, the TSX had made up about 80% of the ground it lost in the recession by the end of 2010.

Another important price index is that for housing. Here we use the Teranet-National Bank index, which is based on comparisons in six major cities of the prices at which the same houses sold on at least two occasions. We need an index of the value of the existing *stock* of houses, and for this purpose the Teranet-NB index is the best available in Canada. Its methodology is similar to that of the widely used S&P Case-Shiller home price index in the U.S. and is more suitable in the present context than Statistics Canada's new house price index.

According to the Teranet-NB index, house price changes in Canada's six major cities have been much more moderate than share price changes. Note also that house prices peaked a quarter later than share prices, that is in 2008Q3, and also hit their trough a quarter later, in 2009Q2. From the time the SFS was conducted until 2008Q3 the index rose 27.6%, and from that point to its trough it fell by 8.1%. The subsequent rebound, under the influence of record low interest rates, has more than made up the ground lost in the recession. House prices in 2010Q4 were 5.1% above those at the pre-recession peak.

While the prices of some assets are highly volatile, others are not, and some never change. There are no price changes for deposits, savings bonds, or guaranteed investment certificates, for example, or indeed for debts. These may be termed fixed-price assets.

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[9] While the Toronto Stock Exchange is heavily dominant in Canada people do of course own shares not listed on the TSX. The largest non-TSX component is likely shares listed on U.S. exchanges. The behaviour of U.S. and Canadian share price indexes is highly correlated, however, and the magnitudes of fluctuations are very similar. Another point is that the weights on different stocks change over time in the S&P TSX index, in the simplest case due to stocks leaving or joining the index. Thus a person might be holding a representative TSX portfolio at the start of a recession, but not at the end of the recovery unless portfolio composition is adjusted.

[10] Computed using the midpoint as the reference level, as explained earlier.

[11] The fall would be somewhat greater if measured using daily, or even more frequent, TSX data. However, some smoothing of the data is probably appropriate to get a sense of the "true" decline. Investment advisors are constantly urging people to "buy and hold", and those who hold shares e.g. via DC plans may be constrained in how often they can adjust their portfolios. So high frequency changes in share prices may not be relevant to many, and perhaps most, shareholders.

In the exercise carried out below the different assets are assigned price changes as indicated in this table:

Asset Category	Price Index Used	% Price Change from...	
		2008Q2 to 2009Q1	2009Q1 to 2010Q4
Deposits, "Other Financial Assets", DB Pension Plans*, Debt	None	0	0
Bonds	5-10 year Government of Canada bonds	6.6	3.4
Shares	TSX composite index	-51.2	41.9
Mutual Funds	0.65 x Share price index + 0.27 x Bond price index + 0.08	-33.8	28.9
Registered Assets	0.49 x Share price index + 0.18 x Bond price index + 0.33	-26.3	22.2
DC plans and "Other Retirement Funds"	0.53 x Share price index + 0.41 x Bond price index + 0.06	-27.0	24.4
Principal Residence, Other Real Estate	Teranet-National Bank house price index	-5.9	12.2
Business Equity	Capitalized Value of Self-Employment Income per self-employed worker	-9.8	4.2

*See text for discussion of the valuation of DB Pension Plans.

Some of the above price assumptions require more explanation. "Other Financial Assets" are in a small miscellaneous category and we have no information about the composition of these assets. We therefore do not attempt to assign a price index, and ignore their possible price changes. DB pension plans are also assumed not to show price changes, which may seem problematic. As is well known, DB pension funds are invested mostly in bonds and shares, which of course experience large price changes, and these funds also hold other variable-price assets such as real estate. But those price changes do not result in a change in the value of the promised pension to the plan member. Despite some headline-making exceptions, such as the cases of Abitibi Bowater and Nortel in recent years, the collapse of pension plans in Canada is quite rare.[12] The value of a pension to the DB plan member is the present value of the promised

[12] How unusual it is for employer pension plans to fail in Canada is reflected in Ontario's experience during the recession. As of March 31, 2008 there were 7,761 pension plans in Ontario according to the 200708 annual report of the Financial Services Commission of Ontario (FSCO). In its 2008-09 annual report, the FSCO reported a net increase during 2008-09 of only 18 in the number of insolvent companies for which it was coordinating the administration of pension plans.

future pension stream, which is unaffected by fluctuations in the market value of the assets held by the pension fund as long as the probability of plan failure is small enough to be ignored, which in practice it is.

While plan members are protected from fluctuations in the value of DB pension fund assets, it is nonetheless interesting to know how much that protection is worth. As reported in the Appendix, it can be estimated that DB pension plans in Canada would on average have lost 26.3% of their value during the recession due to asset price changes, with the assumptions we are making in this paper, and that there had been a rebound of 24.1% by the end of 2010.

Mutual funds, registered assets and DC plans are all modelled here as if they consisted entirely of shares, bonds and fixed-price assets, where the latter category is taken to include treasury bills and money market funds as well as deposits and GICs.[13] The Appendix outlines how the relative shares of these three main asset types in the holdings of mutual funds, registered plans, and DC plans are determined. The above table indicates that mutual funds have the highest weighting for shares, and therefore show the second largest decline during the recession, exceeded only by pure share holdings. Registered assets and DC plans were a little less severely affected by the recession because of their heavier weightings on fixed price assets and bonds respectively.

Finally, we have allowed for changes in the value of business equity by capitalizing the current stream of net self-employment income per hour. This produces a price decline of 9.8% during the recession and an increase of 4.2% from the end of the downturn to the end of 2010.

Estimates of Price Impact Effects During and After the 2008-09 Recession

Table 5 gives a snapshot of some of the impact effects of the above assumed price changes in the 2008-09 recession and the recovery of 2009-10. In many respects the dominant price change is that of shares, and we therefore time the downturn and recovery to coincide with the behaviour of the TSX. That is, the downturn lasts from 2008Q2 to 2009Q1 and the recovery begins in 2009Q1 and was still continuing in 2010Q4, the last quarter in our data. Note that since share prices tend to lead real fluctuations, the downturn in these terms ended earlier than did the recession, which is of course defined in terms of the rate of change of real GDP and ended in 2009Q2 rather than 2009Q1. As mentioned previously, house prices both peaked and hit their trough one quarter after share prices. Bond prices were on an upward path through the recession, due to the policy-induced decline in interest rates. But the decline in share prices is the dominant

[13] Ideally, savings bonds should also be treated as fixed-price assets, but the data do not separate bonds and savings bonds.

asset price trend in the recession, both because of the magnitude of share holdings and the size of their price decline. So in what follows, we consider the change in value of all assets from 2008Q2 to 2009Q1 and then from 2009Q1 to 2010Q4.

We see first that, taking all population groups together, average net worth declined by 10.7% in the downturn and had rebounded by 12.6% by the end of 2010. There is some variation across groups, with the more highly educated, and families with male MIEs, experiencing a larger decline in the recession and a greater rebound since. There is little age trend. Larger impacts are found for financial assets - - non-retirement financial assets fell 19.7% in the recession and rose 12.2% by the end of 2010, while retirement assets in total (pensions plus registered retirement assets) dropped 14.3% in the downturn and had subsequently increased 12.2% by the end of 2010.

Given that the calculations here treat DB pensions as a fixed-price asset, and that we class 87% of the SFS families as DB pension holders, the fluctuations found in the value of total retirement assets due to price changes might be regarded as somewhat surprising. The size of the fluctuations is a reflection of the fact that registered assets and DC plans have grown to represent about half of all retirement assets. Hence, the considerable security of DB pensions in Canada no longer insulates the third pillar of our retirement income system from the impacts of cyclical downturns.

While DB pension plans do not insulate the third pillar from the effects of the recession, they do provide some valuable insurance. If DB pension plans had, in fact, been DC then price changes would have caused a 26.4% drop in total retirement assets during the recession, and a rebound of 23.4% since. Net worth would have declined 14.3% in the downturn and would have increased 15.7% afterward. Comparing these impacts with those found in our main results, we see that the insensitivity of DB pension plan rights to asset price changes provided valuable insurance to pension holders during the recession.

Table 5 also provides information on fluctuations in non-financial assets, which includes business equity as well as housing, other real estate and vehicles. As we saw above, under our assumptions price changes would have led to a 5.9% decline between 2008Q2 and 2009Q1 and a subsequent recovery of 12.2% to 2010Q4. The size of this decline and recovery would be somewhat larger if we took the decline from the peak of the housing index in 2008Q3 to its trough in 2009Q2, as we noted earlier, but even so the fluctuation is much smaller than those in shares, mutual funds, registered assets or DC plans. According to our estimates, the value of families' business equity was also relatively stable over the recession, with just a 9.3% decline in the recession and a 4.3% increase afterwards to 2010Q4. We thus find that, in total, the third pillar retirement assets showed considerably more vulnerability to the asset price changes

associated with the 2008-09 recession than did the value of houses and other non-financial assets.

As we saw earlier, not all recessions feature a stock market collapse, and a stock market collapse can occur without a recession (as in 2001-02). So it would not be appropriate to conclude on the basis of this exercise that the third pillar of the RIS is *always* more vulnerable to cyclical downturns than families' other major assets. However, in the world we live in now, where registered assets and DC plans have become so important and are of rising importance as time goes on, it is a reasonable conjecture that future recessions that are accompanied by a serious fall in the stock market will have a tendency to affect the value of third pillar assets strongly.

Size Distribution of Asset Price Impact Effects of the 2008-09 Recession

Table 6 shows summary aspects of the size distribution across families of some of the 2008-09 recession impact effects we have been examining. It shows the distribution of % changes in net worth and total retirement assets by size interval for families by sex, education and age of MIE. While the first panel of the table, for net worth, shows that the modal impact in all the groups is negative but less than 10%, there is a long tail. A few families in each gender and education group experienced a loss of net worth greater than 75%. The age breakdown indicates that these families are concentrated in the 25-34 and 35-44 year age ranges. How are such high negatives effects on net worth possible when the largest asset price drop we have is the 51.2% decline for shares? The answer is that net worth equals assets minus debts. There is no asset price impact on debts. So a family with a significant investment in stocks, or even in registered assets or a DC plan, but also with significant debt, could also see its net worth go down by more than 51.2%. This is the unpleasant effect of leverage working in reverse.

While the modal range has a net worth decline of less than 10% in the recession, the group with a 10 – 20% fall is not close behind. And this is true in all age groups. Of those around retirement age, the 55-64 year olds, 30.9% were in this group. While some of the people in this group would have seen their net worth rebound after the recession, others may have divested themselves of their mutual funds, stocks and RRSPs, or have been forced into retirement with their diminished DC plan holdings - - in other words may not have been able to rebound. Retirement income prospects for such individuals could easily have fallen 10 – 20% as a result of the 2008-09 recession.

It is also important to keep in mind that while the calculations reported in Table 6 take into account, and are indeed based on the variation between families in portfolio composition, the full variation in portfolios is not captured at this point. Some people invest in blue chips and others in mining stocks; some DC plans declined 30% in the recession, others 60%; a few DB pension

plans failed while the rest remained intact. So the true variation in net worth impacts of asset price changes across families during the recession was larger than reflected in Table 6. The next section attempts to capture that full variation in its modeling of differences in recessionary impacts on expected retirement income.

The second panel of Table 6 shows the variation in impact effects on total retirement assets - - i.e. the sum of pension plan values and amounts in registered retirement assets. In this case, there is no reverse leverage effect and the maximum decline is 27.0% - - our estimate of the % decline in mean DC plan value in the recession. Accordingly, the table indicates that no family saw a decrease of 30+%. But there is still considerable variation. The highest frequency is in the 20 – 30% decline group, which would capture families who had only registered assets, DC plans, or some combination of those two. Since DC plans are relatively infrequent, it seems likely that a large portion of the families in this group had only registered assets. Note that the frequency in this group is higher for males, and increases with both education and age.

Families with only DB pensions would show up in the "0, with Retirement Assets" group in Table 6. The % in this group is less than 12% in all cases, and is exceeded by the number experiencing a less than 10% decline of their retirement assets except in the case of the low education group. This reflects the fact that most of those with DB pensions also hold some registered assets, the latter being responsible for the decline in their total retirement assets. That the latter are quite sizeable is reflected in the fact that the % of families with a 10 – 20% decline of their retirement assets is greater than the % with no change in most of the groupings.

The asset price effects reviewed above are interesting in the present context because they may lead to changes in retirement incomes. If, for example, a self-employed person has been saving diligently in RRSP form and suffers a 40% loss in the value of that RRSP on the verge of the expected time of retirement there is bound to be a significant effect, even if it is only that retirement has to be postponed. In other cases, losses may not be recovered in the subsequent recovery of the economy and the stock market, either because the individual has chosen investments that do not rebound to the same extent as the market as a whole, or because the individual throws over the "buy and hold" strategy and converts risky RRSP assets to safe form at the bottom of the market or otherwise misses the upturn.

7. Impact Effects of Asset Price Changes on Retirement Incomes of Older Workers, 2008-09

In order to study retirement income effects we need to construct estimates of expected retirement income. This can be done most reliably for people who are in their peak earning years or nearing retirement, since their labor earnings are comparatively stable and their pension status is well established. Also, since they will be retiring before long the "best guess" that can be made about their retirement incomes should be reasonably close to what they will actually receive.

In the results reported here we look at a subset of the SFS families in which i) there is at least one earner, ii) the age of the major earner is between 50 and 64 (inclusive), and ii) there are no more than two adults. This gives us a sample of 1,050 working families, for whom reasonable predictions of income flows in retirement, including RPP, CPP/QPP, OAS, GIS and RRSP-derived income, can be made. In making those predictions we assume that the 2008 public programs were in a steady state and would continue unchanged. All predicted incomes are in constant 2008 dollars. All workers are assumed to retire completely at 65 and take full CPP/QPP pensions starting at that time.

Note that the full retirement assumption means we are predicting zero labor earnings in retirement. Many actual retirees continue to do some paid work, so that our expected retirement incomes are what retirees are *entitled* to by virtue of their various pensions and retirement savings, rather than a full estimate of retirement income.[14] Average labor earnings of those over age 65 are sufficiently small, however, that this is not a major issue.

Table 7 shows the level and composition of expected retirement income for this sample. The average expected retirement income is $49,168. Of this amount 18% is in the form of RRSP and other investment income, and the remainder is divided about equally between RPP, CPP/QPP and OAS/GIS income. The division is similar whether it is a male or female that is the major earner. On the other hand expected income from RPPs, and RRSPs and other investments is less important for those with low education (no high school diploma), and more important for those with high education (postsecondary grads): the public pensions that provide the rest of retirement income - - CPP/QPP and OAS/GIS fall from 72% of total income for the low

[14] Note that there are alternative concepts, and definitions of retirement. For many workers "retirement" is a clear concept set down by collective agreements or individual labor contracts. It means that the worker's full-time regular job has ceased, although they are of course free to seek other employment or perhaps return to the original employer on a part-time basis. In cases where retirement is not defined contractually, people may consider themselves "retired" even if they continue to do some paid work. In any case, retirement is not inconsistent with having some employment.

education group to 45% for the high education group. For comparison, CPP/QPP and OAS/GIS provide 55% of predicted retirement income for the sample as a whole.

The incidence of expected receipt of the different forms of retirement income is shown in Table 7. Almost everyone will receive OAS - - there are few families in the sample where the members' predicted net incomes are high enough for all their OAS to be clawed back. (In 2008 the clawback started at net income of $64,718 and applied at a 15% rate, so that OAS was completely clawed back at income of $104,903.) CPP/QPP receipt is also near universal for this sample, since all families have at least one earner. Overall, 33.8% will receive GIS; this fraction is higher for females (41.9% vs. 30.7% for males) and the low education group (57.7%). Receipt of income from RRSPs is high both for families with male MIEs and those with female MIEs, and is 77.2% overall. As for registered plans, the incidence of RRSPs rises with education, but the gradient is steeper going from mid to high education in the case of RRSPs than it is for RPPs. The incidence of other investment income is high (92.1% overall) and, perhaps surprisingly, does not vary much with either sex or education of the major earner.

Panel II of Table 7 shows incidence and mean amounts for people with different pension situations. There are a number of interesting differences between the groups. For example, DB pension holders, who not only face less risk than DC plan members, have the highest mean expected retirement incomes - - $59,369 vs. $55,785 for the DC people. They will receive more in all forms of retirement income, not just RPP income, except for OAS and GIS, where they get a little less. Those without an RPP are *much* more likely to qualify for GIS - - 65.3% incidence vs. 14.0% and 14.5% for DC and DB plan holders respectively. And they are also less likely to have an RRSP - - 66.3% incidence vs. 83% or more for RPP holders.

What are recession impacts on expected retirement incomes like? If you keep your job and you have a DB pension, as we indicated earlier, there is arguably little effect of a "normal" recession. The impacts of a prolonged slump or depression, or even a prolonged period of slow growth, could be more serious, as poor investment returns on pension fund assets force increases in employee contributions or reductions in benefits. On the other hand, recessions may have serious and fairly immediate implications for DC plan holders. First, while the markets may recover, the best estimate of the income that can be generated by any amount of capital still depends on the value of that capital. If that value has gone down 30 – 40% or more, then there has been a big impact on expected retirement income. Further, if the worker is forced into early retirement as a result of the recession, perhaps annuitizing at a bad time, the impact on retirement income could be quite severe.

As when we considered the impacts on net worth and asset values above, we will begin by assuming that DB pensions are not affected by the decline in asset prices at the onset of the recession. If again we abstract from differences across individuals in how their DC plan funds

and private savings are invested, we will find that a recession like that of 2008-09 has little impact on expected retirement income for DB pensioners but a large impact for DC plan holders. Table 8 shows estimated impacts of the initial asset price declines of a recession with the 2008-09 characteristics. We see an average fall of just 3.4% in expected retirement income for DB pensioners vs. a decline of 11.0% for DC plan holders. The drop for the DB pensioners is due to the fall in the value of their RRSPs and other investments, while for DC members there is also a large decline in value of their pension plan holdings.

Interestingly, Table 8 shows that the 38% of the (population weighted[15]) sample who have neither DC plans nor DB pensions only suffer an average decline in expected retirement income of 3.8%, barely more than experienced by those with DB pensions. This reflects that, as discussed above, over 70% of the retirement income of this group will be composed of CPP/QPP, OAS and GIS, and that GIS benefits rise for GIS recipients when non-OAS/GIS income, including investment income, goes down. For those with no RPP the average % increase in GIS is 6.9% and 44.1% of families in this group see a rise in their GIS - - by an average of 15.6%. There is a smaller cushioning effect of GIS for the other groups.-

Table 8 also compares the distribution of % changes in net worth and retirement incomes when we take individual differences in asset price changes into account vs. when they are ignored. In order to prepare estimates with individual differences in price impacts it is necessary to get an idea of the variation in returns across individuals, and to make some assumptions where evidence is not available. Mutual funds provide a popular way for Canadians to invest, both inside and outside their RRSPs. Over the fifteen year period 1997-2011 the annual standard deviation (SD) of returns across equity balanced mutual funds in Canada was 5.7% and for fixed income balanced funds was 3.0%.[16] In 2008 and 2009 the equity balanced funds had SDs of 4.9% and 8.7% respectively, so that even when average returns deviated greatly from the norm (they were -21.3% and 22.6% respectively in 2008 and 2009) the variance in returns was relatively stable.

To get an idea of possible differences in the price change impacts of the 2008-09 recession for different people, we made plausible assumptions regarding the SDs of returns across individuals for the various asset types included in the SFS. Following the evidence on balanced equity mutual funds, and taking into account the performance of balanced fixed income mutual funds as

[15] This % is calculated using Statistics Canada's population weights, rather than weighting families in the sample equally. The population weights allow adjustment for differences in response rates related e.g. to region and city size. In the rest of the discussion when we refer to "x% of the sample" we are reporting population-weighted numbers unless noted otherwise.

[16] These numbers were calculated by the authors using data from the Globe and Mail's "Globe Investor" website, http://www.theglobeandmail.com/globe-investor/.

well, we assumed that the expected annual SD for mutual funds over 2008-2009 would be 5%. Mutual funds achieve fairly high diversification. Results from Goetzmann and Kumar (2001), however, strongly suggests that people who manage stock investments on their own diversify to a much smaller extent.[17] Goetzmann and Kumar found that the average number of stocks held by investors, through a large discount brokerage, ranged from 4.2 at the start of their study period in 1991 to 6.5 at its end in 1996.[18] Evidence provided by Elton et al. (2003) suggests that with such a low level of diversification, the annual SD would be about double the fully diversified level for NYSE investors.[19] Assuming that mutual funds can be considered fairly well diversified, we have therefore assumed that the standard deviation of returns on stock portfolios equalled 10%.

We have assumed that RRSPs have similar variability in returns to mutual funds, setting their standard deviation at 5.0%. DC plans hold less stock and more bonds in Canada than do mutual funds (see appendix), so we assume they have a slightly lower standard deviation of 4.0%. Business equity and real estate investments appear to be examples of almost completely undiversified investments, and we have assumed that their standard deviations are 10% points above those of mutual funds, in line with the evidence of Elton et al. (2003) regarding the effect of diversification on the variance of returns.

Table 8 shows that when individual differences in asset price changes are taken into account as described above, there is more variability in the changes to net worth and expected retirement incomes resulting from the recession of 2008-09 than it would otherwise appear. At the same time, the difference in impacts created by individual variability is perhaps not as great as one might expect, based on anecdotal evidence. The explanation may be that anecdotes are based on people who are having quite extreme experiences that are a poor guide to broader experience.

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[17] The results of Kotlikoff (2008) suggest the intriguing possibility that the lack of diversification may not always be a mistake. He find that concentrating rather than diversifying a family's portfolio is often necessary to diversify its overall holdings, which include human capital.

[18] Goetzmann and Kumar (2001) had a sample of 40,000 investment accounts from a single brokerage, which allowed them to follow the trading activity and returns received by the investors over time. A number of previous studies, using survey data, had also found substantial under-diversification in household investments, but were not able to observe actual portfolio performance. For references to the earlier literature see Goetzmann and Kumar.

[19] Elton et al. (2003, Table 4.8) gives results of calculations using all stock returns on the New York Stock Exchange. The expected portfolio monthly variance was 13.651 with six stocks and 7.058 with full diversification. This gives standard deviations of 3.695 and 2.657 respectively. (With *zero* diversification, that is holding just one stock, the standard deviation rises to 6.828.) Assuming that individual shareholders have double the standard deviation of returns than mutual fund holders, as we do here, thus appears to provide realistic allowance for the effects of non-diversification.

In the first panel of the last column of Table 8 we see that there would have been considerable variability in the changes in individual net worth resulting from the 2008-09 recession even if there had been no differences in the price change for particular asset types. A fifth of a percent of families in the 50-64 year old group would have suffered declines of more than 75% of their net worth. (Some of these people would have had very low net worth and could have suffered a very large drop in net worth due to "reverse leverage", but even so the prospect of a 75+% drop in net worth is not inviting.) And 7.9% had a drop of 20% or more. Taking individual variation in price effects into account, the second panel shows 10.7% with a decline of more than 20%, and at the other end of the distribution a rise from 0.1% to 4.4% who actually made some gains over the period.

In the Retirement Income columns of Table 8 we see a sharp contrast in the situation of DC plan holders vs. those with DB pensions or without pensions. When individual variations in price impacts are ignored (top panel) only 15.4% of those without an RPP see a decline in expected retirement income of more than 10%, and the figure is just 6.8% for those with DB plans. In contrast, 62.4% of the DC plan people have a drop of 10% or more, and 2.5% have a decline greater than 20%. Again, introducing individual variation in price impact effects causes some spreading out of the distribution, but perhaps not as much as one might have expected.

Another interesting aspect of these simulations is the cushioning role played by GIS. For those with no RPP, we saw in Table 7 that initial incidence of GIS is high, at 65.3% and the mean amount received ($3,003 averaging over GIS recipients and non-recipients in the group) is quite significant. For this group there is an average % increase in GIS of 6.9%, and 44.1% of the families see a rise in their GIS - - by an average of 15.6%. The average dollar increase is $207 per family.

In contrast, GIS incidence and amounts are much lower for DB and DC recipients and fewer DB and DC plan holders have an increase in GIS receipt when the recession hits in our simulations - - just 10.8% and 18.5% respectively. The average % increases are 3.8% and 7.3% for DB and DC respectively, and the average dollar increases are just $16 and $39.

8. Permanent Effects of Asset Price and Unemployment Changes on Retirement Incomes of Older Workers

As we have noted, recessions vary in depth and duration, and there are also large differences in the speed of recovery after a recession. The above two sections have focused on the impact effects of asset price changes in the downswing of a recession. The results are suggestive, but because asset prices generally recover after a recession, it might appear that there is no

permanent damage to expected retirement incomes. But that would be a misleading impression. We need to analyze what the permanent effects are, and how to measure them. And we need to extend our analysis beyond the 2008-09 recession. As preparation for this analysis we will examine Table 9, which summarizes salient characteristics of the 1981-82, 1990-91, and 2008-09 recessions and subsequence recoveries in Canada.

The top panel of Table 9 compares the experience of the TSX in the "bear markets" associated with these three recessions. Note first that the downturns are all relatively short - - 13, 14 and 9 months' duration in 81-82, 90-91 and 08-09 respectively. There is more variation in the length of time it takes the market to recover. After the 1981-82 recession the S&P TSX index got back to its previous peak in April 1983, just 10 months after its trough. After the 1991-92 decline it took almost three years for the index to return to its previous peak, on the other hand. And, since the 2008-09 crash the TSX has not recovered to its previous peak (14,715) although it did get close for a few months, hitting 14,137 in February 2011. In mid 2012 it is languishing in the 11,300 – 11,500 range. It may be that we are experiencing the beginning of one of the fairly long periods of lower real stock prices that Shiller (2005) identifies as following the largest booms in the stock market.[20]

One way of summarizing the price impact of each recession on the stock market is to add up the % shortfall of the S&P TSX from its previous peak month by month during each slump.[21] The result can be expressed in equivalent years of price shortfall. For example, if the index is 50% below its previous peak for a year, that would give a total of 50 percentage points of shortfall. Being 50% below the previous peak for two years would represent 100 percentage points of shortfall - - that is, it would be equivalent to a 100% price fall that lasted one year. The last row of the first panel of Table 9 shows the result.[22] The 1981-82 recession produced price declines equivalent to a 41.3% drop for one year, and the 90-91 recession imposed a similar burden at 42.4%. Finally, the 2008-09 cumulative price shortfall tops both of those, at 78.7%.

The second panel of the table looks at GDP, unemployment, and interest rates in the three recessions and recoveries. Note that the timing is a little different from that of the stock market slumps, reflecting the fact that the stock market is a leading indicator for the real economy. In terms of maximum GDP decline the 1981-82 recession was worst, producing a fall of 5.0%, while the 1990-91 recession was the least severe with just a 3.5% decline. The 2008-09 recession

[20] Shiller (2005) points out, for example, that real U.S. stock prices did not regain their 1966 peak until 1992.

[21] For the 2008-09 recession the TSX has not regained its previous peak. We therefore cumulate the shortfall until May 2012, the latest completed month at the time of writing.

[22] In these calculations we compute % changes using the previous peak S&P level as the denominator. Otherwise the shortfall %s computed at different points during a slump would not be relative to the same base.

caused a 3.9% fall. In terms of duration, the 1990-91 recession was the worst, with a period of two and a half years from the trough to a recovery of GDP to its pre-recession level. The recovery from our most recent recession was the quickest - - it took just a year and a quarter.

Turning to unemployment, we see that the 1981-82 and 1990-91 recessions were more severe than the 2008-09 recession, producing increases in unemployment to 13.1% and 10.5% from 7.2% and 7.3 respectively. In comparison, the rise of unemployment from 6.2% to 8.6% in the 2008-09 recession is modest. Also, it is important to note that unemployment was very slow to come down after the earlier recessions. The table shows that at the point where GDP had fully recovered, unemployment was still 11.3% in 1983 and 11.5% in 1993. In the latter case unemployment actually rose from the recession's trough to the point where GDP had recovered fully.

As with asset prices, we can get an idea of the overall severity of unemployment during a slump by cumulating the % excess over the pre-recession level. This excess added up to 16.0% for the 1981-82 recession (and recovery period), 11.8% for 1990-91 and just 6.4% for 2008-09.

Finally, Table 9 shows what happened to interest rates in the three recession & recovery periods, as reflected in the yield on five-year Government of Canada bonds. Interest rates fell over all three slumps. However, inflation rates also fell - - so much in the 1981-82 event that real interest rates were higher in 1983 than they had been in 1981. In the 1991-92 and 2008-09 cases the declines in nominal interest rates and in the inflation rate were of about the same size so that real interest rates appear to have changed little. However, the inflation rate of 3.4% in the quarter before the 2008-09 recession was an outlier. For almost 20 years the Bank of Canada has been quite successfully targeting an inflation rate of 2%, and Canadian's expectations of inflation have been quite firmly anchored at that level for some time. It can therefore be argued that the drop in the nominal interest rate shown in the table from 3.1% in September 2008 to 2.0% two years later represents a fall in the real interest rate. The real interest rate has essentially gone to zero. .

Table 10 explores how we can make estimates of the possible effects of recessions on retirement income, drawing on the stylized facts about Canadian recessions. The table shows results for recessions of two, three, and four years duration. These correspond very roughly to the 2008-09, 1981-82 and 1990-91 recessions and their recovery periods. These recessions have two main effects:

i) The growth in the value of stocks and other personal assets is interrupted - - we assume for the full duration of the recession/recovery period. The lost growth is assumed to be 6% per year for stocks and business equity, 4% for mutual funds and RRSPs, and 2% for bonds and investment real estate. Both DB and DC RRPs also lose out on 4% annual asset growth through the recession/recovery, which reduces expected retirement income accordingly.

ii) The unemployment rate rises. Here we are dealing with older workers (i.e. aged 50 to 64). We assume that their unemployment rate rises by 1.5 % points in a two year recession/recovery, 2.5% in the three year event, and 3.5% in the four year slump. These assumptions are based on the observed average elevation of unemployment rates for workers aged 55+ in the three recessions we have looked at here compared with their pre-recession rates. The increased unemployment rate is assumed to hold throughout the recession/recovery for simplicity.

These highly stylized assumptions give recessions full credit for being destructive events. The justification for assuming a permanent effect on stock values is that slumps have a severe effect on profits and retained earnings. Bond values are of course less affected. Normal growth in real estate values at 2% per year is based on the idea that they will grow hand-in-hand with GDP, whose trend rate of growth is about 2%, but which, by definition, has zero growth over the slump. Not only DC plan values but also DB values are assumed to fall because reduced growth of pension fund assets due to the slump will ultimately result in adjustments (higher contributions and/or lower pension payments) that reduce the present value of participating in a DB pension.

The first panel of Table 10 shows the distribution of effects on expected retirement incomes (referred to below simply as "retirement incomes" where that should not be misleading) when there are asset price effects, but no unemployment impacts. The second panel introduces unemployment effects, and the third considers the impact of a secular decline in real rates of return, such as is widely believed to have accompanied the most recent recession/recovery.

In each panel of Table 10, for each recession there are two columns - - one assuming no behavioural response, and the other where there is "full behavioural response". The latter case assumes that people want to smooth consumption over the lifetime, are forward-looking and try to optimize. These are the basic assumption of the life-cycle model (LCM) that provides economists' standard paradigm for analyzing saving and consumption decisions. As mentioned earlier, evidence has accumulated that people do not always behave according to the predictions of this model - - for example failing to save enough for their retirement (see e.g. Bernheim and Rangel, 2007). It may be, then, that a best guess is somewhere between the no response and full response results.

The asset price and unemployment changes we are modeling all reduce remaining lifetime wealth, or *RLW*, which is the present value of labor earnings up to retirement at age 65, and transfer income that will be received after that (CPP/QPP, OAS and GIS) plus current net worth. Assuming there is no change in real interest rates, if there is, for example, a 5% reduction in *RLW* people who are behaving according to standard versions of the life-cycle model will want to reduce consumption by 5% at all ages. Taking the purpose of retirement income to be paying

for retirement consumption, this means a 5% reduction in retirement income is desired. Such a reduction may or may not be possible. If the individual or family has sufficient RRSP holdings or other financial assets, it may be possible to reduce retirement income by running down those assets prior to retirement. On the other hand, if such holdings are small, people may reach a "corner solution" where they can only reduce total retirement income by some amount less than 5% even if they liquidate RRSPs and other financial assets before retirement.

With a "behavioural economics" hat on, one may be skeptical about the full response case described. It may be, for example, that prior to the recession, some people know they have been saving too little for retirement but just don't have the self-discipline or initiative to do something about that. The size of their savings reaction to a 5% reduction in *RLW* may be zero, even if they have some RRSPs and other financial assets - - the recession may simply have made those holdings more appropriate in relation to the family's (now reduced) lifetime wealth. This provides an example of why a "best guess" at actual impacts may lie somewhere between our no response and full response cases.

The first panel of Table 10 shows that the impact of the stylized recessions described can be sizeable even if there are only asset price effects and no unemployment impacts. Even a mild two year slump will reduce retirement incomes, on average, by 5.2% if there is no behavioural response. At the other extreme a four year event causes a 7.06% impact in the no response case, on average. And the frequency distributions show that some people have considerably larger impacts - - at least 20% of the sample see a drop in retirement income of more than 10%, looking across the three recession/recovery lengths and keeping to the no response case.

We also see from this first panel that behavioural response can have quite a large effect. In each run the impact is quite a bit less when people are allowed to adjust their savings in response to asset price shocks. The mild two-year slump produces an average reduction in expected retirement income of just 1.9%, while even the severe four-year slump only cuts retirement income by 3.8% on average. Recall that people are losing, on average, about 4% of the value of their financial assets (including RPPs) for each year of slump here. Planned retirement income does not fall as much because labor earnings have not been reduced. So the % drop in *RLW* is less than that in e.g. the value of RPPs and forward-looking people will adjust by increasing their savings to prevent retirement income from falling too much.

Of course, some people do suffer a loss of labor earnings in a slump. Here we simulate the effect by randomly assigning enough people in our sample to a year of unemployment during the slump to increase unemployment by the required amount (1.5, 2.5 and 3.5 % points in the three different slumps, as described above). This means that 3% of the sample will experience unemployment during the two-year slump, 7.5% in the three-year slump, and 14% in the four year slump. The employment effects being assumed are thus not negligible. In the simulation

they lead to reduced pension contributions, lowering RPPs, and also to reduced CPP/QPP eligibility (a 1/40th loss of CPP/QPP payout is assumed for each year of unemployment).

The second panel of Table 10 shows that, while adding unemployment effects increases retirement income effects, the impact is not as large as might have been expected. In the middle case, the three-year slump, the average impact rises only from 6.12% to 6.18% in the no-response case and from 2.80 to 3.09% with behavioural response. The somewhat greater sensitivity to adding unemployment when behavioural response is allowed is interesting. It is due to the fact that the average % reduction in *RLW* is increasing, leading to larger indirect effects, in the form of a fall in RRSPs and other private financial assets.

Finally, the third panel shows results assuming a permanent decline in real rates of return of two percentage points is caused by the slump. This is relevant to the 2008-09 recession and spluttering subsequent recovery, but likely not to most recessions. The 2008-09 recession was of course accompanied by a worldwide financial crisis. The monetary policy response was a radical decrease in interest rates, bringing short-term real rates below zero and longer term real rates close to zero. Four years after the onset of the recession this situation shows no sign of letting up. Older workers are getting used to the idea that the reduction in real interest rates will be with us for a while. Full recovery from a financial crisis of the severity that was experienced can take a decade or more, the world has been warned by economic historians. This means that, at least for the 50-64 year olds in our sample it is reasonable to behave as if the reduction in real rates of return is permanent. The fall has been at least two percentage points for the GICs, bonds, and fixed income mutual funds that Canadian households invest in. Here we assume a two percent fall across the board.

The special significance of a decline in real interest rates that can be treated as permanent for decision-making is that it produces a substitution effect toward earlier consumption, reducing desired retirement consumption.[23] There is also an income effect, which should reduce planned retirement consumption, and retirement income of course, even further.[24] Here, in order to

[23] Another aspect of the change in returns associated with the global financial crisis and the uncertain recovery that followed has been a rise, and fluctuations in, volatility. Increased risk is predicted to increase saving in the standard version of the life-cycle model we use below, with the typical assumption that the coefficient or relative risk aversion is greater than 1 (see Davies and Shorrocks, 2000, p. 617). It is therefore possible that taking into account increased volatility would reduce the saving reduction we model here. Taking risk into account satisfactorily in an applied life-cycle model is challenging for a range of reasons (see Haliassos and Michaelides, 2002) and is beyond the scope of the present exercise.

[24] Note that while the impact of a lower interest rate on current *saving* is theoretically ambiguous , due to opposing income and substitution effects, in the case of retirement consumption the income and substitution effects are in the same direction. In addition, it may be noted that simulations based on realistic assumptions about incomes and

quantify the effects, following frequent practice in economics we assume that individuals attempt to maximize an intertemporal CRRA (constant relative risk aversion) utility function:

$$U = \sum_{t=1}^{T} (1+\rho)^{-t} \frac{{C_t}^{1-\gamma}}{(1-\gamma)}$$

Here T is the (certain) length of life, C_t is consumption, ρ is the rate of time preference, and γ is the inverse of the intertemporal elasticity of substitution. With this utility function the individual plans for consumption to grow at a constant rate g, given by:

$$g = \frac{(r-\rho)}{\gamma}$$

Prior to the most recent recession real interest rates were in the neighbourhood of 2% over a number of years. However, there is little evidence that Canadians were planning growth of consumption over time, least of all during retirement. We have therefore assumed $\rho = 0.02$, which gives $g = 0$ and is in the range of popular values used in the literature. We use $\gamma = 2$, a representative value from the literature, which implies the intertemporal elasticity of substitution, at ½, is substantially below unity, in line with much empirical evidence. The result is that a decline in interest rates of two percentage points leads to about a 0.5% reduction in planned retirement consumption for every year that workers in the age range 50-65 have left before retirement at 65. Thus, a 55 year old worker will plan for 10% lower average consumption in retirement, giving a 10% fall in retirement income as well in the life-cycle model of saving.

The third panel of Table 10 shows that bringing in interest rate effects increases the impact on expected retirement income greatly when behavioural effects are allowed. In the mild two-year slump the average decrease in retirement income goes from 2.0% to 5.8%, and the severe four-year case gives almost a 10% average retirement income reduction. Interestingly, the impact is relatively uniform. Only 2.3% of the sample have a reduction of more than 10%, which contrasts with a figure of 39.7% without behavioural response. This reflects the fact that, with behavioural response, the change in retirement income is a *planned* change. It should also be kept in mind that the reduction in welfare is less than suggested by the fall in retirement consumption, which is offset to an extent by a relative increase in consumption during the working period when there are behavioural effects.

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interest rates show that a negative impact of a fall in interest rates on current saving can also be anticipated (see Summers, 1981).

9. Policy Impacts

The RRSP and other losses associated with the 2008-09 stock market crash precipitated a lively discussion in Canada over possible pension reforms. Two central policy alternatives emerged. One was CPP/QPP enhancement, the other the creation of a new publicly-sponsored or mandated system of low-cost retirement savings plans that expand the number of people saving for retirement, particularly encouraging those not covered by RPPs to do more retirement preparation.

On November 17, 2011, the federal government introduced Bill C-25, the Pooled Registered Pension Plans Act, as a first step in setting out the legislative framework for PRPPs that applies to federally regulated industries and employment in the territories.[25] The federal government also announced proposed amendments to the federal *Income Tax Act* in December 2011 to accommodate PRPPs. Provincial legislation and regulations are required to implement PRPPs in the provinces. The first to take up the challenge was Quebec, which in its 2012 budget announced a system of Voluntary Retirement Savings Plans (VRSPs) that will be its version of PRPPs.

Under the federal legislation PRPPs would be established by financial institutions or other licensees. A single PRPP could be used by multiple employers. Employers would have the choice of whether to offer PRPPs to their employers. A key feature is that participation would be offered to employees on an opt-out basis, providing the "nudge" which the literature on behavioural economics has established is important in getting enrolment rates up (see Bernheim and Rangel, 2007, and Thaler and Sunstein, 2008). The plans are intended to be low-cost, achieving significant economies of scale and passing on the benefits of low management expense to plan members.

The Quebec version of the PRPP has features that provide a little help in modeling, although it is possible, and perhaps likely, that the plans will differ considerably across provinces and may even not be offered in all provinces. Interestingly, it will be *mandatory* for Quebec employers with more than five employees to offer VRSPs to their employees. The default contribution rate will rise through a phase-in period to reach 4% in 2017. Employees will have 60 days in which to opt out. Subsequently they will be able to drop out, but any savings already in the VRSP will be locked in until retirement, except under exceptional circumstances such as disability.

[25] See the backgrounder at http://www.fin.gc.ca/n11/data/11-119_3-eng.asp

Ontario has begun to consider how to introduce PRPPs but has indicated they would like to see an enhanced CPP as an element in pension changes. There are alternative ways in which the CPP/QPP could be enhanced. One possibility, which is modeled here, is to increase both contribution and benefit rates by a certain percentage. Currently CPP/QPP provides a normal retirement pension of no more than $11,840 (for those retiring at age 65), an amount based on 25% of yearly maximum pensionable earnings (YMPE). Employees and employers each pay contributions at a rate of 4.95% of earnings. The system is widely believed to be safe and sound, although that has been challenged (see Robson, 2011). If the system is sustainable it would presumably also be if the contributions and benefits were both increased by, say 50%.

Simply raising contributions and benefits by the same percentage is not the only way to enhance the CPP/QPP. Another option is to raise the YMPE, which is relatively low, for example in comparison to the cutoff income at which Americans stop paying social security contributions. Rather than increase contribution and benefit rates one could simply raise YMPE to, say, $75,000 and keep it at a constant level relative to median or mean earnings thereafter. This would raise pensions for people earning more than YMPE, but would provide no benefit to those earning less than that. This strategy can therefore perhaps be seen as providing differential benefit to the middle class.

Table 11 shows some of the results of introducing CPP/QPP enhancement or PRPPs in our model, in terms of the impact of recession/recovery on retirement incomes. The goal is not to set out the effects of these pension reforms themselves. It is to study how the prior existence of such elements in our pension system would affect the sensitivity of retirement incomes to slumps. Therefore, the starting point is taken as a world in which either enhanced CPP/QPP or a PRPP system have already been phased in. To model this starting point one has to consider the crowding out effect of these systems. CPP/QPP is the easiest to deal with since it does not affect the rate of return to individual saving. In principle, enhancing CPP/QPP could affect lifetime wealth and how much people want to save in RRSPs and non-registered private assets. However, with realistic assumptions on earnings profiles, the internal rate of return on CPP/QPP contributions is similar to, or better than what people can expect on their RRSP or other savings at present. We therefore ignore the possibility of effects of CPP/QPP enhancement on lifetime wealth and assume that enhancing CPP/QPP simply crowds out private savings on a one for one basis. We raise both CPP/QPP contributions and benefits by 50%, but make no change to YMPE. The result of this change is that about half of the people in our sample abandon their RRSPs or other private financial assets completely.

We take the 2017 Quebec default rate of 4% as the contribution rate for workers who do not opt out when PRPP is offered. We assume that 75% of workers who are not currently covered by an RPP participate. Of those in our sample 37.95% do not have an RPP. That fraction falls to 9.7% with the introduction of PRPPs, accomplishing the major goal of extending pension coverage

more broadly. We assume that PRPP contributions crowd out other private savings only at a 50% rate, implicitly allowing workers who participate in PRPPs to make voluntary contributions in addition to the default.[26] Since PRPPs are expected to have a higher rate of return than equivalent existing savings vehicles, we expect the composition of savings for these individuals will move toward PRPPs and away from RRSPS, and that they will want an effective increase in their overall retirement savings due to the higher rate of return.

Table 11 shows that enhanced CPP/QPP and a PRPP system have opposite effects on the impacts of slumps on retirement income. Table 10 indicated, for example, that the average reduction in retirement income due to the unemployment and interest rate effects of a two-year slump, without a PRPP system or changes to the CPP/QPP, would be 5.41% without behavioural response and 5.79% with response. Bringing in CPP/QPP enhancement reduces these effects to 5.05% and 4.84% respectively, while introducing PRPP instead gives figures of 5.69% and 5.97%. The reason for the difference is that enhancing CPP/QPP displaces RRSPs and other private savings, which are susceptible to the asset price effects of a recession, whereas introducing PRPPs increases the role of private saving, with the opposite effect.

10. Impacts Related to Unemployment over the Career and Early Retirement

In this section we provide more perspective on the effects of unemployment and early retirement caused by recessions by performing illustrative calculations based on the idea that we live in a society where recessions are recurrent events, and that each worker will go through at least two or three slumps during his/her career. The aim is to see how large these effects can be, and how they depend on factors like the time of labor market entry or retirement.

Our calculations use the average earnings trajectory of families in the 2005SFS and are parameterized to generate the observed mean DB or DC plans, for DB and DC plan holders respectively. In the DB case it is assumed that a full pension equals half of final average pay (FAP), and that 30 years of service (YS) are required for a full pension. If YS < 30 the pension is reduced in proportion to the shortfall. The DB pension is non-indexed and both average earnings and prices for the economy as a whole are assumed to rise in nominal terms by 2% per year. In the DC case we find that a parameterization with contributions equal to 10% of earnings each

[26] We are ignoring the possibility that workers who currently have an RPP may decide to contribute to a PRPP as well. The higher rate of return on PRPPs could induce these individuals to raise their overall retirement savings. That is an interesting effect, but its size and significance is difficult to predict, given the current early state of PRPP implementation. Note also that recessionary impacts on retirement incomes would be magnified if this form of increased retirement savings were modeled.

year and a 3% real annual rate of return generate the required pension wealth. Results are shown in Table 12.

Table 12 shows the reduction in real pension income to be received at age 60 by workers affected by unemployment or reduced retirement in different ways. DB pensions can be affected through impacts on either YS or FAP, or on both. For the effects of unemployment we assume that there is an effect on YS in all cases. (The situation where YS is unaffected but FAP is reduced is similar to early retirement without an effect on YS, which is addressed in the third column.) The first column shows the unemployment effect if FAP is not affected. Impacts are simply proportional to the loss of YS - - one year of unemployment produces a 3.3% loss while 10 years of unemployment reduce the pension by 33.3%. One may ask what is realistic. Recessions have recently come at approximately 10 year intervals. In view of this, a worker in a cyclically sensitive industry, like construction or auto manufacturing could conceivably spend an average of one year per decade unemployed, producing a 10.0% loss of pension income.

The second column of Table 12 shows that unemployment impacts can be considerably magnified if they also reduce final average pay. In this column it is assumed that the worker is always employed at age 59. Otherwise we would be considering the impacts of early retirement, rather than merely unemployment. This softens the blow, but in order to see how bad things can be we assume that unemployment is a single spell preceding the worker's 60^{th} year. In this case, under the assumptions we have made, three years of unemployment would reduce the pension by 14.0% rather than 10.0%. That is a significant impact.

The last two columns of the first panel of Table 12 illustrate the possible impacts of early retirement under DB plans. First we see the impact if YS is unaffected, which comes through the reduction in FAP. For the case of early retirement by 3 years, we see that the pension is reduced 5.8%. More extreme cases are of course not unlikely. If the worker is forced to retire at age 55 instead of 60 the pension falls by 9.4%, and early retirement by 10 years produces an 18.0% pension hit. These effects are all magnified when the period of early retirement subtracts from years of service (YS) - - a "worst case scenario". In that case, just retiring early by 3 years reduces the pension by 15.2%, while retiring 5 or 10 years early cuts the pension by 24.5% or 45.3% respectively.

As discussed by Bodie et al. (1988) DB plans tend to be backloaded, in the sense that benefits are augmented more quickly toward the end of the career for each additional year of work. Here this happens because working longer increases FAP. Comparing the last two columns in the first panel of Table 12 allows us to see the relative impact of this effect. The third column shows the impact of early retirement on FAP alone. As we have seen, this is smaller than the effect of reducing YS alone (see the first column of results). The size of the FAP effect is governed by the shape of the age profile of earnings, which we take from the SFS data. While earnings

continue to rise until age 60 in that profile, the rate of increase will be affected if earners in the SFS are reducing their hours of work as they approach retirement. Unfortunately the SFS does not report hours of work. Thus it may be that we understate the FAP effect due to underestimating the rate of increase of earnings for people who continue to work full hours in their final years on the job.

The second panel of Table 12 shows calculations for DC plans, which are affected differently from DB pensions. In the DB case, if YS > 30 and unemployment or early retirement do not affect FAP, there is no impact on the pension. In contrast, with a DC plan *any* interruption or termination of employment reduces contributions to the plan and the projected pension at age 60. Timing of interruptions also becomes important. Other things equal, earlier interruptions cause more of a loss in pension than later interruptions since each dollar of contributions grows to a larger amount by retirement the earlier it occurs. (In contrast, for DB plans later interruptions tend to have a larger relative impact due to backloading. See Bodie et al., 1988.) On the other hand, when younger, people earn less and lost contributions are proportionally less. The first column of the second panel of the table shows that, overall, the first effect dominates, with earlier interruptions affecting the eventual pension more severely. The desire to avoid this effect may be one reason for the fact that the pension in a DB plan is typically independent of the *timing* of years of service.

Timing is important in another way, which also shows up in the table. Suppose recessions occur as regular as clockwork, once every 10 years, and that they throw the employee out of work for a year each time they hit. Assume all workers are first covered by the DC plan at age 25 (earlier they were at school or moved between jobs and never reached pension vesting even when they were in a plan). Then they might be hit by recession at, say, ages 34, 44 and 54, for a total of three years of unemployment. But they might also experience their first recession at 25, and be out of work at ages 35, 45, and 55, for a total of four years of unemployment.[27] In the first case the pension is cut by 7.7%; in the latter case it is cut by 12.1%. Such capricious effects of recession timing are by no means unrealistic. In practice recessions don't come at precise, regular intervals and they are not all of the same severity. It is quite possible that one worker in an industry may be relatively little affected by recession-induced unemployment while another, born a decade later, might have a very different experience. These vagaries are increased when one thinks of early retirement effects.

Like the effects of unemployment, those of early retirement are fairly simple under a DC plan. The contribution period is interrupted, possibly by several years, and the capital one has

[27] It might seem odd to be thrown into unemployment at age 25, i.e. just after having been hired. But of course this does happen, since the most junior workers are typically the first to be laid off. If business picks up later they may return to the job, just as may older workers who are laid off.

accumulated in the plan, and the pension one would otherwise have received at normal retirement age, will therefore be lower. There is not the protection that a DB plan member with many years of experience may have, i.e. if his/her YS exceeds the number of years required to qualify for a full pension. Impacts are intermediate between the DB case with YS unaffected and that with each year of early retirement subtracting from YS, although closer to the latter than the former case. It should be noted that these effects are added to those of asset price decline in the DC case, unlike the DB situation. So, if the worker was forced to retire five years early in the 2008/09 recession he/she could have lost 22% of pension income due to early retirement (Table 12) on top of a 27% loss caused by asset price decline (assuming choice of typical investment options in a DC plan), for a total loss of 47%. Even allowing for the fact that older workers may change their investment mix within DC plans toward less risky options the effects could clearly be sizeable. We do not think it is implausible that the losses could be 40% or more for some affected people.

11. Conclusion

We have looked at the trends, facts and data regarding the impacts of cyclical downturns on the third pillar of Canada's retirement income system as well as the modification of those impacts that may be caused by two major alternative pension policy initiatives. The impacts of asset price changes, increased unemployment and changes in interest rates and other yields have been considered, using both a non-behavioural approach and allowing behavioural change according to a conventional life-cycle model of saving and consumption.

The paper has quite a number of findings, and it will be convenient to make a list before making concluding remarks. Here are what we think are the most interesting points and findings:

1. Not all cyclical downturns are the same. Recessions in the real economy may or may not be accompanied by a stock market collapse (1981-82 and 2008-09), and a large fall in the stock market is also possible without there being a recession (2001-02 in Canada).
2. A general financial crisis is rare. The last event of this type prior to 2008-09 was in 1929-33. Effects on the third pillar are stronger than from a decline in the stock market by itself.
3. The fraction of the male labor force covered by employer pension plans fell from 43% in 1976 to 28% in 2010. In contrast, female coverage has *increased*, from a 1970s level of about 28% to 32% in 2010.
4. Both men and women have seen a shift from DB to DC plans, but this trend slowed down for women around 1990. In 2010 21% of men with a pension plan were in DC plans while the figure for women was just 14%.

5. Canadian families have become wealthier over time. Mean wealth rose from a multiple of four times disposable income in 1990 to six times income in 2010 according to the national balance sheets. Correcting for changes in age composition, associated for example with the ageing of the baby boomers, there was about a 40% increase.
6. Pillar 3 retirement assets (registered retirement assets plus employer pension plans) doubled in relation to disposable income from 1990 to 2010.
7. According to the 2005 Survey of Financial Security (SFS) non-financial assets made up 65% of household assets and pillar 3 retirement assets accounted for 26%. Financial assets held directly accounted for the remaining 9%.
8. As people age over the working lifetime, retirement assets approximately double in size relative to other assets.
9. Families with female MIEs are less likely to hold retirement assets than families with male MIEs, and the average amounts they hold are smaller.
10. More highly educated families, and those with male MIEs are more likely to have DC plans and RRSPs or LIRAs. This made these groups somewhat more vulnerable than other groups to asset price declines in the 2008-09 recession.
11. The largest price decline in the 2008-09 was for shares, which fell 51%. Mutual funds were next, with a decline or 34%, followed by DC plans and registered retirement assets at 27% and 26% respectively. Housing and business equity only declined 6% and 10%. Third pillar retirement assets were thus among the assets most strongly affected.
12. In the absence of portfolio changes, DB pension funds would have lost 26% of their value, on average, in the 2008-09 recession. Plan members were insulated from this decline since there were very few failures of DB pension plans.
13. Average net worth of families would have declined 11% in the 2008-09 recession due to asset price changes in the absence of portfolio changes. By late 2010 price increases would have raised net worth by 13%, more than offsetting the recession impact. These effects do not differ much by age.
14. There are quite large differences across families in the simulated impact effects, and permanent effects, of asset price and unemployment changes.
15. Through behavioural response, that is by changing their contributions to registered plans and other forms of saving, it is likely that older workers could offset a significant amount of the damage to expected retirement incomes caused by loss of asset value and unemployment effects. However, if there is a long-run decline in interest rates and other yields, which depresses saving, this is no longer true.
16. An enhanced CPP/QPP system would reduce registered asset holdings and other private savings, leading to smaller recessionary effects on retirement incomes. By expanding private retirement savings a PRPP system has the opposite effect.
17. Detailed analysis shows that for DB plans unemployment caused by recessions can reduce pension income by up to 20 – 25% if it strikes late in the working lifetime and has

a strong effect on final average pay. Early retirement has similarly large effects, ranging up to 40-50% for workers forced to retire 8 – 10 years early.

18. Unemployment and early retirement effects on DC plans may be somewhat smaller than effects on DB pensions. However, if a DB worker's years of service exceed the required minimum and final average pay is not affected, there can even be a zero effect on pension income. In the DC case, timing also seems to matter more. Spells of unemployment early in the career tend to have a large effect.
19. For DC plan members recessions can have a double impact through forced early retirement and reduced asset values. Putting the two effects together, pension losses of 40% or more are possible.

It should be noted that while asset price effects on DC plans and private assets are immediate, those on DB pensions are more subtle and do so over a longer horizon. This paper started out with impact analysis - - looking at the immediate effects of asset price changes, which of course for the DB plan member are zero. But we then moved on to longer-run analysis, in which one recognizes that adjustments to members' DB contributions or benefits are likely necessary to make up for any permanent impact of a recession on DB pension fund holdings. We have argued that such permanent effects are hard to avoid, since the loss of asset values during a recession reflects lost profits that cannot be regained in the future, even if business booms once more. And there is a further effect of a recession accompanied by a severe financial crisis. During the long slow process of rebuilding balance sheets and getting the economy growing normally once more interest rates and other yields can be, and in the present case certainly are, depressed. That has a serious impact on DB plans, leading to a further delayed effect on the present value of participating in such a plan. Thus one must be wary of short-run results that suggest DB plan members are "recession proof" unlike their DC cousins. This is an important point in Canada since DB plan membership is still so much more common than DC coverage.

A limitation of this paper is that we have not modeled the impact of an increase in volatility, such as has been seen in the markets during and after the 2008-09 crash. Such an increase in risk has theoretically ambiguous results, but in the case that economists believe is most likely it will actually increase saving. There is no way at present of knowing whether this effect played a causal role in the increase in personal saving rates after the recession, but it does seem intuitive that people would engage in more precautionary saving in a less certain world. In any case, a post-recession increase in saving helps to restore retirement incomes to an extent, which is an important aspect to keep in mind.

Our modeling of policy alternatives has concentrated on two options: enhancement of the CPP/QPP by raising contribution and benefit rates uniformly by 50%, and a PRPP system with a contribution rate of 4% appealing mostly to workers who are offered the plans by their employer. CPP/QPP can be enhanced in different ways, for example by raising the maximum pensionable

earnings (YMPE) rather than contribution and benefit rates. And since only one province has implemented PRPP so far it is hard to say what the "typical" system will look like. It may be that higher contribution rates will turn out to be more representative in the end, or that PRPPs will become very popular with the public in general. Thus a considerable range of alternatives could have been modeled even sticking to the CPP/QPP enhancement vs. PRPP choice.

While more plan variants could be studied the key thing is that there is a sharp difference in philosophy between the CPP/QPP enhancement and PRPP approaches that comes to bear quite strikingly here. PRPP encourages more private saving and a buildup of more DC-like or RRSP-like assets. This may be a very good thing, but it also reduces the resilience of expected retirement incomes to stock market crashes or slumps. CPP/QPP enhancement does the opposite, by increasing "recession-proof" retirement income directly and crowding out other savings that are recession-vulnerable. Considering other variants of the two approaches is unlikely to alter this conclusion.

There are policy proposals, however, that could produce different results. Some proposals for reform of RPPs and RRSPs, for example that of Ambachtsheer (2008) would emphasize provisions to encourage plan members to make their plan assets safer through such avenues as a deferred annuity purchase mechanism beginning around age 65. This could be implemented as a national scheme along similar lines to the PRPP system, or such precautionary principles could indeed be introduced into the PRPP system itself. Advocates argue that this would provide a safer way for individuals to accumulate retirement savings than available at present, with a higher rate of return than available currently due to economies of scale. It might be possible through such an approach to both encourage more private preparation for retirement and to make retirement incomes more recession-resilient. This is something that would be worth some study.

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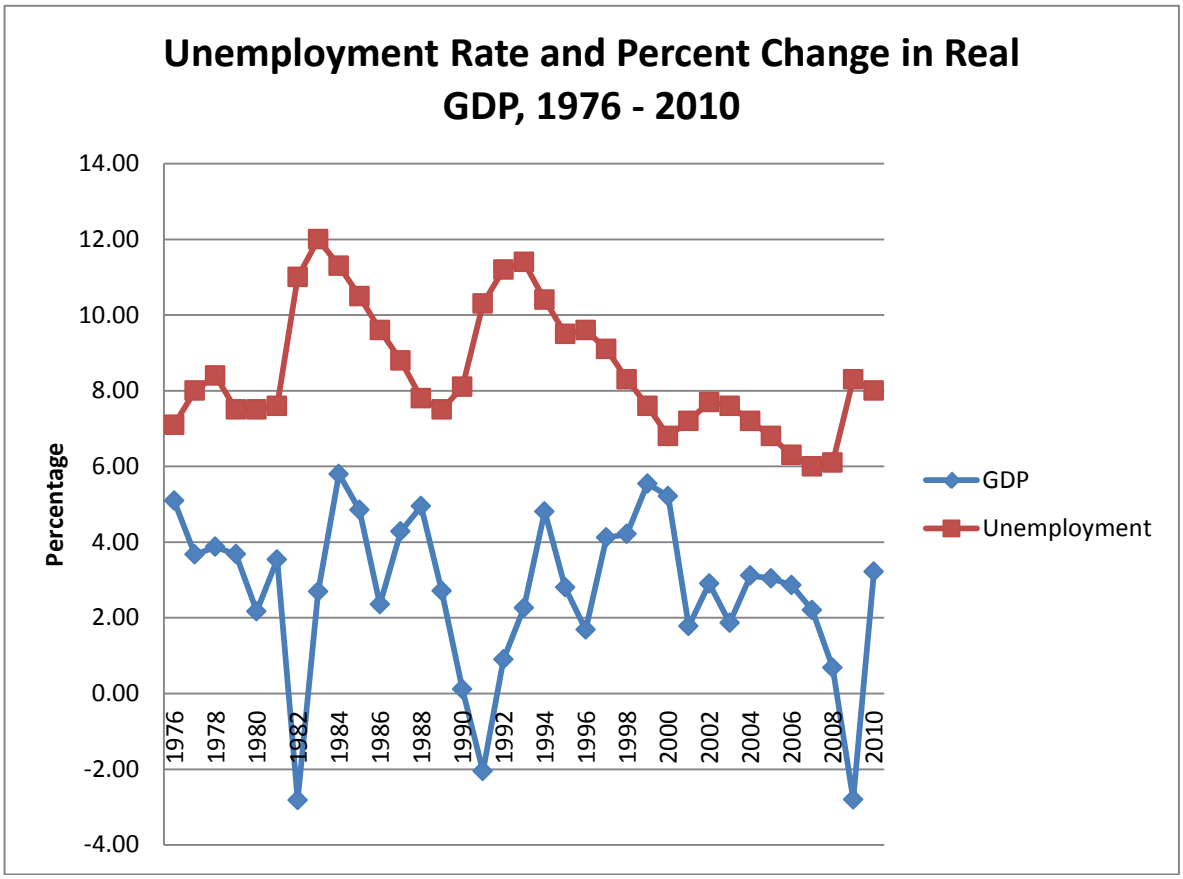
Figure 1



Souce: Cansim series v2062815 and v2461224.

Figure 2

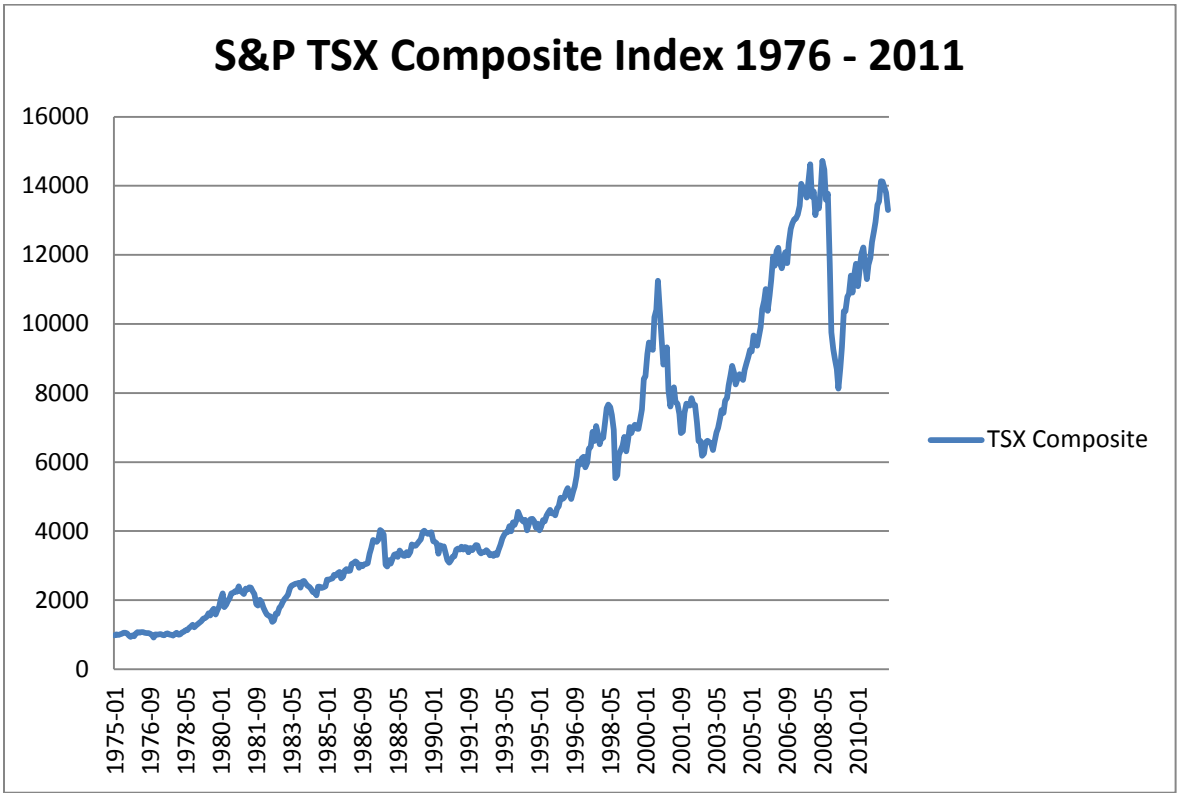


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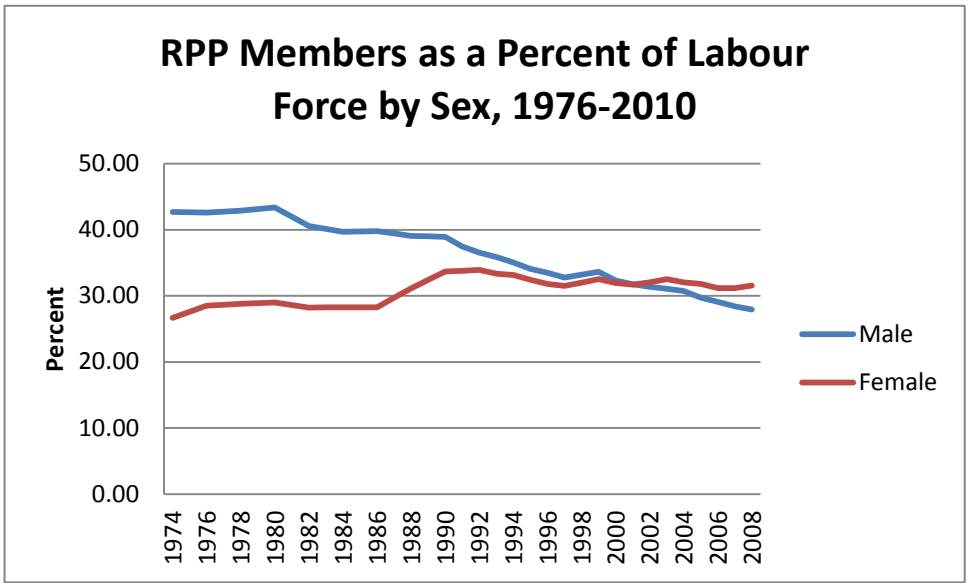
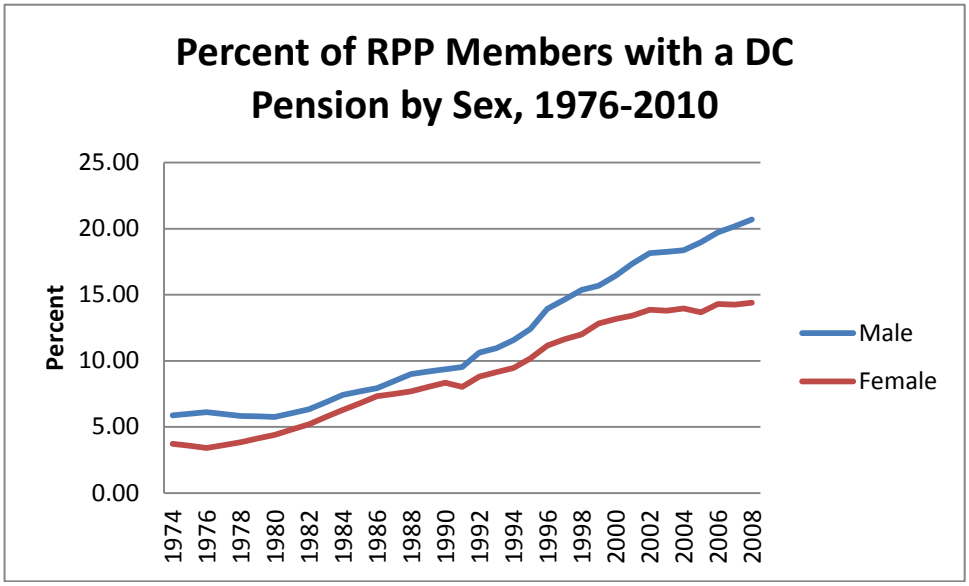
Figure 3



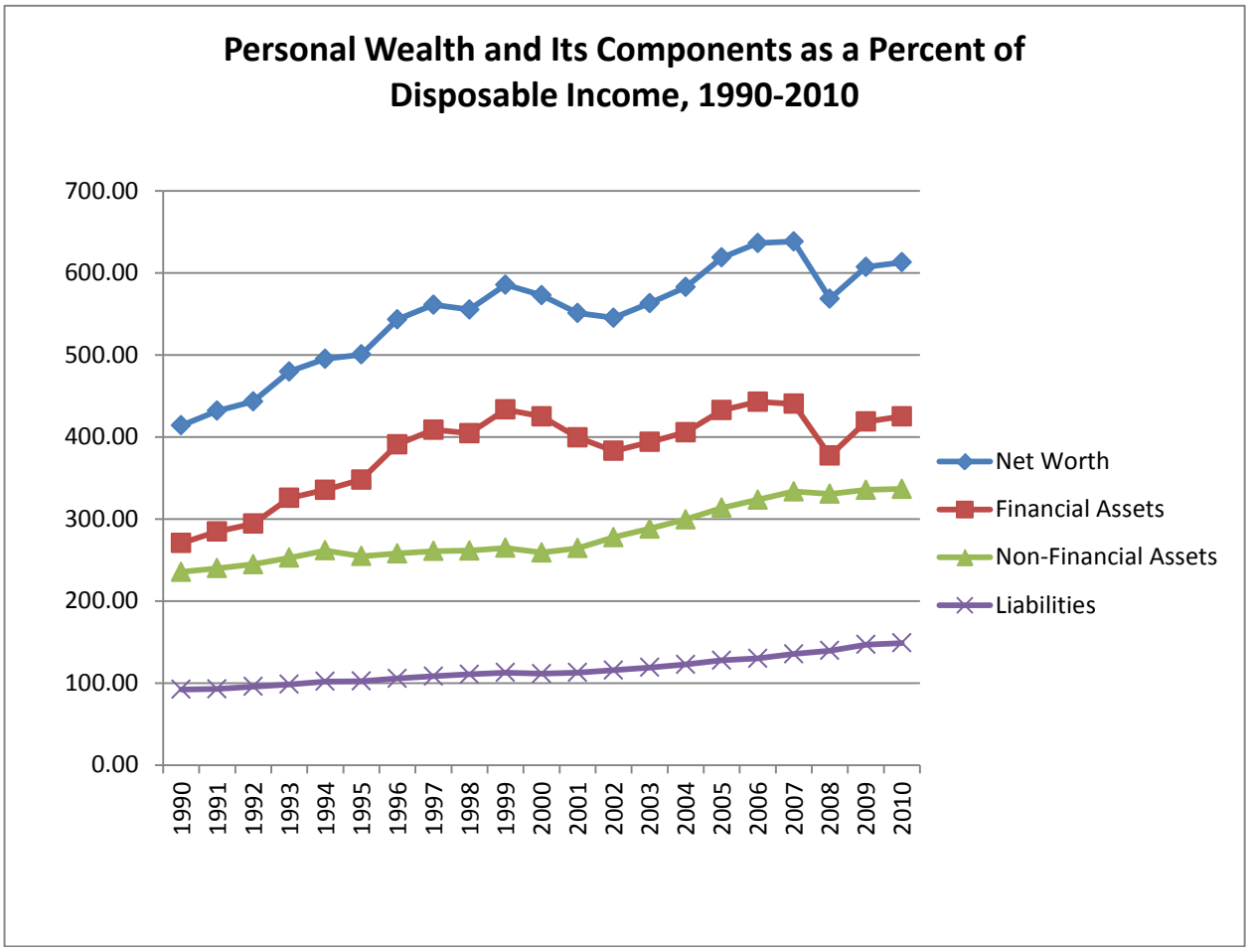
Source: Cansim table 2800008.

Figure 4



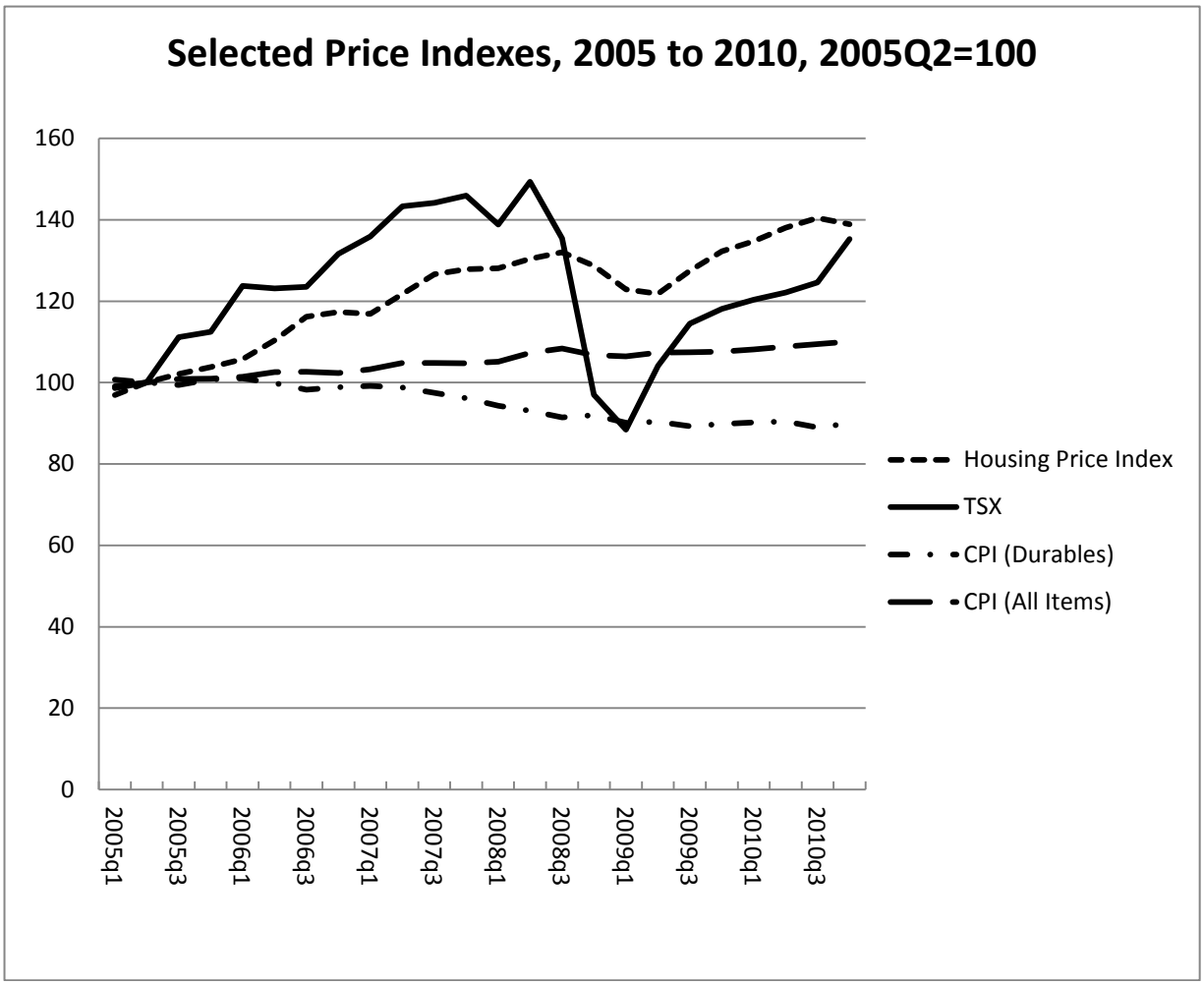
Source: Cansim table 2800008.

Figure 5



Source: Statistics Canada, National Balance Sheet Accounts: Persons and Unincorporated Business Sector.

Figure 6


Selected Price Indexes, 2005 to 2010, 2005Q2=100
160
140
120
100
80
60
40
20
0
2005q1
2005q3
2006q1
2006q3
2007q1
2007q3
2008q1
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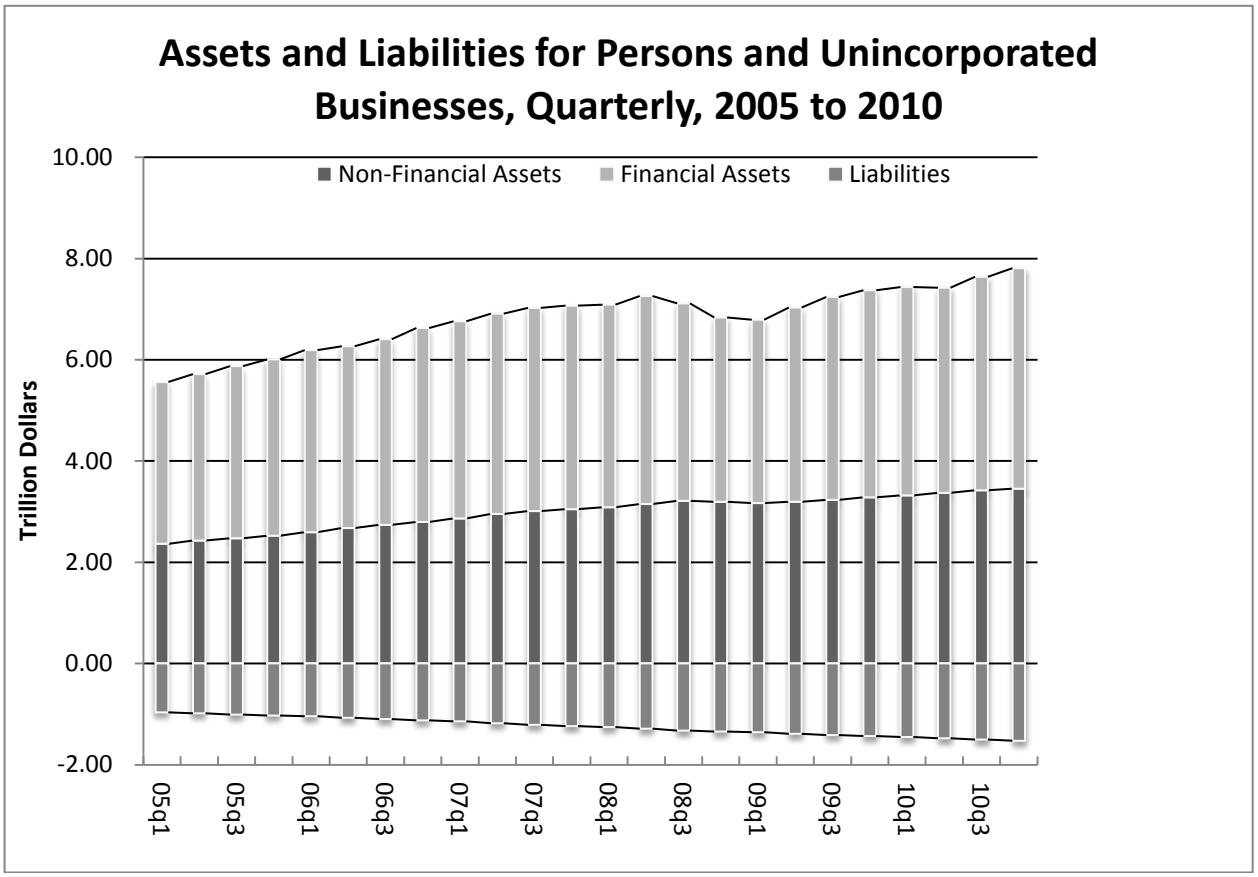
2009q1
2009q3
2010q1
2010q3
Housing Price Index
TSX
CPI (Durables)
CPI (All Items)

Figure 7



Source: Statistics Canada, National Balance Sheets.

Table 1

Proportion of Families Holding Assets and Debts by Age of Major Earner, 2005 Survey of Financial Security

	All	25-34	35-44	45-54	55-64	65-74
Deposits	0.860	0.867	0.858	0.846	0.886	0.954
Mutual Funds	0.119	0.098	0.125	0.126	0.134	0.224
Bonds	0.103	0.088	0.105	0.120	0.133	0.127
Stocks	0.104	0.084	0.097	0.127	0.136	0.174
Other Financial Assets	0.191	0.156	0.287	0.216	0.098	0.047
Total Non-Retirement Financial Assets	0.888	0.901	0.883	0.881	0.913	0.960
RRSPs/LIRAs	0.571	0.509	0.629	0.679	0.703	0.382
RRIFs/LIFs/LRIFs	0.032	0.003	0.008	0.017	0.038	0.360
Employer Pension Plan	0.466	0.411	0.479	0.524	0.598	0.539
…..of which DB	0.404	0.380	0.426	0.461	0.470	0.364
…..of which DC	0.062	0.031	0.053	0.063	0.127	0.175
Other Retirement Funds	0.037	0.034	0.037	0.054	0.028	0.009
Total Retirement Assets	0.701	0.648	0.729	0.779	0.821	0.795
Principal Residence	0.605	0.396	0.685	0.750	0.792	0.734
Other Real Estate	0.159	0.085	0.160	0.200	0.236	0.263
Vehicles	0.765	0.718	0.815	0.810	0.842	0.800
Business Equity	0.193	0.141	0.203	0.228	0.272	0.198
Secured Debt	0.504	0.578	0.618	0.512	0.396	0.131
Unsecured Debt	0.659	0.652	0.717	0.713	0.637	0.477
Total Debt	0.762	0.798	0.843	0.793	0.714	0.499
Number of Families (thousands)	10,914	2,458	2,900	2,652	1,456	359

Table 2

Mean Holdings of Assets and Debts by Age of Major Earner, 2005 Survey of Financial Security, All Families ($)

	All	25-34	35-44	45-54	55-64	65-74
Deposits	13,461	6,077	6,364	15,556	22,150	58,381
Mutual Funds	9,436	2,126	6,159	17,517	10,718	21,607
Bonds	2,073	2,064	1,345	1,255	4,468	8,510
Stocks	6,881	1,206	5,969	10,757	10,474	27,970
Other Financial Assets	4,516	1,274	6,212	5,983	3,328	5,337
Total Non-Retirement Financial Assets	36,367	12,746	26,049	51,069	51,138	121,805
RRSPs/LIRAs	37,228	12,073	28,995	59,144	79,052	47,068
RRIFs/LIFs/LRIFs	3,961	44	496	793	3,355	63,113
Employer Pension Plan	63,674	6,926	34,719	94,942	174,592	119,191
……of which DB	51,434	6,184	30,348	80,650	134,310	85,826
……of which DC	12,240	742	4,370	14,292	40,283	33,365
Other Retirement Funds	1,877	278	1,345	4,392	2,563	403
Total Retirement Assets	106,740	19,321	65,554	159,271	259,562	229,774
Principal Residence	140,088	78,946	165,613	175,698	184,006	194,018
Other Real Estate	37,014	12,746	56,196	37,080	51,920	51,864
Vehicles	13,546	9,635	14,069	16,954	18,827	14,067
Business Equity	52,195	5,627	54,280	80,886	106,491	49,726
Other Non-Financial Assets	21,581	12,876	24,277	25,712	30,346	25,791
Total Non-Financial Assets	264,423	119,829	314,435	336,329	391,590	335,466
Total Assets	407,530	151,896	406,038	546,669	702,291	687,045
Secured Debt	51,968	49,678	78,979	52,639	39,880	10,002
Unsecured Debt	14,316	11,646	15,602	19,237	15,319	11,959
Total Debt	66,284	61,324	94,581	71,875	55,199	21,961
Net Worth	341,246	90,572	311,457	474,794	647,092	665,085
Market Income	58,733	47,488	66,986	72,824	68,887	38,549
After-Tax Income	52,322	43,408	57,987	62,759	59,953	46,116

Table 3

Proportion of Families Holding Assets and Debts by Gender and Education of Major Earner, 2005 Survey of Financial Security

	All	Gender		Education		
	Families	Female	Male	Low	Middle	High
Deposits	0.860	0.845	0.869	0.743	0.864	0.921
Mutual Funds	0.119	0.103	0.128	0.044	0.110	0.182
Bonds	0.103	0.103	0.103	0.068	0.111	0.107
Stocks	0.104	0.079	0.119	0.042	0.090	0.169
Other Financial Assets	0.191	0.181	0.197	0.129	0.169	0.275
Total Non-Retirement Financial Assets	0.888	0.864	0.903	0.769	0.895	0.945
RRSPs/LIRAs	0.571	0.503	0.613	0.297	0.581	0.712
RRIFs/LIFs/LRIFs	0.032	0.030	0.034	0.065	0.027	0.024
Employer Pension Plan	0.466	0.406	0.502	0.272	0.472	0.568
……of which DB	0.404	0.356	0.433	0.217	0.408	0.507
……of which DC	0.062	0.050	0.069	0.055	0.064	0.061
Other Retirement Funds	0.037	0.026	0.043	0.019	0.035	0.051
Total Retirement Assets	0.701	0.630	0.744	0.464	0.712	0.817
Principal Residence	0.605	0.516	0.660	0.486	0.605	0.676
Other Real Estate	0.159	0.147	0.167	0.137	0.144	0.205
Vehicles	0.765	0.692	0.809	0.650	0.769	0.823
Business Equity	0.193	0.185	0.198	0.158	0.181	0.240
Secured Debt	0.504	0.476	0.520	0.237	0.526	0.613
Unsecured Debt	0.659	0.641	0.671	0.569	0.697	0.632
Total Debt	0.762	0.741	0.776	0.599	0.794	0.793
Number of Families (thousands)	10,914	4,124	6,790	1,734	6,248	2,932

Table 4

Mean Holdings of Assets and Debts by Gender and Education of Major Earner, 2005 Survey of Financial Security, All Families ($)

	All	Gender		Education		
	Families	Female	Male	Low	Middle	High
Deposits	13,461	14,213	13,005	13,408	11,146	18,426
Mutual Funds	9,436	6,497	11,221	3,174	7,555	17,145
Bonds	2,073	3,386	1,277	4,317	1,061	2,904
Stocks	6,881	5,887	7,485	3,209	3,836	15,540
Other Financial Assets	4,516	4,230	4,690	4,085	2,867	8,283
Total Non-Retirement Financial Assets	36,367	34,211	37,676	28,194	26,466	62,297
RRSPs/LIRAs	37,228	28,462	42,552	14,559	29,939	66,165
RRIFs/LIFs/LRIFs	3,961	3,124	4,469	6,474	2,273	6,070
Employer Pension Plan	63,674	51,062	71,334	35,122	55,054	98,924
……of which DB	51,434	41,463	57,490	27,242	45,615	78,138
……of which DC	12,240	9,599	13,844	8,408	9,439	20,786
Other Retirement Funds	1,877	2,733	1,357	2,901	1,114	2,898
Total Retirement Assets	106,740	85,380	119,713	59,056	88,380	174,057
Principal Residence	140,088	117,787	153,633	85,486	128,543	196,974
Other Real Estate	37,014	43,352	33,165	54,907	25,372	51,241
Vehicles	13,546	11,001	15,092	9,866	13,514	15,790
Business Equity	52,195	45,595	56,204	38.582	53,580	57,292
Other Non-Financial Assets	21,581	18,916	23,199	14,145	20,555	28,162
Total Non-Financial Assets	264,423	236,650	281,293	202,986	241,565	349,460
Total Assets	407,530	356,241	438,682	290,236	356,410	585,814
Secured Debt	51,968	44,105	56,743	20,960	49,172	76,260
Unsecured Debt	14,316	13,711	14,683	10,878	14,157	16,688
Total Debt	66,284	57,817	71,427	31,838	63,329	92,948
Net Worth	341,246	298,425	367,256	258,397	293,081	492,866
Market Income	58,733	44,888	67,142	28,408	55,237	84,113
After-Tax Income	52,322	42,958	58,009	32,488	50,083	68,820

Table 5
Changes in Mean Asset Holdings due to Price Changes in 2008-09 Recession and 2009-10 Recovery by Sex, Education and Age of Major Earner (%)

I.Net Worth:

			Age Group				
Sex	**Education**	**All Ages**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**
Both	All	-10.7	-11.1	-10.3	-11.1	-10.4	-12.0
		12.6	16.2	13.4	12.3	11.2	12.8
	Low	-8.9	-10.7	-7.5	-10.5	-8.9	-8.5
		11.4	16.8	12.2	11.0	11.3	10.4
	Middle	-10.2	-10.5	-9.9	-10.6	-10.1	-10.7
		12.1	16.2	12.9	12.0	10.4	11.8
	High	-11.9	-11.7	-11.6	-11.8	-11.1	-16.5
		13.5	16.0	9.4	12.9	12.1	16.0
Male	All	-11.0	-11.1	-11.0	-11.1	-10.8	-12.0
		12.7	16.6	14.1	12.3	11.1	12.4
Female	All	-10.2	-11.2	-8.9	-11.5	-9.2	-12.0
		12.3	15.6	12.1	12.4	11.2	13.5

II. Non-Retirement Financial Assets

Gender	Education	All Ages	25-34	35-44	45-54	55-64	65-74
Both	All	-19.7	-9.3	-21.1	-23.7	-18.7	-19.0
		12.2	17.0	12.5	11.6	11.5	14.6
	Low	-14.9	-18.6	-16.2	-13.5	-14.4	-13.7
		12.7	15.8	13.5	11.6	12.4	11.6
	Middle	-13.4	-16.0	-14.8	-12.4	-13.4	-14.3
		11.4	13.5	12.5	10.4	11.5	12.2
	High	-15.2	-20.2	-13.7	-15.0	-13.2	-21.2
		12.9	17.0	7.3	12.7	11.2	18.1
Male	All	-14.3	-17.2	-15.8	-13.7	-13.9	-16.1
		12.2	14.6	13.3	11.3	11.8	13.7
Female	All	-14.2	-20.1	-12.1	-14.8	-12.1	-20.5
		12.1	16.9	10.2	12.6	10.4	17.6

Table 5 (continued)

III. Registered Retirement Assets: -26.3% in downturn, 22.2% in recovery

IV. DB Pensions: no changes (would be -26.5% in downturn, 24.1% in recovery if gains and losses flowed through to plan members)

V. DC plans: -27.0% in downturn, 24.4% in recovery

VI. Employer Pension Plans (DB & DC)

Sex	Education	All	25-34	35-44	45-54	55-64	65-74
Both	All	-5.6 5.0	-3.1 2.8	-3.7 3.3	-4.4 3.9	-6.7 6.0	-8.1 7.2
	Low	-6.5 5.8	-7.1 6.3	-2.7 2.1	-1.5 1.4	-9.0 8.0	-5.2 4.6
	Middle	-5.0 4.5	-3.8 3.4	-4.8 4.3	-3.5 3.2	-6.6 5.9	-5.8 5.2
	High	-6.1 5.4	-2.0 1.8	-2.2 1.2	-5.7 5.1	-6.2 5.5	-13.2 11.8
Male	All	-5.6 5.0	-3.8 3.4	-4.4 3.9	-4.7 3.6	-6.9 6.1	-6.5 5.8
Female	All	-5.5 4.9	-1.5 1.4	-2.3 2.0	-5.1 4.5	-6.2 5.5	-13.8 12.4

VII. Pensions & Registered Retirement Assets

Gender	Education	All	25-34	35-44	45-54	55-64	65-74
Both	All	-14.3 12.2	-18.9 17.0	-14.7 12.5	-13.6 11.6	-13.4 11.5	-17.1 14.6
	Low	14.9 12.7	-18.6 15.8	-16.2 13.5	-13.5 11.6	-14.4 12.4	-13.7 11.6
	Middle	-13.4 11.4	-16.0 13.5	-14.8 12.5	-12.4 10.4	-13.4 11.5	-14.3 12.2
	High	-15.2 12.9	-20.2 17.0	-13.7 7.3	-15.0 12.7	-13.2 11.2	-21.2 18.1

Table 5 (continued)

Male	All	-14.3	-17.2	-15.8	-13.7	-13.9	-16.1
		12.2	14.6	13.3	11.3	11.8	13.7
Female	All	-14.2	-20.1	-12.1	-14.8	-12.1	-20.5
		12.1	16.9	10.2	12.6	10.4	17.6

VIII. Non-Financial Assets

Sex	**Education**	**All**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**
Both	All	-6.1	-5.4	-6.0	-6.3	-6.4	-6.0
		9.6	10.1	9.9	9.4	9.1	10.1
	Low	-6.1	-5.2	-6.1	-6.6	-5.6	-6.5
		9.8	9.6	10.9	8.3	9.9	9.8
	Middle	-6.1	-5.4	-6.0	-6.2	-6.7	-5.7
		9.3	10.1	9.6	9.3	8.4	10.2
	High	-6.0	-5.4	-6.0	-6.2	-6.1	-5.6
		9.9	10.2	-6.7	9.7	10.0	10.5
Male	All	-6.1	-5.4	-5.9	-6.2	-6.6	-6.2
		9.6	10.3	10.0	9.4	8.7	9.8
Female	All	-6.1	-5.3	-6.3	-6.4	-5.8	-5.6
		9.7	9.8	9.7	9.2	10.3	10.6

IX. Business Equity: -9.3% in downturn, 4.3% in recovery.

Note: The first line for each group shows the % change in mean asset value from 2008Q2 to 2009Q1. The second line shows the change from 2009Q1 to 2010Q4.

Source: Author's calculations using the 2005 Survey of Financial Security and asset price changes as described in the text.

Table 6

Size Distributions of % Change in Value of Net Worth and All Retirement Assets from 2008Q2 to 2009Q1 by Sex and Education of Major Earner (%)

I. Net Worth

	All	Sex		Education		
% Change	Families	Male	Female	Low	Middle	High
x<-75	0.2	0.2	0.2	0.1	0.3	0.2
(-75, -60]	0.1	0.1	0.2	0.2	0.2	0.0
(-60, -50]	0.1	0.0	0.2	0.0	0.1	0.2
(-50, -40]	0.2	0.2	0.2	0.2	0.3	0.0
(-40, -30]	0.5	0.5	0.5	0.1	0.4	1.1
(-30, -20]	4.5	3.8	5.6	3.1	4.3	5.7
(-20, -10]	27.4	30.4	22.4	16.0	26.7	35.5
(-10, 0)	49.5	50.8	47.4	49.5	50.7	47.1
0	12.7	9.5	18.0	27.6	11.8	5.9
(0, 10]	3.5	3.1	4.1	3.1	3.7	3.3
(10, 25]	0.7	0.8	0.7	0.3	1.0	0.5
>25	0.6	0.6	0.5	0.0	0.8	0.5

			Age		
% Change	25-34	35-44	45-54	55-64	65-74
x<-75	0.3	0.4	0.0	0.2	0.0
(-75, -60]	0.1	0.0	0.4	0.0	0.0
(-60, -50]	0.4	0.0	0.0	0.0	0.0
(-50, -40]	0.3	0.1	0.2	0.3	0.0
(-40, -30]	1.1	0.3	0.1	0.1	0.0
(-30, -20]	4.4	5.2	3.9	3.4	9.7
(-20, -10]	28.6	30.8	27.5	30.9	28.7
(-10, 0)	37.8	51.5	57.7	57.9	56.1
0	15.7	8.6	8.5	6.1	4.5
(0, 10]	8.0	2.3	1.1	0.7	0.9
(10, 25]	2.1	0.7	0.0	0.3	0.0
>25	1.3	0.1	0.3	0.2	0.0

Table 6 (continued)

II. All Retirement Assets

		Sex		Education		
% Change	**All Families**	**Male**	**Female**	**Low**	**Middle**	**High**
< -30	0.0	0.0	0.0	0.0	0.0	0.0
(-30, -20]	33.7	35.1	31.3	25.7	34.2	37.1
(-20, -10]	10.8	12.4	8.1	3.4	10.5	15.7
(-10, 0)	16.6	18.0	14.2	7.2	17.2	20.9
0, with Ret. Assets	9.1	8.8	9.4	10.2	9.2	8.0
No Ret. Assets	29.9	25.6	37.0	53.6	28.8	18.3

	Age				
% Change	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**
< -30]	0.0	0.0	0.0	0.0	0.0
(-30, -20]	32.5	34.0	35.2	38.6	45.8
(-20, -10]	9.5	14.6	12.2	10.1	4.9
(-10, 0)	10.9	16.0	22.7	25.2	18.9
0, with Ret. Assets	11.9	8.3	7.8	8.2	9.8
No Ret. Assets	35.2	27.1	22.1	17.9	20.5

Note: "All Retirement Assets" includes both registered assets and all employer pension plans.

Source: Author's calculations using the 2005 Survey of Financial Security. See text.

Table 7

Composition of Expected Retirement Income of SFS Individuals and Couples with Earnings and with Major Earner Aged 50-64: Incidence and Mean Amounts

I. By Sex and Education

Income Source	All	Sex of Major Earner		Education of Major Earner		
		Female	Male	Low	Middle	High
1. Incidence						
RPPs	62.1%	60.7%	62.6%	47.4%	64.1%	66.1%
CPP/QPP	98.9	100.0	98.4	97.6	99.6	98.0
OAS	100.0	100.0	100.0	100.0	100.0	99.9
GIS	33.8	41.9	30.7	57.7	33.6	20.8
RRSPs	77.2	73.0	78.9	59.4	77.2	87.3
Other Investments	92.1	87.3	93.9	88.9	91.6	94.9
2.Means (All Individuals and Couples)						
RPPs	$13,152	13,095	$13,174	$6,001	$11,781	$20,139
CPP/QPP	14,873	13,046	15,587	11,122	14,773	17,216
OAS	10,819	9,837	11,203	10,952	10,605	11,201
GIS	1,412	1,623	1,330	2,806	1,274	916
RRSPs	6,861	6,341	7,064	2,795	5,803	11,429
Other Investments	2,050	2,085	2,037	874	1,605	3,669
Total Retirement Income	49,168	46,027	50,395	34,550	45,843	64,570

Table 7 (continued)

II. By Pension Type

Income Source	All	DC	DB	No Pension
1. Incidence				
RPPs	62.1%	100.0%	100.0%	0.0%
CPP/QPP	98.9	100.0	100.0	97.6
OAS	100.0	100.0	100.0	100.0
GIS	33.8	14.0	14.5	65.3
RRSPs	77.2	87.0	83.2	66.3
Other Investments	92.1	96.1	93.8	88.6
2.Means (All Individuals and Couples)				
RPPs	$13,152	19,038	$21,662	$0
CPP/QPP	14,873	16,790	17,009	11,444
OAS	10,819	11,587	11,131	10,186
GIS	1,412	534	417	3,003
RRSPs	6,861	6,369	6,975	6,875
Other Investments	2,050	1,466	2,173	2,045
Total Retirement Income	49,168	55785	59,369	33,554

Table 8

Change in Expected Retirement Income and Net Worth in 2008-09 Recession, SFS Individuals and Couples with Earnings and with Major Earner Aged 50-64, by Pension Status: Size Distribution of Impact Effects

I. No Individual Differences in Price Impacts

	Retirement Incomes				
% Change	**All**	**DC Plans**	**DB Plans**	**No RPP**	**Net Worth**
<-75	0.0%	0.0%	0.0%	0.0%	0.2%
(-75, -50]	0.0	0.0	0.0	0.0	0.4
(-50, -30]	0.0	0.0	0.0	0.0	0.8
(-30, -20]	0.9	2.5	0.5	0.8	6.5
(-20, -10]	15.4	59.9	6.3	14.6	28.8
(-10, 0)	69.7	37.7	80.7	64.2	58.6
0	12.9	0.0	10.1	20.4	4.7
(0, 10]	1.2	0.0	2.4	0.0	0.1
>10	0.0	0.0	0.0	0.0	0.0
Mean % Change	-4.4	-11.0	-3.4	-3.8	-9.3

II. With Individual Differences in Price Impacts

	Retirement Incomes				
% Change	**All**	**DC Plans**	**DB Plan**	**No RPP**	**Net Worth**
X<-75	0.0	0.0	0.0	0.0	0.2 %
(-75, -50]	0.0	0.0	0.0	0.1	0.3
(-50, -30]	0.1	0.1	0.1	0.1	1.5
(-30, -20]	1.3	2.6	0.5	2.0	8.7
(-20, -10]	15.5	57.5	7.6	13.8	28.3
(-10, 0)	65.5	39.3	76.8	58.0	52.0
0	12.9	0.0	10.1	20.4	4.7
(0, 10]	4.6	0.6	4.8	5.5	4.1
x>10	0.0	0.0	0.0	0.1	0.3

Table 9

Characteristics of Recession/Recovery Periods in Canada, 1980 to Present

	1981-82 Recession & Recovery	1990-91 Recession & Recovery	2008-09 Recession & Recovery
I. Stock Market			
Start of TSX decline	May 1981	August 1989	May 2008
End of decline	June 1982	October 1990	February 2009
TSX recovery over	May 1983	August 1993	n.a.
S&P TSX % Decline*	-42.3%	23.2%	44.8%
Cumulative % Price Shortfall*	41.3%	42.4%	78.7%
II. Real Economy			
Start of recession	Q3 1981	Q2 1990	Q4 2008
End of recession	Q4 1982	Q1 1991	Q2 2009
End of recovery	Q4 1983	Q3 1993	Q3 2010
GDP % decline in recession	5.0%	3.5%	3.9%
Unemployment rate at start and end of recession	7.2%, 13.1%	7.3%, 10.5%	6.2%, 8.6%
Unemployment rate at end of recovery	11.3%	11.5%	8.0%
Interest Rate at start of recession and end of recovery	15.7%, 11.0%	11.3%, 6.4%	3.1%, 2.0%
CPI Inflation rate at start of recession and end of recovery	12.8%, 4.6%	5.3%, 1.8%	3.4%, 1.9%

*% calculated using initial period as denominator.

Table 10

Estimated % Impact of Permanent Asset Value Losses and Unemployment on Expected Retirement Incomes with and without Behavioural Response: Frequencies

% Change in Retirement Income	Duration of Recession/Recovery					
	Two Years		Three Years		Four Years	
	No Behav. Response	Behav. Response	No Behav. Response	Behav. Response	No Behav. Response	Behav. Response
I. No Unemployment or Interest Rate Effects						
<-20	0.00%	0.00%	0.00%	0.13%	1.17%	0.13%
(-20, -10]	20.15	0.13	24.21	0.00	32.28	0.83
(-10, -5]	25.38	0.64	31.75	2.31	28.55	3.89
(-5, 0)	47.05	91.80	36.62	90.14	30.58	87.73
0	7.42	7.42	7.42	7.42	7.42	7.42
Mean	-5.20%	-1.90%	-6.12%	-2.80%	-7.06%	-3.84%
II. With Unemployment Effects						
<-20	0.00%	0.00%	0.00%	0.13%	1.17%	0.13%
(-20, -10]	20.33	0.13	24.82	0.00	38.52	1.46
(-10, -5]	25.89	0.64	31.67	2.88	25.90	18.49
(-5, 0)	46.76	92.20	36.54	90.02	34.40	79.92
0	7.03	7.03	6.97	6.98	0.00	0.00
Mean	-5.23%	-2.02%	-6.18%	-3.09%	-7.80	-6.92
III. With Unemployment and Interest Rate Effects						
<-20	0.00%	0.00%	0.00%	0.13%	1.17%	0.13%
(-20, -10]	21.19	0.13	27.03	0.76	38.52	2.21
(-10, -5]	26.55	12.83	33.66	34.60	25.90	49.8
(-5, 0)	46.54	85.59	38.23	64.17	34.40	47.9
0	5.73	1.45	1.08	0.33	0.00	0.00
Mean	-5.41%	-5.79	-6.69	-7.96	-7.80	-9.55

Table 11

Estimated % Impact of Permanent Asset Value Losses and Unemployment on Expected Retirement Incomes With New Pension Features in Place: Frequencies

% Change in Retirement Income	Duration of Recession/Recovery					
	Two Years		Three Years		Four Years	
	No Behav. Response	Behav. Responise	No Behav. Response	Behav. Respoinse	No Behav. Response	Behav. Response
I. Enhanced CPP/QPP/QPP in Place						
<-20	0.00%	0.00%	0.00%	0.13%	1.17%	0.13%
(-20, -10]	18.15	0.13	21.98	0.18	30.21	1.73
(-10, -5]	27.88	4.34	32.27	10.65	28.17	20.60
(-5, 0)	39.09	93.76	31.19	87.32	26.42	76.06
0	14.88	1.76	14.57	1.73	14.03	1.48
Mean	-5.05%	-4.84%	-5.87%	-5.78%	-6.72%	-6.77%
II. PRPP in Place						
<-20	0.00%	0.00%	0.00%	0.13%	1.18%	0.13%
(-20, -10]	21.20	0.13	27.28	0.75	39.27	2.06
(-10, -5]	27.56	12.76	38.92	34.51	33.07	50.21
(-5, 0)	50.17	86.78	32.72	64.28	26.48	47.60
0	1.08	0.33	1.08	0.33	0.00	0.00
Mean	-5.69%	-5.97%	-7.13%	-8.25%	-8.38	-9.95

Table 12

Illustrative % Impacts of Unemployment and Early Retirement on Expected Retirement Income, DB and DC plans - - Age-Earnings Profile from SFS 2005, All Families

I. DB Plans

Years Lost from Job	Unemployment Effects Assuming Loss of YS		Early Retirement Effects	
	FAP Unaffected	Max effect on FAP without early retirement	YS Unaffected	Max effect on YS allowed
1	3.3	5.2	2.0	5.2
2	6.7	9.7	3.9	10.3
3	10.0	14.0	5.8	15.2
4	13.3	18.3	7.6	19.9
5	16.7	22.4	9.4	24.5
6	20.0	26.4	11.2	29.0
7	23.7	30.4	12.9	33.3
8	26.7	34.2	14.7	37.4
9	30.0	38.0	16.3	41.4
10	33.3	41.7	18.0	45.3

Note: FAP = final average pay, equals average pay over final 3 years. YS = Years of Service. YS ≥ 30 generates a full pension. Normal retirement is at age 60.

II. DC plans

Years Lost from Job	Unemployment Effects		Early Retirement Effects	
	Ages when unemployed	Loss of Pension Income (%)	Age of Early Retirement	Loss of Pension Income (%)
1	29	3.0	59	4.7
1	39	3.1	58	9.2
1	49	2.5	57	13.5
1	59	1.8	56	17.8
3	34, 44, 54	7.7	55	21.9
4	25, 35, 45, 55	12.1	54	25.9
4	29, 39, 49, 59	10.8	53	29.9
6	34-5, 44-5, 54-5	16.4	52	33.8
8	25-6, 35-6, 45-6, 55-6	23.9	51	37.6
8	28-9, 38-9, 48-9, 58-9	21.3	50	41.2

Note: FAP = final average pay, assumed to be average pay over final 3 years on job. YS = Years of Service. It is assumed that YS ≥ 30 generates a full pension.

Appendix

Sources for Price Series

Asset Category	Price Index Used	% Price Change from...	
		2008Q2 to 2009Q1	2009Q1 to 2010Q4
Deposits, "Other Financial Assets", DB Pension Plans*, Debt	None	0	0
Bonds	5-10 year Government of Canada bonds	6.6	3.4
Shares	TSX composite index	-51.2	41.9
Mutual Funds	0.65 x Share price index + 0.27 x Bond price index + 0.08	-33.8	28.9
Registered Assets	0.49 x Share price index + 0.18 x Bond price index + 0.33	-26.3	22.2
DC plan Plan and "Other Retirement Funds"	0.53 x Share price index + 0.41 x Bond price index + 0.06	-27.0	24.4
Principal Residence, Other Real Estate	Teranet-National Bank house price index	-5.9	12.2
Business Equity	Capitalized Value of Self-Employment Income per self-employed worker	-9.8	4.2

*See note on DB Pension Plans below.

Bonds: Computed from the yield on 5-10 year Canadian government bonds, Cansim series v122486.

Shares: Standard and Poor's/Toronto Stock Exchange Composite Index, monthly close, Cansim series v122620.

Principal Residence, Other Real Estate: Teranet-National Bank Composite House Price Index. See http://www.housepriceindex.ca/ for data and methods. The index covers Calgary, Halifax, Montreal, Ottawa, Toronto and Vancouver, which are weighted according to population.

Mutual Funds, Registered Assets, DC plans and "Other Retirement Funds": price series are constructed by taking a weighted average of the Bond and Share price series noted above and a notional "price series" for assets that either have zero or very small price changes (e.g. GICs, Cash, Deposits, Money Market Funds, and Treasury Bills) - - "fixed-price" assets. The latter notional price series takes the value 1.0 in all periods.

Mutual Funds: weights determined on basis of relative shares of stocks, bonds, and cash (or equivalents, such as equity funds, bond funds and so on) in the holdings of Canadian mutual

funds as of June 30, 2006, reported by the Investment Funds Institute of Canada. See http://statistics.ific.ca/English/Reports/MonthlyStatistics.asp

Registered Assets: weights determined on basis of the relative shares of stocks, bonds, and cash (or equivalents) in the holdings of Canadian RRSPs estimated using evidence from the 2005 Survey of Financial Security provided by Pyper (2008, pp. 7-8). Pyper (2008) shows the % of respondents holding a particular asset type in their RRSP, and the median amount for those with the given asset type. In the calculations done here the medians are treated as means for those with the given asset type. On that basis 58.7% of RRSP holdings were invested in mutual funds. The stock/bond/cash split of those mutual funds is assumed the same as that of mutual funds held by individuals directly (i.e. not through a registered account).

DB Pension Plans: in the main results it is assumed that the value of DB pension plans to members does not fluctuate with asset prices, since default is rare. The value of these assets to plan members is the present value of expected future pension payments, which is not affected by asset price fluctuations per se. The change in the value of the *funds* held by DB pension plans due to asset price changes can of course be estimated, however. The 2006 asset holdings of DB pension plans (Mintz, 2009, Table 5) indicate relative shares of stocks, bonds and "cash" of 51.6%, 44.2% and 4.2% respectively. Using these weights, the value of DB funds would have declined 26.3% in the recession and their rebound would have been 24.1% by 2010Q4.

DC plans and "Other Retirement Funds": there is no information in the 2005 SFS public use data regarding the composition of "other retirement funds". These are a small part of the average portfolio. These funds are assumed here to be composed in the same way as DC plans. The asset holdings of DC plans are reported for 2006 in Mintz (2009, Table 5), and the weights on stocks, bonds and cash used in this study are based on the relative shares of those asset types (or equivalent) in that source.

Business Equity: the capitalized value of the current net income stream of self-employment income per hour of work by self-employed workers, where this stream is treated as a perpetuity. Income is from Cansim v15856987 and hours worked from Cansim v3411866.