Age in Place or CCRC? That is the Question!

J. Welch September 29, 2019

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EXECUTIVE SUMMARY

Far from being the quiet twilight of life, retirement is a bumpy collection of life-altering events and phases. Phases are the quite intervals between life-altering, events. Life-altering events may require large spending in the year of the event; trigger a change in spending levels, or both. Examples of life-altering events are *downsizing to smaller living quarters, loss of spouse, or broken hip*. Inclusion of life-altering events and their anticipated costs in retirement planning is more important than the actual timing, and is often a neglected aspect of retirement planning.

This Phase/Event Retirement Paradigm (PERP) has been formulated as a linear programming model and implemented as computer based retirement planning tool. The adviser and her clients map out a retirement plan using the tool's paradigm. The map includes things the client wants to do, and events the client can't avoid. The tool computes a plan with maximum Disposable Income consistent with the defined retirement phases. The model's constraints adhere to the Federal tax code, honor the IRS Required Minimum Distributions, and don't deplete savings before the end of the plan. The value of individual retirement options is measured in terms of maximuml Disposable Income and the plan's surplus at the end. The tool projects a tax efficient schedule of withdrawals from the client's tax-deferred, Roth IRA, and taxable accounts.

Three popular retirement strategies are 1) **Age In Place**, 2) move into a **Continuous Care Retirement Community (CCRC)** or, move into **Custodial Care (CC**). This paper illustrates the use of this tool to quantitatively evaluate these retirement strategies.

INTRODUCTION

Comfortable, secure retirement requires the management of the client's spending and the management of the client's retirement income. Spending management includes recognizing the difference between essential spending and discretionary spending and budgeting for them accordingly. Retirement income management includes determining when to make retirement saving withdrawals in a tax efficient way that maximizes disposable income and does not leave the client asset deprived toward the end of the plan.

One issue facing the newly retired couple is choosing where and how they are going to spend their golden years. Three common options are:

1. **Aging In Place (AIP)** is to continue to live in the pre-retirement home, independently, and comfortably, regardless of age, income, or ability level.
2. A **Continuing Care Retirement Community (CCRC)**, is a type of retirement community in the U.S. where a continuum of aging care needs—from independent living, assisted living, and skilled nursing care—can all be met within the community single, stand-alone facility. CCRC's frequently require a substantial entrance fee. CCRP usually generally offer a full menu of amenities.

3. **Custodial Care** is non-medical care that helps individuals with their daily basic care, such as eating and bathing. Custodial Care clients downsize into a smaller facility, thereby facing the similar rigors as the CCRC couple. Custodial care contracts are generally month to month, may have a modest one-time sign-up fee, but there is no large entrance fee. Custodial Care institutions tend to be smaller than CCRCs and offer fewer amenities.

Generally, a couple will begin retirement by aging in place when a major **life-altering event (LE),** such as loss of spouse or major injury, brings down reality. The house and its contents are sold and refuge is sought in a custodial care facility.

The CCRC definition assumes that various levels of personal care, from independent living to nursing home care, need to be available to the CCRC population. If a CCRC offers a spectrum of services to its aging population then it must follow that in the course of aging a client is expected to pass through the various phases of support requirements.

The physiology of aging is a fundamental attribute of the retirement phase of life. As retirement progresses the client and spouse become progressively less independent and more restricted in daily activities. A **phase** is a period of physical and financial steady state that begins and ends with major Life-altering events**.** Aging is not a continuous curve but is a step-wise discontinuous function of different phases.

The **Phase/Event Retirement Paradigm (PERP)** consists of sequence of phases and life-altering events. **Phases** are periods of constant spending, indexed to inflation. Two adjacent phases will meet at a life-altering event, such as sale of the house or death of a spouse. Life-altering events change the characteristics of the succeeding phases such as the difference in annual cost between independent and assisted living.

PERP is formulated as a linear programming model which is solved to produce a tax efficient, savings withdrawal plan that maximizes the model's annual **Disposable Income (DI):** after tax income available for speding. The **Withdrawal Plan (WP)** is the sequence and amount of annual savings withdrawals from the three retirement savings accounts (tax-deferred savings, Roth IRA, and taxable account) each year of the retirement plan.

Section three of this paper defines the Phase/Event Retirement Paradigm and describes how it is modeled as a linear programming application. Section four describes the living options that were modeled. Section five provides computational results for the above three living options. Section 6 reports summary results for variations of the three living options. The appendices contain the literature review and parameter values assumed but not changed in doing the computations of this study.

THE PHASE/EVENT RETIREMENT PARADIGM

Whereas conventional retirement calculators simulate retirement income, the Phase/Event Retirement Paradigm and its computer implementation integrate spending and income in a single unified, optimization model. Actually, the spending component is a set of additional constraints on the income component.Modeling Retirement Spending

This article offers a paradigm of retirement that portrays the retirement in terms of phases and events. The paradigm is based on three concepts.

The first concept is that retirement disposable income can be defined in terms of spending by:

$DI_r = ES_r + DS_r$ for retirement years r, ages 65 through 92.

Disposable Income (DI_r) is the **maximum** after tax money available for spending each year of retirement, based on the client's resources. Disposable income is the sum of essential spending and discretionary spending. **Essential Spending (ES)** is what the client is required to disburse by contract or is required to otherwise spend to survive. **Discretionary Spending (DS)** is the money left over in each year for, non-obligated spending. How spending is assigned to ES is a matter of negotiation between advisor and client. [See Kitces 2012] Discretionary Spending is a spending upper bound based on the client's resources, a budgetary number that it is unwise to exceed lest the client's resources be prematurely depleted.

The second concept is that retirement can be described as a sequence of **phases.** Phases consist of intervals of one or more adjacent years where the retirement Essential Spending is constant except for being indexed to inflation. ES is discontinuous between phases. As the retired client and spouse age they becomes increasingly dependent as they move from one phase to the next. Phases range from independent living to around the clock skilled nursing care.

The third concept is that retirement is punctuated by occasional **Life-altering Events (LE)** that fall at the intersection ages between two phases. Examples of life-altering events are sale of the house, a severe health issue, death of a spouse, entering a CCRC. Usually there is a big difference between the essential spending levels of the adjacent phases.

The model described in this paper uses the client's anticipated ES and LE requirements to compute the maximum DS for the entire retirement plan. Maximum discretionary spending is achieved by minimizing taxes on savings withdrawals while maximizing asset returns. Balancing these two conflicting goals is the essence of optimization.

Modeling Retirement Income Management

For purposes of this study, PERP is implemented using the liner programming application located at URL address www.i-orp.com. The method used in this study was to set up a scenario using parameters of the optimizer, solve it, and measure the results according to the maximized discretionary spending and the minimized plan surplus (Final Total Asset Balance).

The optimizer maximizes discretionary spending for the first year of retirement. Subsequent years are derived from the first:

$DS_{r+1} = (1 + i)DS_r$ where i is the spending inflation rate for the model.

The net result of this is that the amount money available for discretionary spending, indexed to inflation, is constant for all of retirement. Model failure is not permitted. Of course, DS_r may be small or zero but never negative.

RETIREMENT OPTIONS

The retirement living options considered for this study are:

1. **Age in place (AP)** and deny that anything will change – until the big crisis. The big crisis is normally some sort of health issue that forces the client to employ home health care assistance at considerably greater cost.

2. Plan for a graceful downsizing into a **Continuing Care Retirement Community (CCRC)**. Downsizing includes the organized disposal of the clients' assets in order to fit into a smaller living area and the tax efficient transition into the next phase. The inevitable health crises moves the client from independent living to assisted living, at a considerable cost increase.
3. Age in Place until circumstances dictate moving to **Custodial Care (CC)**.

This paper assumes that far from being a straight line, retirement spending is a collection of flat places and peaks.

Table 1 Assume three 65 year old couples on the edge of retirement as they consider where to live in retirement. Their options are evaluated with the aid of an Internet accessible computer model that projects income management for the entire span of retirement (www.i-orp.com). While their retirement plans are for the entire span of retirement, their model are revisited annually and decisions are made and implemented one year at a time. (Welch 2017).

Table 1: Retirement Timeline

Couple's Strategy			AP		CCRC		CC	
Age	Event	Phase	**LE**	**ES**	**LE**	**ES**	**LE**	**ES**
65	Retire	Indep. Living		10		10		10
70	Sell House				400			
70	Join CCRC				200	40		
80	Loss of Spouse		30		30	33		82
85	Health Issue	Assisted Living		50		100		110
92	FTAB	Bequest	683		188		188	

Table 1 summarizes their retirement timelines. The choice and timing of life alternating events are conjectures based on their adviser's experience and the client's wishes. The costs shown in Table 1 are justified in the appendix.

1. At age 65 the three couples retire. Their Essential Spending of $10K is their spending floor from retirement to age 70, primarily taxes on their home. Their annual Disposable Income is computed by ORP to be $80K.
2. At age 70 the CCRC couple sells their house with the proceeds going into their taxable account. The CCRC couple pays their entrance fee from their taxable account and moves into their CCRC.
3. At age 80 all three couples suffer loss of spouse. Although the planning horizon is age 92, life expectancy tables indicate that both partners will not survive past age 78. Loss of spouse causes a $30K outlay for funeral expenses. ORP will reduce Age in Place (AP) Discretionary Spending by 25%. It is generally recognized that loss of spouse reduces spending by less than 50%. CCRC Essential Spending is reduced by the no longer applicable monthly second occupant fee.
4. The survivors' major health issues are encountered at age 85. Moving to more intensive care raises Essential Spending. The AP survivor elects to remain in their home and to bring in home health aides. The CCRC survivor moves to assisted living within the CCRC facility. When the Custodial Care (CC) spouse died, the survivor sold the house and moved to a custodial care facility. When the health crisis occurs the CC survivor, now a custodial care resident, moves, within the facility, to a higher level of support care. When the Custodial Care (CC) spouse died, the survivor sold the house and moved to a custodial care facility. When the health crisis occurs the CC survivor, now a custodial care resident, moves, within the facility, to a higher level of support care.

(Further investigations could be done to determine the role of delayed annuities and reverse mortgages to help with the end of life increased expenses.)

5. At age 92 the plan ends and all that remains is to tidy up couples' inheritances. All three plans intended to leave a surplus of $100K in real dollars. The CCRC couple sold their house at age 70 and applied the proceeds to their CCRC entrance fee. 80% of the CCRC's uninflated entrance fee goes to the heirs. The AP survivor lived in the house to the end and the inflated value of the house passed to their heirs as part of the bequest.

The **Final Total Asset Balance (FTAB)** is set at $100K of today's dollars. FTAB is the plan's surplus at the planning horizon, i.e. the **sum** of the client's assets at the end of the plan.

Aging In Place Results

The AP couple lives all of retirement in the residence they occupied before and at retirement. Aging in Place includes having later in life services, care and needed support be provided in the residence. These needs change over time as the client ages.

Loss of spouse for the AIP couple results in $30K of funeral expenses at age 80. ORP will reduce Discretionary Spending 25% beginning at age 81. Consensus among financial advisers is that loss of spouse results in a reduction in the couples income but that 50% is too large to be realistic.

ORP computes AP's maximum Discretionary Spending at retirement to be $80K. This is the client's maximum unobligated income from all retirement sources, after taxes, and in today's dollars.

Figure 1: Age in Place Source of Funds

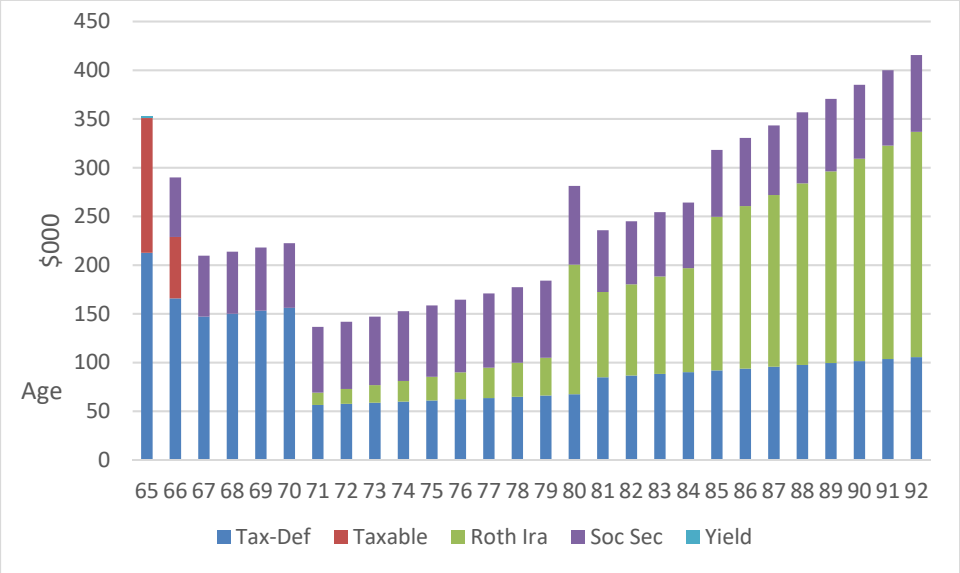


Figure 1shows the savings withdrawal schedule for the Age in Place strategy. A frequent client concern is the timing of savings withdrawals order to minimize taxes and satisfy the IRS required minimum distribution. The composition of each bar shows the source and amount of optimal savings withdrawals. Tax-deferred savings are distributed in parallel with the taxable account throughout retirement. Social Security income is constant except for being indexed to inflation.

The Age In Place phases shown in Figure 1 are:

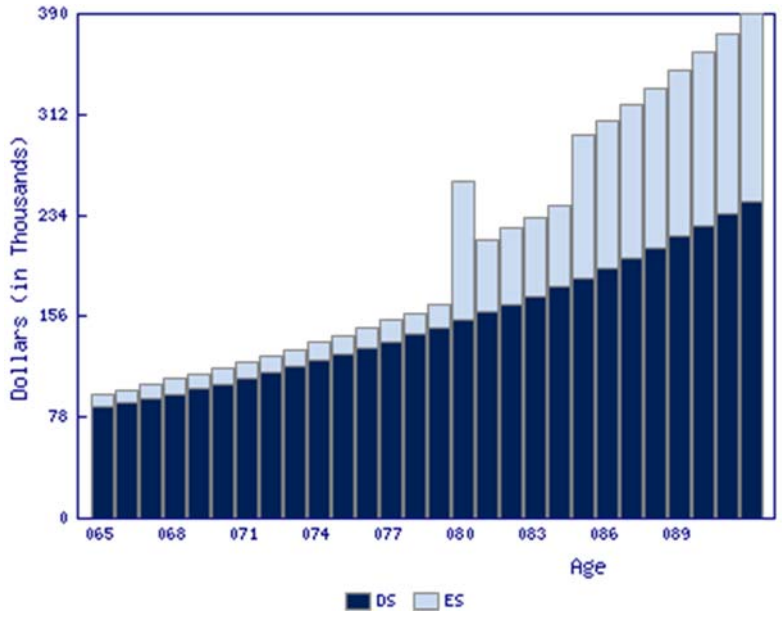
1. *Independent living, married couple phase* ends at age 80 with loss of spouse. The event cost at age 80 is for funeral expenses.
2. *Single Independent living* (Widowhood) extends to the health crisis at age 85. A single person has 25% less essential living expenses than a married cou*ple.*
3. *Home health care,* in the client's home begins with the health crisis. This is where the AIP client is basically receiving assisted living services in their residence.

ORP's Discretionary Spending for the Age in Place option is $85K in today's dollars. Discretionary Spending is the money left after all taxes and Essential Spending requirements have been satisfied. Disposable Income will vary, year to year, as Essential Spending varies phase to phase. Discretionary Spending is maximized in today's dollars and fixed for the retirement plan, indexed for inflation. Because Discretionary Spending is maximized and fixed for all ages of the plan it is a good single number measure of the value of the plan.

Personal income tax is paid on tax-deferred withdrawals and a combination of personal income tax and capital gains taxes are paid on taxable withdrawals. Roth IRA's tax free withdrawals are held in reserve waiting for the expensive home health care aid at the end of the plan. This is preferable to paying higher personal income taxes on tax-deferred withdrawals.

Figure 2 shows how DS and ES constitute DI. Planned Essential Spending varies widely across the plan according to the demands of each age. The optimizer has maximized DS at retirement age and subsequent DS values are this constant indexed to inflation. The sum of ES and DS is DI, Annual Disposal Income.

Figure 2: Age In Place Spending



Given retirement's projected events and each phase's essential spending ORP computes maximum discretionary spending at retirement. Subsequent years are this value indexed to inflation. Variations in disposable income are caused by costs of extraordinary and changes in essential spending. Optimization assures that sufficient savings are retained to meet changes in spending needs later in the plan. Of course, any unforeseen spending invalidates this plan. But that is a whole separate topic addressed in the 3-PEAT paper (Welch 2017)

Error! Reference source not found. shows Disposable Income for each retirement age for the Age in Place strategy in the bottom row.

Table 2: Age In Place Cash Flow

Age	RMD	Tax Def	Taxable	Roth IRA	Soc Sec	Yield	Taxes	DI
65		106	16			7	13	117
66		107	23			7	16	122
67		50	16		70	6	16	127
68		52	19		71	6	16	132
69		54	22		73	5	17	137
70	80	80	6		74	5	23	142
71	84	84	7		76	5	24	148
72	88	88	9		77	5	25	154
73	92	92	11		79	5	26	160
74	97	97	12		80	5	28	167
75	102	102	14		82	4	29	173
76	105	147			64	4	36	180
77	107	155			66	5	38	187
78	110	163			67	5	40	195
79	112	172			68	5	42	203
80	112	205	48		70	3	55	271
81	113	184			71	3	45	213
82	114	193			72	3	47	222
83	113	203			74	4	50	231
84	112	214			75	4	52	240
85	107	238	118		77		69	363
86	95	334		53	78		87	378
87	82	315		79	80		81	393
88	71	255		135	82		63	408
89	58	253		150	83		62	425
90	42	254		165	85		62	442
91	23	259		177	86		63	459
92		264		190	88		64	478

CCRC Computations

A **Continuing Care Retirement Community (CCRC)** is a land based cruise ship for the elderly. A CCRC features all manner of distractions from what the ravages that the aging is doing to membership. A CCRC requires a hefty entrance fee, with several zeros after the first significant digit and a monthly per person fee. Table 3**Error! Reference source not found.** demonstrates ORP's view of cash flow for a couple hiding from life in an CCRC.

Table 3: Continuing Care Cash Flow

Phase	Retirement						Independent, couple living									Widowed					Assisted Living							
Age	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
TaxDef	217	158	147	150	153	156	50	46	48	50	53	56	59	62	66	67	85	87	88	90	92	94	96	97	99	101	103	106
AfterTax	117	56	29				36	38	42	47	52	58	65	72	79													
RothIRA						185										101	54	59	64	69	221	233	245	258	271	285	300	315
IRA2Roth	217	158	122	94	94		14	8	9	10	11	12	14	16	19													
GuarInc		61	62	64	65	66	68	69	70	72	73	75	76	78														
Yield	3	1					13	12	11	10	8	7	5	2														
Taxes	44	40	35	35	35	36	18	17	18	18	19	20	21	22	23	17	17	18	18	19	19	19	20	20	20	21	21	22
DI	76	79	82	85	88	372	134	139	144	150	156	163	169	176	183	232	185	192	200	208	363	377	392	408	424	441	459	477

The rows are sources of income and defined as follows:

1. **TaxDef** contains savings withdrawals from the Tax-deferred Account. Withdrawals are subject to personal income taxes.
2. **Taxable** contains savings withdrawals from the regular, conventional brokerage, savings accounts.
3. **Roth IRA** contains savings withdrawals from the Roth IRA.
4. I**RA2Roth** contains conversions from the Tax-deferred account to the Roth IRA. Conversions are subject to personal income taxes.
5. **Soc Sec** contains Social Security income.
6. **Yield** contains interest income and stock dividends from the Taxable account.
7. **Taxes** are state and Federal and capital gains taxes paid.
8. **DI** contains each year's Disposable Income.

Disposable Income is described as follows:

DI = TaxDef + Taxable + Roth IRA – IRA2Roth + Soc Sec + Yield – Taxes.

within ORP's $1,000 rounding tolerance.

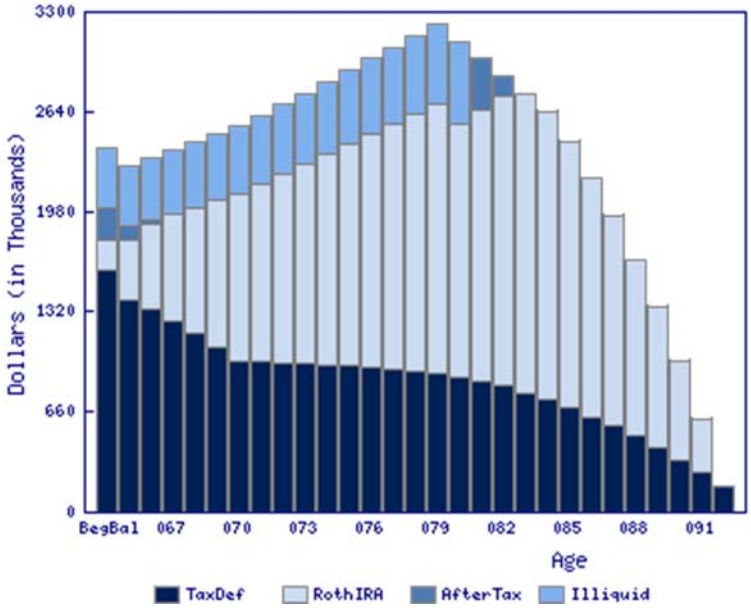
1. **Ages 65-70, retirement living** in the family homestead until decisions are made. This should be the phase when the household is being downsized in preparation to moving to the smaller quarters of the CCRC. The CCRC spike at age 70 begins with the sale of the house and the infusion of the proceeds into the Taxable Account. The income from the actual home sale transaction is not shown directly in Figure 3. The spike indicates the use of the increased taxable savings to pay the CCRC entrance fee.
2. **Ages 70-80**, **Married couples independent living** in a CCRC after buying in at age 70 and ending with the loss of spouse at age 80. The age 70 spending spike of Figure 2 is the taxable withdrawal for the CCRC entrance fee along with enough tax deferred withdrawal to bring taxable income to the top of the 15% tax bracket. From age 70 through age 76 there is enough surplus from the house sale in the taxable account to hold tax-deferred withdrawals in the 15% tax bracket for much of the couple's independent living phase.
3. **Ages 81-85, Single independent living** in the CCRC until a major health crisis at age 85. During this phase Essential Spending is reduced to single occupancy. **Ages 85-92**, Major health crisis puts the client in assisted living while "waiting for God". The high Essential Spending of the phase reflects the high cost of increased personal attention.
4. **Ages 86-92, Assisted Living Phase,** this is phase in which the survivor requires the most assistance and has the and has the highest Essential Spending.

The interesting thing about **Error! Reference source not found.** is the large IRA to Roth IRA (row IRA2Roth) conversions that are scheduled early in the plan. ORP is paying higher taxes early in the plan because it is economically advantageous over delaying them. In fact there is a 2% improvement ($2,000) in Discretionary Spending when partial conversions are employed over the first 6 years of the plan.

ORP's strategy in Figure x is to anticipate climatic events by doing partial conversions, up to a level deemed economical by taxes, and then make the major outlay with taxed funds from the Tax-deferred Account and untaxed funds from the Roth IRA. ORP's optimizer seeks out the level where partial conversions before the major event, while raising taxes before the event, reduce total taxes for the anticipator period as well as the event. ORP executes this plan not once, but twice in the same retirement plan; once for paying the CCRC's entrance fee at age 70, and again before loss of spouse.

Many clients will become anxious about such massive prepayment of taxes which is when the calming of the financial advisor is called for. The computed gain is $2,000 **per year** over 30 years of retirement. At the same time ORP is taking into account the difference between rates of return on the different saving accounts in how it does its withdrawals. ORP favors retaining funds in higher yielding accounts while making distributions and sometimes rebalancing accounts to improve overall asset returns.

Figure 3: Custodial Care Asset Balance



Four retirement phases can be seen in this diagram:

Assisted living monthly fees tend to be triple independent living. The interesting thing about **Error! Reference source not found.** is that ORP squirreled away taxable savings when the early tax-deferred withdrawals supplemented taxable withdrawals. ORP has held back on Roth distributions until the end when they replace taxable withdrawals in supplementing tax-deferred withdrawals.

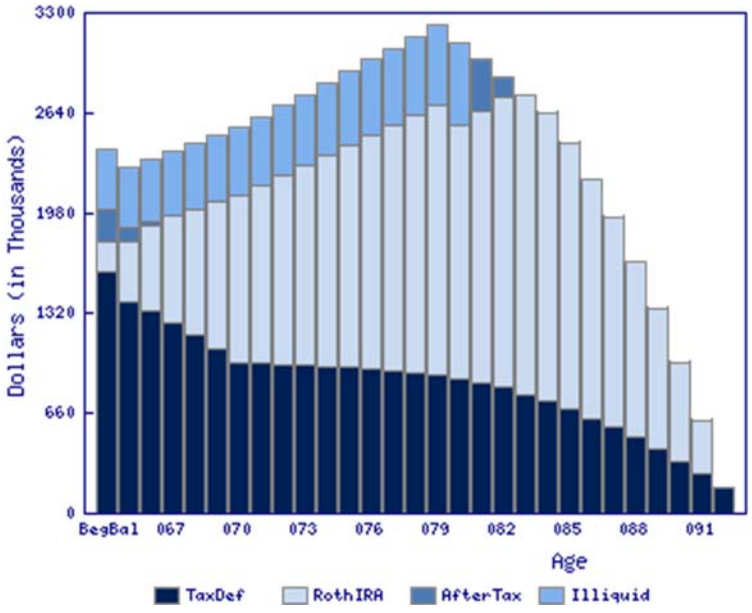
ORP's Discretionary Spending for the CCRC option is $57K in today's dollar. Discretionary Spending is the money left after all Essential Spending requirements have been satisfied.

ORP ends the plan with an inflated FTAB of $188K. The CCRP returns 90% of the original entrance fees ($180K) so the client's bequest is $368K.

Custodial Care

The **Custodial Care (CC) Model** begins as Age in Place but loss of spouse sends the survivor is off to a custodial care facility.

Figure 4: Custodial Care Asset Balance Report.



Discretionary Spending Comparison.

Figure 6 contrasts the Discretionary Spending for the two options.

Figure 5: Discretionary Spending

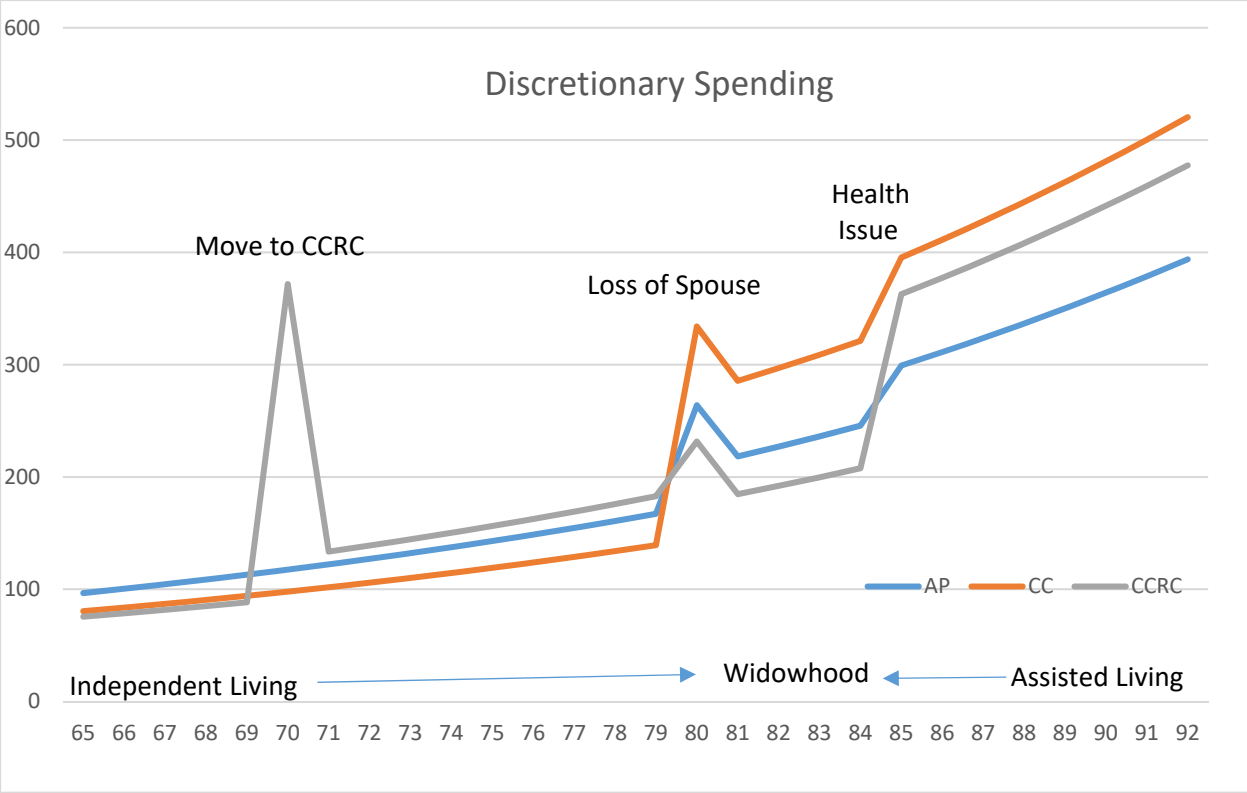


Figure 6 Discretionary Spending

Maximum Discretionary Spending is computed by ORP as constant over retirement, indexed by inflation. Most of the difference in magnitude for these two options can be attributed to the $200K entrance fee required by the CCRC. 90% of the entrance fee is returned when the client leaves the CCRC. During occupancy that money's returns are going to the CCRC and not to the client. The returned fee is the original money and does not reflect inflation during occupancy. The result is that the AIP has more discretionary spending than the CCRC for this particular scenario because AIP has the equivalent to the CCRC entrance fee invested in the stock and bond market at a return rate that is higher than the income inflation rate.

At age 92 the AIP client dies with the house valued at $683K in inflated dollars.

The CCRC surplus is $171K, the inflated original $100K estate. The returned entrance fee is $180K, 90% of the $200K entrance fee. Thus the total CCRC estate is$1.034M.

Error! Reference source not found. shows the couple's assets at retirement to have been $2.4M.

The caveat cited earlier still applies: There are other factors besides economics to be considered when deciding where to live.

Disposable Income Comparison

Figure 7 comparison of the disposable incomes for the two options is insightful because it reveals and contrasts some of the mechanics of the tool's model. The four phases of the retirement plans are clearly visible in chart of Figure 7.

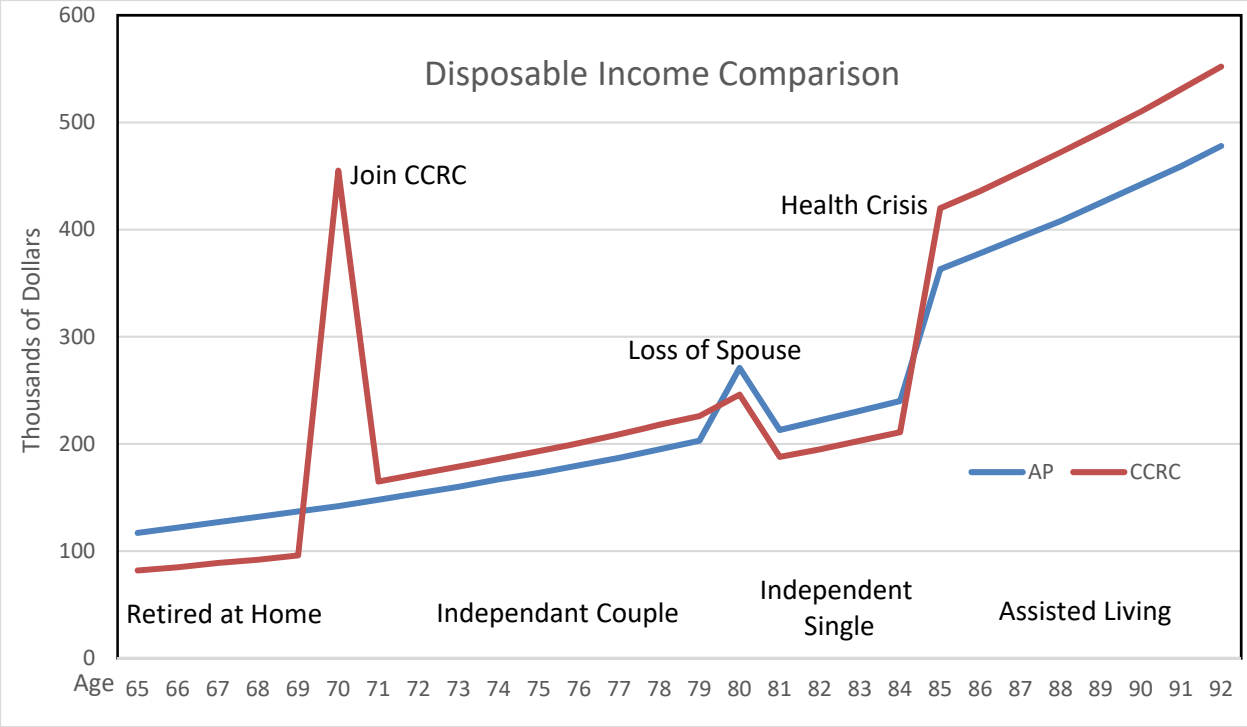


Figure 7: Disposable Income Comparison

Differences between the two disposable incomes are due to differences in their maximized essential spending. CCRC's $200K entrance fee is money whose returns are going to benefit the CCRC and not the client

The CCRC spike at age 70 is the sale of the house and the infusion of the cash proceeds into the Taxable Account. This transaction is not reflected in Figure 3. The spike is the use of the increased taxable savings to pay the CCRC entrance fee.

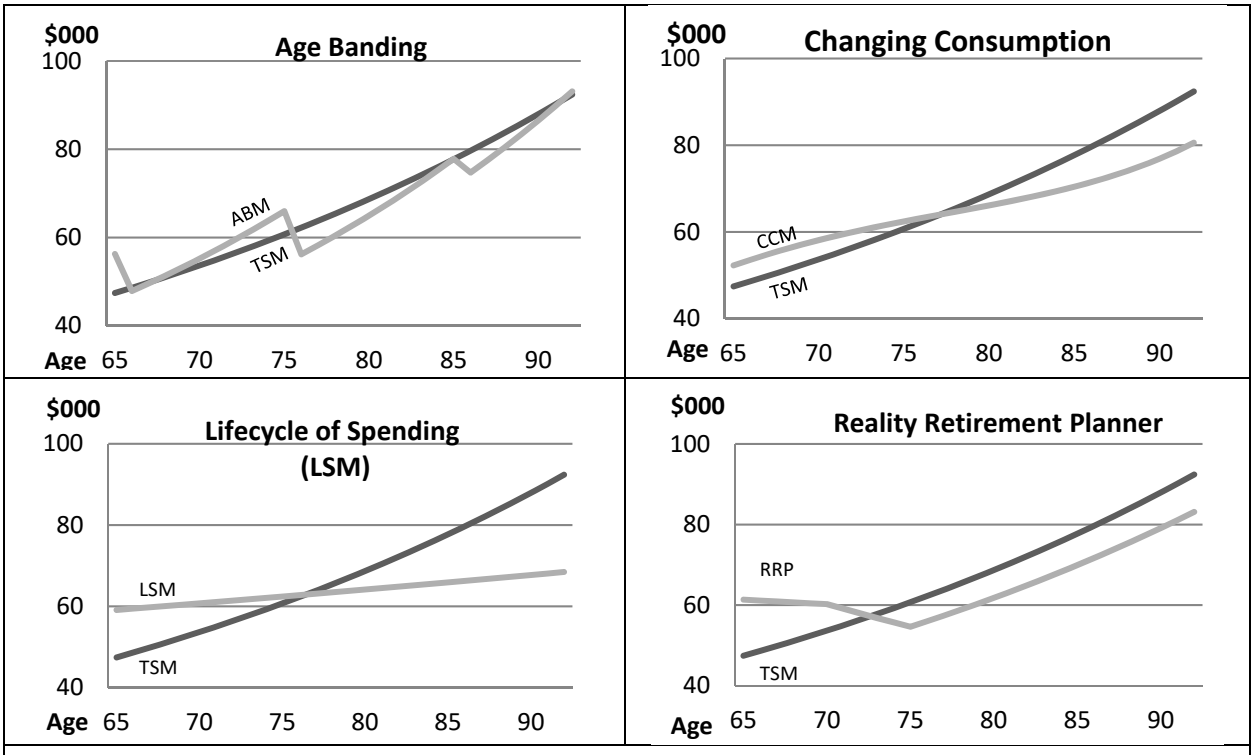
During the initial retirement phase CCRC reduces spending to conserve savings which is used to contribute to CCRC's entrance fee. CCRC's spending is higher during the Independent Couple phase because not all of the house sale proceeds was needed for the entrance fee and the surplus is distributed across the subsequent phases. (This observation is not visible in Figure 3 but is apparent from the tool's other reports.)

Age 70 shows a spike in income to cover the funeral expenses for the deceased spouse. CCRC shows a larger reduction in disposable income during the independent single phase because CCRC essential spending (Table 1) is higher than AIP essential spending.

Spending Model Comparisons

Most of the available retirement calculators compute the Traditional Spending Model which is to annuitize disposable income into constant withdrawal over retirement, adjusted for inflation. In his paper on spending models Welch [2016] compared four alternative spending model implemented in ORP to the tradition spending model. Each spending model is based of a database of user transactions in managing their savings withdrawals. Figure 8 displays these comparisons.

Figure 8: Spending Model Comparisons



- Each panel contrasts one alternate spending model to the Traditional Spending Model (constant spending indexed to inflation).
- The spending models' y-axis's are different from PERP because the spending curves are for different retired couples.

All of the spending methods, including PERP, are constant spending tied to the rate of inflation. PERP lowers its rate its overall spending rate in order to conserve funds to cover the occasional spending spikes.

Discussion

According to Figure 6 AIP's annual Discretionary Spending is $79K and CCRC's Discretionary Spending is $65K. What is to be made of the $14K annual Discretionary Spending difference? The naïve interpretation is that AIP is the cheaper alternative, which is probably true. But a straight cost comparison ignores the fact that AIP has non-quantifiable costs that are not included in the model, i.e. the effort that family members expend to support the AIP client. On the other hand, the CCRC offers substantial entertainment amenities which are omitted from these calculations. The free-market followers of Adam Smith assume responsive pricing in retirement service providers' fees. Therefore, the $14K difference represents the difference in market value between AIP and CCRD in today's market. In other words, AIP family support and CCRC amenities account for the $14K Discretionary Spending difference between these models. Thus the choice between the options comes down to not only to a cost comparison but to how well the amenities suit the client not only now but in the future.

While the comparison of strategies is interesting it is not altogether reliable.

Table 4 compares the mostly incomparable Discretionary Spending values.

Table 4: Discretionary Spending Comparison

Model	Discretionary Spending	Disposable Income
Age in Place	$81K	$91K
CCRC	$66K	$76K
Custodial	$70K	$80K

Discretionary spending is difference between Disposable Income and Essential Spending. Disposable Spending is constant across time and the value that ORP is maximizing and as such is a suitable summary measure of the plans. But plans with higher Essential Spending, such as CCRP will have lower Discretionary Spending.

CONCLUSION

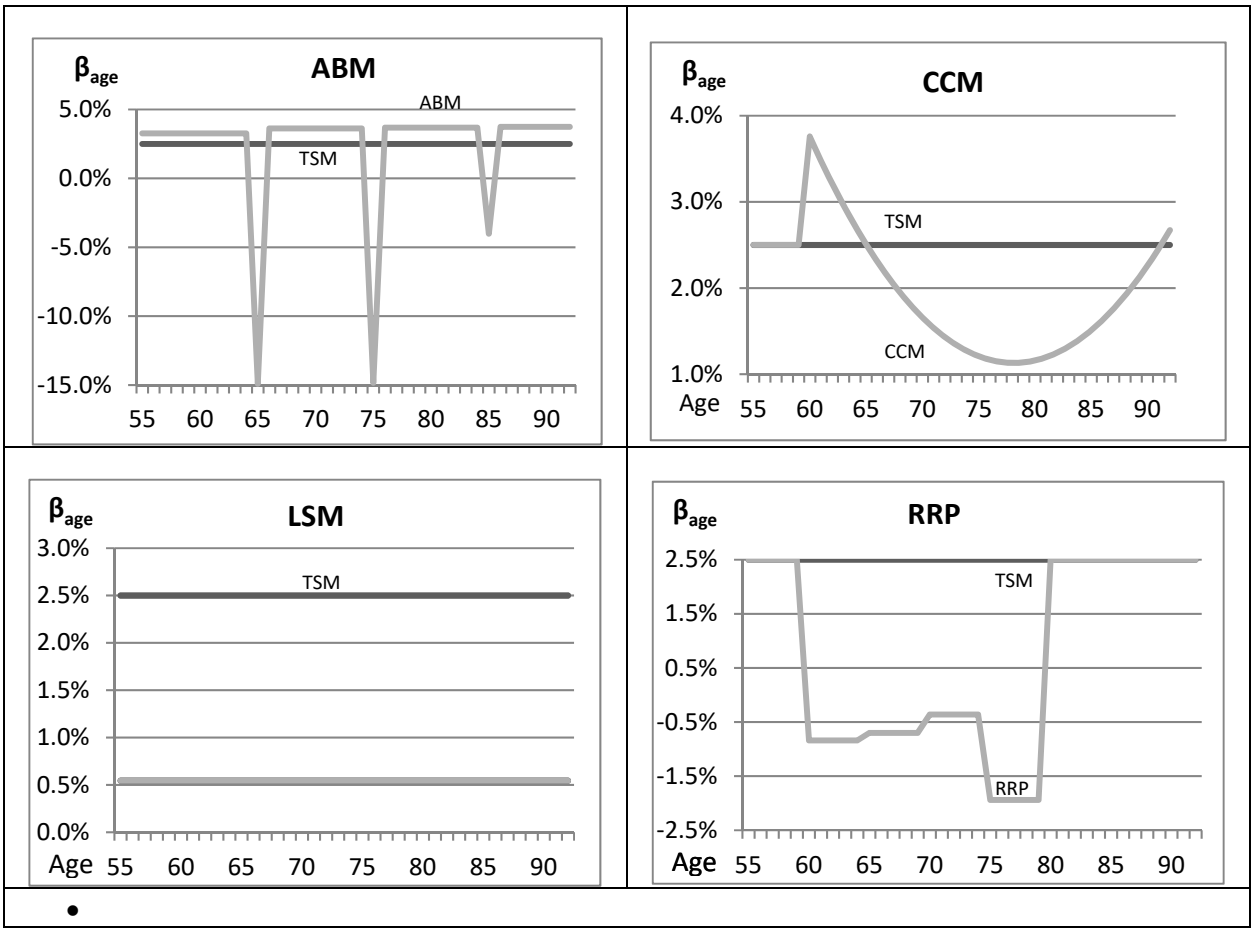
This model integrates two paradigms sometimes seen in the retirement literature.

1) Income Management: DI = ES + DS. DI is maximized through the tax efficient withdrawals of retirement savings. ES includes income taxes which are computed as part of DI maximization.
2) Spending Management: the retirement phase and event driven time-line description of retirement is where phases are periods quiet and stability, punctuated by high cost events. Spending management includes capital preservation during phases, anticipating the financial demands of the inevitable life-altering events.

These concepts are integrated into a linear programming application which has two practical uses:

1) Support the annual 3-PEAT (Welch 2017) retirement savings adjustments, including saving for the inevitable retirement changing crisis. 3-PEAT is based on the idea that retirement plans are made in the context of the full plan of retirement but are implemented one year at a time. At the first of the year the 3-PEATpractitioner collects her end of the brokerage account statements, and other fills in the tool's input parameter form with her yearend account balances and runs the tool. The tools output begins with the next year's withdrawals which the client executes.
2) Provide a retirement strategy evaluation tool for the retiree who is looking for computational support in making the AIP/CCRC decision, how to fund AIP, or in deciding which CCRC to choose and when to move to custodial care. (This is not an inconsequential decision due to the CCRC requirement for a large, up front entrance fee.)

Figure 9: Income Rate Change for Each Year of the Base Scenario
Assumptions:
- Base scenario.
- Retiree's age and retirement age are set to 55 to show each alternate spending model's active age range.



We can't predict the future but we can plan for its anticipated events.

Absent from the model is the role of the family caregiver(s) (i.e. daughters[1]) and the economic contributions that they provide on a volunteer, non-cash basis. One might suspect that the typical AIP client consumes more family resources than the CCRC client. The contribution of family caregivers is a whole different research project that is outside the scope of this model.

Although the tool is available, via the Internet, to the general public its intended audience are retirement planning practitioners.

The Retirement Phase Paradigm is not without precedent:

> In *The Structure of Scientific Revolutions*, Kuhn (1970) saw the sciences as going through alternating periods of *normal science*, when an existing model of reality dominates a protracted period of puzzle-solving, and *revolution*, when the model of reality itself undergoes sudden drastic change. Paradigms have two aspects. Firstly, within normal science, the term refers to the set of exemplary experiments that are likely to be copied or emulated. Secondly, underpinning this set

[1] "The best long-term care insurance in our country is a conscientious daughter," wrote the authors, all of whom are fellows at Stanford University's Clinical Excellence Research Center, which studies new methods of health care delivery. (Rabin 2017)

of exemplars are shared preconceptions, made prior to – and conditioning – the collection of evidence (Wikipedia 2018).

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GLOSSARY

CCRC: Continuing Care Retirement Community. Continuing care retirement communities are retirement communities with accommodations for independent living, assisted living and nursing home care, offering residents a continuum of care. A person can spend the rest of his life in a CCRC or life plan community, moving between levels of care as needed.

CC: **Custodial Care** is non-medical care that helps individuals with their daily basic care, such as eating and bathing. Custodial Care clients downsize into a smaller facility, thereby facing the same rigors as the CCRC couple. Custodial care contracts are generally month to month, may have a one-time sign up, fee but there is no large entrance fee. Custodial Care institutions tend to be smaller than CCRCs and offer fewer amenities.

DI: Disposable Income, DI = ES + DS, total amount of money available for spending in a year.

DS: Discretionary Spending is unobligated, after tax money available for whimsical expenditures. Maximum DS is computed by ORP. Discretionary Spending is the money left after all Essential Spending requirements have been satisfied. Disposable Income varies year to year as Essential Spending varies phase to phase. Discretionary Spending is maximized in today's dollars and fixed for the retirement plan, indexed for inflation. This makes it a good measure of the overall value of a plan.

Entrance Fee: The quite large sum of money the many CCRCs require clients deposit with the CCRC. In some cases some or most of this deposit is recovered when the member leaves.

ES: Essential Spending: Annual money that is contractually obligated or otherwise required for retirement living. Essential spending is constant for a phase, adjusted for inflation.

FTAB Final Total Asset Balance: is the sum of all assets, savings and the house, at the end of the plan.

Planning Horizon: age of the end of the retirement plan. IRS actuaries estimate one spouse of a married couple will last to age 92, but they don't say which one. Planning horizon is a practical upper bound on the retirement plan. Planning horizon is different from life expectancy, which for a 60 year old is somewhere between age 78 and age 80.

Retirement: A definitive event at an definitive age in ORP modeling. This is the age at which the ORP switches from savings accumulation to savings distribution. Retirement related activities are modeled before retirement.

APPENDICES

Literature Review

Every retirement planning research paper written about simulating retirement since Bengen [1996] assumes constant spending, indexed to inflation. This means that spending at retirement is computed by the calculator or fixed by input and succeeding years spending are that value indexed to inflation. Constant spending is both computationally straight forward and intuitively appealing. One consequence of this is that retirement savings are withdrawn in much the same manner; each year's withdrawal is the amount withdrawn at retirement age, indexed to inflation. This is known as annuitizing savings, i.e. withdrawing a constant amount throughout retirement, indexed to inflation.

The computational engine used in this study is the Optimal Retirement Planner (ORP) a linear programming based retirement calculator. ORP computes the maximum disposable income available over all retirement for the given asset situation.

Linear Programming

ORP is a **Linear Programming (LP)** application that finds the optimal solution for conflicting requirements. Linear programming is a mathematical tool where a process is modeled as a set of linear equations. Normally there are more variables than equations; this means there are many solutions to the equations. The **objective function** that spans the entire system and assigns a cost or profit to each activity in the system. This function computes the profit for a solution to the system of equations. The optimal solution is one with the maximum value of the objective function.

The genius of linear programming is the simplex method (Dantzig 1963) that evaluates a relatively small number of candidate solutions as it seeks the optimal solution, which is guaranteed to maximize the objective function.

Ragsdale, Seila, and Little (1994) and Coopersmith and Sumutka (2011) demonstrated that the linear model is a suitable representation of the retirement income management process. They each laid out the retirement model in algebraic form. The competing forces of the retirement income model are minimizing taxes (cost reduction) and maximizing compounded asset returns (profit maximization). Linear programming finds the optimal balance between these two objectives.

Welch (2008) was the first, and thus far only retirement calculator, to make a linear programming based retirement calculator available to the retail market via the Internet. ORP maximizes disposable income at retirement and indexes subsequent years to inflation. ORP reverses the usual retirement calculator architecture and maximizes annual disposable income for a given estate (plan surplus). The conventional practice is to maximize plan surplus for an assumed spending level.

Welch (2015a) demonstrated linear programming's advantage over the conventional savings withdrawal practice of distributing the taxable account until depletion, then the tax-deferred account, followed by the Roth IRA.

In subsequent papers Welch demonstrated the utility of LP platform in conducting research into retirement income management strategies. Welch (2015b) compared four spending models that are based on databases of user retirement spending. Welch [2016] modeled partial IRA to Roth conversions, concluding that there is no overall economic advantage to conversions. Conversions front loaded the payment of taxes while not doing conversions increased total taxes but spread them over all of retirement.

Welch[2017] reported on how some retirees self-manage their retirement income by doing full retirement scenario analysis but implement their decisions one year at a time.

Occam's Razor

Occam's Razor is a principle of Philosophical Studies.

***Occam's Razor**: No more assumptions should be used than are necessary.*

The advantage of using LP for financial modeling is that Occam's Razor is being applied to the experiments by having the LP optimizer compute optimum values for the scheduling and withdrawal amounts from savings accounts, minimize income taxes paid , minimize IRMMA Medicare premiums, maximize dividend income, and interest collected from bonds in the taxable account. These are all variables that have to be explicitly specified by conventional research projects of this ilk but whose optimal values are computed by ORP. It has long been observed that two LP models variations will have similar optimal values because their different solution paths bring them to similar locations in the solution space. The family of results generated by LP based experiments will be superior to simulation results.

Facts Used in this Study

The Facts of Table 5: Constant Facts are values that are not subject to change by client or adviser.

Table 5: Constant Facts

	Balances in Thousands of Dollars	
Facts	Retiree	Spouse
Current Age	65	65
Tax-Deferred Account	800	800
Roth IRA Account	100	100
Taxable	200	
Illiquid Assets - House	400	
Illiquid Asset cost basis	100	
Mortgage Balance	0	
Social Security Benefits Principle Investment Amount	30	30

Financial Environmental Assumptions

The environmental parameters Table 6 are not personal to the client but apply at the national level and change due to acts of Congress or due to market forces. They may be changed by the adviser to assess the impact on the retirement plan of changes in the financial environment.

Table 6: Environmental Assumptions

Parameter	Value	Comments
Long term capital gains tax rate	15%	
State Income Taxes	0	None
Trump Tax		Expires in 2025, tax tables revert to old values
Rate of income inflation	2%	The Federal Reserve's stated target. ORP applies this inflation estimate to income and tax brackets.
Rate of spending inflation	4%	Reflecting retirement living costs derived from the Senior Citizen League's study (2017).
Stocks' rate of return	7%	The 10 year Rate of Return (ROR) for popular S&P 500 index funds as reported by Zack.
Bond Yield	3.5	Moody's . Aaa Corporate Bond Yield
Social Security	25%	Reduction in Social Security benefits in 2035 when the Trust Fund is depleted.

Client Policy Choices Applied to this Study.

The policy assumptions of Table 7 are personal choices about parameters that the client may want to manipulate to do scenario evaluations.

Table 7: Policy Choices

Policy	Retiree	Spouse
Age to Retire	65	65
Planning horizon age	92	92
Age to Start Social Security	Full Retirement Age, 67	Full Retirement Age, 67
Age to Sell Home	80	--
Amount of plan surplus (Estate)	100	--
Percent Savings is Stocks	60	60
Percent Savings in Bonds	40	40

Assume annual rebalancing of saving allocations to maintain stock and bond ratios.

Healthcare Rate Estimates.

The healthcare service rates used in this study come from those prevailing in Southern Maryland in 2019.

1. CCRC rates are drawn from the Financial Disclosure for Riderwood Village, Silver Spring, MD. Riderwood is your quintessential CCRC, with 2,800 clients on a 160 acre campus. The entrance fee for a one bedroom apartment averages $200K. Monthly fee averages $2,313 plus $948 second occupancy for a monthly fee of $3,261 or roughly $40K annually. Riderwood's average assisted living monthly fee is $8,100, or $97K per year.
2. Home With You Senior Care, LLC provides home healthcare aids for a $21.50 hourly rate, or $860 for a 40 hour work week. This works out to an annual charge of $44,720.

3. The Hybrid rates are drawn from Arbor Terrace, Fulton MD. Arbor Terrace has a one time, $3K entrance fee assessed at entry. Thereafter, the client can leave with 30 day notice. Arbor Terrace monthly rental is $6,795 for their smallest, one bedroom apartment. There is a $2,400 surcharge for their highest level of supportive care.

These are just intended to be representative estimates for one geographical area and not an accurate survey of the National market.

The Spending & Income Model

This appendix discuss how the spending and income models are tied together as an integrated model.

ORP maximizes Disposable Income (DI) by scheduling savings withdrawals in such a manner as to minimize personal income taxes on savings withdrawals and guaranteed income (Social Security).

$DI_r = TDW_r + RothW_r + TW_r + GI_r - taxes_r$ for retirement years r, age 65 through 92

The W variables are savings withdrawals and available for the optimizer to manipulate while computing maximum disposable income. Taxes are a consequence of withdrawals and guaranteed income. DI for the first year of retirement and the withdrawal schedule for the plan's first year are the optimizer's important results.

Recall that $DI_r = ES_r + DS_r$.

So substituting for DI $ES_r + DS_r = TDW_r + RothW_r + TW_r + GI_r - taxes_r$

ES and GI are constant so it follows that DS_r is proportional to $TDW_r + RothW_r + TW_r - taxes_r$

By definition, the optimizer maximizes DS_0. DS is constant across retirement except for being indexed to inflation: $DS_r = DS_{r-1}*(1 + inflation)$.

DS will be constant across all of retirement, when indexed to inflation. Figure 2 shows how DS is constant over retirement while ES and thus DI are highly variable.

An important model constraint is FTAB = 0

The plan's **Final Total Asset Balance (FTAB)** is the sum of all assets, savings and the house, at the end of the plan. For the scenarios in this study FTAB = 100 means that final solution is to a $100K inflated surplus. This is a hard constraint in that the plan cannot fail by allowing FTAB to go negative. FTAB = 100 is a soft constraint in that FTAB is minimized while being $100K or larger. Most commonly a surplus occurs when the house is not sold and becomes part of the estate.

The measure of a scenario for purposes of the paper is maximum $DS_0 > 0$ and minimum FTAB >= 100.