Validating the Optimal Retirement Planner

J.S. Welch November 2, 2014

Executive Summary

Why should any user believe ORP's results? ORP, the Optimal Retirement Planner, is a retirement calculator that computes the maximum level of spending that can be sustained by the user specified model. This paper addresses the credibility issue by reporting on several experiments that demonstrate ORP's credibility. The experiments are:

- Comparison of ORP's results to conventional practice
- Review of ORP's results for some degenerate scenarios in which all parameters are at their default values except for one or two.
- Comparison of ORP's results to published, quantitative studies which include personal income taxes as part of their implementation.

1 Introduction

A *retirement calculator* is useful only to the extent that users find the guidance provided to be credible. This paper describes the validation of the ***Optimal Retirement Planner (ORP)*** as a retirement planning aid.

These tests are used to establish ORP's credibility:

1. Are the results reasonable?
2. How do the results compare to conventional practice?
3. Do degenerate scenario results make sense?
4. How do ORP results compare to other calculators modeling the same scenarios?

2 Reasonableness of the Results

Only the user knows the context in which she is doing retirement planning. If she is comfortable with the numbers then a necessary condition is satisfied. This is not to say that the retirement calculator's report won't offer any surprises. Justifiable surprises are good. An important purpose of ORP is to acquaint the user with some of the nuances of retirement planning.

3 Conventional Practice

Conventional practice is defined by Ruffenach [2005]:

> "Draw down your taxable accounts first; then turn to tax-deferred accounts, like IRAs … In this way, tax-deferred assets get more time to grow".

For purposes of this discussion the term IRA is used as a surrogate for all tax-deferred accounts.

In order to do a quantifiable comparison between ORP and conventional practice the ***Conventional Practice Simulator*** **(CPS)** was created**.**

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The CPS heuristic withdraws savings from retirement accounts in this order:

1. From the IRA sufficient to satisfy its required minimum distribution.
2. From the taxable account until it is depleted,
3. From the IRA until it is depleted,
4. From the Roth IRA to the end of the plan.

CPS is a spreadsheet that simulates the conventional practice of retirement withdrawals. CPS starts with a low initial spending value and computes the estate. It then iterates through progressively larger spending values until the computed estate goes to zero. CPS declares this spending value to be maximal. It is directly comparable to ORP.

CPS includes the **Required Minimum Distribution (RMD)** and personal income taxes using the Federal income tax tables in its computations. ORP computes the order of withdrawals from the retirement accounts instead of having it programmed into the software. The parameters for the two programs are otherwise identical.

First we examine CPS results to be assured that CPS is operating as specified.

Figure 1 shows the CPS asset balance of retirement savings across retirement.

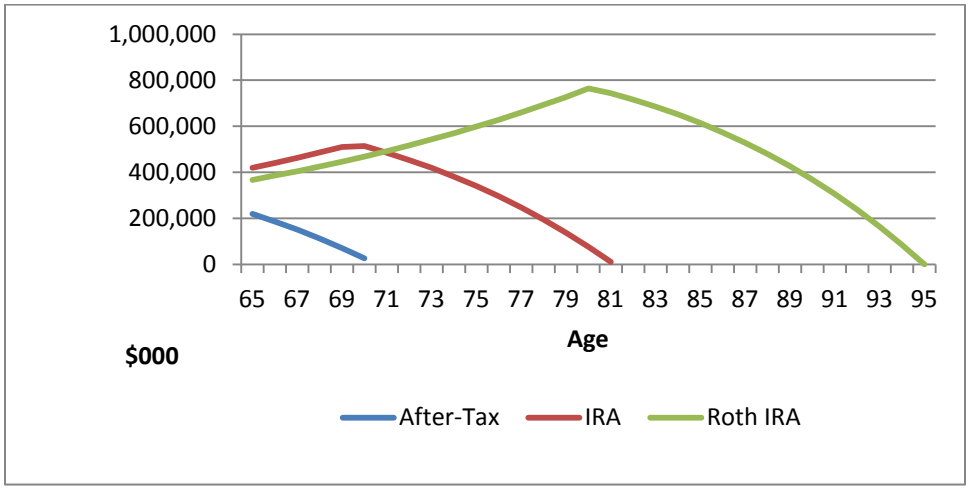

Figure 1: CPS Asset Balances

Figure 1 indicates that CPS functions as conventional practice specifies. The taxable account balance declines as the other two accounts increase. When the taxable account is depleted the IRA starts to diminish while the Roth IRA continues to accumulate. At age 81 the IRA is depleted and money is withdrawn from the Roth IRA until the end of the plan. Since the spending rate is, before inflation adjustment, constant the accumulation and distribution slopes are similar for all three accounts. There is nothing fundamentally wrong with the plan shown in Figure 1; except that it is tax inefficient. (Convincing all retirees to follow conventional practice would go a long way toward reducing the Federal deficit.)

Figure 2 shows the savings account balances for ORP's optimal withdrawal plan.

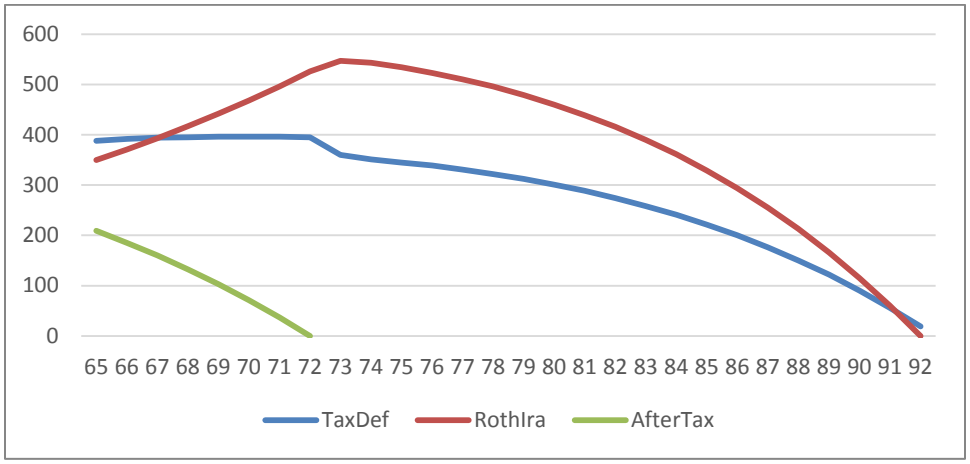

Figure 2: ORP Asset Balances

Figure 2 stands in contrast with the conventional withdrawal plan in Figure 1. Early in retirement the IRA does not grow while the Roth IRA increases in size as long as the taxable account is available to cover spending. Withdrawals from the IRA are made throughout the plan in parallel with withdrawals from the other accounts. This serves to level taxes and is the basis for ORP's tax efficiency.

(Comparing Figure1 to Figure 2 shows why CPS is tax inefficient. In Figure l of the taxable IRA withdrawals are jammed into the 70 to 80 age interval, approximately 1/3 of retirement. Figure 2 shows taxable IRA withdrawals occurring across the entire retirement plan, thereby significantly lowering taxes.)

4 Degenerate Scenarios

Degenerate scenarios are computed with all but one or two of ORP's parameters set to zero.

The degenerate scenarios considered here are:

1) All $1,000,000 in the taxable account only.
2) All $1,000,000 in the Roth IRA only.
3) All $1,000,000 in the IRA only.
4) Same as 3) except with zero inflation
5) Same as 3) except with ROR set to zero.
6) Same as 3) except with both inflation and ROR are zero.
7) No savings at all; Social Security is the only income.

Table 1 reports the maximum annual spending and total spending for the degenerate scenarios. The default value for inflation is 2.5% and 6% for **Rate of Return (ROR).**

Row	Scenario	Annual Spending	Income Taxes	Total Spending
1	**Taxable**	$46,000		$2,108,000
2	**Roth IRA**	51,000		2,349,000
3	**IRA**	48,000	$ 3,000	2,194,000
4	**IRA with 0 inflation**	62,000	6,000	1,919,000
5	**IRA with 0 ROR**	22,000	< 1,000	998,000
6	**IRA with 0 ROR & Inflation**	31,000	1,000	970,000
7	**30K Social Security**	28,000	1,000	1,143,000

Table 1: Degenerate Scenario Comparisons.

Rows 1-3: The spending level for the taxable account is the lowest because of the assumption that taxes are paid for the taxable account annually, effectively lowering the ROR for the account making it a less attractive investment option. There are no taxes on Roth IRA withdrawals and it enjoys the same ROR as the IRA. The difference between the Roth IRA spending level and that of the IRA is the $6,000 income tax paid on IRA withdrawals.

Row 4: With no inflation and regular compounding the assets grow without being devalued by inflation.

Row 5: With no compounding of returns and 2.5% inflation, assets are being devalued without growth.

Row 6: No compounding and no inflation means that things are pretty much at a steady.

Row 7: Unrelated to the others this the case has no savings and is living only on Social Security benefits.

The most important take away from Table 1 is that ORP did actually solve all of these degenerate cases and the solutions did yield meaningful results.

5 Other Retirement Calculators

Very few retirement calculators are comparable to ORP because most do not model personal income taxes and, since they are simulators, their computed estates are overly optimistic. Three calculators have been found in the literature that are comparable with ORP; one an optimizer and two are simulators

5.1 Tax Efficient (TE) Optimizer

Coopersmith's and Smutka's [2011] **Tax Efficient (TE)** linear programming optimizer models personal income taxes and has parameters comparable to ORP. Coopersmith's core scenario can be replicated by ORP. The results are shown in Figure 2.

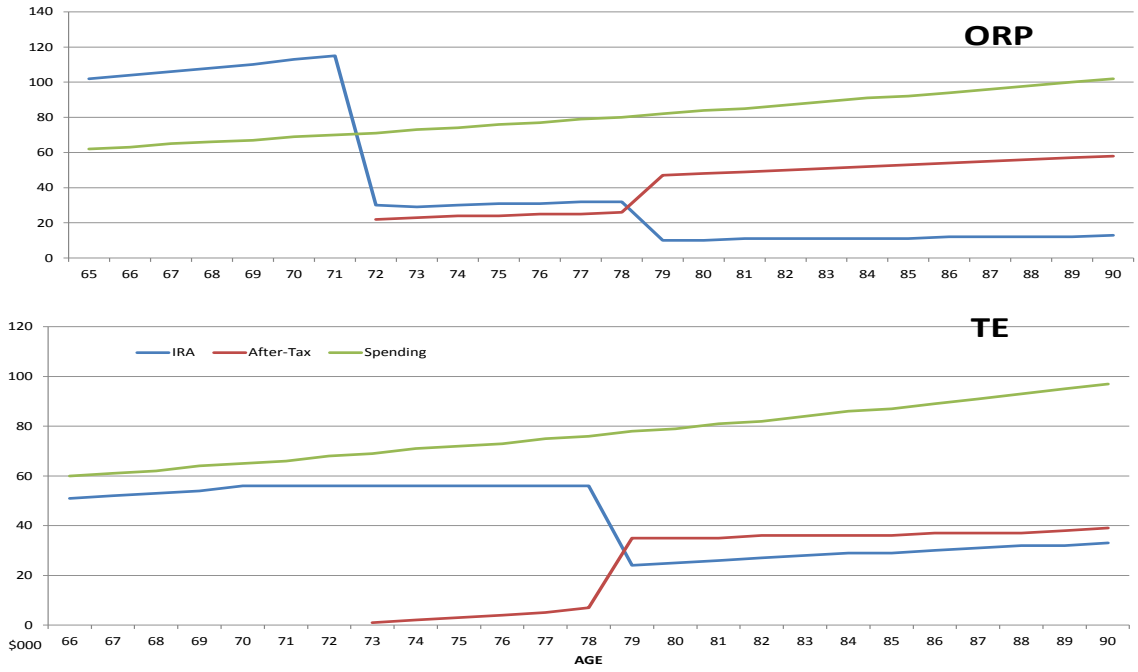

Figure 2: TE vs. ORP Comparison

The green (top) line is annual spending, blue (initially the 2nd line down) IRA distributions and red (initially the lowest line) is taxable distributions.

Before age 70 both systems withdraw more from the IRA than is needed for spending. The difference is transferred to the taxable account

The striking aspect about both graphs is that not only are they similar but they are both running counter to conventional practice. Taxable account withdrawals begin at age 72, not at the very beginning of retirement. Taxable withdrawals continue for the remainder of the plan in parallel with IRA withdrawals. This is caused by the assumed taxable account ROR (7%) being significantly larger than the IRA's ROR (5%). The optimizers are sacrificing tax minimization in pursuit of higher returns.

5.2 Comprehensive Tax Model (CTM)

Sumutka, Sumutka and Coopersmith's [2011] ***Comprehensive Tax Model (CTM)*** is a simulator that includes a detailed, personal income tax module. The purpose of CTM is to examine in detail the impact of a wide range of taxes on 15 retirement savings withdrawal strategies. Sumutka reports that two of their 15 scenarios were significantly superior and they were so similar to each other that only one comparison to ORP need be made.

CTM requires an initial spending amount be specified and the estate is computed. Completely opposite is ORP's requirement that the estate be specified and the spending amount is computed. The experiment was to input the estate amount computed by CTM into ORP and see if ORP's computed spending is similar to value assumed for CTM.

	CTM	ORP
Annual Spending in Today's Dollars	$80,000	$78,000
Estate in Inflated Dollars	1,6010,000	1,608,000

Table 4: CTM to ORP Comparison

The 2.5% difference in spending levels is insignificant, particularly in the light of how different the computer models are.

5.3 Retiree Portfolio Model (RPM)

The Retiree Portfolio Model [Murphy 2015] is a retirement financial forecasting model. It is similar to other planning models in forecasting portfolio results over many years, but doesn't calculate optimum results using historic returns or forecast how much you can spend during retirement. Instead, it is a simulator that calculates results based on solely the user's input. Additionally, and what makes it really different from other retirement models, is a feature that provides an instant comparison of results for common retirement issues, such as "How do Roth conversions impact my taxes, RMD and portfolio?", or "What is the impact on our income if we delay Social Security (SS) benefits?", or "What happens to our taxes if tax rates jump when I'm 80?", or "How much can we afford to spend during retirement if our portfolio only earns 5%?", or "How will buying an immediate annuity impact my portfolio and income?" RPM is a simulator implemented as an Excel spreadsheet rather than an LP optimizer written in procedure languages as ORP is.

Included on the RPM web site is a detailed comparison of RPM's and ORP's results for a medium sized retirement situation. The comparison include matching the year-by-year spending, withdrawals, and account balances for the two systems.

The comparison results are more than acceptable given the difference in algorithms and implementation platforms.

5.4 Reichenstein's Withdrawal Strategy

Reichenstein [2006] published a TIAA-CREF Institute white paper that "… discussed strategies for selecting the sequence of withdrawing funds from savings vehicles during retirement". He reports the results of a quantitative model that includes an approximation for personal income taxes. His base case, from which his study is derived, has a zero estate and begins with an initial withdrawal of $102, 529. Putting the parameters of his base case into ORP, including his zero estate, yields an annual spending level of $105,000. The 1.9% difference between the two models is insignificant.

5.5 Reichenstein's Social Security Study

Reichenstein [2013] reports a quantitative study showing "…the benefits of coordinating the timing of when you begin Social Security retirement benefits with a tax-efficient withdrawal strategy to extend the longevity of your financial portfolio." The study assumes an initial annual, after tax spending level of $36,850, including $18,000 in annual Social Security benefits and reports at what age the retirement savings go to zero, using a tax efficient withdrawal strategy. (The best choice is to wait until age 70 to start benefits.)

His results and a comparison to ORP are shown in Table 5:

	50% Stocks, 50% Bonds		60% Stocks, 40% Bonds	
Age	Longevity	Spending	Longevity	Spending
62	92	$35,000	96	$35,000
64	95	33,000	100	33,000
66	99	34,000	105	34,000
68	104	34,000	112	34,000
70	110	34,000	115	34,000

Table 5: Social Security Benefits

Reichenstein reports 4 studies, two of which are comparable to ORP. The two shown in Table 5 are for doing tax efficient withdrawals for the portfolio allocations shown. The omitted studies are for tax inefficient strategies which cannot be replicated by ORP. The Longevity values, as reported in the study, are the ages at which the retirement savings run out. The Spending columns are ORP computations using the study's initial values except for the assumed spending level of $36,850. The ORP spending values were computed by setting the estate of zero and term of the plan to the age computed by Reichenstein.

ORP's spending levels are within 8% of that assumed by Reichenstein. Even better, ORP's spending levels are consistent with each other for all the different plan lengths. Table 5 may be considered a successful validation of both models.

6 Discussion

ORP's performance in these validation tests should give the user confidence in planning her retirement using ORP's guidelines.

The ultimate test has been 16 years of customer experience and all of the help by people who took the time point out errors, suggest enhancements, and validate ORP's results with spreadsheet models of their own personal situations. (Actually most state it the other way round: ORP validates their spreadsheet.) There is safety in numbers.

7 References:

Coppersmith, W. Lewis and Alan R. Sumutka. "Tax-Efficient Retirement Withdrawal Planning Using a Linear Programming Model". Journal of Financial Planning. September 2011.

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