

Inaccurate Precision: The Danger of Replacement Rate Calculations

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Introduction

Well minded defined contribution (DC) plan fiduciaries and their consultants are increasingly interested in making sure their plan participants are “on track” for a successful retirement. We certainly applaud this mindset and the pursuit of the adoption of plan policies, investments, and investment programs that will lead to a successful retirement. The pursuit of this goal naturally leads plan sponsors to focus on a variety of measures that assist the plan sponsor in determining if their participants are on track. Of these various measures, the most popular is probably the “expected replacement ratio” at retirement, in which the expected replacement ratio identifies the percentage of the participant’s final annual total compensation that can reasonably be “replaced” per year from retirement savings.

These days, as sophisticated mega-plan sponsors perform their due diligence on potential (custom) target date solutions, advice programs, and DC managed account solutions a common focus is on the expected replacement ratio at retirement. In many cases, the plan sponsor will supply the potential vendor with average (or median) plan demographics and ask the vendor for the expected replacement ratio at retirement for the average (or median) plan participant. There are a number of potential pitfalls with this approach that plan fiduciaries should be aware of. Broadly speaking nuances in how one defines the expected replacement ratio as well as differences in how one the expected replacement ratio is estimated make it nearly impossible to meaningfully compare the expected replacement ratio provided by two different vendors.

This paper will explore important differences in how one defines the expected replacement ratio and elaborate how, like any type of projection involving multiple variables over an extended duration, replacement rate estimates estimates can vary materially based on different assumptions and provide varying levels of insight. Based on this analysis, we would strongly suggest plan fiduciaries take a caveat emptor (buyer beware) approach with respect to these projections and use caution before basing any decisions on the values.

Replacement Rate Scenarios

To demonstrate how minor changes in assumptions can lead to dramatically different outcomes for a replacement rate analysis, a “replacement ratio calculator” was built by the author where the various assumptions can be altered. These assumptions were:

1. **Earnings Curve:** whether or not the compensation is assumed to be constant or increase (and have increased) at the growth rate of the weighted average change in compensation of all workers.
2. **Savings Rate Change:** this is the future projected rate of change in a worker’s savings rate. For example, if the value is 1% and the worker is currently saving 5%, the following year the worker would be assumed to save 5.05% ($5\% * 101\% = 5.05\%$), then 5.10%, then 5.15%, etc.
3. **Retirement Age:** this is the assumed retirement age, which can either be a fixed age (e.g., 65) or Social Security Normal Retirement Age (SSNRA), which is the age when the retiree can receive full benefits for Social Security.
4. **Retirement Period:** assumed duration of retirement, in years.
5. **Asset Allocation:** whether or not the projections assume a changing allocation if the participant is in a target-date fund or constant if the participant is assumed to have the same allocation for the entire working period.
6. **Market Forecasts:** return forecasts used for the analysis: Conservative, Moderate, or Aggressive. Additional detail regarding the assumptions for each level is included in Appendix I. Returns are assumed to follow a normal distribution.
7. **Inflation:** inflation value to convert the analysis in “real” terms, i.e., today’s dollars.
8. **Assumed Outside Assets:** this is the minimum assumed outside savings amount, based on historical compensation assuming outside savings start at age 25. If the DC balance is less than this amount, whatever the difference is, this amount is assumed to have been saved outside the DC plan and is used for the replacement-rate projection.
9. **Target Retirement Success Rate:** this is the probability of success desired for achieving the income replacement amount.
10. **Retirement Equity Allocation:** this is the equity allocation in retirement, based on the same return and standard deviation values as the accumulation portfolio.

Based on the underlying participant- and plan-level assumptions, each test will yield a “Replacement Ratio,” which is the percentage of the employee’s final-year compensation that can be replaced during the retirement period. Note, even if a participant had no current savings and was not deferring, he or she will still be on track to replace some percentage of his or her final-year income based solely on Social Security (~30% depending on income level). Therefore, while these results will seem variable, they would in fact seem more variable if this “constant” were removed.

Table 3 contains the results from three participant scenarios, where the underlying projection assumptions are adjusted. The range in replacement percentages is relatively extreme. For example in Scenario 3.1 the replacement rate is 30%, while in Scenario 3.2 the replacement rate is 84%. The primary reason for the difference is Scenario 3.2 assumes a base outside savings while Scenario 3.1 assumes the only assets that participant has to fund retirement are the assets currently in the DC plan.

Table 3: Sample Scenarios

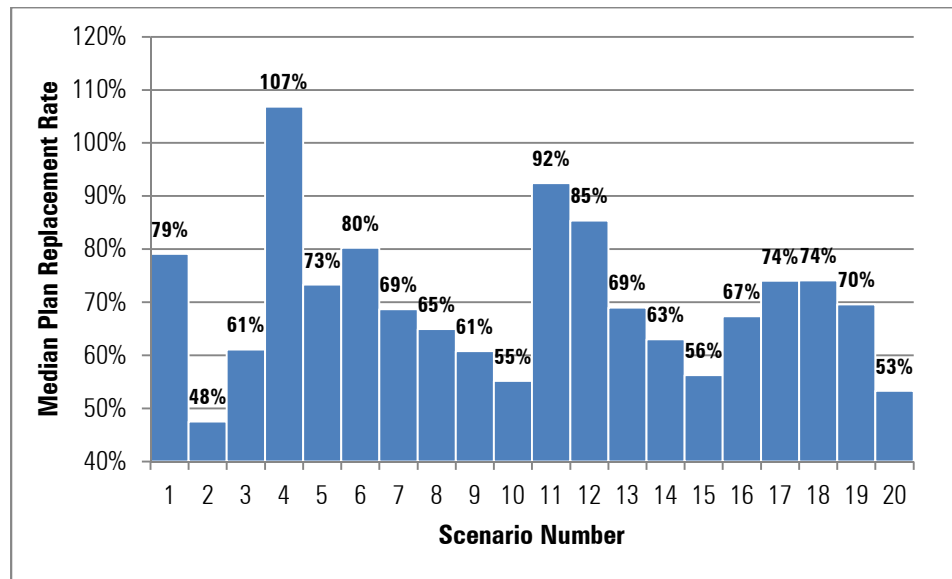
Data Available to Plan Sponsor ("Known" Data)						
Variable	Scenario1		Scenario2		Scenario3	
Age	35	35	45	45	55	55
Earnings	\$60,000	\$60,000	\$80,000	\$80,000	\$100,000	\$100,000
Employee Deferral	6%	6%	8%	8%	10%	10%
Employer Contribution	3%	3%	3%	3%	3%	3%
401(k) Balance	\$20,000	\$20,000	\$250,000	\$250,000	\$50,000	\$50,000
Equity%	80%	80%	70%	70%	60%	60%
In Target-Date Fund?	Yes	Yes	No	No	Yes	Yes

Projection Assumptions ("Unknown" Data)						
Variable	Scenario1.1	Scenario1.2	Scenario2.1	Scenario2.2	Scenario3.1	Scenario3.2
Earnings Curve	No	Yes	No	Yes	No	No
Savings Rate Change (per Year)	0%	1%	0%	1%	0%	1%
Retirement Age	65	SSNRA	SSNRA	65	65	SSNRA
Retirement Period (Years)	25	22	30	22	22	25
Asset Allocation	Constant	Variable	Constant	Variable	Constant	Constant
Market Forecasts	Moderate	Aggressive	Conservative	Moderate	Moderate	Moderate
Inflation	2.5%	3.0%	2.0%	2.5%	2.5%	2.5%
Assumed Outside Assets	No Min	4% Min	2% Min	No Min	No Min	6% Min
Target Success Rate	80%	50%	75%	70%	80%	70%
Retirement Equity %	30%	40%	35%	40%	30%	40%
Replacement % of Final Income	70%	148%	81%	113%	30%	84%

Full Plan Analysis

The previous section highlighted the array of potential replacement rates for three participant scenarios given different key assumptions. In order to better convey the potential differences that could be experienced in a plan-level analysis, we took 100 randomly selected “sample” participants between the ages of 25 and 65 from the 2007 Federal Reserve Survey of Consumer Finances dataset. The sample was adjusted in some cases for reasonableness purposes. We then used the same exact participant statistics to run 20 different plan scenarios varying such factors as earnings curve, savings rate, etc. The underlying plan-level assumptions are included in Appendix 2 and the median replacement rates for each of the 20 tests are included in Figure 4.

Figure 4: Median Plan Replacement Rates for 20 Plan-Level Success Studies

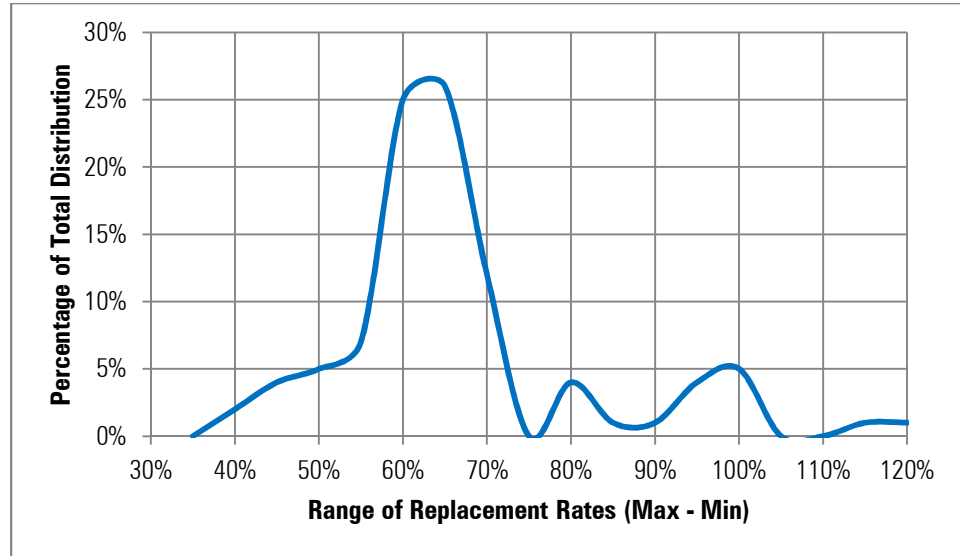


The range of median plan replacement rates was between 48% and 107%. If we assume a normal distribution for the median plan replacement rates (which is somewhat of a stretch), we can assign a 95% confidence interval that the actual median replacement rate for the plan is between approximately 43% and 99%. Therefore, there is a huge potential range of the “actual” median plan replacement rate, and the author would contend even this range is low given the array of unknown data.

Not surprisingly, given the range of median plan-level replacement rates, there is an even greater range difference between maximum and minimum replacement-rate across the twenty scenarios across individual participants, as demonstrated in Figure 5. The maximum range in replacement rates was 193% (67% was the minimum, 261% was the maximum). The minimum range was 38% (between 33% and 72%). It’s worth reminding the reader that since these estimates include Social Security benefits, there is some base replacement assumption within each rate that is based entirely on the Social Security

benefit. If the Social Security benefit were removed, the replacement percentages would only change slightly (since this is somewhat of a constant) yet the magnitude of the relative differences would increase.

Figure 5: Median Plan Replacement Rates for 20 Plan-Level Success Studies



Some simple linear regressions were performed on the analysis to determine which factors caused the greatest potential variations in the outcomes. In general, the following factors will lead to greater deviations in any type of retirement success projection: a larger portion of younger workers, workers with higher levels of compensation, workers with higher levels of savings, and lower relative plan balances. However, each of the factors contributed to the results in different ways, and would affect each DC plan differently based on that plan's actual demographics.

Conclusion

Peter Drucker, the late management consultant famously noted, “What gets measured, gets managed.” Along these lines, measuring, or really attempting to measure, the retirement readiness of a retirement plan should better enable a plan oversight committee to make decisions regarding the plan. Unfortunately, given the large number of unknown variables about participants these studies are likely painting an unreliable estimate of the retirement readiness of a given DC plan.

The findings in this analysis have significant implications for plan sponsors and consultants that have used, or are using, these types of metrics as a decision-making tool. Given the sensitivity and potential variability of replacement ratios to the vast number of assumptions used, plan fiduciaries should never compare replacement ratios calculated by different vendors. If plan sponsor wanted to make decisions based on a replacement ratio study, it should likely hire a single consultant to create a controlled experiment to meaningfully compare replacement ratios. Therefore, plan sponsors and advisors should take considerable caution before basing any decisions on the results of a DC plan success analysis.

Appendix 1: Market Forecasts

	Aggressive	Moderate	Conservative
Equity Return	13%	11%	9%
Fixed Income Return	7%	6%	5%
Equity Std Dev	20%	20%	20%
Fixed Income Std Dev	7%	7%	7%
Correlation	0.1	0.1	0.1

Appendix 2: Plan Scenario Assumptions

	Scenario Assumptions										Results	
	Earnings Curve	Savings Rate Δ	Retire Age	Retire Duration (Yrs)	Asset Alloc	Market Forecasts	Inflation	Assumed Outside Assets	Target Success Rate	Retire Equity %	Median	Average
Scenario1	Yes	1.00%	SSNRA	25	Constant	Aggressive	3.0%	No Min	70%	30%	79.1%	86.7%
Scenario2	Yes	0.00%	65	25	Constant	Conservative	3.0%	No Min	90%	40%	47.5%	46.8%
Scenario3	Yes	1.00%	SSNRA	30	Variable	Moderate	2.5%	No Min	90%	50%	61.1%	62.8%
Scenario4	Yes	2.00%	65	23	Variable	Aggressive	3.5%	6% Min	50%	30%	106.8%	111.4%
Scenario5	Yes	2.00%	SSNRA	20	Variable	Conservative	2.0%	4% Min	80%	30%	73.3%	77.6%
Scenario6	Yes	2.00%	65	23	Variable	Aggressive	3.5%	6% Min	90%	30%	80.2%	80.7%
Scenario7	Yes	0.00%	SSNRA	25	Constant	Moderate	3.0%	No Min	70%	40%	68.7%	70.5%
Scenario8	Yes	0.00%	65	20	Variable	Moderate	2.5%	2% Min	80%	50%	64.9%	68.6%
Scenario9	Yes	0.00%	SSNRA	30	Variable	Moderate	2.5%	No Min	90%	40%	60.8%	61.3%
Scenario10	Yes	0.00%	65	25	Constant	Conservative	2.5%	2% Min	70%	30%	55.1%	56.9%
Scenario11	No	0.00%	SSNRA	20	Variable	Aggressive	3.0%	4% Min	80%	30%	92.5%	97.9%
Scenario12	No	0.00%	65	30	Variable	Moderate	2.5%	6% Min	60%	40%	85.4%	85.8%
Scenario13	No	0.00%	SSNRA	25	Constant	Moderate	2.5%	No Min	70%	50%	69.0%	71.5%
Scenario14	No	0.00%	65	20	Variable	Moderate	2.5%	2% Min	80%	40%	63.0%	66.4%
Scenario15	No	0.00%	SSNRA	23	Variable	Conservative	2.0%	No Min	90%	30%	56.3%	56.7%
Scenario16	No	1.00%	65	25	Constant	Aggressive	3.5%	2% Min	70%	30%	67.3%	71.9%
Scenario17	No	1.00%	SSNRA	20	Variable	Moderate	3.0%	4% Min	80%	40%	74.0%	78.8%
Scenario18	No	1.00%	65	23	Variable	Moderate	2.5%	6% Min	90%	50%	74.1%	72.8%
Scenario19	No	1.00%	SSNRA	25	Constant	Moderate	2.5%	No Min	70%	40%	69.6%	72.7%
Scenario20	No	1.00%	65	20	Variable	Conservative	2.5%	No Min	80%	30%	53.3%	54.9%

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