SPENDING AND SAVING IN THE RRIF/LIF YEARS
The Retiree's Calculator

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LIST OF ABBREVIATIONS AND INITIALISMS

Common abbreviations

CRA	Canada Revenue Agency
CPP	Canada Pension Plan
ETF	Exchange-Traded Fund
LIF	Life Income Fund
LIRA	Locked-In Retirement Account
MER	Management Expense Ratio
OAS	Old Age Security
RRIF	Registered Retirement Income Fund
RRSP	Registered Retirement Savings Plan
S&P	Standard and Poors
TSFA	Tax-Free Savings Account
TSX	Toronto Stock Exchange

Abbreviations used only in this study

B	Balance in RRIF or LIF
W	Withdrawal amount
TI	Taxable income
TP	Tax paid
NI	Net income

1. INTRODUCTION

How long will my retirement funds last? The question is an acute one for the millions of Canadians who have no workplace pensions or whose workplace supports only defined contribution plans. For them, RRSPs or workplace LIRAs are at the centre of their retirement finances and they have only guides like "4% withdrawals have a 95% chance of lasting 30 years in 3% inflation." That rule of thumb and others were developed in the well-known Trinity Study [1]-[3].

Unfortunately, in the year of their 71st birthday, retirees must convert RRSPs and LIRAs to RRIFs and LIFs, respectively (or the less-used option of annuities), and that changes everything. CRA imposes minimum withdrawal rates on RRIFs and LIFs, even if the retiree doesn't need the money at that time. LIFs also have a maximum withdrawal rate. There are several pernicious effects:

- In any fund subject to withdrawals, market downturns in the early years sap the subsequent ability of the fund to recover. The forced large withdrawals in early RRIF/LIF years exaggerate this problem and can quickly deflate the portfolio. The Trinity Study guidelines no longer apply.
- The unnecessarily large early withdrawals, even though followed by low withdrawals in later years, cause the retiree to pay more total income tax than if the same amount had been paid in the same number of constant withdrawals.
- The early forced increase in annual income may cause some retirees to suffer OAS "clawbacks."
- The LIF maximum withdrawal rate may prevent retirees from accessing their money, even if they need it. This becomes a problem in later years of the LIF.

If the Trinity Study guidelines to fund longevity do not apply to RRIF/LIF-holders, then what does? The present document may help. It is a calculator to show how your savings and income evolve (or devolve) in the post-71 world out to age 95, including when the money runs out. If you read it in Mathcad (the package in which I wrote it), then it is interactive - you can change numbers or conditions, and all the calculations and graphs change in response. If you are reading it as a simple PDF, you can mimic all the calculations in your favourite alternative system (e.g., Excel).

Like the Trinity Study, the calculator can incorporate historic market variability. Unlike that study:

- The calculator applies CRA-mandated variable withdrawal rates, instead of fixed withdrawals.
- The calculator allows you to stress-test your finances with fictitious future market behaviour by appending a selected section of the historical record - good, bad or boring - to follow 2013 of the true record. The Trinity Study stuck to what the market had actually produced over the years.
- The calculator allows use of historical inflation rates, as well as fixed inflation rates.
- Because RRIFs and LIFs are intimately tied to income tax, the calculator includes simplified taxation models and even accounts for possible OAS reduction caused by high initial withdrawals.
- The calculator acts to support your target for after-tax spending level for as long as possible, and tracks an external account where you save your forced excess income in the early years.
- On the drawback side, it considers only 44 years (1970 to 2013) of market history, instead of 72 years (1926-1997) of the Trinity Study, although it includes four such markets. It also considers only fixed returns for fixed income, instead of market returns. Later versions may be better.

Most readers will be interested only in this chapter, in Chapter 4, which provides many examples of calculated results for various financial circumstances and in Chapter 5, which gives a short critique of the calculator. Others will be interested in Chapter 2's component models of the calculator (RRIF/LIF withdrawal schedules, simple taxation models, OAS reduction, markets and inflation) and in the calculator itself, in Chapter 3.

This calculator is free, although it works interactively only if you read it in Mathcad. If you have the skills and the interest, I encourage you to improve it or to rewrite it for more accessibility (e.g., in Excel or in Java for server-side operation). If you do, please make the program free to all, just as I have.

Finally, the disclaimers:

- I am not a financial advisor, nor even an MBA. Instead, I am a retired professor of engineering, forced to learn things that didn't interest me because I am at the other end of a defined contribution plan.

- Although I have spent time and thought on it, I make no guarantee whatever about the accuracy of the calculator, and you use it at your own risk. In any case, nothing is hidden - you can read the code yourself to verify what it does.

3. A MONEY FLOW CALCULATOR FOR THE RRIF/LIF YEARS

3.1 About the Calculator

The big question: How long will our money last? The calculator in this chapter should give you some insight, although it doesn't claim to be exact - and of course the future will do whatever it will do.

The well-known Trinity Study [1],[2], which led to the "4% withdrawal in 3% inflation for 30 years with 95% success rate" rule of thumb, gave many and various answers to the big question. Contrast it with studies you can conduct yourself with this calculator:

- The Trinity Study considered only constant-sized withdrawals. The calculator instead accounts for the CRA-mandated variable withdrawal rates, which force larger withdrawals from a RRIF/LIF in the early years.
- The Trinity Study considered 72 years (1926-1997) of recorded rates of market return for bonds and equities (stocks). The calculator instead considers only 44 years (1970 to 2013) of stock market returns (though of four such markets) and only flat (constant) return values for fixed income.
- The Trinity Study stuck to what the market had actually produced over the years. The calculator instead allows you to stress-test your finances with fictitious future market value behaviour by appending a selected section of the historical record - good, bad or boring - to follow 2013 of the true record.
- The Trinity Study allowed only fixed inflation rate of various values. The calculator also allows use of historical inflation rates.
- The calculator also includes a simple model of your personal finance, including your other sources of taxable income and what you do with the excess funds from the early large withdrawals.

This chapter develops the calculator package, which consists of the calculator and some ancillary programs:

- *trajectories*(*A*), the calculator itself, which calculates all important quantities over the years;
- *argcheck*(*A*), which checks the validity of the argument values provided to the calculator;
- *goodbadyears*(*A*), which runs *trajectories*(*A*) over many different values of starting year *mktyear1* and records the age (your age) out to which each starting year can support the target spending level;
- *spendhisto*(*A*,*extflag*), which is similar to *goodbadyears*(*A*), but presents the results as a histogram of how many starting years support a given age out to which full spending at the target level is supported.

What you will see on the pages below are the actual program, since this document is written in Mathcad. Read it, and you can verify its operation for yourself.

Chapter 4, the next one, provides several examples of the calculator's use.

3.3 The Calculator Argument List

The longevities of the funds and the "trajectories" of account balances depend on many, many variables. Those variables are termed the "arguments" of the calculator. They are grouped and defined below.

About you

taxmodel	Use 1 for an individual, 2 for a pension-splitting, equal-aged couple.
myagenow	Your age (in range 71 to 94). This lets you use the calculator at some point during those years, when you wonder how long the remaining funds will last. An age younger than 71 is changed to 71 (the opposite of the fountain of youth). Calculation of new values begins at *myagenow* + 1. If you are calculating for a couple with widely different ages, the calculator is of limited value.
thisyear	What year is it right now, when you are using the calculator? The year is used to adjust tax rates relative to 2013. If you don't want that adjustment, make *thisyear* less than 2014 and the calculator will use the 2013 tax table directly.

About your RRIF/LIF account

LIFflag	Use 1 if your account is a LIF, 0 if it is a RRIF. Many people have both RRIFs and LIFs, but the calculator considers only one or the other. The author simply tired of considering all the variations.
equitysplit	This is the percent of your account in equities (stocks, mutual funds, ETFs, etc). The remainder is considered to be in fixed income (individual bonds, GICs, etc), though not bond funds. Account is continually rebalanced to maintain the split.
Bstart	The starting balance of the account, in thousands ($K). "Starting balance" means the value at age *myagenow*.
InvFee	Fees for maintaining your RRIF or LIF can take many forms, such as an annual fixed charge, or an annual percentage (e.g., investment advisor fees), or transaction fees for buying and selling securities, or MERs in mutual funds and (to a much lesser extent) in ETFs. In the calculator, they are approximated as a single annual "investment fee" as a percentage of the balance in the account.

About market growth and inflation

FIretn	The annual growth rate (%) that applies to the fixed income portion of the account. For simplicity, it is fixed.
whichmkt	Which market affects your equities? Choose from: 1, TSX Composite; 2, TSX Composite total return; 3, S&P 500; 4, S&P 500 total return.
mktyear1	The first year of historic market returns to be applied to the equities portion of your RRIF or LIF. Use a value in the range 1970 to 1990 to stick to actual returns. Values from 1991 to 2014 pick up increasing amounts of the hypothetical market behaviour in the extended market history.
mktseg1 *mktseg2*	The first and last years of the segment of historic market returns used to extend the record out to 2038. *mktseg1* is in range 1970 to 2013, *mktseg2* is in range *mktseg1 + 1* to 2013.
SaveRetn	The annual rate of return (%) of the savings account. If it is negative, the rate of return is taken to be the same as the market applied to the RRIF or LIF.
InfRate	Annual inflation rate (%). If it is negative, historical inflation rates are used, starting at *mktyear1*.

About your personal finances

SaveStart	The savings or non-registered investment account that holds the excess income from the forced withdrawals from your RRIF or LIF will be called *Save*. Its initial value (i.e., at *myagenow*) is *SaveStart* , to represent your savings at that age.
IPstart	The initial annual value (i.e., at *myagenow*) in $K of all your pensions or taxable annuities that are indexed to inflation, including CPP, but *not* OAS. If you are calculating for a pension-splitting couple (*taxmodel* equals 2), make it your combined indexed pensions.
NIP	The annual value in $K of all your taxable pensions that are not indexed to inflation. If you are calculating for a pension-splitting couple (*taxmodel* equals 2), make it your combined non-indexed pensions.

OASstart The initial annual value (i.e., at *myagenow*) in $K of your OAS payments. OAS is also indexed to inflation, but is treated separately, since it is subject to clawback. If you are calculating for a pension-splitting, equal-aged couple, make it your combined OASes. The calculator treats the two OAS streams as equal.

OASthstart OAS clawback is based on a threshold applied to taxable income (Section 2.3). The threshold is indexed to inflation in the calculator, on the assumption that CRA does the same. *OASthstart* is its initial value (i.e., at *myagenow*). The threshold for the 2012 tax year was $ 69.562 K, but you should look up its present value at the Service Canada website [8].

SpendTarget Your annual spending *Spend* ***in post-tax $K*** is indexed to inflation by the calculator. Its target value is *SpendTarget*. It is a key quantity, since the calculator works to support your specified spending level. Of course, the higher the spending, the sooner the funds run out.

The argument array

Placing all the arguments explicitly in the calculator's argument list would be clumsy and would take up too much space. Instead, we'll put them in a 5x4 argument array, defined as follows:

$$A = \begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix}$$

Packing arguments like this allows procedures to be called with a single argument *A*. The only drawback is that they have to be unpacked within the procedure, but that's easy.

3.3 General Description of the Calculator Package

More about the calculator operations

Within *trajectories*, the calculator program, calculations follow a straightforward pattern of year-by-year computation of RRIF/LIF income generation and spending/saving outside the RRIF/LIF. In words, it looks pretty much like this:

4. USE OF THE CALCULATOR, WITH MANY EXAMPLES

4.1 The Sandbox Area

This is an area where you can try various argument values and see what their effect is. The graphs can be copied to the clipboard and pasted into other documents.

Enter the arguments

Mathcad is a great analysis package, but it doesn't support good user interfaces. So, a reminder: this is the layout of the arguments array.

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix}$$

Definitions of the variables are in Section 3.3.

Enter numerical argument values in the matrix below following the pattern above:

$$A := \begin{pmatrix} 1 & 71 & 2014 & 0 \\ 50 & 800 & 0 & 0 \\ 1 & 1985 & 1985 & 1992 \\ 0 & 2 & 0 & 11 \\ 0 & 6.5 & 70 & 55 \end{pmatrix}$$

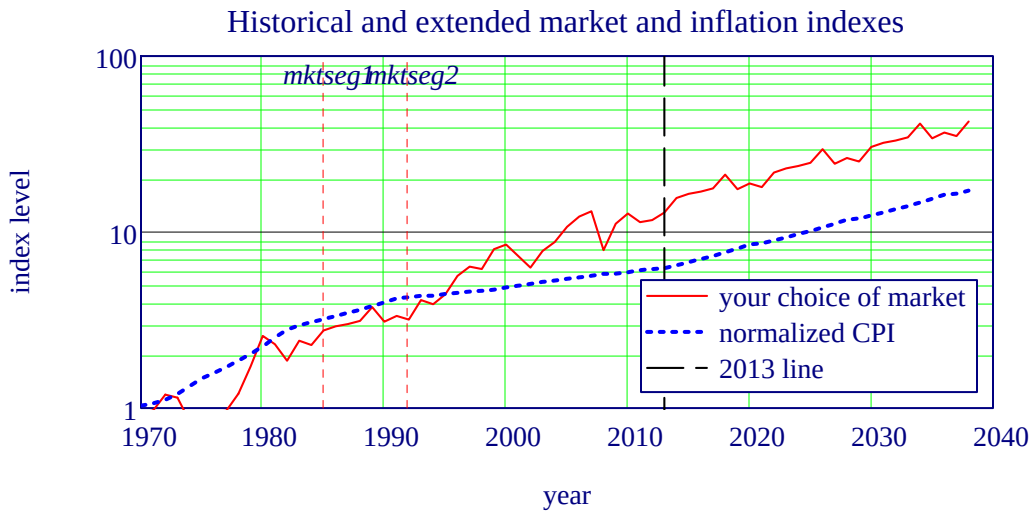
Check them: $argcheck(A) = \text{"OK, good to go"}$

View the results

Now run the calculator $R := trajectories(A)$

Even if you did not select use of historical records of markets and inflation in your arguments above, it is interesting to see the extended market index and extended inflation index. Calculate them, then display.

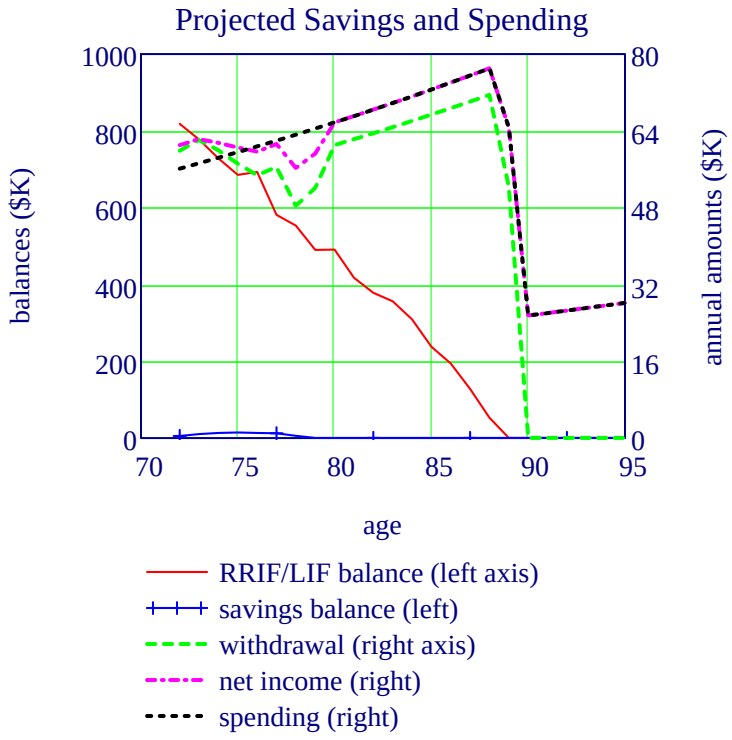
$$H := ExtendedHistory(A)$$



Historical returns up to 2013; after that, an extension by repetition of the selected segment (*mktseg*1 to *mktseg2*) to allow some stress-testing.

Next, a detailed plot of key quantities for the selected start year: *mktyear1* = 1985

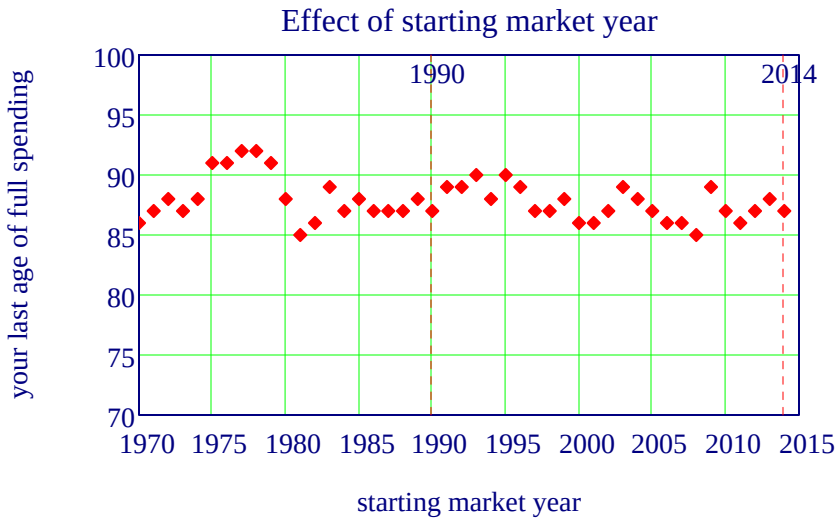
lastfullspend(*R*) = 88



Remember to read the annual amounts (withdrawal, net income, spending) from the right-side axis.

See how the starting market year (corresponding to age *myagenow*+1) affects to the age which full spending can be supported. Remember, "95" means "95 or older."

$gb := goodbadyears(A)$



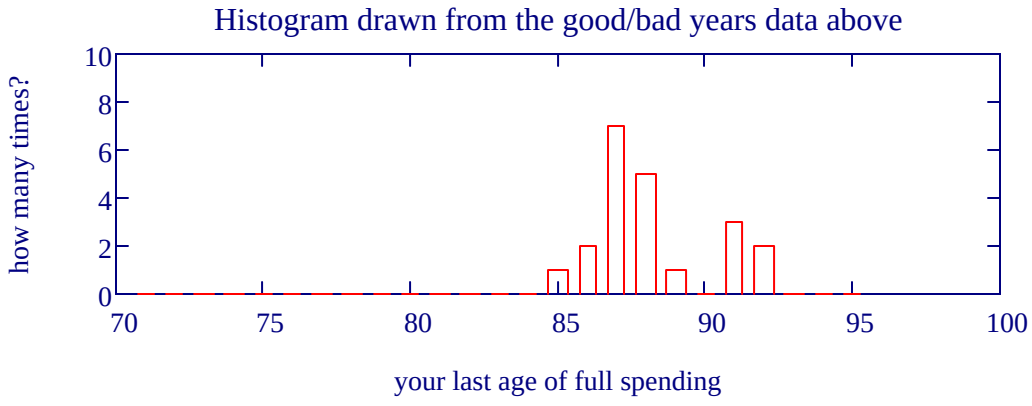
1990 is the last starting market year for which only historical market values affect the outcome.

After 1990, increasing amounts of the extension play a role; by 2014, all returns are from the extension.

Age 95 means "95 or older."

And a histogram of the same data, using $extflag := 0$ (use 0 to limit to the true historical record)

$luck := spendhisto(A, extflag)$

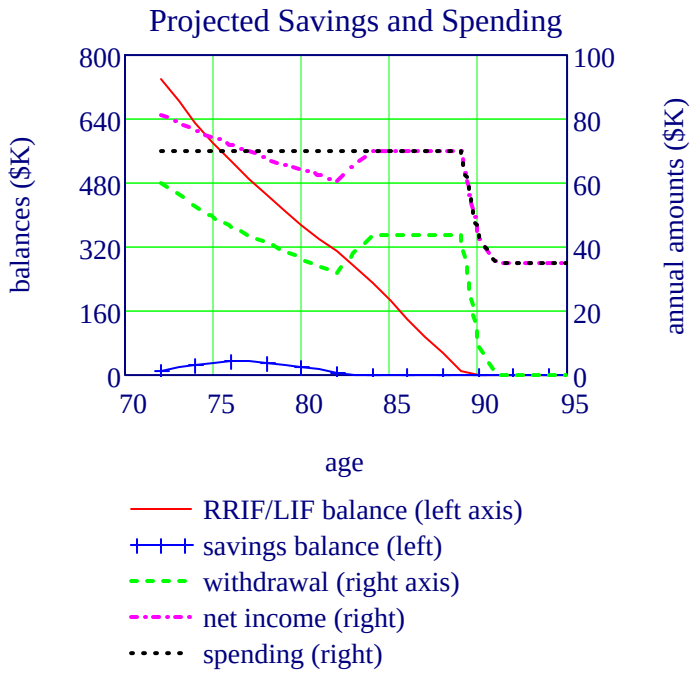


4.2 Examples

Super simple RRIF

The Section 2.7 couple again. No inflation, no market returns. Spending target $70K, RRIF $800K, combined CPP $22K and combined OAS $13K.

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix} = \begin{pmatrix} 2 & 71 & 2014 & 0 \\ 0 & 800 & 0 & 0 \\ 1 & 1985 & 2000 & 2011 \\ 0 & 0 & 0 & 22 \\ 0 & 13 & 70 & 70 \end{pmatrix}$$



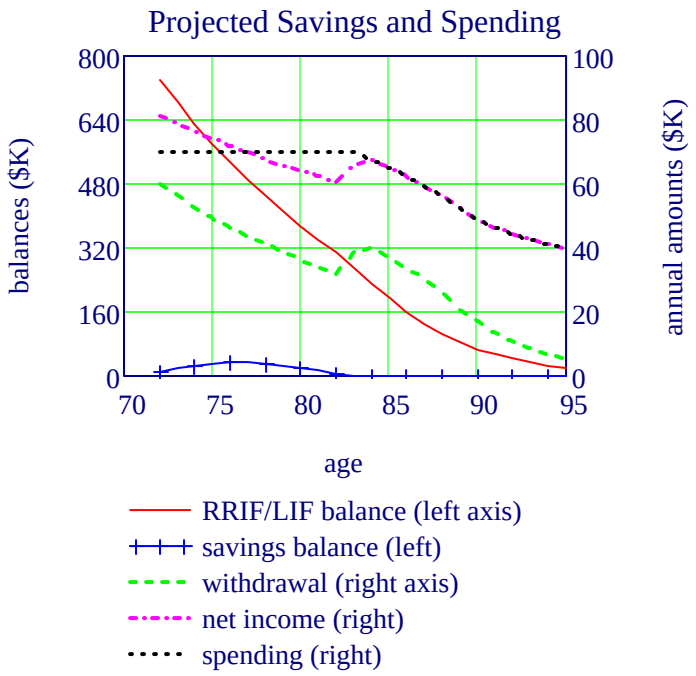
What happened:

- Initially, min RRIF withdrawals generated excess income, which was put in savings account.
- By age 76, min withdrawals not enough, so drew on savings until exhausted at age 82.
- After age 82, maintained spending by increasing RRIF withdrawal, RRIF then depleted more quickly, up to age 89.
- By age 90, RRIF is exhausted and spending drops to the level supportable by CPP and OAS.
- There was no OAS clawback (not shown).

Super simple LIF

Same as the super simple RRIF example above, but now the couple has a LIF.

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix} = \begin{pmatrix} 2 & 71 & 2014 & 1 \\ 0 & 800 & 0 & 0 \\ 1 & 1985 & 2000 & 2011 \\ 0 & 0 & 0 & 22 \\ 0 & 13 & 70 & 70 \end{pmatrix}$$



What happened:

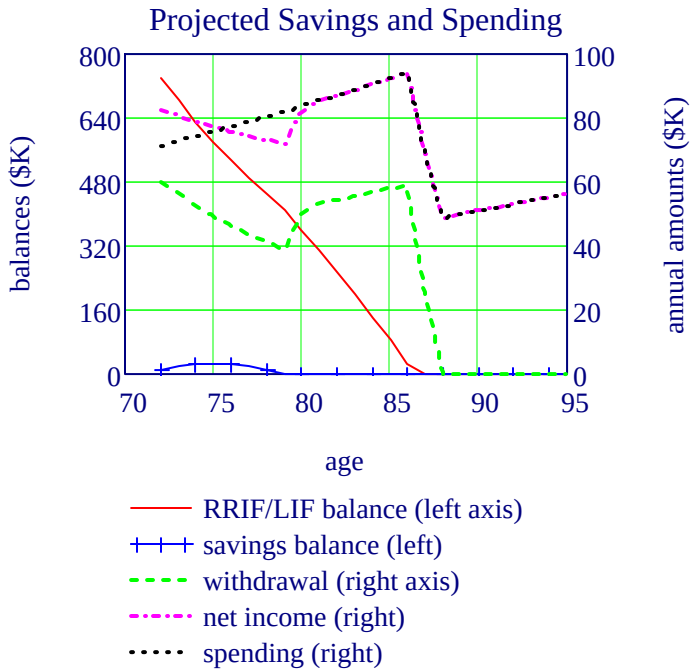
- Initially, min LIF withdrawals generated excess income, which was put in savings account.
- By age 76, min withdrawals not enough, so drew on savings until exhausted at age 82.
- After age 82, it tried to maintain spending by increasing withdrawals from LIF, but hit the max withdrawal limit at 83.
- Max withdrawals forced a slow decline of spending from 84 on, asymptotic to the CPP and OAS limit.
- At age 90, the LIF still held almost $67K, but the retiree could get only a little per year.

If the steady decline in spending from age 84 is a worry, perhaps some anticipatory withdrawals in the early (pre-max-withdrawal) years would be helpful, despite the extra tax incurred by the higher taxable income.

Super simple RRIF - but with inflation

Back to the RRIF for this couple - but now 2% inflation is working against them, and they have not invested the funds in the RRIF in either fixed income or equities.

taxmodel	*myagenow*	*thisyear*	*LIFflag*	2	71	2014	0
equitysplit	*Bstart*	*InvFee*	*FIretn*	0	800	0	0
whichmkt	*mktyear1*	*mktseg1*	*mktseg2*	= 1	1985	2000	2011
SaveRetn	*InfRate*	*SaveStart*	*IPstart*	0	2	0	22
NIP	*OASstart*	*OASthstart*	*SpendTarget*	0	13	70	70



What happened:

- Initially, spending rose on track with inflation, even after the savings buffer ran out and withdrawals increased.
- By age 86 or 87, the RRIF was exhausted, and spending dropped to the CPP and OAS level (which had also increased, because they are indexed to inflation).

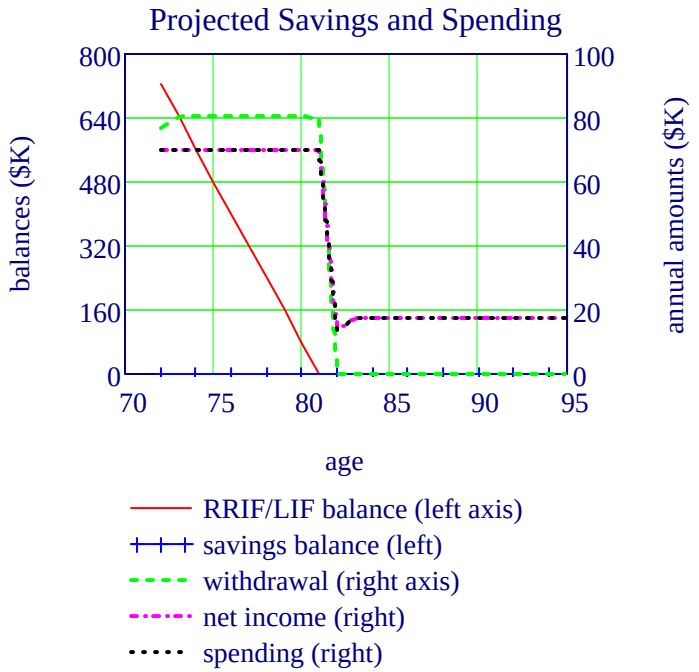
This couple needs to generate some return from their RRIF so that it can sustain their target spending level longer.

Super simple RRIF - an individual

The couple in the examples above benefited from pension splitting. A single person would have a higher taxable income, pay more tax and possibly suffer from OAS clawback. Let's check.

Keep RRIF savings and spending target the same, just change the tax model and cut the CPP and OAS in half.

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix} = \begin{pmatrix} 1 & 71 & 2014 & 0 \\ 0 & 800 & 0 & 0 \\ 1 & 1985 & 2000 & 2011 \\ 0 & 0 & 0 & 11 \\ 0 & 6.5 & 70 & 70 \end{pmatrix}$$



What happened:

- Minimum withdrawals were insufficient in early years, so large withdrawals and no excess income for savings.
- When RRIF is exhausted by age 81, OAS rebounds a bit because no more clawback.

This is shock - the funds ran out at age 82, compared with 89 for the couple. The reasons:

- The individual had only half of the couple's CPP and OAS.
- All RRIF withdrawals went to one person - so progressive taxation means much higher taxes.
- The higher taxable income caused serious OAS clawback. Over the years, this added up to

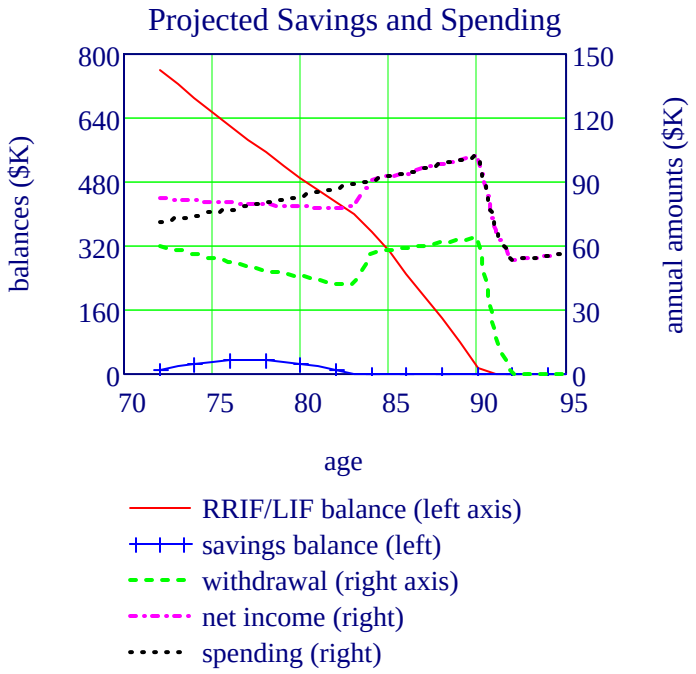
cumulative OAS clawback $\sum R^{\langle 8 \rangle} = 36.342$ $K

Worse, it might be harder for one person to accumulate that RRIF than for two people. Reduce spending? Maybe, but not by one half. But see another example later on.

Simple RRIF with fixed income growth and inflation

Back to the couple who found that inflation caused their RRIF to be exhausted at age 86, instead of 89. Now they would like to put their RRIF to work with fixed income investments. Unfortunately, their return is only 3% - certainly better than nothing, but how much does it help?

taxmodel	*myagenow*	*thisyear*	*LIFflag*	2	71	2014	0
equitysplit	*Bstart*	*InvFee*	*FIretn*	0	800	0	3
whichmkt	*mktyear1*	*mktseg1*	*mktseg2*	= 1	1985	2000	2011
SaveRetn	*InfRate*	*SaveStart*	*IPstart*	0	2	0	22
NIP	*OASstart*	*OASthstart*	*SpendTarget*	0	13	70	70



What happened:

- The FI returns kept the RRIF going longer during the initial min withdrawal period.
- When larger withdrawals were required from age 84, after the savings ran out, the RRIF ran into the ground fairly quickly.
- Nevertheless, it lasted to age 90, instead of age 86.

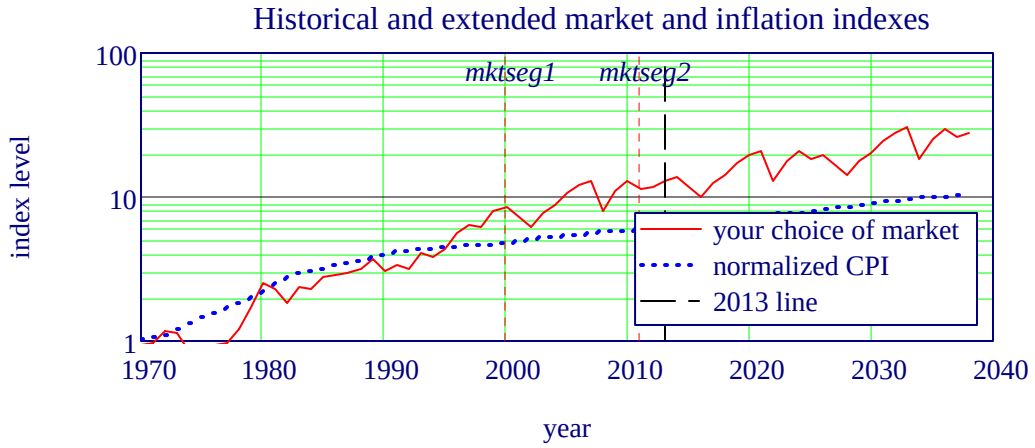
Investment of the RRIF was very important in offsetting the effects of inflation. Two other interesting points:

- If the fixed income return had been 2%, it would not have been sufficient to cancel the 2% inflation and restore matters to the first super simple RRIF example, where the RRIF ran out at age 89.
- Giving the savings account a 3% return, too, made no noticeable difference. Not surprising, since that account is small, even at its peak value.

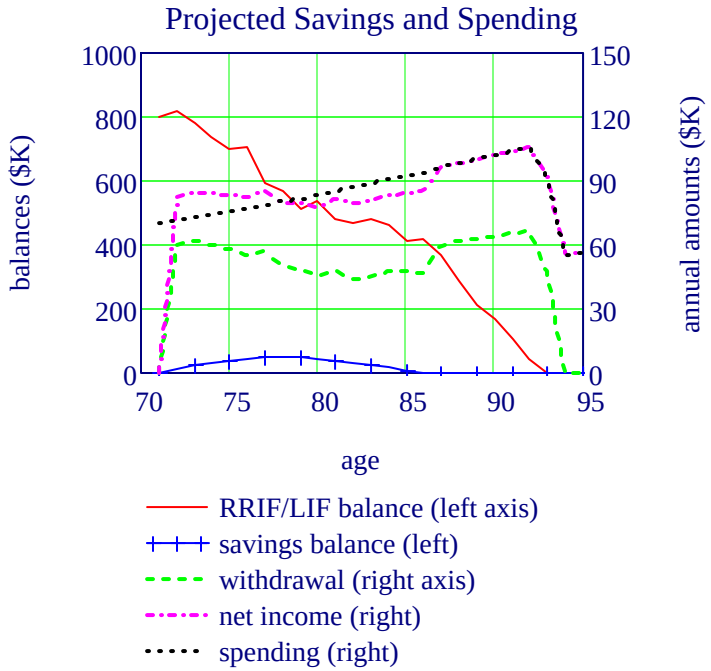
RRIF with market returns - not simple, but very rewarding

Now the couple decides to put half of their RRIF into equities; specifically, an ETF for the S&P/TSX Composite. The other half is in fixed income at 3%. Cost of running their investments is 1%.

But what are the market returns? Here, we'll replay the market as if it were starting at 1985 again. For stress-testing, market returns post-2013 will be set to repetitions of the fairly unpleasant 2001 to 2011 years. This is how it looks, together with historical and extended inflation.



Here is the effect on their retirement if the market behaves like a replay from *mktyear1* = 1985



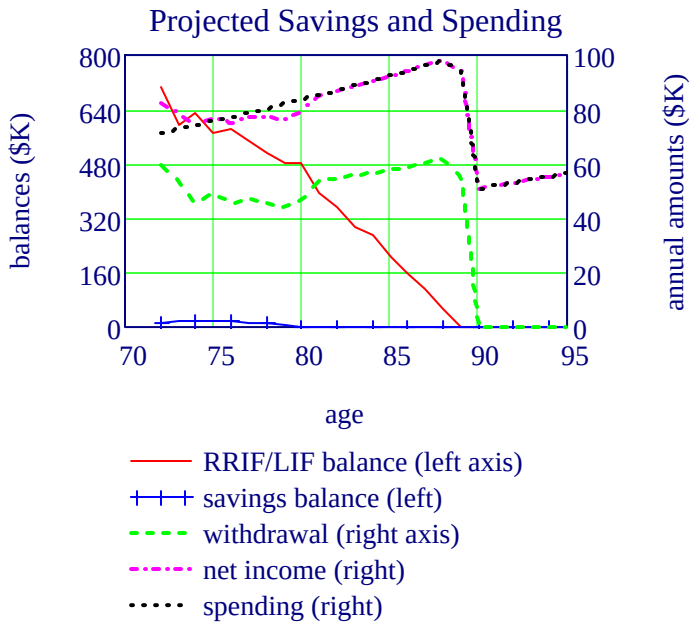
Comments:

- Now, full spending is maintained out to age 92.
- The RRIF balance wobbles in response to the market.
- This plot is for a specific starting market year - so don't draw conclusions until you have seen several historical market records.

For reference, the argument array for this plot was

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix} = \begin{pmatrix} 2 & 71 & 2014 & 0 \\ 50 & 800 & 1 & 3 \\ 1 & 1985 & 2000 & 2011 \\ 0 & 2 & 0 & 22 \\ 0 & 13 & 70 & 70 \end{pmatrix}$$

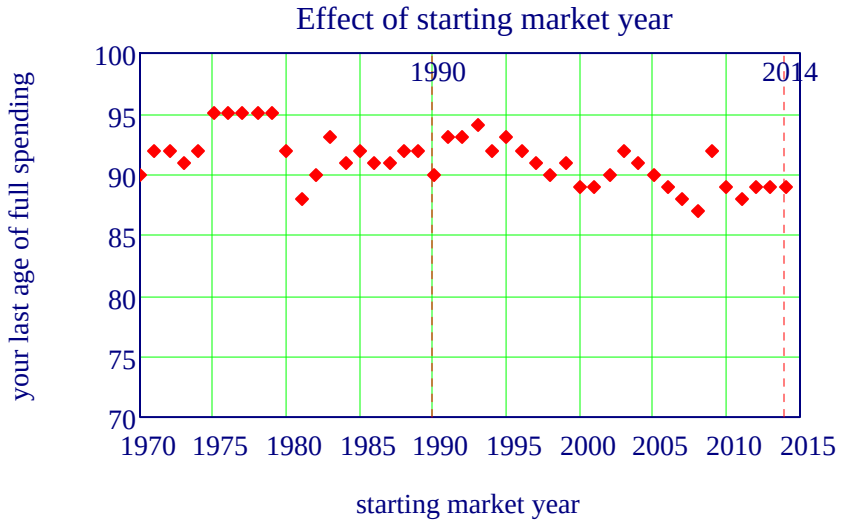
Much depends on market behaviour in the early years. Now try launching the RRIF in the notorious recession of 1981. Change *mktyear1* in the argument array to 1981.



mktyear1 = 1981

Not great - now the last full-spending age is 88 years, instead of 94, when the market started at 1985.

Starting year in the market is important, so try all starting years and see how long full spending lasts.



1990 is the last starting market year for which only historical market values affect the outcome.

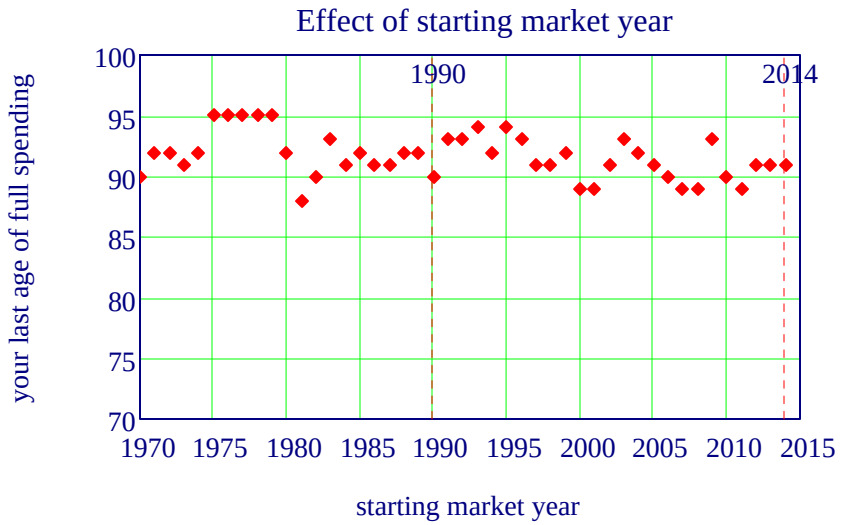
After 1990, increasing amounts of the extension play a role; by 2014, all returns are from the extension.

Age 95 means "95 or older."

Regarding the increasingly worrying performance for starting years 2005 and beyond, remember that they are affected increasingly by the market extension, which was 2000 to 2011, a rather unpleasant time. Many of the years on the right hand side of the plot were therefore affected by them twice.

Try extending the market instead with 1985 to 1992. They were not exciting years - not much return, but not much turbulence, either. To compensate, start in the awful year 1981. Here are the arguments:

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix} = \begin{pmatrix} 2 & 71 & 2014 & 0 \\ 50 & 800 & 1 & 3 \\ 1 & 1981 & 1985 & 1992 \\ 0 & 2 & 0 & 22 \\ 0 & 13 & 70 & 70 \end{pmatrix}$$



1990 is the last starting market year for which only historical market values affect the outcome.

After 1990, increasing amounts of the extension play a role; by 2014, all returns are from the extension.

Age 95 means "95 or older."

That was a bit safer than the other market extension.

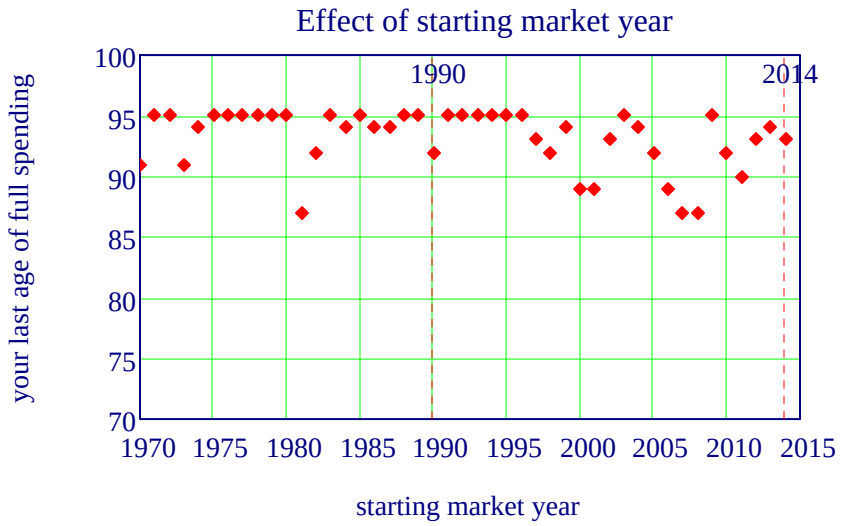
It appear that relying on the market almost always greatly improves the longevity of the funds - but there are some unfortunate times to be considered.

Juicing it up - an all-equities RRIF

What would happen if the couple had put all their RRIF into equities? We'll keep the same bland extension years, 1985 to 1992, so the arguments are

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix} = \begin{pmatrix} 2 & 71 & 2014 & 0 \\ 100 & 800 & 1 & 0 \\ 1 & 1981 & 1985 & 1992 \\ 0 & 2 & 0 & 22 \\ 0 & 13 & 70 & 70 \end{pmatrix}$$

The result can be seen below. The number of "failures" (funds running out in one's 80s) has increased, but but the number of notable "successes" (funds lasting to 95 and beyond) has increased more.



1990 is the last starting market year for which only historical market values affect the outcome.

After 1990, increasing amounts of the extension play a role; by 2014, all returns are from the extension.

Age 95 means "95 or older."

Summary - increasing the fraction of equities significantly improves performance most of the time, but it decreases reliability, since the number of failures increases, too.

Markets and budget - the individual revisited

Recall the example above, "Super simple RRIF - individual," and the shock at finding his or her RRIF would run out at age 81, when a couple with the same RRIF could make it last to age 89. Let's see what can be done.

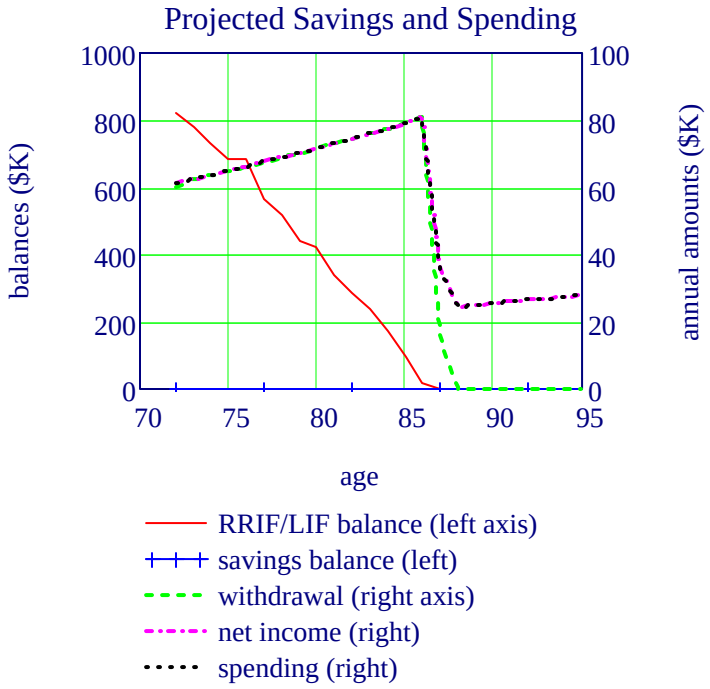
A few changes in succession:

- Set inflation to 2%. That doesn't help, of course. Now the RRIF lasts only to age 80.
- Reduce annual spending from $70K down to $60K. Now it lasts to between 82 and 83.
- Invest the RRIF in 50/50 fixed income and equities. Fixed income annual return 3% (slightly optimistic). Equities in an ETF that follows the TSX Composite. Investment fee 1%.
- For the market returns, extend beyond 2013 with repetition of the bland years 1985 to 1992.

If the market followed the behaviour of the market starting in 1985, the argument array would be

$$\begin{pmatrix} taxmodel & myagenow & thisyear & LIFflag \\ equitysplit & Bstart & InvFee & FIretn \\ whichmkt & mktyear1 & mktseg1 & mktseg2 \\ SaveRetn & InfRate & SaveStart & IPstart \\ NIP & OASstart & OASthstart & SpendTarget \end{pmatrix} = \begin{pmatrix} 1 & 71 & 2014 & 0 \\ 50 & 800 & 1 & 3 \\ 1 & 1985 & 1985 & 1992 \\ 0 & 2 & 0 & 11 \\ 0 & 6.5 & 70 & 60 \end{pmatrix}$$

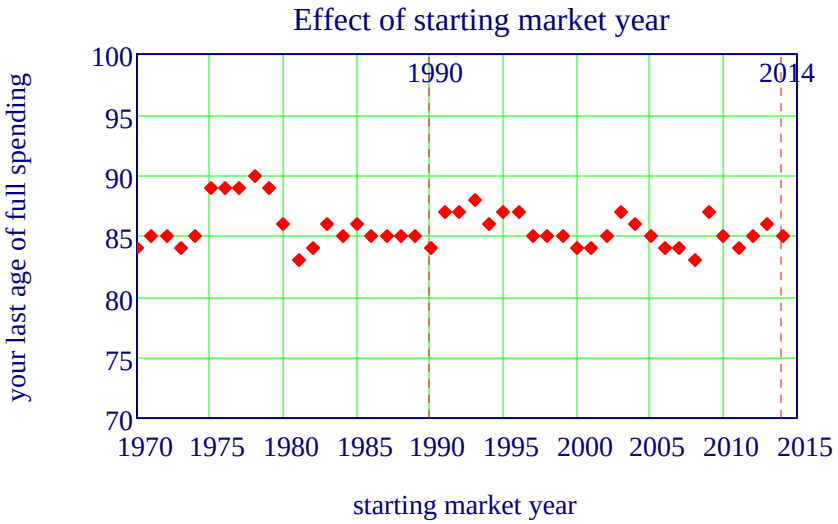
And this would be the experience, given the relatively benign starting year $mktyear1 = 1985$



What happened:

- Min withdrawals not enough to meet spending needs, so withdrew more; no excess income.
- RRIF balance decline was slowed by investments.
- Last year of full spending was age 86, a significant improvement.

Of course, the market starting year plays a large role, so now we look at the experiences with all starting years, with this result:



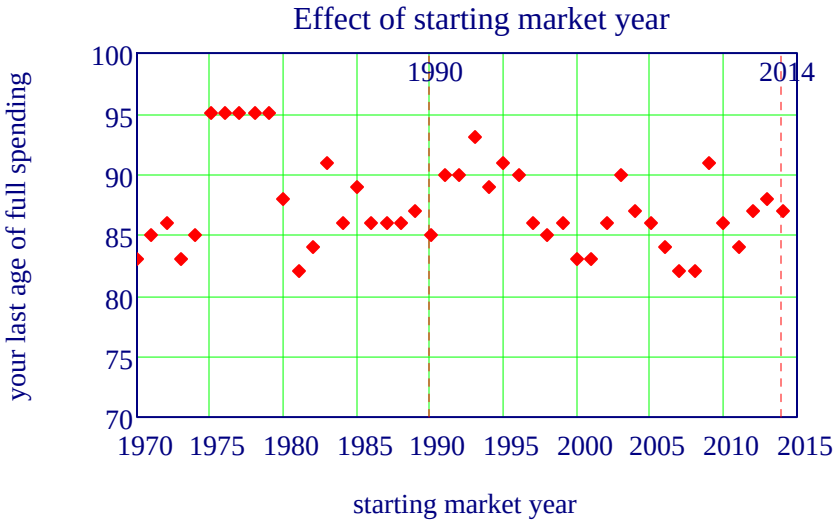
1990 is the last starting market year for which only historical market values affect the outcome.

After 1990, increasing amounts of the extension play a role; by 2014, all returns are from the extension.

Age 95 means "95 or older."

The RRIF duration is quite variable, ranging from age 83 to 90, which is an improvement over the 82 or 83 achievable with just spending reduction to $60K in 2% inflation. Clearly, investment helped.

And if some investment helped somewhat, would full investment in the market do even better? We've seen the result in a previous example. For the RRIF invested 100% in equities, we see this:



On average, a big improvement - but there's more scatter, with a few starting years poorer than the 50/50 portfolio case.

5. SHORTCOMINGS AND DEVELOPMENT OF THE CALCULATOR

The calculator works well, and it sketches possible futures in ways that other available calculators cannot do. However, it has some shortcomings, and they should be noted as areas for future development:

- It operates to keep the spending level constant in inflation-adjusted dollars. However, spending targets during retirement may vary with time, being larger in the early, active years and, possibly, larger in the later years because of health issues.
- Its tax model is quite simple and it makes an assumption that CRA will continue to adjust it for inflation.
- It makes use of historic equities and inflation - but it has no data for bond indexes. That limits its portfolios to a simplistic split between equities, modeled by historic and extended markets, and fixed income, modeled by a fixed annual rate of returns.
- A big shortcoming... although Mathcad is a beautiful package for mathematical and computational explorations, few people have it. The calculator must be ported to another platform, such as Excel or Java.

The scope of the calculator needs attention as well. At present, it is confined to retirees' post-71 experiences, assuming that each year is much like the previous one. The scope really should be expanded in at least two ways:

- The calculator would be much more useful if it began at 65 years, a nominal retirement age.
- Also - hard though it is to think about the prospect - the death of a spouse. As well as the emotional devastation, there are financial consequences for the survivor, and the calculator ought to provide some guidance.

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