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RETIREMENT DRAWDOWN CHOICES

RRIF, TFSA and Non-registered Accounts

October 2022

Research conducted by:
Doug Chandler, FSA, FCIA

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Executive Summary

Canadian retirees often have investments in a Registered Retirement Income Fund (RRIF). They are required by income tax regulations to withdraw a minimum amount every year. They are permitted to withdraw more. But should they? Current taxes can be minimized by deferring RRIF withdrawals, but the long-term outcome depends on the taxes that will be paid in the future as well. The choice that will maximize future spendable funds depends on:

- the taxes they pay on a discretionary withdrawal in the current year;
- the taxes they will pay on investment income outside of a RRIF;
- the taxes they will pay in the future if funds are left in the RRIF; and
- the number of years until withdrawal is necessary

Current tax rates and government benefit plans are known, but it is a challenge to assess the combined effect of the many income-tested benefits and tax credits. Other factors are unknown, since they depend on future returns on investments, longevity and other contingencies. Retirees are forced to make a choice without knowing for certain that a discretionary RRIF withdrawal will improve their long-term financial position.

In some cases, the choice will be clear while, in other cases, it will depend on individual priorities. Some individuals rely on their retirement savings to meet routine living expenses and will be swayed by the "ruin probability" (the chance of running out of money or being forced to reduce spending before they die). Others will focus on the expected value of their estate. By applying an actuarial model that captures and synthesizes the variability in investment returns and ages at death and the complexity of tax rates, we can shed light on both perspectives.

At the outset, it was intended that this research would determine if a manageable set of guidelines for financial planners who are called upon to advise clients on drawdown strategies could be articulated and outline what those "rules" would be. Once the full complexity of investment risks, longevity risks and Canada's morass of taxes, credits and income-tested benefits for seniors was taken into account, this research concluded that simple, single-scenario projections of the value of a drawdown strategy are unreliable and misleading.

Financial planners will need to continue to rely on a combination of professional judgment and financial models to guide their advice concerning drawdown strategies. It is often said that models should be as complicated as necessary, but no more so. By employing a complicated actuarial model to assess the drawdown decision problem, this research could help guide choices in model design. The research indicates that:

- consideration of sequence-of-returns risk in combination with the full range of potential ages at death can lead to different conclusions than analysis based on one or a small number of scenarios
- income-tested benefits that apply during an individual's lifetime but not to the taxation of an estate can sway decisions
- while the uneven pattern of effective tax rates contributes to some of the conclusions in this research, a perfect inventory of all the details of tax rates and jurisdictional differences may not be as important in models used to guide decisions
- accurate estimation of rates of investment return and sensitivity to variations in taxes based on different investment strategies, although important for other financial planning advice, may not be crucial to the choice of which type of investment account to draw down first

When RRIF withdrawals in excess of the minimum prescribed in the tax regulations (and in excess of the requirements for current spending) are invested in a non-registered account, taxes on non-registered investment income drag down any

advantage attributable to tax brackets. Despite media stories highlighting opportunities to take advantage of differences in tax brackets, this research found that demonstrating added value can be quite difficult.

Different situations can give very different results. However, in general, the value of accelerated RRIF withdrawals may be overstated when an estimate of the average rate of return on investments is used without regard to variability. Advantages can disappear when investment returns are above average (because of extra taxes on non-registered investments) and when investment returns are below average (because the fund is exhausted before death and the anticipated high rates of taxation on estates never arise). In the analysis in this report, some opportunities that improve the average outcome come with increased risk of financial distress.

Accelerated RRIF withdrawals can also seem attractive for a couple, since tax rates are increased and government benefits are reduced after the death of a spouse. However, it is difficult to demonstrate that taking advantage of income splitting to avoid taxes on funds intended to support a surviving spouse will actually reduce the survivor's financial risk.

Added value from RRIF withdrawals is slightly easier to demonstrate when the excess withdrawals are used to fund Tax-Free Savings Account (TFSA) contributions, partly because taxes on investment income are avoided, but also because the Guaranteed Income Supplement (GIS) and other benefits targeting low-income seniors can offset the risk of below-average returns or an above-average payout period. This is clearly demonstrated in one case study. However, even with the apparent merits of a TFSA, a strategy of maximizing TFSA contributions in another case study fail to deliver the hoped-for results.

Introduction

The Drawdown Choice

The key feature of a RRIF is that it is tax-deferred. No taxes are paid until withdrawal. Whether or not continuing the tax deferral is advantageous depends on the time horizon and the applicable effective tax rates. Future effective tax rates will depend on

- investment returns and their effect on the client's tax bracket;
- whether either or both the RRIF owner and their spouse will be alive later (and hence eligible for income-splitting and income-tested government benefits); and
- other factors such as eligibility for benefits and tax credits that are contingent on health status.

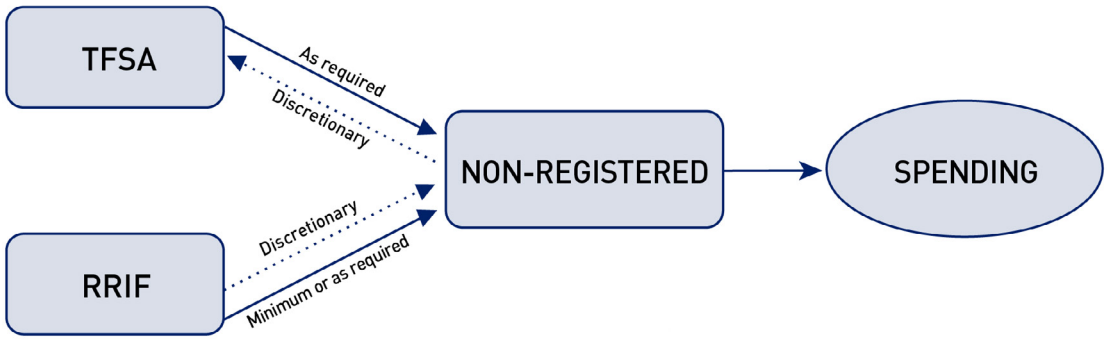
The choice to hold investments in a RRIF, TFSA or non-registered account is not made in a vacuum. Even after individuals and couples have decided to stop working, start drawing Old Age Security (OAS) and Canada or Quebec Pension Plan (C/QPP) and workplace-based pensions and converted their RRSP and other tax-deferred retirement savings to a RRIF, they must continue to make retirement income planning decisions about how to invest and whether to adjust their spending habits in light of their financial prospects. Their choices about where to hold investments are constrained by:

- minimum RRIF withdrawal rates under the income tax regulations;
- maximum RRIF withdrawal rates if the funds came from workplace-based pension plan (locking-in);
- lifetime limits on TFSA contributions; and
- restrictions on the types of investments that can be held in each type of plan.

While asset mix strategy and spending plans are important – more important than the drawdown strategy – those decisions are out of scope. Asset mix and spending decisions need to be made separately based on the needs, objectives, risk profile and time horizon of individuals. This research does not address questions such as which securities to sell to raise cash for taxes and spending or how much to spend. To avoid these questions, we proceed on the premise that spending and the overall mix of investments will not be changed by choices to move assets from one plan to another.

The research question is not framed as "Which account should be used to pay expenses?" Expenses are always paid from a non-registered bank or investment account. Rather, we focus solely on discretionary transfers out of the RRIF and in or out of the TFSA. Of course, if individuals or couples do not have enough cash and non-registered assets to pay their taxes and meet their spending needs, withdrawals from the RRIF or TFSA are not discretionary. This framework for evaluating drawdown strategies is illustrated in Figure 1 below.

Figure 1: Framework for Evaluating Drawdown Strategies



In this framework, all discretionary transfers between accounts are in kind, not in cash. That is, when Canadian or foreign stocks or bonds are withdrawn from the RRIF, they will remain stocks or bonds in a TFSA or a non-registered plan, and their investment returns will be taxed accordingly. The pre-tax value of investments in a RRIF is diminished by the taxes paid on withdrawal, but this does not alter the after-tax value or the overall risk/return position of the portfolio.

For example, suppose an individual with a 40% marginal tax rate decides to make a $10,000 discretionary transfer of shares in a Canadian corporation from their RRIF. The net proceeds after shares are sold to pay taxes (20% withheld on withdrawal and another 20% when their tax return is filed) is $6,000, still in shares. If the shares are then contributed in kind to the TFSA, then $10,000 of shares in the RRIF are replaced by $6,000 of shares in the TFSA. Eventually, the shares will be sold and the after-tax value will be spent (or distributed to beneficiaries of the individual's estate). The proceeds from the TFSA investment will be identical to the proceeds from the RRIF investment if the client's effective tax rate remains 40% but will be higher or lower if the effective tax rate changes.

If the individual decides to hold the shares in their non-registered account, the eventual after-tax value will be diminished by capital gains taxes and by the tax treatment of dividends in the intervening years. Tax credits on eligible dividends from Canadian public corporations might wipe out the basic taxes on the dividends, but the grossed-up dividends will diminish eligibility for income-tested tax credits and other government benefits. Thus, the drawdown choice depends not only on the marginal tax rates applied to RRIF withdrawals but also on the kinds of investments that are transferred between accounts and the way those investments are taxed.

Dealing with Uncertainty

This research brings together three key sources of uncertainty related to the drawdown choice: investment returns, longevity and effective tax rates. Death and taxes may be certain, but the timing of death, the amount of taxes and future investment returns are decidedly uncertain.

Risk-free investments are conceivable but the appeal of higher expected returns from riskier investments is irresistible. This is particularly true when inflation is deducted from investment returns and long-term investment risk is weighed against uncertainty about future personal care needs and other personal and societal changes. Since all these factors affect the taxes and income-tested government benefits that erode disposable income, they all have the potential to affect the outcome of a drawdown choice.

One way to address these uncertain future events is to select a single deterministic scenario and base the decision on that. The selected scenario might be "middle of the road" or "pessimistic". For example, if the concern is that an individual will experience financial distress in the event investment returns are unfavourable, then financial planning would focus on minimizing the likelihood of this event. The deterministic assumptions would be consistent with this outcome. To shed light on risks, results can be developed on a few contrasting deterministic scenarios.

In contrast to the single-scenario approach, large pension plans with substantial budgets for actuarial analysis can weigh the risk/return trade-offs over a probability distribution of all possible outcomes. The model employed in this research takes a mixed actuarial approach to provide insight into risks related to the most important and quantifiable factors – a stochastic approach to investment returns, a probability distribution for longevity, and a contrasting scenario approach to other sources of uncertainty.

Organization of Report

The report is organized into the following sections:

1. Background information on the taxes and income-tested benefits considered, the key variables that determine the outcome in any single scenario, and limitations on the scope of analysis
2. A review of existing approaches to the drawdown choice and of approaches used by researchers and others to evaluate retirement income strategies and outcomes more broadly
3. Exposition of the actuarial model and metrics used to evaluate risks and outcomes of drawdown choices
4. Analysis of case studies of illustrative situations
5. A summary of conclusions

Appendices:

A. A glossary of the technical terms and acronyms used in the report
B. Details of the effective tax rates used in the model, including itemized tax and clawback rates for Alberta, British Columbia and Ontario
C. Details of methods and assumptions used in the actuarial model to address longevity, investment returns and taxes
D. An overview of aspects of the Canadian retirement income environment relevant to the drawdown choice and the actuarial model
E. Acknowledgements

Sections 4 includes sample cases that are deliberately borderline, with no clear preference for the accelerated drawdown strategy under consideration. This is done to highlight the challenge of making a choice. Examples where the choice is more clear-cut are also included.

It is recommended that individuals who are not already familiar with the Canadian retirement income environment review Appendix D before proceeding to the main body of the report.

1. Background

Taxes and Income-Tested Benefits

When considering the effect of a drawdown strategy, it is not the individual's overall average tax rate that matters. It is the change in disposable income directly attributable to the selected strategy. If an individual is contemplating a discretionary transfer of securities from the RRIF to the non-registered account,

(i) How much will the transfer increase current-year income taxes and reduce government benefits?

(ii) How much will the inclusion of investment income on the transferred securities in taxable income reduce annual rates of return?

(iii) If the individual does not make the discretionary transfer but instead keeps the securities invested inside the RRIF for as long as possible, how much will the eventual RRIF withdrawal increase income taxes and reduce government benefits in the future?

Effective Tax Rates

The overall change in the non-registered account balance will be less than the gross value of securities transferred from a RRIF. The shortfall, expressed as a percentage of the transfer under consideration, is described here as the "effective tax rate". In this context, the phase-out of an income-tested government benefit such as the GST credit or an increase in the deductible for a government program such as BC Fair Pharmacare is just like an income tax.

The concept of an effective tax rate comes up in discussions of the "poverty wall" that can prevent individuals on social assistance from rejoining the workforce. The loss of government benefits from earning a modest amount of income can exceed the employment income, particularly after taking account of childcare, commuting costs and other employment-related costs. The total loss of government benefits that prevents participation in the labour market is described as the "participation tax rate" (Milligan 2020). It is constructed from "Marginal Effective Tax Rates" – the taxes payable on one extra hour of work as a percentage of the wage for that hour[1].

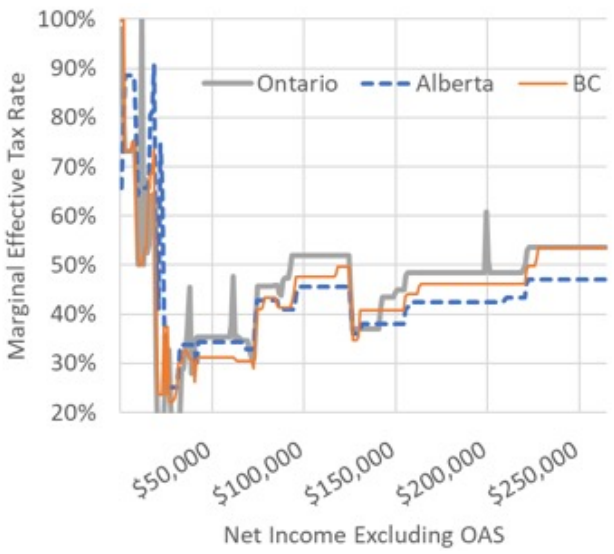
Similarly, supports for low-income seniors can create a "retirement saving wall" – a disincentive to start retirement saving or an incentive to wind down all available tax-deferred retirement income in order to take full advantage of government support programs. While ending participation in the tax-deferred retirement income system is one possible drawdown strategy, the participation tax rate is not the primary focus. Rather, marginal effective tax rates on each additional $1,000 of RRIF income or investment income are used to construct effective tax rates for the changes in net income attributable to a particular contemplated strategy.

Complete withdrawal from the tax-deferred retirement income system may not be an important strategy but there may be natural RRIF withdrawal amounts based on a strategy of "topping up to bracket" – withdrawing just enough from a RRIF to bring net income up to the next step in the marginal effective tax rates.

[1] *The concept of effective tax is also used to estimate the net burden of government on a new business venture, incorporating tax credits and incentives as well as basic corporate income taxes. The Department of Finance (2019) uses the term Marginal Effective Tax Rate to describe the aggregate additional tax attributable to a new venture.*

For illustration, the Marginal Effective Tax Rates on a $1,000 RRIF withdrawal by a taxpayer who began receiving maximum OAS benefits at age 65 and has no special medical, disability or other deductions are shown in Figure 2 below.

Figure 2: Marginal Effective Tax Rates in 2022

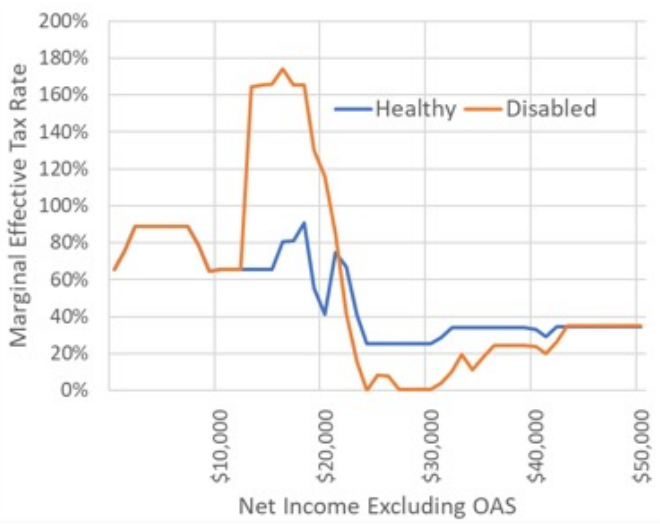


Determination of Marginal Effective Tax Rates begins with the taxes and credits that are calculated as part of the Canada Revenue Agency annual tax return process (with instalments and withholdings during the year and adjustments in the spring of the following year). Figure 2 also includes sales tax credits and income benefits that are paid by other government departments, generally based on the prior year's net income. Some of these amounts are calculated as part of the annual tax return process, while others are calculated and administered entirely outside the income tax system.

Programs that are aimed at individuals with low incomes are often disregarded by financial planning researchers and practitioners. This is appropriate in many, but not all, circumstances. An individual with moderate income at the outset might adopt a strategy of running down their RRIF while building up their TFSA so that, eventually, subsidies based on low taxable income will be an important part of their overall financial picture. This strategy can cushion the effect of poor investment returns in the worst-case outcomes. If the purpose of analysis is to minimize the impact of worst-case outcomes, then low-income support programs could be important considerations.

It is also conventional to disregard health-related tax credits and benefits. But health problems and personal support needs tend to accumulate over time, so that they are much more prevalent at advanced ages than during early retirement years. Figure 3 below illustrates the combined effect of the federal and provincial Disability Amounts and medical expense tax credits (with $10,000 of annual medical expenses), plus the Alberta Supplementary Accommodation benefit on a single Alberta taxpayer. Caregiver credits are not included.

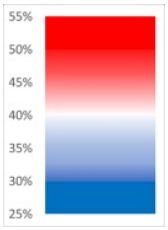
Figure 3: Alberta Marginal Effective Tax Rates by Health Status



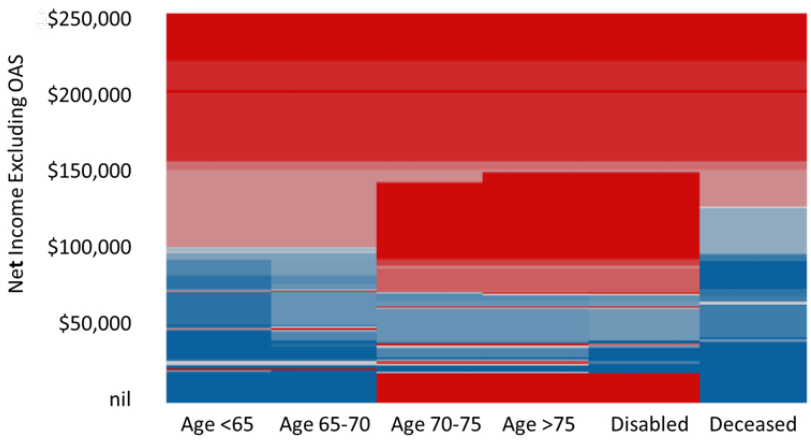
Variations by Age

Effective tax rates are not constant throughout an individual's lifetime. Figure 4 illustrates how tax rates might change over an individual's lifetime. Tax rates are colour-coded, to show the "hot" bands with high effective tax rates and "cold" bands with low effective tax rates. The objective of shifting income from one year to another is to move taxable income to the top of a blue (cold) band in some years and the bottom of a red (hot) band in other years. This representation of tax rates is particularly useful when combined with stochastic projections of income under alternative drawdown strategies:

Figure 4: Ontario Marginal Effective Tax Rates (with OAS commencing at age 70)



- The darkest red band represents effective tax rates over 50%
- The lighter red bands represent effective tax rates ranging from 40% to 50%
- The white bands represent tax rates close to 40%
- The lighter blue bands represent effective tax rates ranging from 30% to 40%
- The darkest blue bands represent effective tax rates under 30%



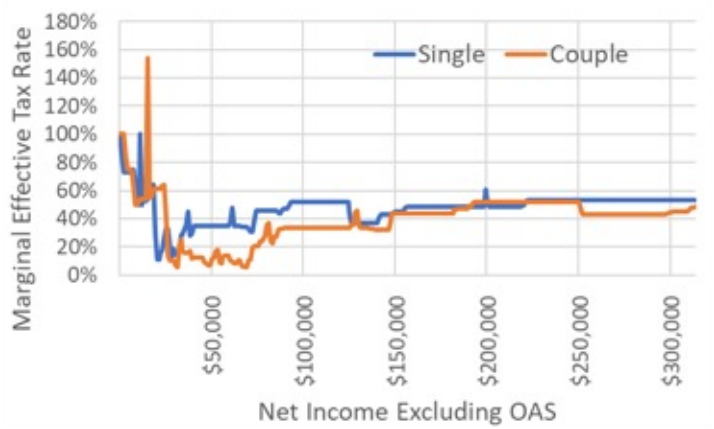
In this representation,

- age-related tax credits begin at age 65
- the OAS and GIS clawbacks begin once OAS is claimed at age 70
- the 10% increase in OAS applicable extends the OAS clawback range in both directions at age 75
- benefits and credits related to declining health apply on top of the effective taxes applicable after age 75
- clawback of income-tested benefits does not apply to taxation of a deceased individual's estate.

Income Splitting

For couples, the ability to split pension and RRIF income translates into lower effective tax rates and higher after-tax income. Figure 5 below shows the effective tax rates that apply to a given level of income (excluding OAS), before and after the death of a spouse. For the purpose of this illustration, it is assumed that splitting of pension and RRIF leads to a 50/50 split of the total household taxable income to each spouse.

Figure 5: Effect of Income Splitting on Rates – Alberta 2022 Rates



The rates for singles are generally higher than the rates for couples. Exceptions are due to the GIS clawback, which extends to a higher level of household income for couples than for singles and the OAS clawback which, for couples, operates over a combined income range of $148,000 to $244,000 (excluding OAS[2]) .

A Retrospective View of Outcomes

A decision to transfer funds from one account to another involves assumptions about the rate of return, the time until funds are withdrawn and the applicable tax rates. In the end, the outcomes will be known and we can assess whether or not the decision was advantageous.

If a discretionary transfer is made from a RRIF at the starting date and the transferred securities are held in a nonregistered account from the starting date until the proceeds are needed at a future date, then the amount that will be available at the future date is determined by the following formula:

$$A\,(1-t_0)\,(1+r-t_e)^n$$

[2] *The range of income in this illustration is based on the 50/50 income split ant the base amount of OAS payable commencing at age 65. In fact (and in the actuarial model), an optimal split of income can lead to one individual reporting income at the bottom of an effective tax bracket and the other individual reporting income in the middle of an effective tax bracket.*

If the same securities are preserved inside a RRIF until needed, then the amount that will be available at the future date is determined by the following formula:

$$A\,(1+r)^n\,(1-t_n)$$

where:

- A is the gross amount of the discretionary transfer
- n is the number of years until the funds are needed. If the trigger for withdrawal is death, then this is simply the number of years until death. If the consequence of a discretionary withdrawal is that the RRIF is exhausted sooner, then the number of years until the RRIF is exhausted can be used to assess the outcome. If the consequence of a discretionary transfer is a reduction in minimum prescribed withdrawals, then an average number of years to the midpoint of the withdrawal period might be used to assess the outcome.
- t_0 is the effective tax rate on RRIF income at the starting date.
- t_n is the effective tax rate on RRIF income at the future date.
- t_e is the average investment tax rate on the non-registered account, expressed as a percentage of assets.The investment tax rate would reflect dividend tax credits and other subtleties unique to the kinds of assets that were transferred from one account to another, rather than the overall asset mix of the portfolio. It might also reflect variations in investment income tax brackets in response to variable investment returns. A typical investment tax rate would be in the range of 1% to 2%, depending on the anticipated tax bracket, the types of investments and (to a modest extent) the pace of recognition of capital gains through portfolio turnover.
- r is the pre-tax average rate of return on investments.

The calculation of value is the same for a couple as for a single person. Differences arise in the input variables:

- t_0 The effective tax rate appliable to immediate RRIF income would reflect optimal pension splitting. It might be the effective tax rate of one spouse or the other or a blend of the two.
- t_n The effective tax rate appliable to deferred withdrawal would depend on the circumstances, for example higher tax rates after elimination of pension splitting on the first death or lower effective tax rates if the survivor's income is above the top of the OAS clawback range.
- n The number of years that withdrawal is deferred would be until taxes are payable on the second estate or, if the funds will be used to address financial need during a period after the first death, the midpoint of the period of survivorship.

A retrospective view can be applied in either nominal dollars or real dollars (net of inflation). The investment tax rate depends on nominal returns.

This retrospective view can lead to a single-scenario approach to deciding whether or not to make a discretionary transfer. Such an approach involves making fixed assumptions in advance about each of the variables. The projected spendable income from the amount that could be transferred is then estimated using the same retrospective formula as would be used after the fact.

Out-of-Scope Considerations

In practice, individuals and their advisers will encounter options, challenges and opportunities not addressed by the analysis in this report. Comments on some of the limitations of the research are noted below.

Locking in: RRIF funds that were transferred from a Registered Pension Plan are subject to maximum annual withdrawal limits. These limits are not explicitly considered -either in the size of discretionary transfers or in the ability to meet annual spending requirements through RRIF withdrawals.

Estate taxes: Taxes or fees based on the size of an estate (probate or estate administration fees) are excluded from the analysis. Steps can be taken to avoid or minimize these taxes regardless of the drawdown strategy (including beneficiary designations in a RRIF or TFSA and implementation of inter-vivos trusts for non-registered investments).

Targeted Government Programs: It is impractical to systematically incorporate all the government benefits that could affect a drawdown strategy. In assessing the feasibility of a Basic Income for British Columbia, Milligan (2021) identified 192 distinct income and social support programs sponsored by federal, provincial and municipal governments. Many of these programs are based on a means test instead of, or as well as, an income test and so they will not apply to individuals with significant remaining retirement funds, even if those funds are in a TFSA. In some cases, the income formula is well-documented and easily linked to current or projected future taxable income but in many other cases, the eligibility rules are subjective or conditional on special circumstances. Benefits that would not often apply to retirees are excluded even though they might have important interactions with RRIF withdrawals if they do apply. The following are examples of benefits that might give rise to effective taxes but are not included in the analysis.

- The federal Canada Caregiver Amount and similar provincial tax credits for caregivers are available to the caregiver of an individual with a disability, in addition to the disability credit. While the Disability Amount can be transferred from the disabled person to their caregiver spouse, the Canada Caregiver Amount cannot be transferred to the disabled person. It is, in part, subject to a test on the income of the disabled spouse, effectively increasing the amount that can be claimed by the caregiver spouse when the disabled spouse has too little income to fully utilize their Disability Amount. Thus, when the disabled person's income is low (after optimized pension splitting), this credit can reduce the effective tax rate applicable to a future RRIF withdrawal.
- Provinces and municipalities provide subsidized housing with eligibility determined by rent as a percentage of income and the number of spaces available.
- Eligibility for student loans and grants for post-secondary education depends on household income, including parents' income.
- The Canada Child Benefit and other benefits for children are paid to parents (or custodial grandparents) based on household income.
- Workers' compensation benefits, including retirement benefits for permanently injured workers, are not taxable but affect net income, GIS and OAS clawbacks.
- Some municipalities provide subsidized or free access to public transit and recreation centres for low-income residents.
- There are special benefits for low-income veterans and members of Indigenous groups.

Foreign Taxes: Individuals with ties to foreign countries (citizenship, property, residency or income) may be subject to foreign taxation as well as Canadian taxation. Some types of investments are subject to foreign withholding taxes even if they are in a tax-sheltered account. For example, income on U.S. securities is subject to U.S. taxation when held in a TFSA but not when held in a RRIF.

Age Limits: Eligibility for RRIF income splitting is not available when the transferring spouse is under 65. GIS benefits include spouse's and survivor's benefits but only if age restrictions are met.

Changes in Laws: The analysis is based on Canadian laws in 2022. It is reasonable to expect that the overall structure of income taxes and income-tested benefits will persist. In particular, it is reasonable to expect that thresholds and amounts will keep pace with inflation, even if there is no explicit provision for indexation. Nonetheless, these rules and benefits vary from time to time and from province to province. For example, Alberta tax and benefit rates were de-indexed in 2019 and tax rates were reindexed retroactively in 2022. The analysis assumes indexation of both tax and benefit rates from 2021 levels. A retiree who moves to another province or country could experience very different tax rates from the rates contemplated in the decision. If a strategy depends on a very specific and unusual income-tested benefit, there is a greater risk that a change in rules will undermine the strategy.

Other Tax Shelters: The principles behind the analysis can be extended to drawdowns of permanent life insurance policies, professional corporations and other vehicles with unique tax treatment. They may also apply to decisions to contribute to other registered tax shelters:

- RESPs provide tax-deferred investment income for children's or grandchildren's post-secondary education while preserving the original contributions for the contributor's own use.
- When a retiree's goals include contributions to an RDSP for a child or grandchild, the retiree may not wish to deplete RRIF assets beyond the RDSP transfer/rollover limit.

However, tax rates for these other structures were not considered.

Philanthropy: When one of the client's goals is to make significant donations to registered charities, limits on the deductibility of donations or the ability to avoid capital gains taxation through donation of appreciated securities may affect drawdown strategies.

Changes in Family Status: Marriage, divorce, addition or deletion of dependents (parents, children), changes in alimony and other changes in circumstances can have significant effects on current and future taxes.

2. Existing Approaches

Financial planners and the general public are well aware of the different types of accounts and the drawdown choices available. This topic is covered at least superficially in publicly available retirement planning guides and in newspaper and magazine articles. In the course of preparing a financial plan for a retired client, advisors would usually prepare projections of financial assets, taxes and disposable income that reflect a drawdown strategy they believe is appropriate. Projections reflect varying degrees of sophistication, in terms of their approaches to taxes, longevity and investment risk.

Actuaries and other researchers have taken a variety of approaches to variability in rates of return, longevity and other factors. Until now, the most sophisticated approaches do not appear to have been applied to the problem of deciding which account to draw down first. Nonetheless, past research is relevant because it shows the metrics and mechanics that can be applied to the problem.

Personal Stories and Guidelines

Articles on drawdown strategies in trade publications and newspapers usually take the form of personal stories. The facts and circumstances of an individual are stated and a conclusion is reached as to the best strategy. For example:

- Cestnick (2022) compares two hypothetical single individuals. One withdraws extra funds from his RRIF to provide $6,000 of after-tax income which is contributed to his TFSA and reinvested. The other does not. At death, the first individual is projected to have a significantly larger estate. The article explains that this strategy hinges on having a large residual RRIF balance at death. The estate tax bracket is higher than the tax bracket during the individual's lifetime.
- Feigs (2017) examines options for a widower whose spending needs are covered by pensions and who has not yet begun to make RRIF withdrawals. The article suggests accelerated RRIF withdrawals to top-up taxable income to around the bottom of the 33% federal tax bracket for 5 years, with much smaller RRIF withdrawals thereafter, bringing income close to the bottom of the OAS clawback range. Extra funds in non-registered accounts might be used for charitable donations or gifts to family members. The strategy is reported to be supported by "a number of income projection iterations" (ibid, para. 9).
- Connolly (2016) considers the expected value of the after-tax estate for a hypothetical 65-year-old widower in the context of 2015 changes to maximum marginal tax rates and reductions to RRIF minimum withdrawal rates. Accelerated RRIF withdrawals are advantageous if the tax rate while alive is 25% but not if it is 40%. This is because investment taxes in the non-registered account erode the advantage over a 50% tax rate on the estate over a projected 30-year life expectancy.
- Maley (2021) examines the complicated situation of a couple with several registered, non-registered and TFSA accounts. The conclusions are based on a financial projection at a fixed rate of return to age 95. Recommendations include paying off debt, topping up RRIF withdrawals in the short term to fill up the bottom tax bracket, deferring C/QPP benefits, continuing TFSA contributions, and drawing down non-registered assets over the first ten years of retirement. The discussion mentions sequence-of-returns risk but it is unclear how this affects the conclusion (other than deferring C/QPP). It is suggested that non-registered funds can be used to avoid untimely RRIF withdrawals to meet unusual lump-sum spending needs.
- Maley (2022) examines the situation of a couple whose primary assets are real estate and RRIFs. RRIF withdrawals are being accelerated to support delay of C/QPP. The unique feature of this story is that the financial advisor uses a stochastic model (Monte Carlo simulations) to assess the likelihood that the assets (excluding the principal residence) will support fixed spending until the younger spouse reaches age 90. The conclusion is that riskier assets with higher returns are more likely to succeed.
- Vettese (2022) examines a single individual with a RRIF and non-registered investments. He uses deterministic projections to compare projected taxable income with proportionate withdrawals from the two accounts to projected taxable income with a non-registered assets drawn down first. The present values of the two strategies are almost identical. A year-by-year projection illustrates that drawing down the non-registered assets first provides more after-tax income for the first five years but lower income for the remaining decades of retirement. The conclusion is that keeping the RRIF intact for as long as possible is generally an inferior strategy.

Personal stories provide conclusions for a specific set of facts. Sometimes they provide calculations and background information to support the conclusions. While the circumstances and background may suggest applicability of the conclusions to similar sets of facts but not to others, there is usually no attempt to provide generalized rules or procedures for making drawdown decisions. In contrast, some publications are more general in scope but less specific in conclusions and applicability of specific strategies.

- Heath (2021) discusses the possibility of using early RRSP (or RRIF) withdrawals in order to permit deferral of C/QPP and OAS benefits and to avoid the OAS clawback. Topping up to the top federal bracket is mentioned as a strategy for high-income retirees. Potential goals for the suggested strategies include maximizing government benefits and minimizing tax at death.
- Prevost (2020) provides background information on the way various types of investments and drawdowns are taxed and suggestions for tactics to minimize fees and taxes. Ontario tax brackets are adjusted for GIS, age credits and OAS.
- Rempel (2019) discusses strategies for asset allocation by type of investment and between accounts. Suggested strategies include deferring RRIF conversion to maximize GIS, judicious recognition of capital gains, use of Canadian dividend-paying stocks in non-registered accounts (with a caveat for the GIS clawback range), and accelerating RRIF withdrawals prior to commencing OAS benefits.
- Kirbyson (2007) provides a collection of suggestions from financial planners, including accelerated withdrawal and pension splitting to avoid the top marginal tax bracket. The loss of pension splitting on the first death is mentioned as one advantage of accelerated withdrawals.
- Royal Bank of Canada (2018) provides a collection of tactical suggestions. For individuals in high tax brackets, it suggests withdrawing assets that attract the least tax first. For couples with significantly different tax brackets, it suggests using the low-income spouse's taxable assets and the high-income spouse's non-taxable assets first. Accelerated RRIF withdrawals are suggested if individuals expect to be in a higher tax bracket in the future. Drawing from a TFSA for emergency cash flow (and replenishing later) is suggested.
- Brayman (2015) uses deterministic projections from age 60 to age 90 to evaluate alternative drawdown strategies. The "Common Rule" of using the RRIF last was compared to strategies that employed discretionary RRIF withdrawals to top up income to the top of a tax band (either the same band throughout retirement or two different bands at different times). The Common Rule never outperformed the discretionary withdrawal strategies. A "Time Value of Tax" strategy is proposed, using the value of marginal taxes for various bands and time horizons to estimate the relative cost of a dollar of income at different times.

Stochastic and Analytical Models

Analytical models use probability distributions to measure uncertainty. In contrast, stochastic models measure uncertainty by projecting a large number of different outcomes. Each projection, called a trial, uses different investment returns, determined by random numbers and assumptions about the distribution of rates of return. In addition to indicating an average outcome, stochastic and analytical approaches provide information on the potential range of outcomes. When different variables (like tax rates) interact with investment returns in non-linear ways, models can capture the combined effect of patterns that are completely missed by a deterministic projection. A stochastic model is a practical way of capturing multiple risks when their distributions and interrelationships are too complex to be combined into a single multivariate probability distribution. This approach is also called Monte Carlo simulation.

Only one of the models reviewed here was applied directly to the question of which type of account to draw down first. The value in examining them is to see how they approached the combination of risks faced by retirees and the metrics used to assess outcomes.

- AIPlanner.com is an on-line stochastic model for retirement planning, described in Irlam (2020). It is optimized for the U.S. tax code.
- Macdonald, Avery, Morrison (2018) uses a stochastic model of inflation, financial market returns and mortality to test alternative trade-offs between risk and return for a representative affluent Canadian. The results illustrate a drop in spendable income at the point where financial assets are exhausted, with different percentiles of trials reaching this point at different ages.

MacDonald, Morrison, Avery and Osberg (2018) extends this analysis, including certainty-equivalent income as a metric for comparison of strategies. This approach assigns utility to guaranteed income and assesses the utility of alternative risky strategies relative to this benchmark.

- Price (2021) uses a stochastic model of various retirement income solutions to illustrate the range of retirement income that might be expected. Since the purpose is to compare an uninsured longevity pool to insured annuities and fixed-rate withdrawal plans, stochastic cohort mortality is included in the projections of the longevity pool option. Results take the form of
    - graphs of projected retirement income at the 5th, 50th and 95th percentiles;
    - the present value of lifetime payments and (for fixed-rate withdrawal plans) the present value of bequests; and
    - the maximum drop from initial income.
- Selden (2020) grapples with all the pieces of the retirement financial planning challenge from first principles, using an analytical approach. While the attempt bogs down, there are many useful ideas buried in the details. There are also reminders of correlations and risks that model-builders tend to ignore. At a high level, retirement finance is expressed in terms of five processes:
    - Investment return generation process
    - Stochastic consumption processes,
    - Portfolio longevity (a product of investment and consumption),
    - Human mortality, and
    - Continuous management and monitoring – the process of changing tactics in response to emerging events.
- Davis (2019) develops a quantitative framework for evaluating a full range of defined benefit, defined contribution and shared-risk retirement income plans. For the payout phase, the metrics considered include
    - shortfall risk,
    - volatility risk,
    - level of accessible wealth (liquidity),
    - death benefits as a percentage of total payout, and
    - cost risk to the sponsor.

  While most of these metrics are more relevant to the choice between personal investment funds and various types of employer-sponsored retirement income, the analysis does address the linkage between these performance metrics and the underlying investment, inflation and longevity risks.
- Huang (2016) takes an analytical approach to optimizing drawdown of taxable and non-taxable accounts. By assuming a fixed rate of investment returns, a simple formula for longevity and simple formulas for marginal tax rates, it is possible to solve for optimal drawdown strategies. It is observed that most Canadian retirees maintain a mixture of both types of investments throughout their retirement, despite the tax advantage of drawing down taxable accounts first. However, none of the simple marginal tax rates considered can support observed behaviour.

In selecting which variables to ignore and which to assess on a probabilistic, stochastic or deterministic approach in the actuarial model, the primary consideration was their potential effect on the difference between competing drawdown strategies.

Input from Financial Planners

Approaches to the drawdown decision were discussed in focus group meetings with financial planners in 2021. The participants provided insights into the approaches they currently use, the types of projection tools they have available, and the considerations most important to their clients. Some observations from those discussions are provided below. These observations do not purport to be representative of the industry as a whole.

- Although financial planning software that incorporates Monte Carlo simulations is available and the risk of outcomes different from assumptions is taken into consideration, financial planners typically present clients with projections based on a fixed rate of return. Longevity risk is discussed by reference to year-by-year projection results. Investment risk may be explained using contrasting scenarios rather than confidence intervals or Monte Carlo simulation results.
- Software packages used to prepare the projections generally factor in taxes and income-tested government benefits but some packages may use simplified tax rates. Overriding the tax factors in the software may be difficult or impossible. Some packages make it easy for the financial planner to illustrate alternative drawdown strategies while others do not. This does not mean that the software is unreliable for its intended purpose (of illustrating long-term adequacy of retirement savings), merely that it may be less effective for the more specific purpose of weighing alternative drawdown strategies.
- Financial planners specialize in one type of clientele or another and have expertise and tools relevant to their area of specialization.
- Sequence-of-returns risk is an important consideration in financial planning. This is how financial planners describe the relationship between variability of returns and timing of cash flows.
- "Topping up to bracket" (withdrawing enough from a RRIF to increase taxable income to the top of a tax bracket) is a widely understood concept.
- The drawdown question is not usually presented to a client in terms of discretionary transfers from a RRIF to a non-registered investment account. Rather, it is characterized in terms of the account to be used to pay living expenses.
- Clients do not want to contemplate possible future disability or divorce and generally do not contemplate future changes in laws, even though these contingencies can disrupt plans and lead to regrets.
- It is usually clear whether a client is at risk of running out of money. If so, the focus will be on lifetime income rather than estate value.
- Not all clients optimize asset allocation for tax.
- The decision about which account to draw on is made year by year, but multi-year strategies must be considered.
- Conventional wisdom would be to:
    - avoid drawing down RRIF when doing so would increase the OAS clawback; and
    - draw down the RRIF quickly to maximize government benefits if annual income is less $40,000.

3. Actuarial Approach

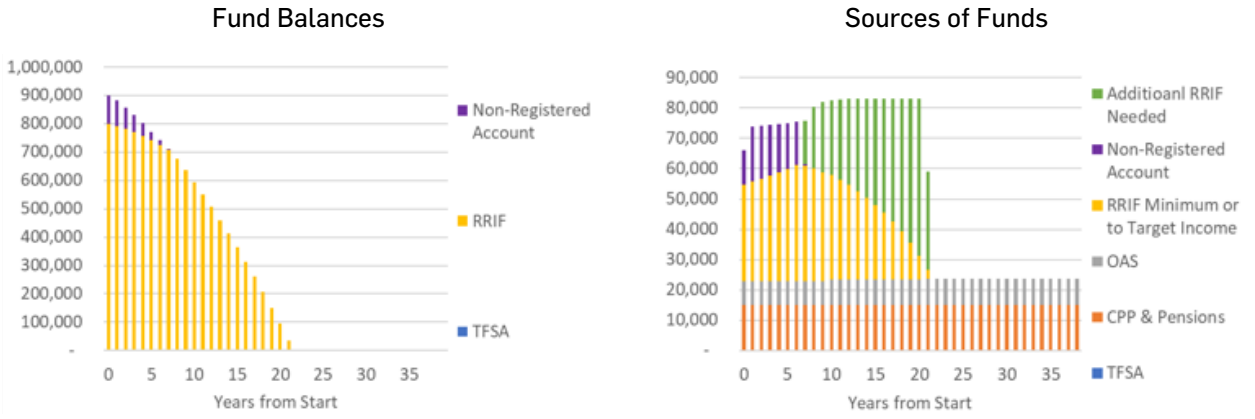
The actuarial approach used to evaluate drawdown strategy produces two key metrics:

- the ruin probability - the chance of running out of money before death if spending continues at a predetermined rate (an indicator of the risk of the financial distress of being forced to reduce spending); and
- the actuarial present value of the estate - the after-tax amount expected to be payable to beneficiaries after death, discounted for the time value of money

Ruin Probability

For illustration, Figure 6 below is a projection of the "die broke" strategy for a 65-year-old described in Section 4 below. In this projection, there is no TFSA and there are no discretionary transfers from the RRIF. Investment returns are at a fixed rate of return of 3% per year (after fees and inflation).

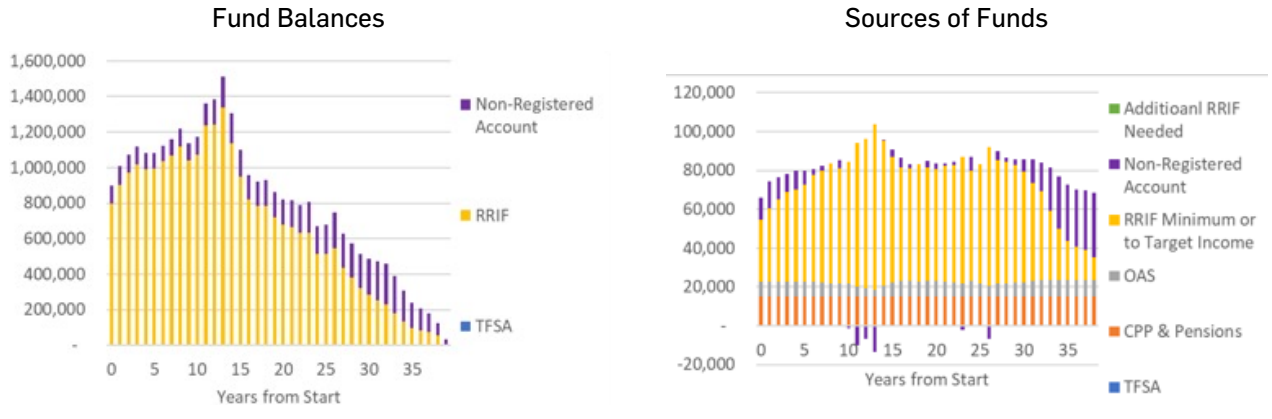
Figure 6 Projection with Expected Investment Returns



Initially, the non-registered account is used to supplement other sources to pay annual spending and (after the first year) the prior year's income taxes. Once that account is exhausted in the seventh year, RRIF withdrawals are increased. OAS increases by 10% at age 75. Taxes (especially the OAS clawback) increase in response to additional RRIF withdrawals. The RRIF is exhausted in the 21st year, at age 86. Since the probability of surviving from age 65 to age 86 is 48%, this would be the ruin probability if there were no investment risk.

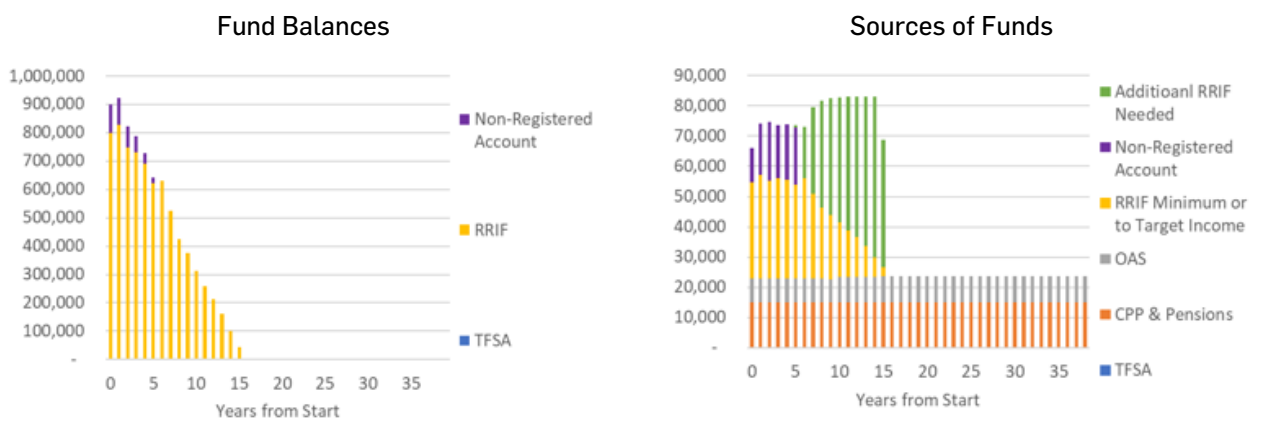
When we introduce simulated investment risk, the picture changes in each stochastic trial. Sometimes, favourable returns mean the funds last longer: sometimes the funds are exhausted sooner. Examples of two such stochastic trial are shown in Figure 7 below.

Figure 7: Stochastic Trial with Favourable Investment Returns



In the favourable trial, the funds last the full length of the projection (to age 105). The probability of surviving from age 65 to age 105 is 0% and so the ruin probability for this stochastic trial is 0%. The draw on the RRIF never exceeds the minimum. In fact, in some years minimum withdrawals are more than sufficient and the excess is added to the non-registered account balance (shown as a negative source of funds). Taxable income is high enough to eliminate a significant portion of the OAS benefit in some years. The time-weighted average real rate of return is 4.3%: better than the 3.0% expected rate but far from exceptional. What makes this trial favourable is the rates of return in the crucial early years. The dollar-weighted average real rate of return is 7.2%.

Figure 8: Stochastic Trial with Unfavourable Investment Returns



In the unfavourable trial, funds are exhausted in the 15th year. Taxes are lower, requiring a slightly lower annual draw on funds. If the funds had lasted for the full 40-year projection period, the time-weighted average rate of return would have been 2.5% but the rates of return were poor in the first few years and the dollar-weighted average rate of return to the 15th year when funds were exhausted was -0.5%. The probability of surviving for 15 years from age 65 to age 80 is 71% and so the ruin probability for this trial is 71%.

In the actuarial approach, the overall ruin probability is the average of ruin probabilities from a large number of stochastic trials, each with a different, randomly generated, sequence of investment returns.

Actuarial Present Value of Estate

The actuarial present value of the estate is a way of combining all the outcomes into a single number. It combines all possible ages at death and all possible investment balances at each future age. It would normally be discounted for the time value of money – giving a larger present value to estates that are disbursed to heirs in the early years of projection and smaller values to estates disbursed in the distant future. If the risk-free real rate of return is 0%, the actuarial present value is simply the probability-weighted average of the real values of all possible future inheritances. The formula for the actuarial present value of the estate is:

$$\sum_{n=1}^{1000} \frac{1}{1000} \sum_{t=0}^{39} (1+RFR)^{-t} \times {}_{t|}q_x \times Estate_{n,t}$$

where:

$\boldsymbol{RFR}$ is the risk-free real rate of return

${}_t\boldsymbol{q}_x$ is the probability of death $\boldsymbol{t}$ years after the starting age $\boldsymbol{x}$; and

$\boldsymbol{Estate}_{n,t}$ is the projected real after-tax value of the estate at time $\boldsymbol{t}$ of trial $\boldsymbol{n}$

This formula makes the simplifying assumption that deaths occur at the start of the year. The tax payable at the start of every year after the first (in respect of the prior year) is deducted but none of the cash flow items that occur during the year are applied.

Note that the time value of money used in this calculation does not factor in the equity risk premium (ERP), variations in simulated investment earnings between trials, or taxes on investment earnings. These components of the rate of return on invested assets are a consequence of investment choices and the trade-off between risk and return. Individuals can take as much risk as they like, regardless of whether the investments are held in a tax-sheltered account or a non-registered account and regardless of whether the investments are held by the original contributor or their surviving spouse or beneficiaries. The purpose of discounting is to bring all possible outcomes of a drawdown decision to a common point in time, not to estimate the additional investments (and risks) that would be required to replace an expected inheritance. Sensitivity analysis is included to illustrate the effect of the discount rate on the conclusions.

Sources and Uses of Funds

One key feature of the model structure is the way in which accounts are drawn down in year-by-year projections. Funds are needed each year to:

- meet the specified spending target;
- pay the prior year's taxes (including the OAS clawback and income-tested government benefits); and
- make TFSA contributions in accordance with a drawdown strategy (if RRIF and non-registered account balances are sufficient).

The primary sources for these funds are:

- OAS, C/QPP and private pensions;
- minimum RRIF withdrawals (based on rates prescribed in tax regulations and the simulated RRIF account balance); and
- discretionary additional RRIF withdrawals in accordance with a drawdown strategy

If the primary sources of funds are more than needed, the excess is regarded as negative withdrawal from the non-registered account balance. If the primary sources of funds are insufficient, secondary sources of funds (in order of priority) are:

- the non-registered account
- the RRIF; and
- the TFSA

Additional details on the application of secondary sources of funds for couples and other aspects of the methods and assumptions used in the actuarial approach are included in Appendix C.

4. Case Studies and Analysis

In this section of the report, hypothetical case studies are used to evaluate drawdown strategies. Year-by-year projections and other results are first presented with a baseline drawdown strategy and set of assumptions and then the effects of alternative strategies and assumptions are explored.

- The Single Individual with "Die Broke" Plan case study introduces and explains the model and results in the context of a younger retiree with a relatively long time horizon. Both the value of the estate and the risk of financial distress are important considerations. This case study includes sensitivity tests to provide insight into the importance of investment strategy, longevity and provincial variations in marginal effective tax rates.
- The Low Income Individual case study addresses the well-known strategy of running down taxable income quickly and then relying on a GIS and a TFSA to stave off financial distress. A mid-retirement starting age is used and the pace of RRIF drawdown is designed to keep taxable income below the OAS clawback threshold.
- The TFSA Exception case study is designed to demonstrate that maximizing TFSA contributions does not always maximize the after-tax value of an estate. With a starting age at the beginning of the retirement period, the time horizon is quite long and so events over the course of retirement outweigh the circumstances of the estate.
- The Couple case study introduces additional features of the model required to address income-splitting and the period of survivorship. It reflects two individuals in mid-retirement but with different life expectancies, leading to a relatively long period of survivorship. This case study explores the significance of the survivorship period. It includes analysis of the sensitivity to survivor lifestyle costs and the discount rate used to calculate the actuarial present value of the estate.
- The High Income Couple case study addresses a situation in which the primary concern is with estate taxation. There is very little risk of running out of money or even slipping into the OAS clawback range. To ensure sufficient emphasis is placed on the value of the estate, a relatively high starting age is used.

Single Individual with "Die Broke" Plan

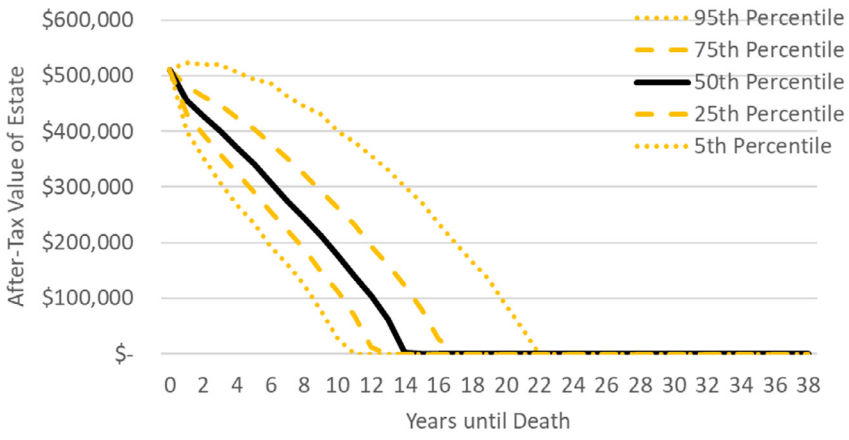
For this first case study, the annual allowance for living expenses and the opening balances have been chosen to deplete the available funds over a life expectancy of 20 years. The individual has enough non-registered funds to support spending requirements with minimum RRIF withdrawals for several years but, in the absence of very favourable investment returns, the non-registered funds will run out and the individual will need to increase RRIF withdrawals to support the current level of living expenses. The increase will push the individual into the OAS clawback range. This suggests it might be better to push RRIF income up to the bottom of the clawback range immediately, preserving the non-registered investments for longer.

Starting Position in 2022:

- $100,000 in a non-registered balanced fund (before payment of taxes, OAS clawbacks and income-tested benefits for the year prior to the beginning of the projection)
- No unrealized net capital gains or losses or undeducted realized losses
- $800,000 in a RRIF balanced fund
- No TFSA
- Age 65
- C/QPP of $15,000 per year
- OAS of $7,800 per year (before clawback)
- Spending of $66,000 per year
- Baseline investment strategy and financial assumptions (see Appendix C)
- Ontario taxes and benefits

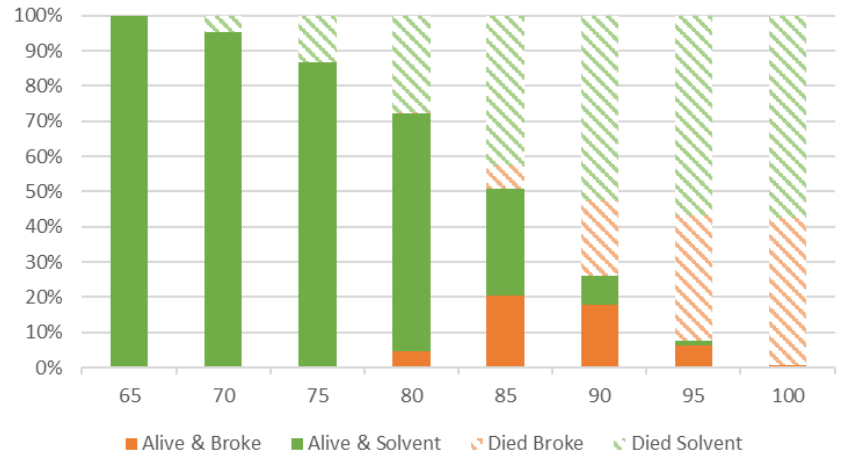
The distribution of time until funds are exhausted can be seen from Figure 9 below. Initially, the after-tax value of the estate is $510,000 (after deducting tax on the initial $800,000 RRIF balance). From there, it may go up or down, depending on investment returns.

Figure 9: Percentile Distribution of Simulated After-Tax Value of Estate



The ruin probability depends on both the probability distribution of years until death and the simulated distribution of years until funds run out. The distributions of probabilities of solvency and survival are combined in Figure 10 below. The overall ruin probability is 42.4%, calculated as the average of 1000 stochastic trials.

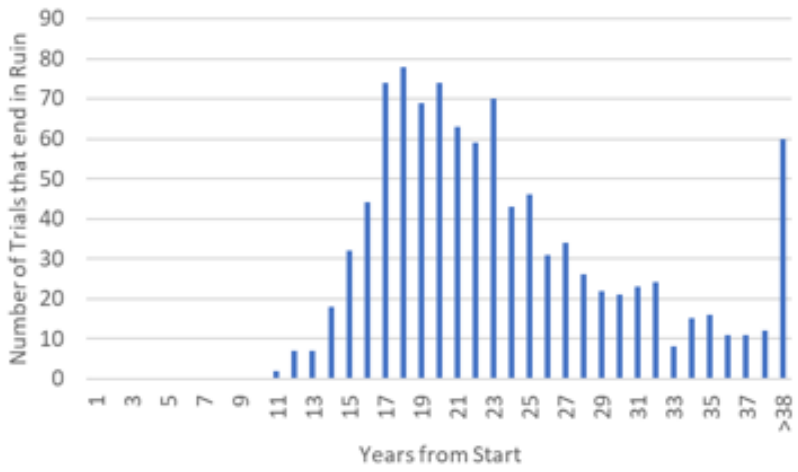
Figure 10: Probabilities by Attained Age



This illustration shows the chance of surviving to age 85 is, as expected, about 50%. Although the annual allowance for living expenses was set to target depletion of the funds at that age, the probability of being alive with no funds remaining at age 85 is only 20%, about half the probability of surviving. There is almost no chance this individual will survive until age 100 with funds remaining.

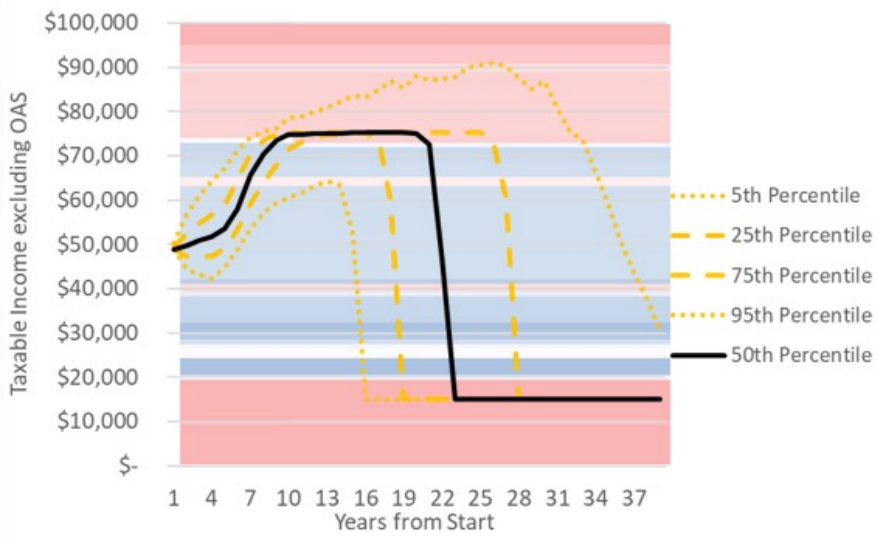
Figure 11 below shows the number of trials (out of 1,000) that lead to ruin in each year, assuming the individual is still alive. On average, the funds are exhausted after 18.8 years. The most likely outcome is that the funds are exhausted during the eighteenth year. Although the plan was to die broke in 20 years, the average years to ruin is less than 20 because the probability of being alive when funds are exhausted is higher in the earlier years.

Figure 11: Distribution of Year of Ruin



Variability in investment returns does not only affect the number of years until funds run out. It also affects the level of future taxable income and the resulting marginal effective tax rates. Figure 12 below illustrates this by superimposing a percentile distribution of projected taxable income onto the colour-coded marginal effective tax rates.

Figure 12: Impact of the Income Trajectory on Marginal Effective Tax Rates



This shows that, although there are some trials that would push up income from minimum RRIF withdrawals and thereby push taxable earnings into the OAS clawback range, most trials lead to RRIF income that, beginning around age 75, is just sufficient to meet the spending target of $66,000 per year and pay income taxes. This income level persists until the RRIF is exhausted and income falls to nothing more than C/QPP (plus OAS and partial GIS). For the most part, marginal effective tax rates are in the blue zone (under 40%), but when income is driven by RRIF withdrawals to meet spending requirements, taxable income is slightly above the OAS clawback threshold. That is, most but not quite all of the RRIF withdrawals are taxed at a rate less than 40%.

Testing Alternative Strategies

a) So far, the illustrations of this "die broke" case study do not entail any discretionary transfers from the RRIF or TFSA contributions.

There are several other strategies to consider:

b) Make a one-time $60,000 TFSA contribution by transferring securities from the non-registered account to a TFSA, even though doing so will mean the non-registered account will be exhausted sooner and withdrawals from the RRIF will need to be increased sooner to meet the spending target (this will consume most but not all available TFSA contribution room)

c) Make maximum TFSA contributions, including a one-time $60,000 catch-up contribution and annual $6,000 transfers of securities into a TFSA, even though doing so means withdrawals from the RRIF will need to be increased sooner

d) Transfer securities with a value of $23,000 (less withholding taxes) from the RRIF to the non-registered account, to increase taxable income in the first year close to the bottom of the OAS clawback range

e) Continue to make transfers from the RRIF to the non-registered account to increase taxable income close to the bottom of the OAS clawback range every year until the RRIF is exhausted

f) Make maximum transfers to a TFSA and also make transfers every year from the RRIF to the non-registered account to increase taxable income (i.e. (c) and (e) combined)

While the strategy of not making any discretionary transfers will minimize taxes in the first year, all of the other strategies would seem to have merit – either because they have the potential to move income to a year when marginal effective tax rates will be lower or (in the case of TFSA strategies) because they protect investment income from taxes.

Table 1 below shows key metrics for each strategy:

- The Single Scenario Value of Estate is the projected after-tax value of the estate in the 20th year, with investment returns (after fees and inflation) of 3% per year. This is not a result from the actuarial model but is included for comparison. This approach is highly dependent on the tax rates used and, in this case study, reflects the account balances just before funds run out.
- The Ruin Probability is the most important metric for this case study.
- The Actuarial Present Value of Estate is an average over all trials and all ages at death, including the many instances in which the estate value is nil. With lower spending, the risk of financial distress would be negligible and so the actuarial present value of the estate would be a more important metric.
- The final column of the table is the Average Years to Ruin. This average is weighted by the probability of surviving to the year when ruin occurs and so it gives no weight to the possibility of funds lasting beyond the 40-year projection period used in the actuarial model.

It can be observed in Table 1 that all but one of the alternative strategies increase the actuarial present value of the estate. However, none of them reduce the ruin probability or extend the expected number of years to ruin. Additional analysis of the strategies follows the table.

Table 1: Key Metrics for Alternative Strategies in "Die Broke" Case Study

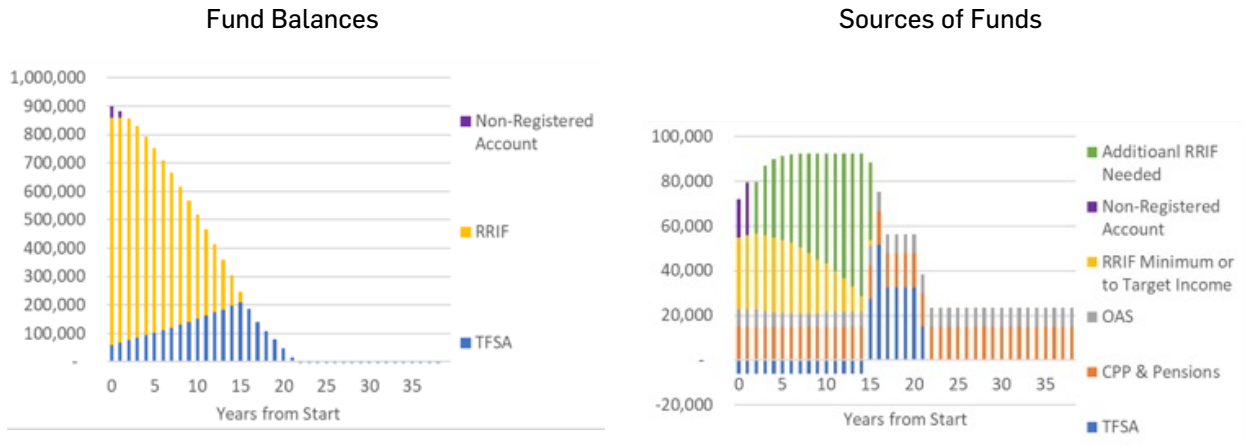
Option	Single Scenario Value of Estate	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	$49,917	42.4%	$173,336	18.8
b) One-time TFSA contribution	$39,239	42.7%	$191,337	18.6
c) Maximum TFSA contributions	$26,658	43.9%	$192,911	18.4
d) One-time top-up to bracket	$48,287	42.6%	$172,772	18.8
e) Annual top-up to bracket	$19,013	45.2%	$174,362	18.5
f) Combination	$31,953	43.4%	$195,547	18.5

TFSA Strategies

A strategy of accelerating drawdown of non-registered funds for the purpose of making TFSA contributions would be favourable to the extent of the effective taxes on non-registered investment income. However, in this case, the non-registered account is a limited source of funds, and so TFSA contributions from non-registered funds lead to more rapid exhaustion of the non-registered account followed by use of the RRIF as the source of funds for year-to-year needs.

Option (c), maximum TFSA contributions, is illustrated by Figure 13 below, showing a deterministic projection of fund balances and sources of funds when TFSA contributions are added. There is a $60,000 catch-up TFSA contribution (out of the non-registered account) and $6,000 in annual contributions beginning in the first year and continuing until both the non-registered account and the RRIF are exhausted. This figure can be compared to Figure 6 to see how the strategy change affects the projection.

Figure 13: Deterministic Projection with Maximum TFSA Contributions



One consequence of applying this strategy is that total RRIF income and taxes are determined by the sum of the spending target and TFSA contribution. There is no stochastic variability in taxable income until the RRIF balance is exhausted. After that, the individual must rely on the TFSA balance (plus C/QPP, OAS and partial GIS) as the source of funds for the $66,000 spending target. GIS and the OAS clawback are treated as effective taxes (negative or positive) and not shown in the projected sources of funds.

Although a TFSA strategy avoids onerous taxation of the RRIF balance if death occurs before the RRIF is exhausted and provides access to GIS benefits sooner, it does little to extend the period before funds run out. In fact, the ruin probability increases by 1.2% because part of the transfer of securities from the RRIF to the TFSA will be subject to the OAS clawback. When TFSA contributions are maximized each year, the effective tax rate on transfers from the RRIF to the TFSA is higher than it would have been if the money had been left in the RRIF until it was needed.

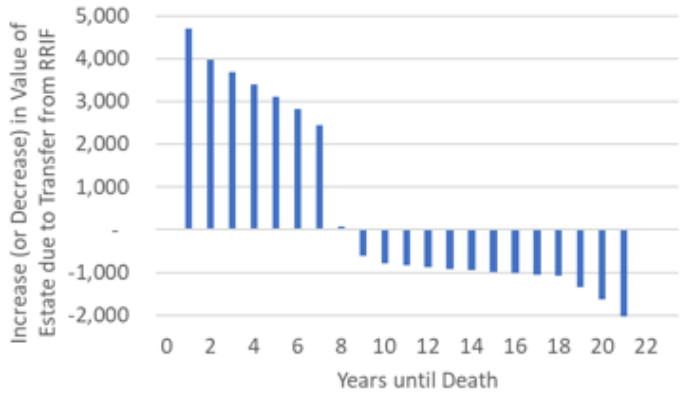
RRIF Strategies

In the absence of a TFSA contribution, the individual's taxable income in the first year of projection consists of C/QPP, OAS, non-registered investment income and a minimum RRIF withdrawal of 4% of the opening balance, a total of $56,000. Within a few years, increases in annual RRIF withdrawals (due to depletion of the non-registered investment balance) will translate into income in excess of the OAS clawback threshold and higher effective tax rates. This would suggest there is an opportunity to make additional transfers of securities out of the RRIF for the first few years to increase net income to the OAS clawback threshold. Those additional transfers of securities in early years reduce the minimum withdrawals in subsequent years, until the point where the non-registered account (including the additional transfers) is exhausted and RRIF withdrawals must be increased to meet the spending target.

Discretionary transfers of securities from the RRIF to top-up taxable income to the OAS clawback threshold year after year can be effective in improving short-term outcomes but ineffective in the long term. The optimal strategy might be to wait several years. But it is not necessary to examine every possible deferral period or every possible interaction of transfers with minimum withdrawals. If Option (a) is superior to options (d) and (e), then the first year transfer from the RRIF is undesirable. The decision to defer to the third year can wait until the second year.

A comparison of option a) and option d) is simple enough to lend itself to evaluation of a single-scenario approach to the drawdown strategy choice. Figure 14 below shows the change in projected estate value in each future year attributable to a discretionary first-year transfer.

Figure 14:
Increase in the After-Tax Value of the Estate with an Extra $23,000 Transferred from the RRIF and Fixed in Investment Returns



Some explanation of the details in this comparison is required.

- If death occurs immediately (zero years from start), there is no effect because the full value of the RRIF will be taxable in the estate in any event.
- If death occurs one year after the transfer, there is a gain of $4,700 because the $23,000 discretionary transfer is taxed at an Ontario rate of 31.6% instead of the maximum rate applicable to the estate of 53.5%
- If death occurs two years after the transfer, the first year gain is offset by a small loss of income-tested government benefits (phase-out of the Ontario Energy & Property Tax Credits) based on higher income in the first year.
- If death occurs in the 2nd through 7th year, taxation of investment income at a rate of approximately 1.2% of the after-tax amount erodes the advantage of the first year transfer.
- Assuming minimum RRIF withdrawals are reduced after the initial transfer, the lower annual withdrawals which would have been taxed at an average effective tax rate of 34.7% (including Band 4 of the Ontario Health tax and phase-out of the Age Amount and Ontario Energy & Property Tax Credits) erode the advantage of the first year transfer.
- Non-registered funds are exhausted in the 7th year rather than the 6th year and if death occurs in the 7th year, then the RRIF withdrawal that would have been made in the 6th year to support spending is taxed as part of the estate rather than as regular income.
- If death occurs after the 7th year, the accumulated taxes on non-registered investment income and differences in income tested benefits during the first six years remain as a reduction in the total value of the estate (and the gap grows with foregone interest on those taxes)
- If death occurs during the last year or two before funds are exhausted (in the 22nd year), then estate taxes are lower than 53.5% and so the advantage of the first year transfer is smaller.

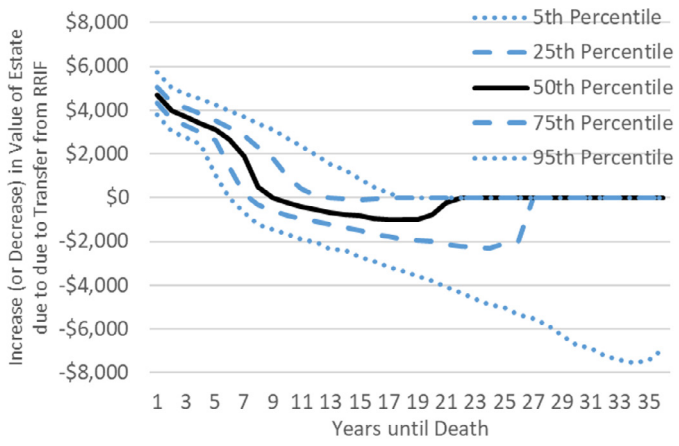
As shown in Table 1 above, the deterministic projection for 20 years produces an estate of $49,917 under strategy (a) and $48, 287 under strategy (d). The difference of $1,630 is shown in Figure 14 above. However, this outcome is entirely dependent on the 20-year time horizon. If a fixed time horizon is to be used to determine whether or not the RRIF withdrawal is advantageous, the question of which year to use becomes critical:

- The non-registered account will be exhausted in 6 or 7 years regardless so any effect of accelerating RRIF drawdown is worn off by the end of that time
- Life expectancy is 20 years
- The entire account expected to be exhausted in 22 years (better than the 18.8 year average shown above, since that statistic ignores the favourable outcomes in which funds last until death.

If the expected rate of return were reduced by 0.5% to take account of sequence-of-returns risk, the effect of taxes on non-registered funds is dampened slightly but the overall picture is unchanged. On the other hand, tax credits and income-tested benefits play an important role in the overall result. Basic Ontario and federal taxes are 29.65% over the entire range of taxable income under consideration (aside from estate taxation) but marginal effective tax rates vary from 34.6% at the bottom of the range to 30.6% at the top of the range (with a spike due to the Ontario Heath Premium at $72,000).

Factoring in variability of investment returns changes the picture somewhat. The year-by-year effect on the after-tax value of the total estate is illustrated with variable investment returns in Figure 15 below.

Figure 15:
Distribution of Increases in the After-Tax Value of the Estate with an Extra $23,000 Transferred from the RRIF



While there is likely to be a benefit when death occurs before the seventh year, in the longer term the discretionary immediate transfer is detrimental because:

- in scenarios with favourable investment returns, the funds last longer and taxes on investment income eventually outweigh the advantage in tax rates; and
- in other scenarios, the fund balances will be depleted before death and the 34.7% effective tax rate on the immediate discretionary transfer will outweigh the effective taxes saved later.

When the distribution of ages at death is factored in, the actuarial metrics shown in Table 1 above indicate a slight disadvantage from the discretionary transfer. Making the discretionary transfer from the RRIF reduces the actuarial present value of inheritances from $173,336 to $172,772 and increases the overall ruin probability from 42.4% to 42.6%.

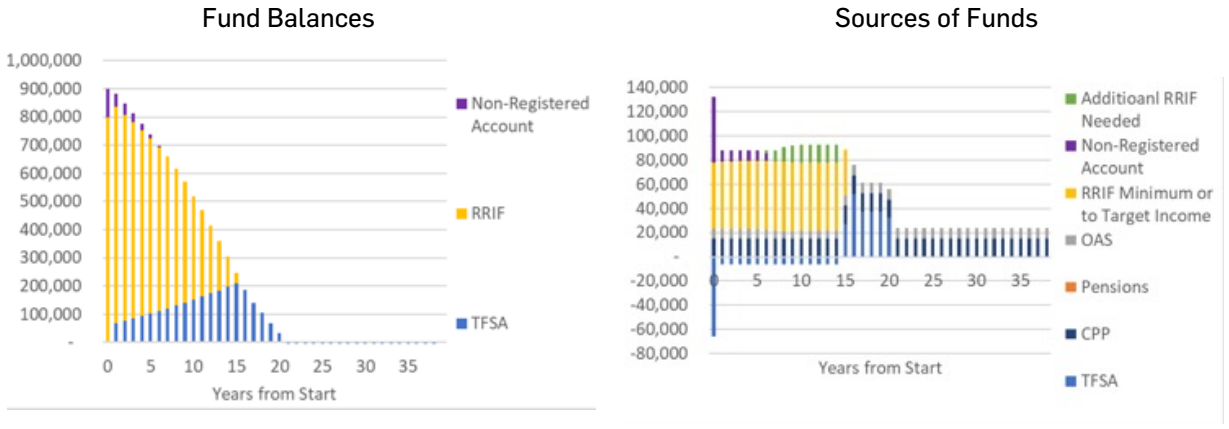
Combined TFSA & RRIF Strategy

A strategy of accelerating drawdown of a RRIF for the purpose of making TFSA contributions (or avoiding TFSA withdrawals) depends solely on the tax rate applied to RRIF income, since there are no taxes on investment income in a TFSA or a RRIF[3] . If the effective tax rate applied to accelerated RRIF withdrawals is higher than would apply if the RRIF withdrawals were deferred, then the outcome will be favourable. The time horizon and rate of investment return do not matter, except to the extent portfolio growth might eventually lead to a different tax bracket.

Option (f) does not exactly produce this direct transfer from the RRIF to the TFSA. It combines accelerated drawdown of the RRIF and maximum TFSA withdrawals, with the non-registered account retained for roughly the same period of time as in option (a), albeit with a smaller balance due to the initial TFSA catch-up contribution.

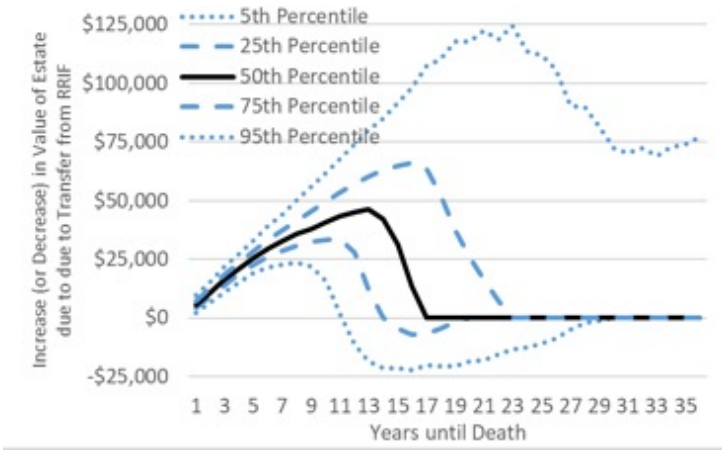
[3] *This presumes U.S. securities are not being shifted from the RRIF to the TFSA. U.S. withholding taxes apply to a TFSA but not to a RRIF.*

Figure 16
Deterministic Projection with Maximum TFSA Contributions and Accelerated RRIF Drawdown



As shown in Figure 17 below, the results of this approach are generally favourable, relative to option (a). The actuarial present value of the estate is increased from $173,336 to $195,547. However, the scenarios with poor early investment returns include scenarios in which Option (f) leads to default a year earlier than option (a). The advantage of reduced estate taxes is never realized and variations in effective tax rates on RRIF drawdown (including income-tested benefits) are outweighed by taxes on investment income. Consequently, Option (f) produces a slightly higher ruin probability.

Figure 17
Distribution of the Increases in the After-Tax Value of the Estate with Maximum TFSA Contributions and Accelerated RRIF



Sensitivity of Key Results

So far, all of the analysis has been based on a single set of circumstances and the baseline assumptions outlined in Appendix C. Insight into the relevance of the conclusions to different circumstances can be obtained by examining the effect of alternatives. Table 2 below repeats the comparison of options a), d) and f), varying one input at a time.

Table 2: Key Metrics for Alternative Circumstances and Assumptions

Baseline (Ontario, 20 yr life expectancy, ERP=3%, σ=9%, 20% portfolio turnover)

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	42.4%	$173,336	18.8
d) One-time top-up to bracket	42.6%	$172,772	18.8
f) Combination	43.4%	$195,547	18.5

Riskier Investments (ERP=6%, σ=18%)

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	**25.0%**	**$771,109**	**17.0**
d) One-time top-up to bracket	25.1%	$767,190	17.0
f) Combination	**25.6%**	**$923,874**	**16.7**

Safer Investments (ERP=1%, σ=3%)

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	64.7%	$79,074	17.3
d) One-time top-up to bracket	64.7%	$79,130	17.2
f) Combination	66.0%	$83,365	16.9

Active Investments (100% turnover for capital gains)

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	42.4%	$172,888	18.8
d) One-time top-up to bracket	42.7%	$172,029	18.8
f) Combination	43.5%	$195,063	18.5

Fit (25-year life expectancy)

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	58.7%	$121,778	19.7
d) One-time top-up to bracket	58.9%	$121,025	19.7
f) Combination	59.4%	$140,112	19.4

Frail (15-year life expectancy)

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	25.4%	$235,196	17.8
d) One-time top-up to bracket	25.6%	$235,050	17.8
f) Combination	26.6%	$261,331	17.5

Alberta Tax & Benefit rates

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	**44.6%**	**$179,313**	**18.5**
d) One-time top-up to bracket	**44.8%**	**$178,536**	**18.5**
f) Combination	**44.7%**	**$196,379**	**18.3**

BC Tax & Benefit Rates

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	**41.0%**	**$182,492**	**19.0**
d) One-time top-up to bracket	**41.2%**	**$182,174**	**18.9**
f) Combination	**41.8%**	**$209,568**	**18.7**

Observations:

- Investment risk can have a dramatic impact on the metrics under consideration but changing the investment strategy does not change the conclusion that transfers increase the risk of financial distress
- Changing to safer investments does change the conclusion concerning the actuarial present value of the estate, although the effect is negligible (Moving from option (a) to option (d) represents a shift of securities with a pre-tax value of $23,000 and reduces the result by $564 with baseline investments but increases the result by $56 with safer investments)
- Portfolio turnover rate does not materially affect the differences in results between options
- Variations in life expectancy (because of the age, gender, health or other characteristics of the individual) do not change the conclusions
- Applying tax rates from different jurisdictions does not change the conclusions.

Low Income Individual

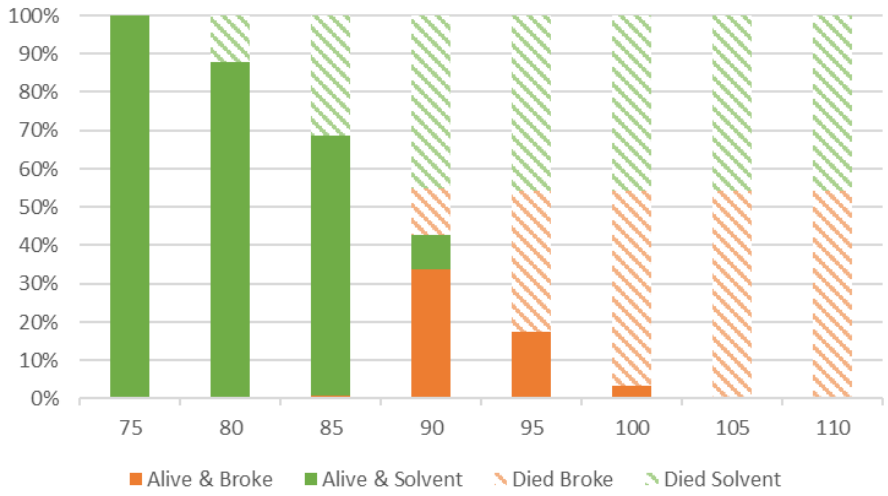
It is generally understood that individuals with modest income will do better with a TFSA and GIS benefits than with a RRIF. This can be demonstrated using the actuarial model.

Facts:

- Age 75
- $200,000 in a RRIF
- No TFSA or non-registered funds
- C/QPP of $10,000 per year
- OAS of $8,500 per year (including age 75 increase)
- Spending of $35,000 per year
- Conservative investing strategy (risk-free rate RFR=0%, equity risk premium ERP=2% ERP, variability $\boldsymbol{\sigma}$=6%)
- Ontario taxes and benefits

If the investments are kept in the RRIF, $16,500 must be withdrawn each year to meet living expenses in excess of C/QPP and OAS. This is comprised of a minimum required withdrawal of about $11,000 and an additional withdrawal of about $5,500. The combination of minimum and additional withdrawals continues until the RRIF is exhausted. Income taxes are roughly cancelled out by partial GIS and other income-tested benefits such as the GST credit and the Ontario property tax credit. The RRIF will last about 14 years, which matches the individual's life expectancy. The actuarial model shows there is a ruin probability of 54.1%, as illustrated below.

Figure 18:
Probabilities of Low Income Individual's Outcomes by Attained Age



Increasing the first-year withdrawal to $50,000 (to bring first-year income to the bottom of the OAS clawback range) front-loads the taxes and creates a small non-registered investment account to cover spending and provides a few years of increased government benefits. However, once the non-registered funds are exhausted, RRIF withdrawals must increase and, overall, this strategy does not reduce the risk of financial distress. The strategy can be improved by moving the additional withdrawals to a TFSA rather than a non-registered fund, but this only reduces the ruin probability from 54.1% to 50.0%

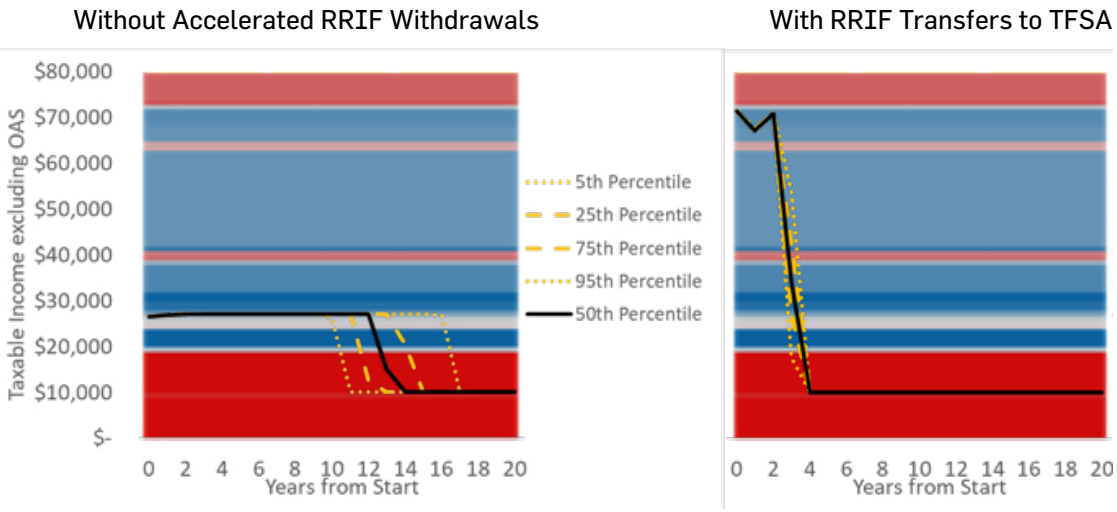
Maintaining this pace of accelerated withdrawals until the RRIF is exhausted (part way through the fourth year) does notably improve the situation. After four years of paying taxes, the only remaining sources of taxable income are C/QPP and OAS. The investments outside the RRIF last longer because of higher GIS and other low-income benefits starting in the third year. If they are moved to a TFSA, the ruin probability is reduced to 37.7%. This strategy has the added benefit of increasing the actuarial present value of the estate from $34,342 to $38,720, as shown in Table 3 below.

Table 3: Key Metrics for Alternative Strategies in Low Income Case Study

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	54.1%	$34,342	13.5
b) RRIF in 1st year, no TFSA	54.8%	$33,760	13.4
c) RRIF & TFSA in 1st year only	50.0%	$33,543	14.0
d) Four-year transition to TFSA	37.7%	$38,702	15.9

Marginal effective tax rates with the accelerated RRIF withdrawal strategy are illustrated by Figure 19 below, comparing net income (excluding OAS) with the RRIF alone on the left and with the four-year transition from the RRIF to the TFSA on the right. The extra withdrawal successfully moves income from the top of a blue effective tax range to a red effective tax range.

Figure 19:
Impact of the Income Trajectory on Marginal Effective Tax Rates



While it is evident from Figure 19 above that RRIF investments run out in ten to fifteen years without accelerated withdrawal, the point where the TFSA runs out is not evident, since withdrawals do not generate taxable income. The time until all accounts are exhausted is illustrated in the figures below, showing the probabilities of outcomes and the after-tax value of the estate with the accelerated withdrawal and transfer to the TFSA. As compared to Figure 18 above, Figure 20 shows the risk of financial distress at age 90 is significantly reduced.

Figure 20:
Probabilities of Low Income Individual's Outcomes with RRIF Transfers to TFSA over Four Years

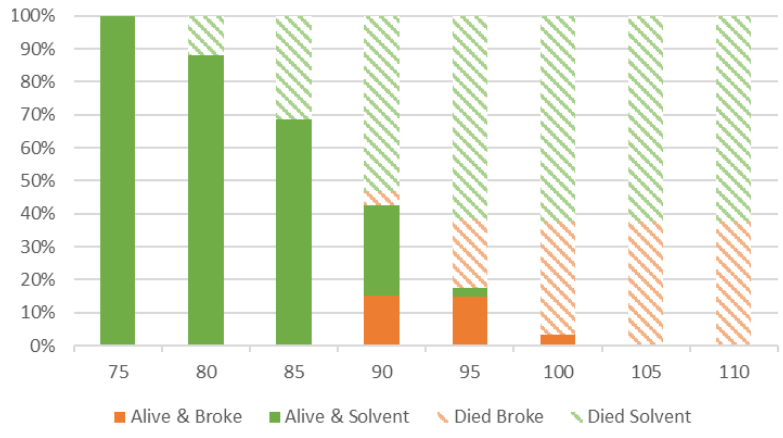
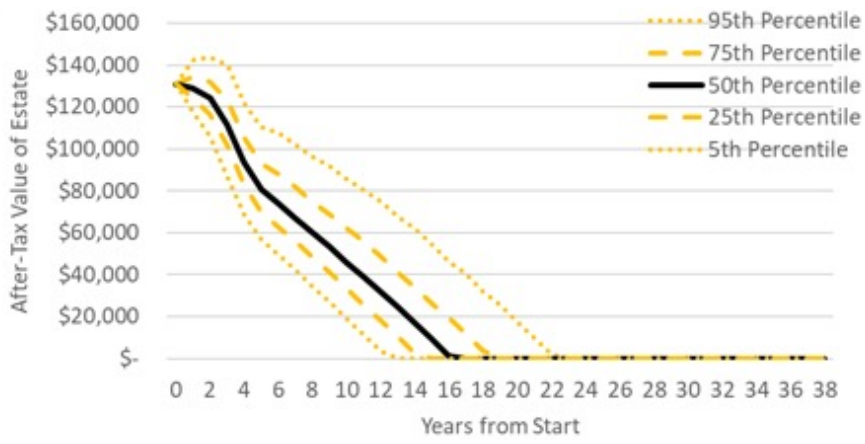


Figure 21:
Distribution of the After-tax Value of the Estate with RRIF Transfers to the TFSA



TFSA Exception

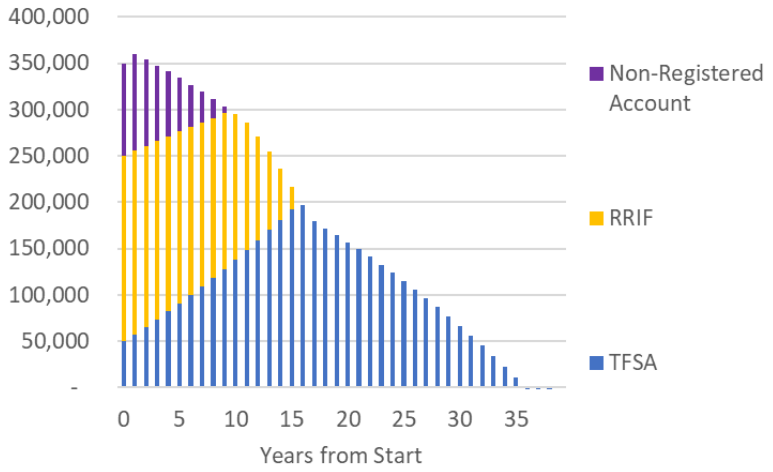
In general, maximizing TFSA contributions is beneficial. Investments are tax-sheltered and will not be subject to onerous taxation in an estate. Of course, this is not always the case. Transferring investments from a RRIF to a TFSA will only work out if the tax rate on RRIF withdrawals is lower at the outset than it will be in the future. This includes future minimum RRIF withdrawals as well as estate taxation. This can be illustrated by a case in which the initial discretionary RRIF withdrawal will trigger OAS clawbacks, but future minimum RRIF withdrawals will not.

Facts:

- Single
- Age 65
- $200,000 in a RRIF
- $100,000 non-registered funds (with no unrealized gains or losses)
- C/QPP of $12,000 per year
- OAS of $7,800 per year
- $50,000 in a TFSA, with $28,000 of unused contribution room
- $50,000 per year fully indexed employment pension
- Spending of $70,000 per year
- Baseline investing strategy as described in section 5 (risk-free rate RFR=0%, equity risk premium ERP=3% ERP, variability $\boldsymbol{\sigma}$=9%)
- Alberta taxes and benefits

With TFSA contributions of $6,000 per year, but no attempt to catch up unused contributions or accelerate RRIF withdrawals, funds would appear to be sufficient, as shown in the deterministic forecast of fund balances in Figure 22 below.

Figure 22: Deterministic Projection of Fund Balances



The actuarial model produces a ruin probability of 23.0% and an actuarial present value of the estate of $163,235. Taxable income is $80,000 per year and, in the absence of variability in investment returns or accelerated RRIF withdrawals, taxable income will remain at that level for the next decade. After non-registered funds are exhausted, taxable income would increase (into the OAS clawback range) because of extra RRIF withdrawals to support the spending target. Once the RRIF is exhausted, taxable income will be reduced to nothing more than C/QPP, OAS and the private pension.

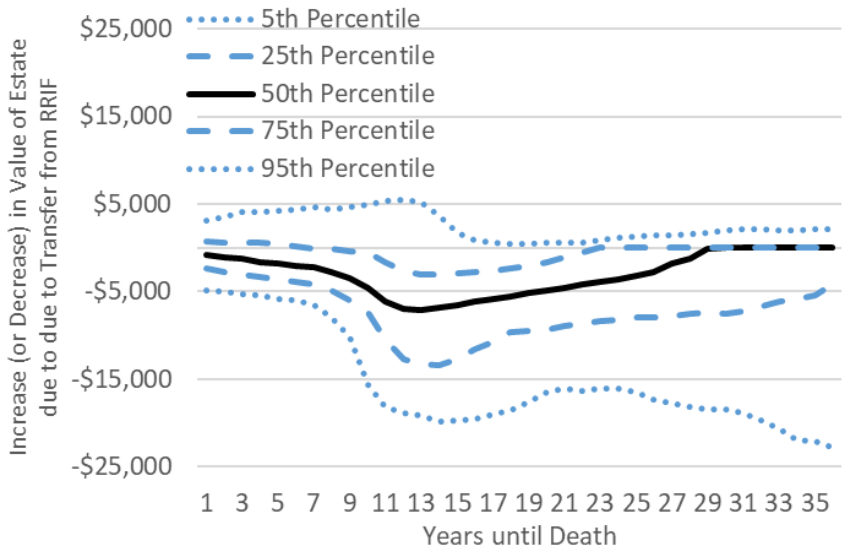
It would seem that moving investments from the RRIF to the TFSA might be a good idea since, even after the OAS clawback, the effective tax rate on the RRIF withdrawal would be less than the tax rate on RRIF funds left in the estate. However, this is not the case, as shown in Table 4 below.

Table 4: Key Metrics for Alternative Strategies in TFSA Case Study

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	23.0%	$162,235	23.3
b) RRIF to TFSA in 1st year	24.1%	$158,327	23.1

The RRIF is likely to be depleted during the individual's lifetime, with no OAS clawbacks in most instances. The effect of withdrawing $50,000 from the RRIF and contributing the $28,000 after-tax proceeds to the TFSA is to increase the ruin probability to 24.1% and reduce the actuarial present value of the estate by $3,908. This outcome is illustrated in Figure 23 below, showing year-by-year effects of shifting from option (a) to option (b).

Figure 23:
Increase in the After-Tax value of the Estate with a Transfer from the RRIF to the TFSA



Option (b) tends to give poorer outcomes in the stochastic trials with below average investment returns. The most extreme loss of value will arise if the transfer causes the RRIF to be exhausted a year or two before death, when the transferred securities would otherwise have been taxed as a small estate. That is, incurring a first-year OAS clawback to transfer funds from the RRIF to the TFSA and avoid future OAS clawbacks will be a losing strategy if investment returns are poor and future OAS clawbacks would not have occurred in any event.

Couple

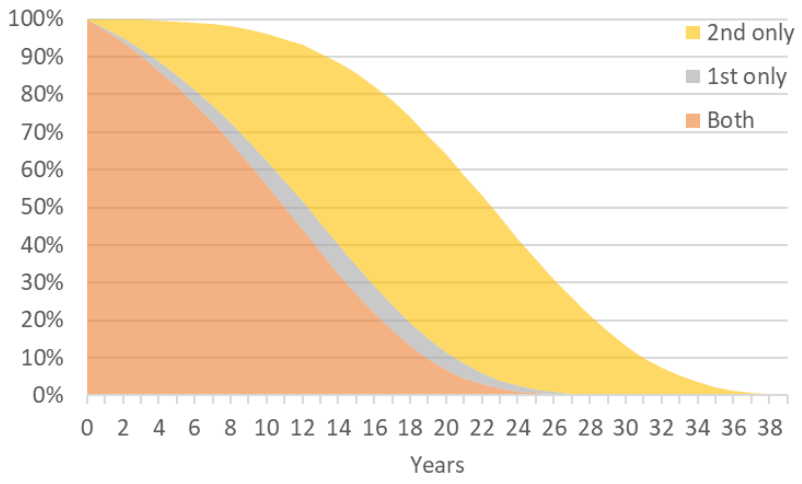
In this case study, the couple has sufficient funds to support a very comfortable lifestyle and will likely leave a substantial estate. However, they depend in part on pensions that will be reduced on the first death, and so a sustained period of survivorship combined with poor investment returns poses a risk that the investment funds will be exhausted prior to the second death.

Facts:

- First person:
  - Age 71 but in poor health, life expectancy is that of a 78-year-old: 12 years)
  - $1,200,000 in a RRIF balanced fund
  - No non-registered funds or private pensions
  - C/QPP of $14,000 per year
  - OAS of $7,500 per year
- Second Person:
  - Age 70 and in excellent health, life expectancy is that of a 66-year old: 21 years)
  - No RRIF or non-registered funds
  - C/QPP of $10,000 per year
  - OAS of $10,000 per year (commenced at age 69)
  - Non-indexed defined benefit pension of $20,000 per year, with a survivor benefit of $12,000 per year

- The couple has, in total, $100,000 in TFSAs
- C/QPP survivor benefit will be $15,000 per year (indexed)
- Spending of $100,000 per year with no reduction on 1st death
- Baseline investment strategy and financial assumptions described in Appendix C
- British Columbia taxes and benefits

Figure 24: Survival Probabilities for Couple



In the absence of investment volatility or discretionary transfers from the RRIF, the funds can be expected to last for 35 years (to age 106), so long as both individuals are still alive. Since other sources of funds are more than adequate for the first several years and the prior year's taxes have already been paid at the beginning of the projection, part of the second individual's defined benefit pension is not required and can be invested in non-registered funds for use when inflation erodes the purchasing power of the pension. A deterministic projection of the account balances and the sources of funds to pay for taxes and spending is shown in Figure 25 and Figure 26 below.

Figure 25:
Deterministic Projection of Couple's Fund Balances While Both are Alive

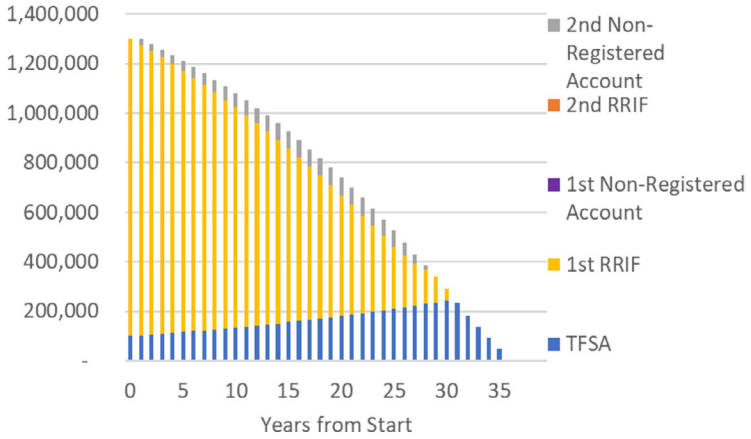
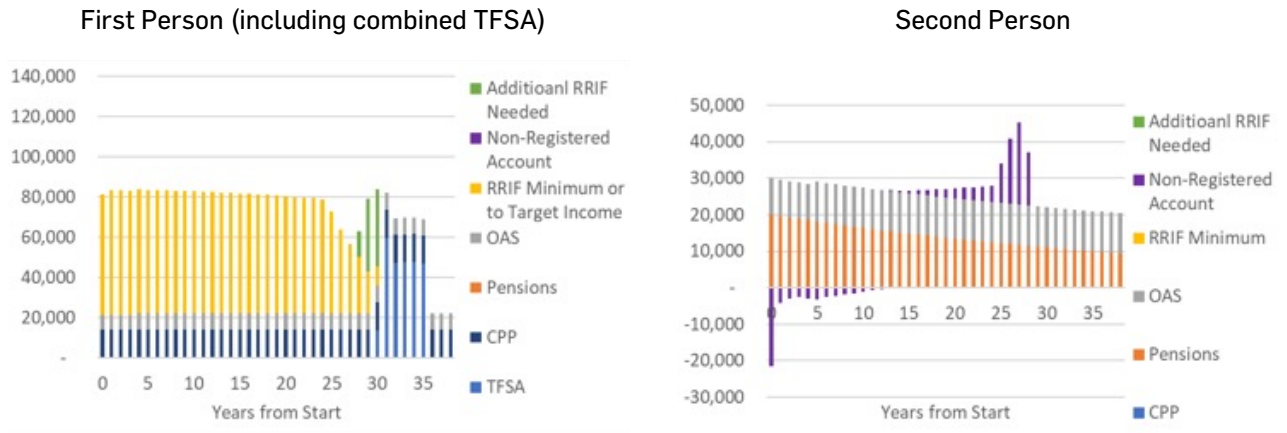
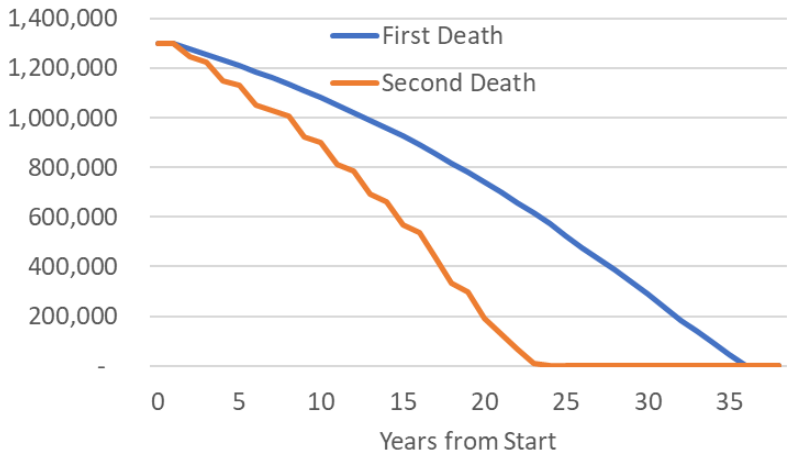


Figure 26:
Deterministic Projection of Sources of Funds While Both are Alive



The challenge begins after the first death. Taxes are increased and C/QPP, OAS and private pension benefits are reduced. In total, the after-tax draw on savings increases by between $27,000 and $29,000 per year. Figure 27 below shows how this extra draw affects the after-tax value of the estate.

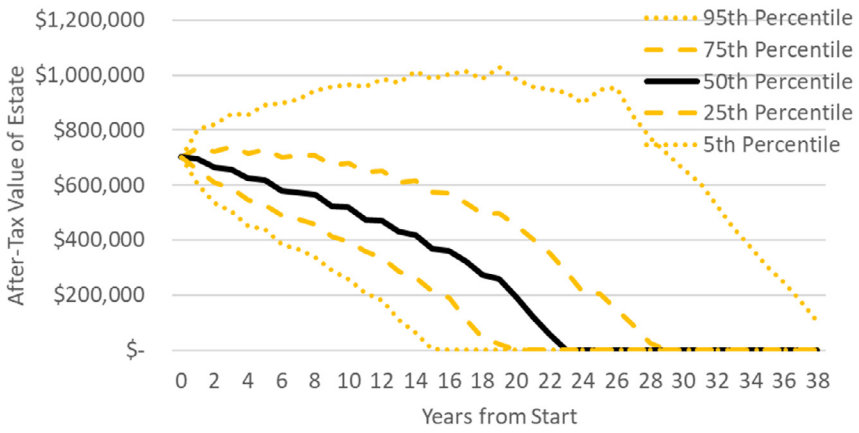
Figure 27:
Deterministic Projection of the Pre-tax Value of the Estate



When the extra draw for the survivor is deducted, funds are exhausted in the 23rd year. The probability that at least one person will survive that long is 50% and, before considering variability of investment returns, this would be the ruin probability.

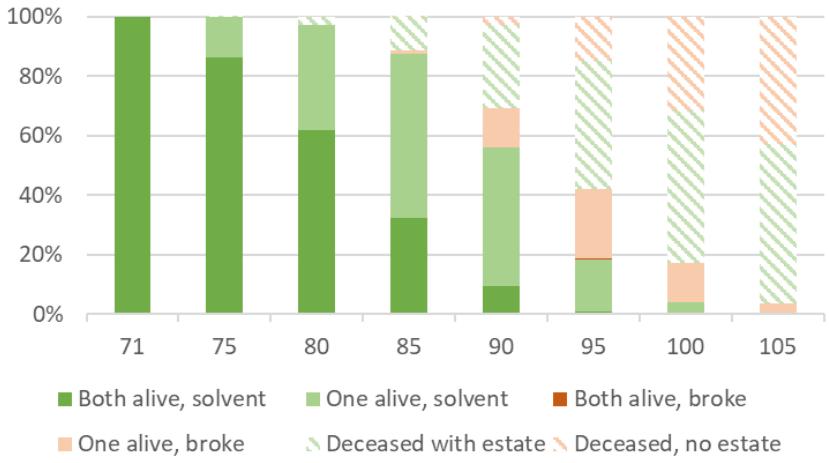
The after-tax value of the estate available on the second death is illustrated in Figure 28, below. This illustration takes account of the variability of investment returns and, while the 50th percentile of the distribution of estate values reaches zero at about the same point as the projection with a fixed rate of return, there is more uncertainty as to whether or not the assets will be sufficient to support the survivor throughout their lifetime.

Figure 28:
Distribution of the After-tax Value of the Estate (Second Death)



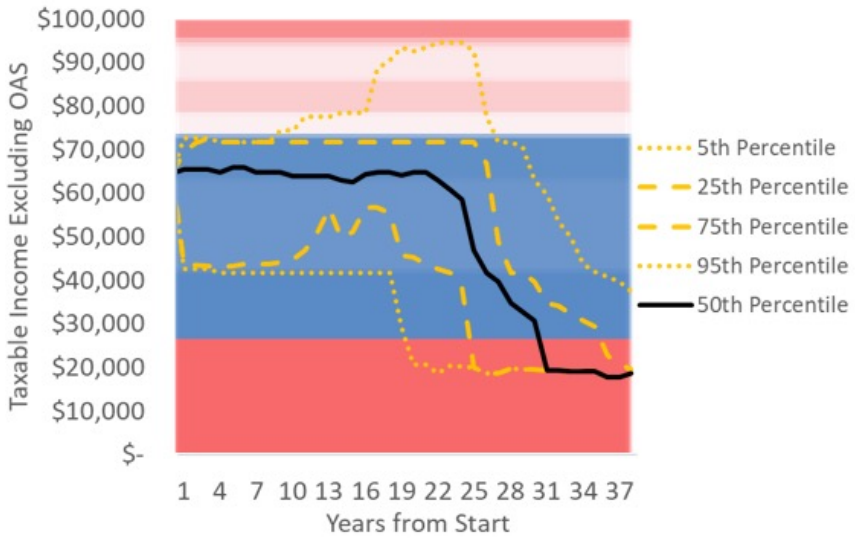
The combined effect of investment return and longevity risk is illustrated in Figure 29 below. The possibility of financial distress while both are alive is very small, while the risk of financial distress for a survivor is significant.

Figure 29:
Probabilities of Couples' Outcomes by Attained Age



Uncertainty as to the size of the account balances leads to uncertainty as to taxable income and effective tax rates, as illustrated in Figure 30 below. Larger increases would attract a higher effective tax rate. Note that the distribution of taxable income in this figure represents the range of possible outcomes while both are alive. A surviving spouse will have higher taxable income.

Figure 30:
Impact of the First Person's Income Trajectory on Marginal Effective Tax Rates (after income splitting)



Testing Accelerated Drawdown Strategies

Optimizing income splitting means that both spouses' incomes must be considered in the determination of the effective tax rate. In this instance, the first year combined taxable income (including OAS) is $122,000 and the optimal split brings the first person's income to the bottom of the second federal tax bracket ($50,000), with the remaining income taxed in the second person's name (with a slightly higher tax rate and partial loss of age amount tax credits). A discretionary transfer of securities from the RRIF of up to $38,000 can be made without affecting OAS benefits.

Four options are considered:

a) No discretionary transfers from the RRIF or contributions to the TFSA

b) A one-time $38,000 transfer from the RRIF, with no contributions to the TFSA

c) A one-time $38,000 transfer from the RRIF, in combination with a $24,000 one-time TFSA contribution, leaving the spouse's non-registered account balance close to the balance in Option (a) once taxes are paid

d) A one-time $38,000 transfer from the RRIF, in combination with a $24,000 first year TFSA contribution and annual contributions thereafter of $12,000 (ignoring the possibility that contribution room might not be available after a prolonged period of survivorship)

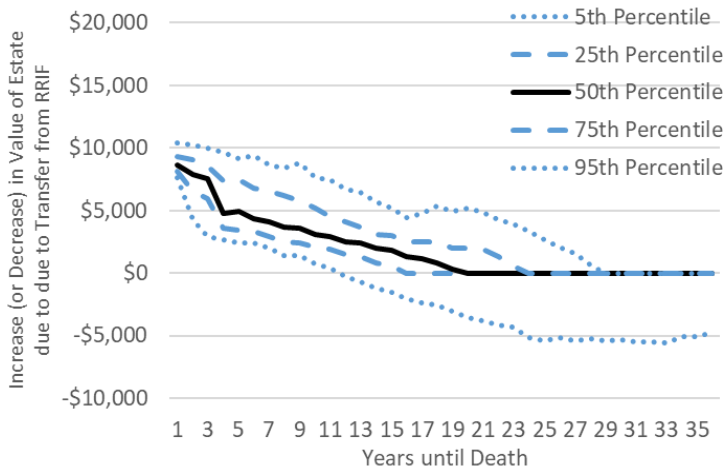
As can be seen in Table 5 below, the discretionary transfers do lead to improvements in the key metrics.

Table 5: Key Metrics for Alternative Strategies in Couple Case Study

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	46.0%	$260,520	20.3
b) RRIF in 1st year only	45.9%	$261,159	20.4
c) RRIF & TFSA in 1st year only	45.0%	$270,146	20.3
d) RRIF in 1st yr & annual TFSA	43.0%	$305,006	20.4

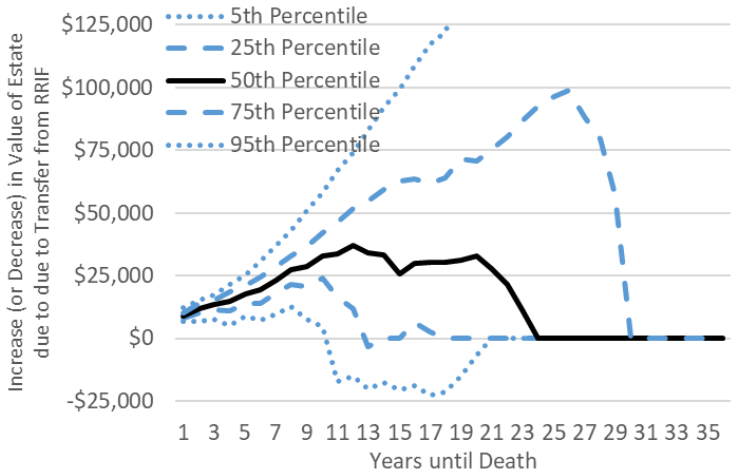
The transfer from the RRIF alone in option (b) makes a small improvement to the metrics. The ability to withdraw RRIF funds in the first year without OAS clawbacks will be advantageous if the funds are used to support survivor's living expenses or bequests during the first decade or so. However, increased income taxes on favourable returns can undermine the value of the discretionary transfer after a decade or more of favourable investment income taxes. The advantage when the survivor's death occurs early is mostly offset by disadvantages when death occurs later, as shown in Figure 31 below, comparing option (a) with option (b). A case could be made that the $639 increase in actuarial value represents more than 2% of the transfer (on a tax-adjusted basis), and this expected gain would justify the transaction. However, the actuarial estimate of the gain is small relative to the uncertainty involved in its estimation.

Figure 31:
Distribution of the Increases in the After-Tax value of the Second Estate with an Extra $38,000 RRIF Transfer Invested in a Non-Registered Account



The TFSA contribution options (c & d) reduce the risk of financial distress for the surviving spouse (in unfavourable trials) and increase the estate (in favourable trials). These advantages translate into a notable overall reduction in the risk of financial distress and increase in the after-tax value of the estate. This is illustrated in Figure 32 below, comparing option (a) with option (d).

Figure 32:
Distribution of the Increases in the After-Tax value of the Second Estate with an Extra $38,000 RRIF Transfer Invested in a TFSA and continuing TFSA Contributions



The reduction in the risk of financial distress attributable to option (c) or (d) is aggravated slightly by the difference in life expectancies but it would be seen even if the life expectancies were the same.

Sensitivity to Survivor's Lifestyle Costs

One of the specifications for this case study is that lifestyle spending will not decline after the first death. Shelter costs will remain unchanged and any reduction in food, health care and other costs will be offset by increased costs for attendant care and work around the home that was previously handled by the deceased spouse. It is worth considering how things would change if two cannot live as cheaply as one. Table 6 below shows the model results if lifestyle costs are reduced upon the first death from $100,000 to $75,000 per year. In comparison to the results in Table 5, reduced spending by the survivor leads to much lower risk of financial distress and a larger estate. If ruin does occur, it will occur later.

Table 6:
Key Metrics with 25% Reduction in Surviving Spouse's Lifestyle Costs

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	16.6%	$511,540	23.9
b) RRIF in 1st year only	16.7%	$511,623	23.9
c) RRIF & TFSA in 1st year only	16.6%	$524,062	23.8
d) RRIF in 1st yr. & annual TFSA	17.6%	$563,167	23.6

The question at hand is whether reduced lifestyle costs change the analysis of drawdown strategies. In options (c) and (d), as noted above, after making accelerated RRIF withdrawals (and paying additional taxes on those withdrawals) until the RRIF is exhausted, the couple or the survivor will have low-tax years in which TFSA withdrawals are used to support lifestyle. Lower lifestyle costs mean the TFSA can be used more slowly, so it lasts longer, with more left for beneficiaries.

Both Table 5 and Table 6 show an actuarial present value of the estate approximately $50,000 larger in option (d) compared to option a). In favourable scenarios where ruin does not occur, paying tax on extra RRIF withdrawals is better than paying taxes on the remaining RRIF balance in the estate of the survivor. That is, the marginal effective tax rates paid on early RRIF withdrawals are lower than the rates that will be paid by the estate later on.

However, it is interesting to note that Table 5 showed a 3.0% reduction in the ruin probability attributable to moving from option (a) to option (d) whereas Table 6 shows a 1.0% increase in the ruin probability. Reduced spending leads to a different conclusion as to the effectiveness of TFSA contributions in reducing the risk of financial distress. In unfavourable scenarios, the marginal effective tax rates on early RRIF withdrawals are higher than the rates that would be paid by the survivor, but only if the survivor's RRIF withdrawals are limited to the level required to support living expenses of $75,000.

Sensitivity to Discount Rate

Calculation of the actuarial present value of the estate involves the time value of money. The after-tax value of a future estate is discounted to the beginning of the projection using a discount rate of 0%. A higher discount rate would lead to smaller present values and, more importantly, would place more weight on premature deaths. Table 7 below illustrates the impact a 3% discount rate would have on the analysis of alternative strategies.

Table 7: Sensitivity of Estate Values to Discount Rate

Option	Actuarial Value of Estate (0% discount)	Increase from option a)	Actuarial Value of Estate (3% discount)	Increase from option a)
a) No discretionary transfers	$260,520		$155,546	
b) RRIF in 1st year only	$261,159	0.2%	$156,039	0.3%
c) RRIF & TFSA in 1st year only	$270,146	3.7%	$160,769	3.4%
d) RRIF in 1st yr & annual TFSA	$305,006	17.1%	$178,447	14.7%

To understand these results, keep in mind the distribution of the number of years until the estate is settled on the second death. Figure 24 shows that this will typically occur 15 to 30 years from the beginning of the projection (at ages 85 to 100).

Figure 31 shows that the advantage of moving from option a) to option b) is largest when deaths are earlier than expected. This is reflected in the shift from 0.2% to 0.3% when the discount rate is changed in Table 7.

Figure 32 shows that the advantage of moving from option a) to option d) arises mostly when deaths are in the expected range and investment returns are average or above average. This is reflected in a decrease in the shift from 17.1% to 14.7% in Table 7.

Overall, the use of a different discount rate does not have a significant effect on the conclusions regarding drawdown strategies.

High Income Couple

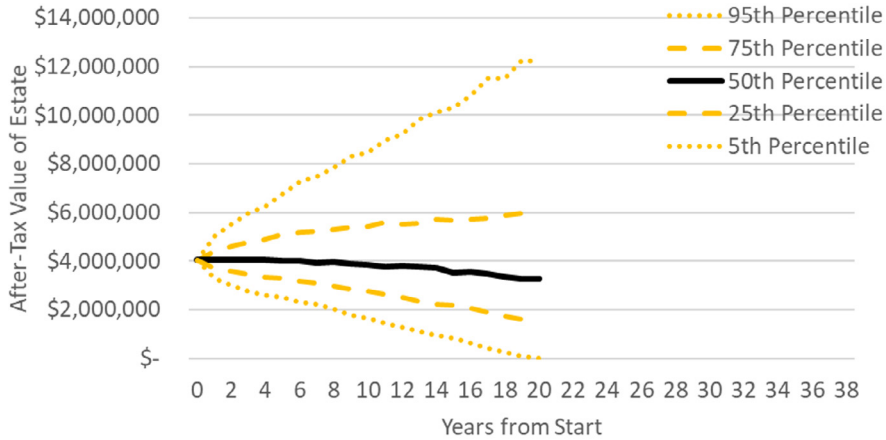
This case study illustrates the use of income splitting to reduce estate taxation when incomes are likely to remain above the OAS clawback range.

Facts:

- First person:
  - Age 91
  - $2 million in a RRIF
  - $3 million in non-registered funds (including $500,000 unrealized gains)
  - C/QPP of $12,000 per year
  - OAS of $8,500 per year (including age 75 increase, before clawback)
- Second Person:
  - Age 91
  - No investments
  - C/QPP of $12,000 per year
  - OAS of $8,500 per year
- The couple has, in total, $200,000 in TFSAs
- C/QPP survivor benefit will be $15,000 per year
- Spending of $200,000 per year with no reduction on 1st death
- Aggressive investing strategy (risk-free rate RFR=0%, equity risk premium ERP=5% ERP, variability σ=15%)
- Ontario taxes and benefits

This investment strategy gives rise to a wide range of potential outcomes, as illustrated in Figure 33 below.

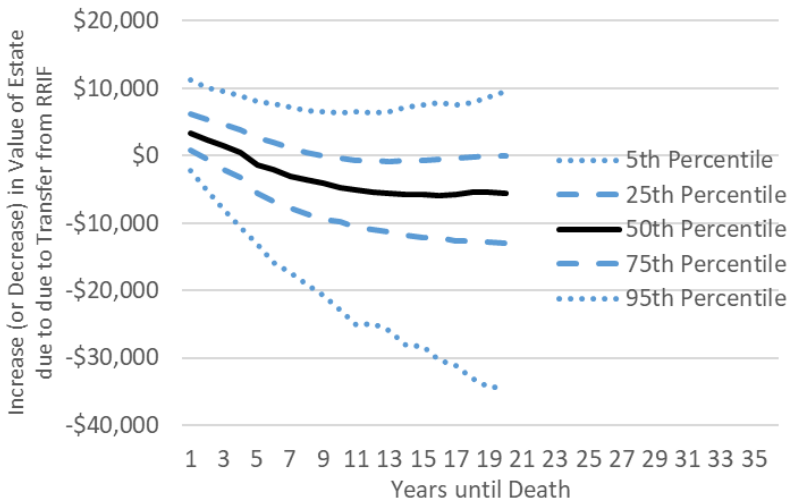
Figure 33:
Distribution of the After-tax Value of the Second Estate



Although not zero, the ruin probability is negligible (0.04%), Financial distress only occurs with an unusually long lifetime and very poor investment returns.

In the first year, combined taxable income is $407,000. Optimal pension income splitting places the first person in the top federal and Ontario tax bracket and places the second person in the third federal bracket (of five) and the third Ontario bracket (of five). Accelerating the RRIF withdrawals with an additional $100,000 withdrawal increases both incomes by $50,000, with a blended effective tax rate of 50.0%. If death were to occur in the second year, this would result in a gain as compared to the 53.5% maximum tax rate applicable to an estate of $3,738 (including one year's investment income). As shown in Figure 34 below, the effect declines over time.

Figure 34:
Distribution of the Increase in the After-Tax value of the Second Estate with an Extra $100,000 RRIF Transfer to the Non-registered Account



Based on the results in Table 8 below, the actuarial model shows the accelerated RRIF transfer would decrease the actuarial present value of the estate by $1,805.

Table 8
Key Metrics for Alternative Strategies in High Income Case Study

Option	Ruin Probability	Actuarial Value of Estate	Average Years to Ruin
a) No discretionary transfers	0.04%	$4,247,705	21.5
b) Extra transfer from RRIF in 1st year	0.04%	$4,245,900	21.4

While outcomes are mostly favourable if both deaths occur within the first five years or so, outcomes tend to be unfavourable if either person lives longer, due to loss of tax sheltering of investment earnings. The stochastic trials with the most extreme differences appear to be attributable to complex interactions between income-splitting and the sequence of investment returns.

5. Conclusions

In every case study, it was observed that longevity is a key determinant of the success or failure of a drawdown strategy. Examination of outcomes year by year often shows that de-registering RRIF securities a few years before death will pay off but keeping securities in a non-registered account for a long time reverses the effect. This pattern is particularly pronounced in the High Income case study. Unless death is reasonably imminent, an approach to the drawdown decision that is based on a single age at death will mask the importance of the time horizon.

The impacts of drawdown decisions indicated by single scenario calculations from the Die Broke case study are large and not consistent with the results of more thorough analysis. The inconsistency is mostly because there is no way of knowing from analysis of a single time horizon whether the conclusion is applicable to a broad range of possible ages at death, or whether the selected age is representative of any kind of reasonable average of good and bad outcomes. The absolute magnitude of the differences in values is because there is no balancing of good and bad outcomes.

Limited investigation of alternative investment risk and return assumptions and marginal effective tax rates from different provinces did not suggest that these are important determinants of the success or failure of a drawdown strategy. This may be because all provinces have marginal effective tax rates that are very far from monotonic. With even modest investment risk, it is difficult to say with confidence that future marginal effective tax rates will be higher or lower than current marginal effective tax rates. Good and bad investment outcomes translate into success or failure of drawdown strategies, dampening the effect of a drawdown strategy and any particular set of tax rates or assumptions on actuarial present values.

Transferring securities from a RRIF to a TFSA can tend to work out very well, as it did in the Low Income case study. However, in other cases where it might appear to be desirable, complications can arise to undermine the strategy. This is seen in the TFSA Exception case study (where the flaw in making RRIF withdrawals to support a TFSA contributions lies in ignoring the situations where the strategy fails). It is also seen in the Die Broke case study, where strategies involving TFSA contributions do indeed increase the present value of the estate but, perhaps unexpectedly, also increase the ruin probability – a measure of the risk of financial distress when returns are unfavourable.

An approach to the drawdown decision that fails to take account of sequence-of-returns risk can lead to accelerated withdrawal decisions that increase downside risk more than they improve upside opportunity. The Die Broke case study shows how variability of investment returns can interact with a fixed rate of spending to increase risk. In general, it would appear that strategies of paying tax sooner to avoid higher tax later are rarely as effective as they would at first appear.

The challenge of drawing clear and convincing conclusions is even greater for couples than for singles. Pension-splitting and the effect of the first death on living expenses significantly expand the uncertainty around marginal effective tax rates. A modest difference in investment returns can lead to an entirely different income split, with the effective tax rate applicable to the drawdown strategy including phase-out of GST credits for the lower income spouse rather than OAS clawbacks for the higher income spouse. Differences in government benefits and spending needs that arise after the death of the first spouse will clearly play a role in assessment of drawdown strategies, but the nature of that role is obscured by uncertainty as to when the period of survivorship will begin and end. Again, the effect of this uncertainty seems to be to dampen both the expected benefit and the confidence one can take in any drawdown decision strategy.

While there are sophisticated ways to approach the drawdown decision, the need for financial planners to cost-justify the effort and explain the conclusions to clients are serious obstacles. If a stochastic model is already being used to provide advice on asset mix or sustainable spending, then that model can enhance the quality of advice concerning the drawdown of different types of accounts. However, care must be taken to ensure the model accurately reflects income-splitting and government benefits that are administered outside the tax system.

It is unlikely that any depth of analysis could lead to a drawdown decision strategy that could be implemented and applied for an extended period of time without review. As circumstances change from year to year, the merits of drawdown options will change. Judgment will be required, particularly in light of the many considerations that were outside the scope of this research.

Future Research

There are limitations to the applicability of this research and ways future research could provide better insights. These are noted below, with the most promising avenues of research listed first:

- More sophisticated long-term optimization of strategies (perhaps including doubly stochastic analysis, with a new optimal strategy introduced at each instantiation of the stochastic projection)
- The use of utility functions or other metrics to give different weights to favourable and unfavourable returns, or to combine the desirability of a large estate with the undesirability of financial distress into a single metric
- Explicit actuarial modelling of morbidity
- Integration of private professional corporations, charitable foundations and other repositories of wealth
- Improved analysis of taxes on different types of investments and strategies for optimizing the allocation of investments to different types of accounts
- More sophisticated models for the distribution of investment returns and inflation

Appendix A: Technical Terms and Acronyms

Registered Retirement Savings Plan (RRIF)

A RRIF is the payout phase of a tax-deferred retirement savings account. This includes:

- A Registered Retirement Savings Plan (RRSP);
- A Registered Pension Plan (either the account balance of a defined contribution pension plan or, subject to transfer limits, the commute valued of a defined benefit pension plan);
- A Pooled Retirement Pension Plan (PRPP); or
- A Deferred Profit Sharing Plan (DPSP)

When funds are transferred from a registered pension plan or a PRPP, some or all may be "locked in" and subject to maximum annual withdrawal limits. This kind of RRIF is called a Locked-in Income Fund (LIF) or Locked-in Retirement Income Fund (LRIF).

Contributions to these plans, whether made by an individual or by their employer or spouse, are tax-deductible. Withdrawals are taxable as ordinary income, irrespective of whether the withdrawals are made in cash or through transfers of securities. Investment income is not subject to taxation (except withholding on investments outside North America). Favourable tax treatment of capital gains and Canadian dividends is lost.

Tax-Free Savings Account (TFSA)

Contributions to these plans are made from after-tax income and are not deductible. Investment income and withdrawals are not taxable (except withholding taxes on investments outside Canada) and are not included in the definition of net income for the determination of income-tested benefits. Contribution room accumulates from at age 18 until death at a rate of $6,000 per year (plus inflation adjustments after 2022). There is no restriction on contributions to a spouse's plan. Withdrawals add to the following year's contribution room (i.e. money that is taken out can be put back in a future year).

Ruin Probability

This is the likelihood of all account balances reaching zero before death in a stochastic projection. It reflects both variability of investment returns and the distribution of ages at death. It is used as an indicator of the risk of financial distress.

Actuarial Present Value of Estate

The actuarial present value of the estate is a way of combining all of the outcomes of an actuarial model into a single number. It is a weighted average of all possible ages at death and all possible investment balances. In each instance, the account balances at death are totalled and estate taxes are calculated and deducted. The resulting after-tax estate available to pay to beneficiaries is discounted for the time value of money at the model's risk-free real rate of return.

Effective Tax

Effective Tax Rate is a term used to encompass all the changes in disposable income arising from an increment in income from private sources (such as RRIF withdrawals and investment income). It encompasses federal and provincial income taxes and credits, income-tested federal and provincial cash benefits (such as OAS and property tax rebates), premiums and contributions tied to provincial programs (such as pharmacare) and provincial benefits for low-income households (such as dental care and access to social housing). It also encompasses income-tested benefits sponsored by municipal governments and non-governmental organizations (such as transit passes and utility company subsidies).

Income

Different measures of income are defined for income tax and benefit calculation purposes

Net Income before Adjustments

- Net Income before social benefit repayments
- used to calculate clawbacks of EI & OAS
- used for GIS and provincial seniors' supplements (after deduction of full OAS)

Net Income

- Line 23600 on the tax return
- Most widely used for income-tested benefits
- Includes workers' compensation and other types of non-taxable income
- Does not include deduction for capital losses carried forward

Total Income

- Not widely used for determining social benefits, since it includes expenses incurred in earning income
- Sometimes used for benefits administered as part of the social assistance net

Taxable Income

- Used to determine tax brackets for basic federal & provincial taxes
- Not used for income-tested credits & benefits

Household Income

- Used to determine sales tax credits and other federal and provincial benefits
- Combined income is used for a couple, usually applied in conjunction with thresholds that are around 150% of single thresholds

Appendix B: Taxes and Clawbacks:

The table at the end of this Appendix itemizes all of the taxes, credits and benefits that are incorporated in the actuarial model. With few exceptions, each tax or benefit phase-out can be broken into pieces, consisting of a minimum, a maximum and a rate. For the actuarial model, tax and phase-out rates are prepared in advance of the simulation. Taxes paid on individual income both before and after death are determined using simulated taxable income (separately for each individual in a couple). Benefits receivable during an individual's lifetime are determined using simulated household net income.

Basic Tax

The federal government and all provincial governments use a progressive structure of tax rates for brackets of taxable income. Non-refundable tax credits are applied to reduce basic tax at the same rate as the first bracket, creating a bottom tax-free bracket. The size of this bracket is modeled by aggregating the following non-refundable brackets

- Basic Personal Amount
- Age amount
- Pension Income Amount

In the actuarial model, capital losses are always carried forward (even though tax rules permit them to be carried back 3 years) and applied to future capital gains or (for estate taxation only) ordinary income.

Sales Tax Rebates and Provincial Support

Most income-tested tax rebates are claimed in the annual tax return based on household income and paid outside the return in the following year. They are typically fully phased out at income levels lower than the bottom of the OAS clawback range.

- The GST/HST credit is paid in quarterly instalments from July to June, based on the prior year's household net income.
- Alberta, Ontario and British Columbia all provide supplements to GIS.
- Alberta and Ontario residents are subject to the federal carbon tax and eligible for rebates that, although claimed as part of the annual tax filing process, are not linked to income. BC operates its own system of carbon taxes and income-tested rebates.
- Ontario Trillium sales and property tax credits are paid as part of the annual tax filing process, based on household net income.
- BC provides a variety of renter's assistance, rent-geared to income and homeowner grants for seniors in different situations. The actuarial model includes the Low Income Grant Supplement, paid subject to an income test to homeowners who qualify for the Homeowner Grant (which is not income-tested and not reflected in the actuarial model). BC programs for low-income seniors who are not homeowners appear to have similar income limits and monthly amounts. The benefit formulas for these programs are complex and not clearly documented on government websites.
- Alberta does not provide property or sales tax credits
- Alberta provides a significant income-tested supplement to individuals who reside in provincially supervised long-term care facilities. This is included in the illustration of effective tax rates for disabled seniors. Ontario and BC also provide provincial support for long-term care but the support does not take the form of income supplements and is not included in the illustration.

In the actuarial model:

- Benefits based on household net income are calculated using net income excluding OAS (the definition used for GIS). For income-tested benefits that are based on household net income including OAS, the applicable minimums and maximums are adjusted by the full age 65 OAS pension. As a consequence, the applicable income range for these credits is slightly mis-stated when OAS is different (e.g. after 75).
- Credits and benefit based on individual net income are combined with basic taxes and calculated using taxable income. The differences between taxable income and net income are due to income splitting and the deduction of capital losses carried forward from prior years.

Health-related Benefits and Credits

Canada's federal and provincial governments have a major role in the provision and funding of health-related services. Some of these programs are related to income, means and/or health status.

- Funding provisions that are tied to income (such as the Ontario Health Premium) are part of the effective tax rate calculation.
- Benefits that are subject to a means test are disregarded, even if they are also subject to an income test (such as dental care reimbursements in BC)
- Benefits that are subject to an income test but not a means test and are routinely used by healthy and unhealthy individuals alike (such as seniors' dental care reimbursements in Alberta and Ontario) are part of the effective tax rate calculation
- Non-refundable credits and income-tested government benefits that depend on health care expenditures or health status can alter effective tax rates for individuals when they are triggered by a decline in health.

This last category presents a tax-planning challenge, since an individual in good health might not be able to foresee future changes in effective tax due to declining health.

- The federal and provincial **Disability Amount** tax credits are available regardless of income but provide no benefit when an individual's income is low enough that taxes would be nil even without the credit. Thus, these credits reduce the effective tax rate by extending the range of incomes on which no income tax is payable. An accelerated RRIF withdrawal intended to avoid a future increase in effective tax rates might not be as effective as planned if an individual becomes eligible for disability tax credits before the withdrawal would otherwise be required.
- The federal and provincial **Medical Expense Tax Credit**s are subject to a deductible of 3% of income (to a fixed dollar amount). These credits reduce the effective tax rate over a band of income by extending the range of income on which no income tax is payable. Assuming eligible medical expenses exceed the deductible but are not enough to bring taxes down to zero, they slightly increase the effective tax rate on a band of income, up to the point where the fixed dollar deductible applies.
- **BC Fair Pharmacare** reimbursements for prescription drug costs are subject to income-related deductibles and co-payments. The percentage of covered individuals who receive benefits ranges from 24% at ages 65-69 up to 81% at ages over 90 (BC Ministry of Health 2021). Some of those beneficiaries would have drug costs in excess of the maximum and so not receive reduced benefits due to a RRIF withdrawal or increase in non-registered investment income. For the most part, the adjustments to reimbursements are gradual but there is a $487 reduction in maximum benefits when household income reaches $30,001. The deductible and income-related maximum copayment continue to increase until household income reaches $315,000 and the maximum copayment reaches $10,000. There is the potential to increase effective tax rates over a wide range of income. The full potential increase would apply if prescription drug costs exceed the income-related deductible but not the income-related maximum copayment.

- All provinces provide some form of subsidized assisted living or nursing home accommodation. Programs are generally subject to availability and/or a means test but the **Alberta Supplementary Accommodation Benefit** is integrated with the Alberta Seniors Benefit and the federal Guaranteed Income Supplement. It provides for the cost of accommodation, structured so that rent in public facilities is covered by OAS, GIS, the Alberta Seniors Benefit and the supplement. For individuals requiring this kind of care, the effect is an increase in the effective tax rate over a narrow band.

As noted in the discussion of out-of-scope considerations, the Canada Caregiver Amount is one of many income-related government credits and benefits not addressed in the model.

Itemized Tax and Clawback Rates

The table below shows the parameters used in the actuarial model to determine taxes. Except for the pieces at the end of the table with special formulas, the tax attributable to each row (if it applies) is determined by multiplying the "Rate" by the part of the income base that lies between the "Lower" and "Upper" bound.

Income-tested government benefits are shown with an income range of one dollar and a rate equal to the benefit that would be paid if income were at the bottom of the range. When combined with the phase-out pieces, this produces a total benefit of nil when income (as defined by the relevant "Income Base") exceed the upper bound of the top phase-out range. While the inclusion of these base benefit amounts does not affect effective tax rates, it does ensure that the totals of taxes and benefits in some interprovincial comparisons realistic. Government benefits that are not subject to income tests, such as federal carbon tax rebates, are not included and so this approach does not completely describe government transfers to individuals or provincial variations.

In some instances, government benefits depend on factors other than income, such as property taxes payable or prescription drug costs. In other instances, details of the limits and rates were not readily available from government websites or other sources. In these instances, reasonable estimates were made based on available information.

Table B-1: Itemized Effective Tax Rates

Description	Jurisdiction	Special	Income Base	Width	Rate	Lower	Upper
GIS - single base amount	Federal	65	Single excl OAS	1	-11659.1	(1)	-
GIS - single below top-up	Federal	65	Single excl OAS	2,040	50%	-	2,040
GIS - single top-up	Federal	65	Single excl OAS		75%	2,040	9,096
GIS - single above top-up	Federal	65	Single excl OAS		50%	9,096	***19,790***
GIS - Married base amount	Federal	65	Household excl OAS	1	-14036.58	(1)	-
GIS - Married below top-up	Federal	65	Household excl OAS	4,080	50%	-	4,080
GIS - Married top-up	Federal	65	Household excl OAS		75.00%	4,080	8,070
GIS - Married above top-up	Federal	65	Household excl OAS		50%	8,070	26,078
Basic Tier 1	Federal		Net Income		15%	-	**50,197**
Basic Tier 2	Federal		Net Income		20.50%	50,197	**100,392**
Basic Tier 3	Federal		Net Income		26%	100,392	**155,625**
Basic Tier 4	Federal		Net Income		29.38%	155,625	**221,700**
Basic Tier 5	Federal		Net Income		33%	221,700	99,999,999
Personal NRTC	Federal		Net Income		-15%	-	**14,398**

Description	Jurisdiction	Special	Income Base	Width	Rate	Lower	Upper
Pension NRTC	Federal		Net Income	**2,000**	-15%	14,398	14,398
Age NRTC	Federal	65	Net Income	***7,898***	-15%	14,398	22,296
Age Amount Phase-out	Federal	65	Net Income		2.25%	***39,826***	92,481
GST Credit - single	Federal		Single excl OAS		***-306.176***	(1)	-
GST Additional Credit - single	Federal		Single excl OAS		-2.00%	***2,120***	***10,158***
GST Credit Reduction - single	Federal		Single excl OAS		5%	***32,026***	38,150
GST Credit - couple	Federal		Household excl OAS		-612.352	(1)	-
GST Credit Reduction - couple	Federal		Household excl OAS		5%	***24,228***	36,475
Eligible Dividend Tax Credit	Federal	Not used	Eligible Dividends		15%		
Non-eligible Dividend Tax Credit	Federal	Not used	Small Businesses				
Disability amount	Federal	Disabled	Net Income	***8,870***	-15%	***22,831***	31,701
Caregiver amount for spouse	Federal	Not used		2,295		13,808	
Canada Caregiver credit phase out	Federal	Not used				***17,670***	
Basic Tier 1	BC		Net Income		5.06%	-	**43,070**
Basic Tier 2	BC		Net Income		7.70%	43,070	**86,141**
Basic Tier 3	BC		Net Income		10.50%	86,141	**98,901**
Basic Tier 4	BC		Net Income		12.29%	98,901	**120,094**
Basic Tier 5	BC		Net Income		14.70%	120,094	**162,832**
Basic Tier 6	BC		Net Income		16.80%	162,832	**227,091**
Basic Tier 7	BC		Net Income		20.50%	227,091	99,999,999
Personal NRTC	BC		Net Income	**11,302**	-5.06%	-	11,302
Pension NRTC	BC		Net Income	**1,000**	-5.06%	11,302	11,302
BC Tax Reduction	BC		Net Income	***9,706***	-5.06%	11,302	21,008
BC Tax Reduction Factor	BC		Net Income	-	3.56%	***21,868***	21,868
Age NRTC	BC	65	Net Income	***5,068***	-5.06%	21,008	26,076
Age Amount Phase-out	BC	65	Net Income		0.76%	37,730	71,546
Fair Pharmacare Tier 1	BC	Disabled	Net Income		1.15%	12,000	30,000
Fair Pharmacare Tier 2	BC	Disabled	Net Income		650.00	30,000	30,001
Fair Pharmacare Tier 3	BC	Disabled	Net Income		3.67%	30,001	45,000
Fair Pharmacare Tier 4	BC	Disabled	Net Income		3.25%	45,000	308,000
Shelter Aid for Elderly Renters	BC	Not used	Single excl OAS		- 979.20	(1)	-
SAFER	BC	Not used	Single excl OAS		3.20%	-	22,801
Homeowners Grant Supplement	BC	65	Single excl OAS		(275.00)	(1)	-
HGS phase-out	BC	65	Single excl OAS	2,000	137.50	25,200	25,201
HGS phase-out	BC	65	Single excl OAS	32,000	137.50	27,200	27,201

Description	Jurisdiction	Special	Income Base	Width	Rate	Lower	Upper
Homeowners Grant Supplement	BC	65	Household excl OAS		(275.00)	(1)	-
HGS phase-out (couples)	BC	65	Household excl OAS	2,000	137.50	20,401	20,402
HGS phase-out	BC	65	Household excl OAS	32,000	137.50	22,401	22,402
BC Seniors Supplement - single	BC	65	Single excl OAS		-1220.198	(1)	-
BC Seniors Supplement phase-out	BC	65	Single excl OAS		50.00%	12	2,101
BC Seniors Supplement phase-out	BC	65	Single excl OAS		75.00%	2,101	2,336
BC Seniors Supplement - couple	BC	65	Household excl OAS		(2,709.50)	(1)	-
BC Seniors Supplement phase-out	BC	65	Household excl OAS		50.00%	12	4,190
BC Seniors Supplement phase-out	BC	65	Household excl OAS		75.00%	4,190	5,017
Disability Amount	BC	Disabled	Net Income	8,303	-5.06%	26,076	34,379
Disability Supplement	BC	Not Used	Net Income				
BC Climate Action Tax Credit (single)	BC		Single excl OAS		-193.5	(1)	-
BC Climate Action Credit Reduction	BC		Single excl OAS		2%	28,343	38,018
BC Climate Action Tax Credit (couple)	BC		Household excl OAS		(387.00)	(1)	-
BC Climate Action Credit Reduction	BC		Household excl OAS		2%	26,567	45,917
BC Sales Tax Credit (single)	BC		Single excl OAS		-75	(1)	-
BC Sales Tax Credit Reduction (single)	BC		Single excl OAS		2%	7,201	10,951
BC Sales Tax Credit (couple)	BC		Household excl OAS		-150	(1)	-
BC Sales Tax Credit Reduction	BC		Household excl OAS		2%	2,402	9,902
BC Dividend tax credit	BC	Not used	Eligible Dividends		12%		
Disability amount phase out	BC	Disabled	Net Income				
Caregiver Credit	BC	Disabled	Net Income	4,844			
Basic Tier 1	Alberta		Net Income		10%	-	131,220
Basic Tier 2	Alberta		Net Income		12%	131,220	157,464
Basic Tier 3	Alberta		Net Income		13%	157,464	209,952
Basic Tier 4	Alberta		Net Income		14%	209,952	314,928
Basic Tier 5	Alberta		Net Income		15%	314,928	99,999,999
Personal NRTC	Alberta		Net Income	19,369	-10%	-	19,369
Pension NRTC	Alberta		Net Income	1,491	-10%	19,369	19,369
Age NRTC	Alberta	65	Net Income	5,397	-10%	19,369	24,766
Age Amount Phase-out	Alberta	65	Net Income		1.50%	40,179	76,159
Disability Amount	Alberta	Disabled	Net Income	14,940	-10%	24,766	39,706
Attendant care expenses	Alberta	Not used	Net Income	11,212	-10%	39,706	50,918
Caregiver Credit	Alberta	Not used	Net Income	11,212	-10.00%	17,826	29,038
Senior's benefit - single	Alberta	65	Single excl OAS		-3431	(1)	-

Description	Jurisdiction	Special	Income Base	Width	Rate	Lower	Upper
Senior's benefit clawback	Alberta	65	Single excl OAS		15.60%	-	21,994
Senior's benefit - couple	Alberta	65	Household excl OAS		-5146	(1)	-
Senior's benefit clawback	Alberta	65	Household excl OAS		15.64%	-	32,903
Alberta Accommodation Benefit	Alberta	Disabled	Single excl OAS		-8340	(1)	-
Accommodation Benefit clawback	Alberta	Disabled	Single excl OAS		1	13,513	21,853
Alberta Accommodation Benefit	Alberta	Disabled	Household excl OAS		-10056	(1)	-
Accommodation Benefit clawback	Alberta	Disabled	Household excl OAS		1	21,891	31,947
Dividend Tax Credit	Alberta	Not used	Eligible Dividends		8.12%		
Dental & Optical - Single	Alberta	65	Single excl OAS		- 1,000	(1)	-
D&O Single phase-out	Alberta	65	Single excl OAS		41.86%	21,487	23,876
Dental & Optical - Couple	Alberta	65	Household excl OAS		-2000	(1)	-
D&O Couple Phase-out	Alberta	65	Household excl OAS		41.84%	42,972	47,752
Basic Tier 1	Ontario		Net Income	6,226	5.05%	-	46,226
Basic Tier 2	Ontario		Net Income	6,228	9.15%	46,226	92,454
Basic Tier 3	Ontario		Net Income	7,546	11.16%	92,454	150,000
Basic Tier 4	Ontario		Net Income	70,000	12.16%	150,000	220,000
Basic Tier 5	Ontario		Net Income		13.16%	220,000	99,999,999
Personal NRTC	Ontario		Net Income	11,141	-5.05%	-	11,141
Pension NRTC	Ontario		Net Income	1,541	-5.05%	11,141	11,141
Age NRTC	Ontario	65	Net Income	5,440	-5.05%	11,141	16,581
Age Amount Phase-out	Ontario	65	Net Income		0.7575%	40,495	76,762
Health Premium Band 1	Ontario		Net Income	20,000	6%	20,000	25,000
Health Premium Flat Band 1	Ontario		Net Income	25,000	0%	25,000	36,000
Health Premium Band 2	Ontario		Net Income	36,000	6%	36,000	38,500
Health Premium Flat Band 2	Ontario		Net Income	38,500	0%	38,500	48,000
Health Premium Band 3	Ontario		Net Income	48,000	25%	48,000	48,600
Health Premium Flat Band 3	Ontario		Net Income	48,600	0%	48,600	72,000
Health Premium Band 4	Ontario		Net Income	72,000	25%	72,000	72,600
Health Premium Flat Band 4	Ontario		Net Income	72,600	0%	72,600	200,000
Health Premium Band 5	Ontario		Net Income	200,000	25%	200,000	200,600
Health Premium Flat Band 5	Ontario		Net Income	200,600	0%	200,600	99,999,999
GAINS (single)	Ontario		Single excl OAS		(996)	(1)	-
GAINS clawback	Ontario		Single excl OAS		50%	-	1,992
GAINS (married)	Ontario		Household excl OAS		(1,992)	(1)	-
GAINS clawback	Ontario		Household excl OAS		50%	-	3,984

Description	Jurisdiction	Special	Income Base	Width	Rate	Lower	Upper
Ontario Sales Tax Credit -single	Ontario		Single excl OAS	332	- 332	(1)	-
OSTC phase-out - single	Ontario		Single excl OAS	25,514	4%	17,715	26,009
OSTC - couple	Ontario		Household excl OAS		- 664	(1)	-
OSTC phase-out - couple	Ontario		Household excl OAS	31,891	4%	16,294	32,882
Ontario Energy & Property Tax Credit - single	Ontario		Single excl OAS		- 1,308	(1)	-
OEPTC phase-out single	Ontario		Single excl OAS	31,891	2%	24,093	89,475
OEPTC - couple	Ontario		Household excl OAS		- 1,308	(1)	-
OEPTC phase-out - couple	Ontario		Household excl OAS	38,270	2%	22,672	88,054
Senior homeowner property tax credit	Ontario	65	Single excl OAS		- 500	(1)	-
SHOPTC phase-out - single	Ontario	65	Single excl OAS	35,000	3.33%	27,201	42,201
SHOPTC - couple	Ontario	65	Household excl OAS		- 500	(1)	-
SHOPTC phase-out - couple	Ontario	65	Household excl OAS	45,000	3.33%	29,402	44,402
Trilium Drug & Dental - single	Ontario		Single excl OAS		- 500	(1)	-
Trilium phase-out - single	Ontario		Single excl OAS	22,200	500	14,401	14,402
Trilium Drug & Dental - couple	Ontario		Household excl OAS		- 1,000	(1)	-
Trilium phase-out - couple	Ontario		Household excl OAS	37,100	1,000	21,502	21,503
Ontario Electricity Support (OESP)	Ontario		Single excl OAS		- 540	(1)	-
OESP Phase-out - single	Ontario		Single excl OAS	28,000	15.83%	24,590	28,000
OESP - couple (upper band)	Ontario		Household excl OAS		-480	(1)	-
OESP Phase-out - couple	Ontario		Household excl OAS	39,000	10.10%	34,250	39,000
Pieces with Special Formulas							
Surtax Tier 1	Ontario		Net Income	4,991	20%	4,991	
Surtax Tier 2	Ontario		Net Income	6,387	36%	6,387	
Tax reduction	Ontario		Net Income	514		-	-
Medical Expense Tax Credit	Federal	Disabled	Net Income	10,000	-15%	31,701	41,701
Medical Expense deductible	Federal	Disabled	Net Income	2,479	0.45%	-	82,633
Medical Expense Tax Credit	BC	Disabled	Net Income	10,000	-5.06%	26,076	36,076
Medical Expense deductible	BC	Disabled	Net Income	2,350	0.15%	-	78,333
Medical Expense Tax Credit	Alberta	Disabled	Net Income	10,000	-10%	39,706	49,706
Medical Expense deductible	Alberta	Disabled	Net Income	2,503	0.30%	-	83,433
Medical Expense Tax Credit	Ontario	Disabled	Net Income	10,000	-5.05%	39,706	49,706
Medical Expense deductible	Ontario	Disabled	Net Income	2,522	0.15%	-	84,067

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Appendix C: Methods and Assumptions

Inflation

All dollar amounts in the actuarial model are expressed in 2022 dollars. This means:

- There is an implicit assumption that annual spending will track CPI.
- There is an implicit assumption that non-indexed government benefits and thresholds will be updated on an ad hoc basis to keep pace with inflation, beginning in 2023.
- For sales tax credits and other benefits paid outside the tax system, the dollar amounts that will be applied to 2022 taxable income to determine payments in 2023 will be adjusted for CPI increases to a date in 2022 and are not yet known. A 2.4% inflation assumption is applied to the 2021 amounts.
- Rates of return on investments and investment balances are projected using a net, real rate of return (that is, after deducting inflation and investment management fees).
- The only place where an explicit long-term inflation assumption is required is in the determination of taxable capital gains. Inflation at a rate of 2% per year is applied to erode the real value of the Adjusted Cost Base and any loss carryforward balances.

Stochastic Projection

The actuarial model involves stochastic simulation of investment returns. Rather than assuming a single, fixed rate of return each year, random numbers are generated and used to produce different rates of return each year. These rates of return are used in year-by-year projections of income, taxes and account balances.

A 40-year projection with 1,000 trials involves 40,000 different random numbers, each producing a different rate of return. These in turn lead to different patterns of capital gains and losses and taxable income. Consequently, although a particular drawdown strategy might appear to save taxes over an individual's lifetime in a simple projection using a fixed rates of investment return, the stochastic simulation can find that it sometimes increases taxes because taxable income slip into a different bracket.

In year-by-year projections, prior year taxes and income-tested government benefits are applied to the non-registered account balance at the beginning of each year. No in-year investment income is attributed to C/QPP, private pensions, RRIF withdrawals or distributions of non-registered investment income. These sources of non-registered cash are used for spending, held to pay net taxes, or invested in the non-registered account at the beginning of the following year.

Distribution of Investment Returns

In the actuarial model, the pre-tax real rate of return for year t in trial n is given by the following formula:

$$r_{n,t} = e^{RFR+ERP+\sigma \cdot \varepsilon_{n,t}} - 1$$

where:

RFR	is the risk-free rate of return (the rate that could theoretically be attainable without any risk)
ERP	is the equity risk premium (the extra return that is expected because of riskier investments
σ	is the variability of returns attributable to riskier investments
$\varepsilon_{n,t}$	is a random number drawn from the standard normal (Gaussian) distribution

This formula means that the increase in value of an investment follows a lognormal distribution. The increase in value over a period of N years is

$$\prod_{n=1}^{N}(1+r_{n,t}) = e^{N \times (RFR+ERP) + \sigma \sum_{n=1}^{N} \varepsilon_{n,t}}$$

With this approach, the time-weighted average rate of return is the same regardless of the time period. The dollar-weighted rate of return will depend on the sequence-of-returns and the net cash flows in and out of the investment accounts. In particular, trials with below-average simulated returns in the early years will have lower long-term dollar-weighted average returns.

The reduction in long-term average returns due to volatility depends on the annual net cash flow out of the fund to meet living expenses. When the financial plan entails spending most or all of the funds over an individual's lifetime, the reduction in the simulated average dollar-weighted rate of return due to risky investments is particularly significant. This raises the question of what we mean by risk and what kind of investment would be considered risk-free.

- If a retiree's objective is to maintain a predictable account balance available to be spent (or distributed as part of their estate) on relatively short notice then the closest thing to a risk-free investment would be a bank savings account. Even this is not completely risk-free since it does not protect against inflation or financial institution insolvency.
- If a retiree's objective is to maintain predictable annual purchasing power then the closest thing to a risk-free investment would be a ladder of inflation-linked bonds. Unfortunately, the Government of Canada issues only a limited number of Real Return Bond series and it would be impractical to construct a ladder made up of these bonds without significant fluctuations in income between maturity dates. There are a few other Canadian issuers of inflation-linked bonds but their bonds are not widely traded.

Either way, retirees will be forced to accept some degree of risk and will seek to be compensated for the risk they assume. It is convenient to consider the risk-free rate of return and the premium for risky investment separately, with the variability of returns tied to the degree of risk. The actuarial model is developed using a set of reasonable baseline assumptions, with a moderate degree of risk. Sensitivity analysis is included to demonstrate the consequences of alternative assumptions or risk strategies.

This extremely simple approach to modelling investment returns provides a framework for comparing drawdown strategies. An economic scenario simulator designed for guiding investment policy or funding targets in a pension fund or insurance company would be considerably more complicated, with multiple asset classes, variability of returns that fluctuates with economic conditions, and links between inflation, interest rates and other economic variables. An economic scenario simulator designed for guiding personal financial planning choices around asset allocation and sustainable spending might have a mechanism for reflecting different asset mixes in different accounts and the natural decline in risk appetite with age.

Baseline Investment Return Assumptions

Risk-Free Rate (RFR = 0%)

In recent years, the rate of return on cash has been less than inflation, suggesting a negative real risk-free rate of return. Real Return Bond yields have been close to zero, with shorter term bonds trading at negative yields. While real risk-free yields were as high as 4% in the latter years of the 20th century, there is no reason to believe those sorts of yields will return any time soon. In fact, Canadian demographic trends predicate lower interest rates (Andrews 2020).

The baseline assumption is a risk-free rate of return of RFR = 0%, net of inflation and fees. This has the convenient feature that the actuarial present value of an estate is simply the average real after-tax value, weighted by probabilities of death at each future age.

Equity Risk Premium and Variability (ERP = 3%, σ = 9%)

The historical averages shown in Table C-1 below suggest an equity risk premium for a portfolio of 100% common stocks in the range of 4% to 6%, with a standard deviation in the range of 17% (CIA 2020). While real-return bond yields are not available for this entire period, it is worth noting that the standard deviation of the excess of stock market returns over the returns on long-term Government of Canada (nominal) bonds was similar to the values shown below. Thus, a retiree's objective does not have a major impact on the standard deviation of stocks relative to the kind of investment they would consider risk-free.

Table C-1: Real Rates of Return for the 75-year period from 1945 through 2019

Asset Class	Rate of Return (net of CPI)	Standard Deviation
Canadian 91-Day T-Bills	1.12%	n/a
Long-Term Government of Canada Bonds	2.52%	n/a
Canadian Common Stocks	6.56%	16.35%
U.S. Common Stocks (in Canadian dollars)	7.55%	17.17%

By simple interpolation, the equity risk premium on a portfolio that has half the risk of the total stock market would be in the range of 2% to 3% and the standard deviation of these returns would be in the range of 8% to 9%. Routine portfolio rebalancing can produce slightly higher average returns or lower risk. Active management and diversification beyond North American public stock markets also have the potential to improve the trade-off between risk and return, although the ability of active managers to outperform passive management, net of fees, is debatable.

Using RFR+ERP = 5%, σ =18%, the lognormal distribution of real returns, 2% inflation and 1% management fees would produce an arithmetic average gross nominal annual rate of return of 10% for a 100% allocation to equities.

Baseline values of RFR+ERP=3% and σ =9% and the lognormal distribution produce simple averages of simulated annual real rates of return of 3.46% and geometric averages (equivalent to a fixed rate of return) of 3.00%. The simulated standard deviation of annual returns is 9.38%.

It is acknowledged that nominal returns on bonds and stocks have been higher than this in recent decades. In the case of bonds, the historical returns can be explained by declining yields. The expected rate of return on a portfolio of bonds that will be held to maturity is the average yield-to-maturity calculated at the current market price (minus an allowance for defaults if necessary). Bond portfolio returns for historical periods are closely linked to the long-term yield at the start of the period. In the case of stocks, the link to bond yields or forward earnings yields at the start of the period is more tenuous but still present – at least for longer time horizons.

[4] *The Canadian Pensioners Mortality Table is applied with generational improvements according to the CPM-B table, beginning in 2022.*

Portfolio Characteristics with Tax Implications

Taxation of investment returns in a non-registered portfolio depends on the type of investments and the rate of portfolio turnover. For the purpose of determining tax on non-registered investment returns in the actuarial model, each year's return consists of a distribution (in the form of interest or dividends) and a capital gain. The baseline assumption for the distribution rate is 2% per annum, consistent with the long-term average dividend yield on common stocks (Ross 2022) and the current distribution yield on bonds (Vanguard 2022). The capital gain is the balance of the simulated rate of return (including the 2% inflation assumption). There is no explicit provision in the actuarial model for Canadian dividend tax credits or foreign withholding taxes.

In a passively managed portfolio, capital gains can accumulate over many years, without attracting taxation until securities are sold to pay living expenses or settle an estate. However, even index funds generate some capital gains and losses due to corporate reorganizations. Rebalancing of a portfolio will also lead to modest turnover. In an actively managed fund, turnover can be much higher. The baseline assumption is that 20% of the unrealized capital gains and losses will be realized each year. A higher percentage is applied when the net cash flow from the non-registered account exceeds 20% (typically during the last year before the account is exhausted).

For couples, as discussed below, there is no explicit acceleration of capital gains taxation on the first death. Since there is no separate projection of the survivor's adjusted cost base from each possible age at widowhood, capital gains are recognized at a fixed pace until the second death.

These simplifications of the true complexity of investment income tax are possible because the investment income used in the calculation of taxable income do not directly flow into the rollforward of account balances. The simplifications preserve

- the disproportionate importance of the estate tax bracket in the taxation of capital gains;
- the tendency for financial distress to occur when there are unrealized (and undeducted) capital losses; and
- relatively stable taxable distributions, in spite of volatile rates of return on market value.

Longevity

A deterministic financial projection requires only a life expectancy. To take account of the risk that an individual will live longer than expected requires an assumption about the distribution of ages at death. In the actuarial model for drawdown decisions, the probability an individual at age x will survival for one year to age $x+1$ is assumed to be

$$p_x = 1/(1 + e^{-14.2+0..135(x-f)})$$

This expression for the probability of survival is equivalent to saying that survival is a log-logistic function of age

$$\ln\left(\frac{p_x}{(1-p_x)}\right) = 14.2 - 0.135(x - f)$$

The constants in this formula were chosen to produce a life expectancy at age 65 of 87.7 years to match a standard male mortality table when the age adjustment factor f is zero. Life expectancies better or worse than this can be obtained by selecting a value for f greater or less than zero. Substituting the physiological age $x-f$ for an individual's chronological age x is a simple approach used in the insurance industry to adjust prices and reserves for life insurance and annuities. For example, an age adjustment factor of $f=2.5$ would produce a life expectancy almost 2.5 years longer and would be similar to the results for a female using the same standard table.

The distribution of ages at death is derived from survival probabilities using the following formula:

$$ {}_{t|}q_x = {}_{t-1}p_x - {}_tp_x $$

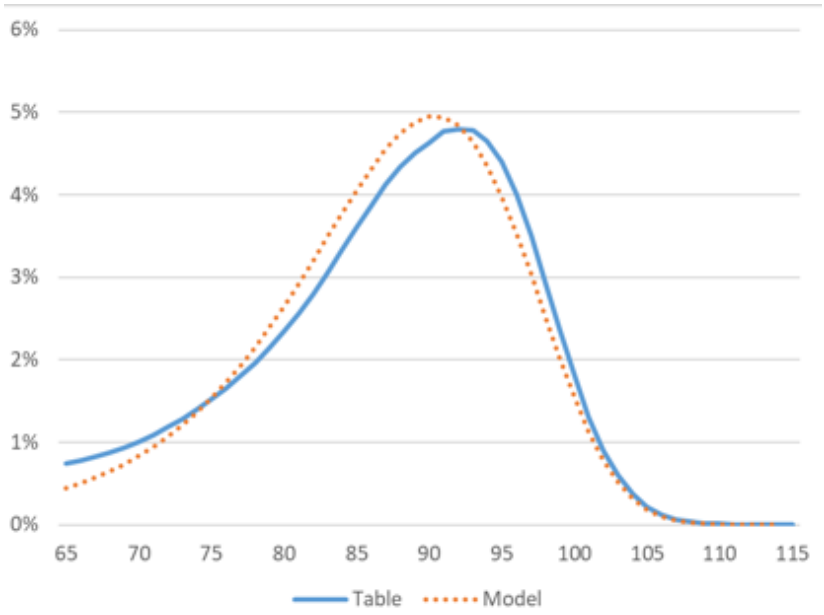
where ${}_tp_x$ is the multi-year probability of survival from age x to age $x+t$

$$ {}_tp_x = \prod_{s=0}^{t-1} p_{x+s} $$

The probability of being alive at the beginning of the projection is ${}_tp_x$=**100%** and so all of the individual probabilities in a distribution of ages at death will sum to 100%.

This approach comes close to reproducing results from the Canadian Pensioners Mortality Table, as illustrated in Figure C-1 below[4] . However, the distribution of mortality rates in a heterogeneous population is not the same as a simple blend of the distributions of mortality rates in homogeneous subpopulations: death rates for individuals increase more rapidly with age than death rates for the population as a whole. (Pitacco 2018).

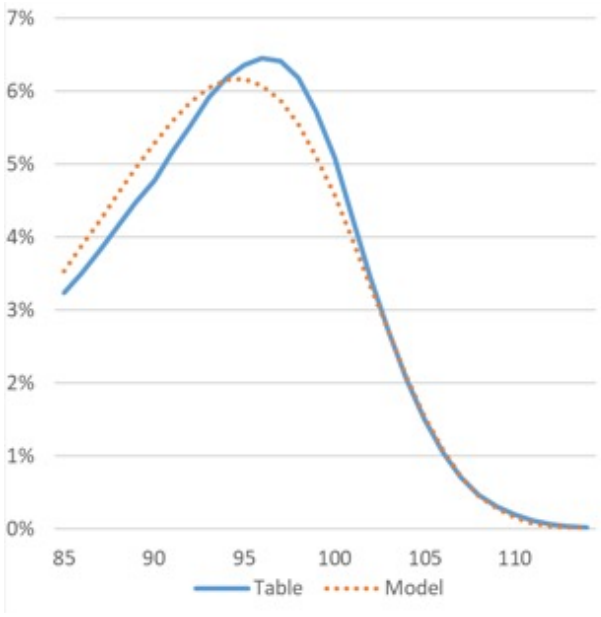
Figure C-1:
Distribution of ages at death compared to standard table – Male 65



In reality, an individual's life expectancy at age 65 could be as little as a few months (with a medical prognosis of shortened life expectancy) or as much as 30 years. The objective of the probability distribution used in the actuarial model is to assign reasonable weights to different possible outcomes of a drawdown strategy, and thereby permit an overall assessment of the value of the strategy. Precise tracking of a population table is not necessary.

The longevity assumption used in the actuarial model is robust, providing plausible distributions of ages at death over a wide range of retiree ages and life expectancies. This is illustrated in Figure C-2 below, comparing the distribution of ages at death for an 85-year old female. Mortality rates from the standard Canadian Pensioner Mortality table for females are reduced by a factor of 0.8, as might be appropriate for a woman who was employed in the education sector and has above-average income[5] . Model rates are calculated using a physiological age 4.3 years younger than age 85. In both cases, the average life expectancy at age 65 is age 91.8. The resulting life expectancy at age 85 is 95.5 years using the table and 95.1 years using the model formula.

Figure C-2:
Distribution of ages at death compared to adjusted table – Female 85



Note that, although the distribution of ages at death has been adjusted to reflect industry, gender and wealth characteristics, the underlying table remains a distribution designed to reflect the aggregate distribution in a population of pension plan members, rather than an individual's prospects. At age 85, most individuals will have health concerns but still have slightly better longevity prospects than this distribution. Some will have severe health impairments and significantly shorter life expectancies.

Joint Lives

Deterministic financial projections are often prepared using a single date of death for both individuals in a couple and making no provision for a period of widowhood. This is problematic for an analysis of drawdown tax strategies since effective tax rates and after-tax income can change significantly upon the first death. In the actuarial model, the probability that one, both or neither of the individuals will be alive at each year in the projection is calculated directly from the model formula for survival probability and the individuals' physiological ages.

It is widely understood that widows and widowers have elevated rates of mortality – especially in the first months and years after the death of a spouse. This is referred to as the broken heart syndrome. However, Moon (2013) suggests that the association between widowhood and mortality may be overstated, after taking account of other factors. The effect

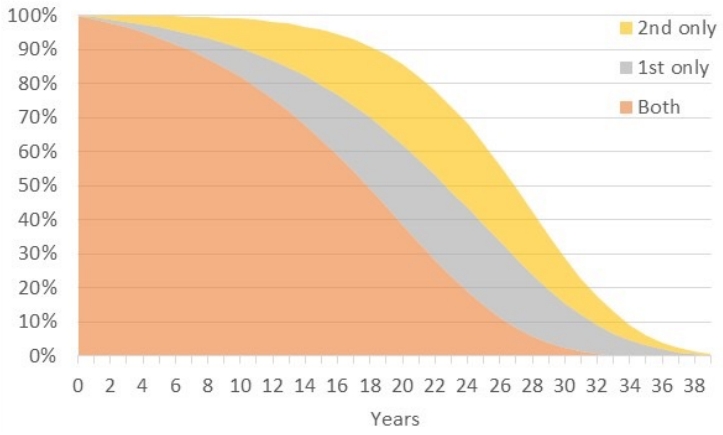
[5] *Pension Experience Committee (2014) describes variations in mortality by industry, sector and earnings and suggests a process for adjusting tables to reflect the circumstances of specific pension plans. Selection of the factor of 0.8 used here does not follow that process rigorously. The underlying table is the combined public and private sector table rather than the public sector table.*

might be to shorten the expected number of years of widowhood by less than one year[6] . Calculations in the model are performed assuming the mortality rates for couples are independent and the broken heart syndrome has no effect. That is, the probability that both individuals, age x and y, will be alive in a given year of projection is simply the product of their individual probabilities:

$$ {}_tp_{\overline{xy}} = {}_tp_x \times {}_tp_y $$

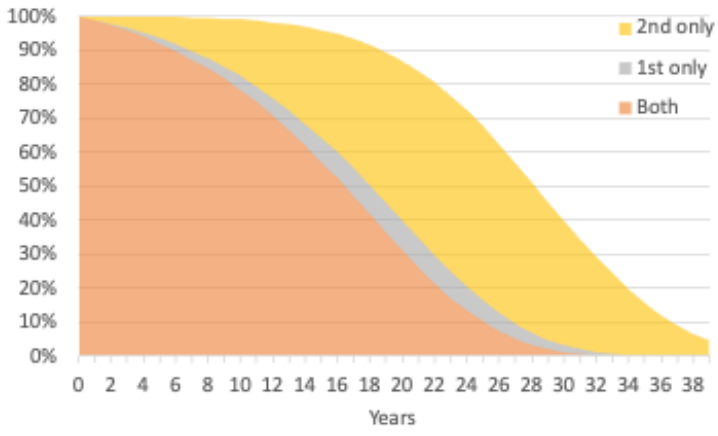
Figure C-3 below illustrates these probabilities, assuming both individuals have a physiological age of 65 at the beginning of the projection (age 65 with no age adjustment factors).

Figure C-3:
Survival probabilities for a couple (both with initial physiological age of 65)



The period of survivorship for a widow or widower receives significantly more weight in the actuarial model when the individuals have significantly different physiological ages, as illustrated in Figure C-4 below. This situation will not be uncommon, since men are often older than their wives.

Figure C-4:
Survival probabilities for a couple (initial physiological ages of 70 and 60)



[6] *Author's calculation using a 10% increase in mortality in all years after the year of first death*

Account Projections for Couples

When financial resources are pooled between spouses, additional opportunities and complexities arise:

- Whose income and assets will be used to pay living expenses?
- How will pension splitting alter effective tax rates on RRIF withdrawals?
- How will the situation change after the first spouse dies?
  - Loss of a spouse means loss of their monthly OAS benefit, a reduction in C/QPP benefits and, in many cases, a reduction in private pensions
  - Death of the first spouse triggers immediate taxation of that individual's capital gains
  - Some types of living expenses might decrease after the first death but if the deceased spouse was the housekeeper, handyman, driver or caregiver, other types of living expenses could potentially increase.

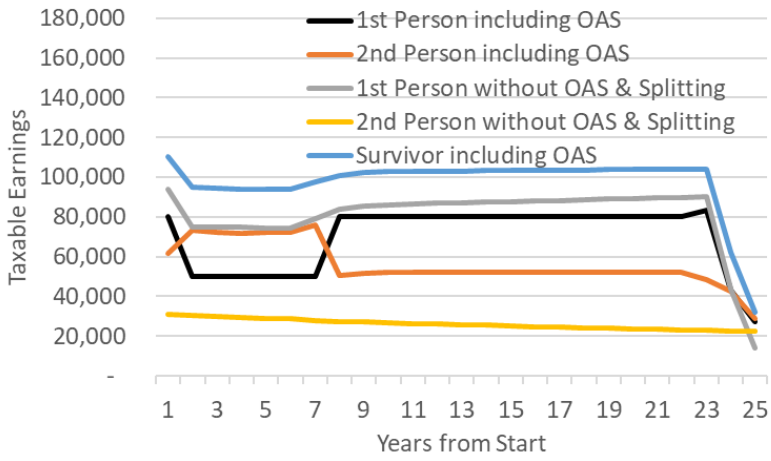
These matters change the parameters for the decision to accelerate RRIF withdrawals. The basic question of whether accelerated RRIF withdrawals lead to lower effective tax rates and better long-term outcomes remains the same.

Rather than simply projecting one individual's account balances, income, taxes and longevity, evaluating a couple's financial prospects involves projecting results for two connected individuals for the period while both are alive and another set of results for the period when only one is alive. One simplification in the model is to make no distinction based on which individual dies first. The distribution of ages at death is expressed in terms of age at first death and age at second death (based on combined survival probabilities). The assets and spending during the period of survivorship are unaffected by the order of the deaths.

The treatment of non-registered accounts presumes that an attempt will be made to equalize incomes. The non-registered account of the individual with the highest income is used to pay living expenses to the greatest extent possible. Pensions, investment income and minimum RRIF withdrawals payable to the spouse with the lower income will accumulate in their non-registered account while the non-registered account of the spouse with the higher income is being drawn down. Taxes are determined and deducted separately for each spouse (after splitting the gross pensions, with no transfer of withholding taxes).

Optimal pension splitting is determined by testing each possible split, ranging from 50% of the first spouse's RRIF and pension income to 50% of the second spouse's pension and income (in $1,000 increments). The optimal strategy is not always obvious because effective tax rates do not always increase as income increases. For example, the optimal strategy might be to lower one spouse's income to the bottom of the OAS clawback range, while raising the other spouse's income well above the top of the OAS clawback range. Splitting pension income within an effective tax bracket has no effect, and so the algorithm for determining the optimal split can give incomes anywhere within the bracket. In the illustration in Figure C-5 below, the first person's RRIF withdrawals in excess of the minimum are used to provide for living expenses beginning in the seventh year. Optimal income splitting brings the first person up to the bottom of the OAS clawback range, while shifting most of the Age Amount tax credit to the second person.

Figure C-5:
Illustration of Incomes with Deterministic Projection of Income



Discretionary transfers from a RRIF to a non-registered account or TFSA are applied to one spouse only. The allocation of RRIF withdrawals in excess of the minimum in order to pay living expenses is applied in proportion to each spouse's account balance. This allocation would typically have no effect on the outcome since income can be split for tax purposes in any event and a RRIF balance is rolled over to the surviving spouse on the first death. The actuarial model approach is to determine minimum RRIF withdrawals using the age of the younger spouse, and so minimum withdrawal rates do not change upon the first death.

TFSA balances are modelled in aggregate since either spouse may contribute and there are no tax consequences on withdrawal or death when the surviving spouse is the successor owner.

Projection of taxes and account balances after the first death involves adjustments to the balances that are first determined as if both spouses were still alive. The estate value on the second death is calculated as follows:

- Year-by-year adjustments to taxes, income-tested government benefits (including OAS) are determined based on the aggregate of investment income, pensions and RRIF withdrawals of the couple
- For each year of projection, the number of years of survivorship (given that the first death has already occurred) is estimated and the accumulated value of adjustments to net cash flow (including changes in living expenses and taxes) is calculated using the simulated investment rates of return over those years
- The accumulated value of adjustments is applied to reduce (or in some instances increase)
  - the combined non-registered account balance (disregarding second-order tax consequences of investment income on accumulated adjustments); or
  - the combined RRIF account balance, with the adjustment grossed up for taxes on withdrawal (if the accumulated value of adjustments exceeds the sum of the couples' non-registered account balances); or
  - as a last resort the combined TFSA balance (with no tax implications).
- The incidence of ruin and the after-tax value of the estate remaining on the second death are determined using these adjusted account balances.

The estimated number of years of survivorship at the beginning of year t is determined by an average of the past years when the first death might have occurred, weighted by the probabilities of a first death in each of those years:

$$t - \frac{\sum_{s=0}^{t-1} s\,({}_{s-1}p_{\overline{xy}} - {}_{s}p_{\overline{xy}})}{\sum_{s=1}^{t-1}({}_{s-1}p_{\overline{xy}} - {}_{s}p_{\overline{xy}})}$$

For example, in the first case study of a couple in Section 4, if the second death occurs between 19 and 24 years after the start of the projection, the calculation of the value of the second estate is adjusted for the extra draw beginning in the tenth year of the projection (assuming the first death occurred at age 75).

Using average years of survivorship rather than an explicit projection of a single life during the period following the first death avoids the need for nested projections. It supports determination of the value of the estate for the survivor at any future point in time, and thereby allows calculation of the actuarial present value of the estate and the ruin probability. This simplified approach does not support full projection or illustration of the distribution of account balances during the survival period.

The development of the account balances from one year to the next occurs in the following sequence of steps:

- A preliminary total of non-registered account net cash flows for the couple is determined, consisting of
  - Prior year's taxes, income-tested government benefits and OAS clawback
  - C/QPP and private pensions
  - OAS before clawback
  - Minimum withdrawals and any accelerated discretionary withdrawals from the RRIFs
- This preliminary total, along with the annual TFSA contribution is allocated to accounts:
  - From non-registered accounts if funds are available, favouring the lower income spouse
  - From the RRIFs to the extent non-registered fund balances are insufficient
  - From the TFSA in place of a TFSA contribution to the extent non-registered accounts and RRIFs are insufficient
- Net income excluding OAS are determined, consisting of
  - C/QPP and private pensions
  - RRIF withdrawals
  - Interest and dividend distributions from non-registered investments
  - 50% of realized net gains or losses (based on the adjusted cost base, investment returns up to the end of the year and the percentage of the account balance that is realized for net cash flow or routine turnover)
- The closing market values of account balances are determined, including
  - prior year's taxes and other cash flows, applied at the beginning of the year
  - the simulated rate of return for the full year
- The Adjusted Cost Base and loss carryforward balances are determined, including
  - The same net cash flows as used in the market value of the non-registered account
  - 100% of net gains or losses realized in current year taxes
  - Application of the Loss Carryforward
- GIS and other benefits that depend on net household income (excluding OAS) are determined
- Taxable income including net OAS is determined, adjusting for application of loss carryforwards, the OAS clawback, and optimal income splitting
- Taxes and OAS clawbacks are determined

Appendix D: Canadian Environment

Retirement Savings Vehicles

The Canadian income tax system offers several distinct options for when and how retirement savings will be brought into taxable income. Often, an individual will take advantage of two or three different vehicles and will move money from one to another over the course of their retirement. The salient tax characteristics of the three most important types of retirement saving accounts are summarized in Table D-1 below.

Table D-1: Tax Treatment of Retirement Savings Accounts

	Contributions	Investment Income	Withdrawals
Tax-deferred (RRIF)	Tax-deductible when made from employment earnings	No taxes (except overseas withholding taxes)	Taxed as ordinary income
TFSA	From after-tax income	No taxes (except U.S. and overseas withholding taxes)	No tax
Non-Registered	From after-tax income	Taxed when realized, with reductions for capital gains and Canadian dividends	No tax, except capital gains tax on previously unrealized gains

Tax-deferred retirement savings are accumulated during an individual's working career in

- Registered Retirement Savings Plans,
- Deferred Profit Sharing Plans,
- Pooled Retirement Savings Plans, and
- Registered Pension Plans.

Tax-deferred retirement savings must mature and be converted to plans that generate lifetime retirement income no later than age 71. Once they mature, no further contributions are permitted. Some options at maturity offer the opportunity to adjust the timing of withdrawals throughout retirement:

- RRIFs, including locked-in transfers from Registered Pension Plans and
- variable benefits from inside defined contribution Registered Pension Plans

Others do not:

- annuities,
- defined benefit pensions,
- Advanced Life Deferred Annuities, and
- Variable Payment Life Annuities.

While the focus of this research is on adjusting the timing of transfers from RRIFs and transfers to or from TFSAs or non-registered investment accounts, there are other kinds of financial instruments and assets with unique tax rules that can be used to meet general retirement income needs and specialized objectives. These include:

- annuities purchased with non-registered funds, including prescribed annuities and charitable annuities,
- universal life and other permanent life insurance products,
- personal-use real estate, including principal residences and cottages, in combination with Home Equity Lines of Credit and reverse mortgages,
- fine art, precious metals, investment real estate, and other specialty assets
- continuations of professional corporations,
- Registered Disability Savings Plans,
- Registered Education Savings Plans for children or grandchildren, and
- charitable foundations.

The principles developed in this research may be relevant to evaluation of these other kinds of retirement assets, although different detailed tax rates will apply.

Tax Expenditures, Social Security, Welfare

Developed economies have complex systems of

- progressive income taxation,
- universal programs to provide services like medicine and home care,
- income support programs like unemployment insurance and
- social assistance programs to alleviate the worst effects of poverty.

The government programs that are relevant to analysis of retirement savings drawdown strategies are those that are calibrated to income and likely to be accessed by senior citizens with retirement savings. We can disregard programs for children, employment-related programs, and means-tested programs. We can also disregard "boutique" benefits for veterans, Indigenous persons and other special groups, although retirees and their advisers will need to consider these programs if they are income-tested and applicable to their situation.

The three most important elements of Canadian government-sponsored retirement income and their implications for drawdown strategies are introduced here.

1. The Canada/Quebec Pension Plan (C/QPP) is a partially pre-funded social insurance program that provides monthly income based on each individual's contribution history. Once recent changes are mature, it will provide annual taxable income of up to $32,200, plus wage and price inflation adjustments[7]. Pensioners will receive less than this because the recent changes are being phased in over a 45-year period ending in 2065, but also in most cases because their contributory earnings were less than the maximum for more years than permitted by the drop-out provisions or they elected to start their pension prior to age 70. Commencement prior to age 70 instead of using RRIF withdrawals to support early retirement typically results in a significant lifetime loss (MacDonald 2020) and higher ruin probability. C/QPP benefits are included in net income for the purpose of determining taxes and income-tested government benefits. C/QPP pension sharing for couples is similar to pension splitting for RRIF and private pension income except that it must be requested in advance.

[7] *The maximum applicable after the changes are mature in 2065 is $1753.78 per month in 2019 dollars (Runchey 2019). This is adjusted for AYMPE increases to 2022 and the 42% postponed retirement adjustment.*

2. Old Age Security (OAS) is a universal income that provides taxable monthly income of $10,400 per year commencing at age 70 and increasing to $11,400 at age 75, plus price inflation adjustments. Most Canadians receive less than this because they elect to start the benefit at age 65 (ESDC Evaluation Directorate 2019), they have less than 40 years of residency, and/or they are subject to the social benefits repayment tax. The social benefits repayment tax is commonly referred to as the OAS clawback and can be a significant factor in drawdown strategies: it reduces the OAS pension (and net income) by 15% of "net income before adjustments" in excess of $79,845 (when 2021 tax returns are filed in 2022).
3. The Guaranteed Income Supplement (GIS) is a basic income program for individuals with ten years of residency in Canada who are receiving OAS or whose spouse is receiving OAS. The federal portion provides $11,400 of annual income for a single individual and $13,700 for a couple, with clawback rates ranging from 50% to 75% of C/QPP and other net income. There is no offset for OAS benefits and there are exemptions for small amounts of employment income.

The combined effect of these programs means that single seniors are entitled to a floor of after-tax government income between $13,000 and $30,000, depending on their years of residency, age, employment history and election to start benefits prior to age 70. For couples, the floor would range from $18,000 to $60,000. A floor of $21,000 to $25,000 per person per year would be typical. This can be an important consideration in drawdown strategies designed to minimize ruin probability: a TFSA can be used to bridge the gap between government benefits and the annual spending target without eroding GIS.

These three core federal government income programs are supplemented by a host of continuously evolving federal, provincial and municipal government programs. In addition to the credits that are calculated and paid as part of the annual tax return process, there are income-tested benefits administered outside the tax system, varying partially or entirely based on net income. Provincial supplements to GIS are calculated using net income excluding OAS. Other provincial benefits are sometimes calculated using customized definitions of income.

The most important income-tested benefits for the purposes of drawdown decisions for healthy seniors are the age tax credit and sales and property tax credits. Income-tested health-related benefits include medical expense tax credits, caregiver tax credits, disability tax credits, subsidized rent in assisted-living facilities, and provincial drug plan premiums, deductibles and co-pays.

Inflation

Since 1992, the Bank of Canada's mandate has been to target a 2% inflation rate. With effective monetary policy tools and no competing objectives, this target has been largely achieved[8] . Even at this low and stable level, inflation remains an important element of the Canadian environment and long-term financial projections.

Most dollar amounts used to determine taxes and government benefits are automatically indexed to the Consumer Price Index. However, the actual spending patterns of seniors do not strictly follow CPI. The basket of goods and services they consume is different from the national average used to determine CPI and changes over the course of their retirement.

Taxation and Government Benefits for Couples

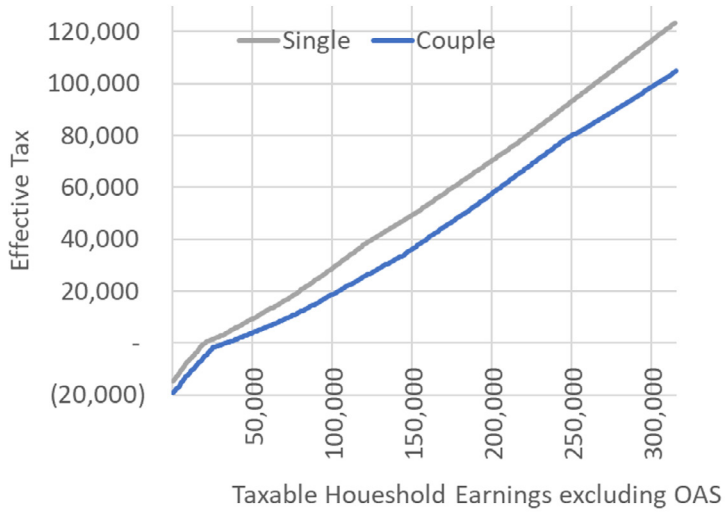
Canada does not follow the U.S. system of joint tax returns for couples. Instead, each individual files their own return, with the capacity to share unused deductions and up to half of their RRIF and pension income. Most income-tested government benefits paid outside the tax system are based on household income rather than individual income, with thresholds for

[8] *The CPI increased from 84.7 in December 1992 to 144.0 in December 2021, an average rate of increase of 1.85%. While the 12-month increase in Total CPI has slipped outside the 1% to 3% target range on several occasions, the less volatile policy benchmarks used by the Bank of Canada stayed inside the target range until the fall of 2021. It remains to be seen how quickly the widespread productivity losses and price increases associated with COVID-19 can be reversed.*

couples that are less than double the single household thresholds. Consequently, a surviving spouse will face significantly higher taxes and lower government benefits than the combined situation prior to the first death. The combination of taxes and income-tested government benefits for a given level of household taxable income is shown in Figure D-1 below. For illustration, it is assumed that the couple's income is split 50/50.

In addition to the increase in taxes and reduction in benefits shown below, the widow or widower will face a reduction in C/QPP benefits, complete elimination of their deceased partner's OAS benefits and (in some cases) a reduction in private pensions. If spending is to be maintained at the same level, additional funds will have to come from the combined RRIF, non-registered account or TFSA. If a RRIF is used, increased withdrawals will translate into even higher taxes and lower income-tested government benefits.

Figure D-1:
Effect of Income Splitting on Total Taxes and Benefits – Alberta 2022 Rates



Income Taxes at Death

Upon death, the entire RRIF balance and half of any unrealized capital gains in a non-registered account are recognized all at once. As a consequence, the effective tax rate applicable to an estate is often much higher than the tax rates that would have applied if RRIF withdrawals were made and capital gains were realized earlier.

There is an exception for rollover of RRIF balances to a spouse. While there are several options for a spouse in the year of death, as discussed in George (2018), they do not require any special attention for the purpose of drawdown strategy. Minimum withdrawals must be made, as usual. Additional withdrawals may also be made and may be included in the tax return for either the estate or the survivor.

Couples can elect to have their minimum drawdowns determined using the birthdate of the younger spouse, even after the first death. In the actuarial model, the entire RRIF balance is rolled over to the surviving spouse and the age of the younger spouse is used to determine the minimum drawdown throughout the projection.

Unlike taxes, income-tested benefits end at death. Consequently, the schedule of effective tax rates applicable to the calculation of the after-tax value of an estate is lower than the rates applicable to the year-by-year development of account balances.

Appendix E: Acknowledgements

The author is grateful to the individuals who contributed their time and expertise to support the preparation of this report, including the individuals recognized below. Any errors are the author's, not theirs.

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This research was funded and released by the
FP Canada Research Foundation, now known as
the Canadian Foundation for Financial Planning™

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October 2022 – REV September 2023