Savings Rate and "Economic Security" in Retirement

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November 3, 1998
Updated: January 27, 2005

Abstract

Some simple number crunching using historical market return data for retirement planning. How much do we need to save to provide for a comfortable and secure retirement?

1 Assumptions

Our assumptions are very important. If you change the assumptions, the results vary significantly. We make no claim that these assumptions are in any way representative of some kind of "average" investor. Please keep this in mind.

We have a 40 year working career over which we save for retirement (e.g., start saving at age 25, retire at age 65). We save the same percentage of our gross salary every year throughout this working life. That is, as our salary (hopefully) goes up, our savings go up proportionally.

Our retirement portfolio is 70% S&P 500 US equities and 30% 20 year US Treasury bonds. This is a moderately aggressive portfolio. We rebalance our portfolio yearly.

Our portfolio expenses are 30 basis points (0.3%). These are very low expenses in today's mutual fund industry, but not impossible to achieve if we use index funds. Investment expenses are a very important part of our analysis. They cannot be ignored. They have a profound impact on the bottom line.

Our salary growth rate over the 40 working years is 1% in excess of inflation as measured by the Consumer Price Index (CPI). This is another critical assumption which has a major impact on the bottom line.

We measure "standard of living" by "net income after taxes and retirement savings." Some living expenses go up as we get older, some go down, and for this example we're calling it a wash.

All savings are tax-deferred and are taxed upon withdrawal in retirement at the regular income tax rate. For simplicity, we assume that our tax rate is the same before and after retirement. This permits us to ignore income tax rates when comparing pre-retirement to post-retirement net income.

Social security plus medicare taxes during the working years total 7.5% of gross salary. These taxes are not paid after retirement, so we need to take this into account when comparing pre-retirement and post-retirement net income.

At retirement, we will receive yearly social security benefits of 20% of our last year's gross salary, with cost of living adjustments. This is another important assumption. If you prefer to assume that there will be no social security when you retire, the results are very, very different. We picked 20% as a reasonably conservative estimate for a middle-class worker.

We do not expect to have a pension, an inheritance, or any other source of income after retirement outside of social security and our savings. We also do not expect to leave a large bequest to our heirs, unless we die young, which we hope doesn't happen, or the markets perform well after we retire, which we hope does happen.

2 Step 1

To begin, we used the assumptions in the previous section together with historical market return and inflation data for 1926 through 1994 to compute the average rolling 40 year annualized real rate of return for our portfolio, after investment expenses.[1] These rates of return are "real," not "nominal," which means they are adjusted for inflation. In fact, we adjusted them for inflation plus 1% to measure them relative to salary growth, which we are assuming exceeds the CPI by 1%. We also computed the standard deviation of these real returns and the best and worst returns.

The results of this first step are:

4.01% = average 40 year rolling real return relative to salary growth (Note: the average nominal return before investment expenses is 9.16%).

0.86% = standard deviation of 40 year rolling real returns.

2.58% = worst 40 year real return (starting in 1940).

5.93% = best 40 year real return (starting in 1926, believe it or not).

3.14% = average minus one standard deviation. 6 of the 33 samples were less than this return (18% of the samples).

4.87% = average plus one standard deviation. 5 of the 33 samples were greater than this return (15% of the samples).

3 Step 2

In the second step, we used the results of step 1 to compute total accumulation after 40 years of saving at rates of 10%, 15%, 20%, and 25% of gross salary. The computations assume monthly dollar cost averaging. The numbers in the table below are the results for the worst sample, the average minus one standard deviation ("bad"), the average, the average plus one standard deviation ("good"), and the best sample. The table entries are total accumulation measured as a multiple of our last working year's salary.

	Worst	Bad	Average	Good	Best
10%	6.95	7.92	9.72	12.00	15.67
15%	10.43	11.89	14.58	18.00	23.51
20%	13.90	15.85	19.44	24.00	31.34
25%	17.38	19.81	24.30	30.00	39.18

[1] The data is from Table 2-4 in reference [1].

4 Step 3

In the last step, we converted the results in the table above to a ratio of post-retirement net income to pre-retirement net income. This measures our relative standard of living before and after retirement. We used the following equations:

Pre-retirement net income = 1.0 - (social security and medicare withholding) - (retirement savings).

Post-retirement net income = (Final portfolio accumulation divided by 20) + (social security benefit). We divide accumulation by 20 to assume a 5% post-retirement withdrawal rate. Analyzing "safe" withdrawal rates is very interesting, but it's beyond the scope of this note. 5% is a typical suggested withdrawal rate.

Here's the results. The table entries measure post-retirement net income as a percentage of pre-retirement net income. Less than 100% represents a decreased standard of living after retirement. Greater than 100% represents an increased standard of living.

	Worst	Bad	Average	Good	Best
10%	66%	72%	83%	97%	119%
15%	93%	103%	120%	142%	177%
20%	123%	137%	162%	193%	244%
25%	158%	176%	210%	252%	320%

5 Conclusions

What can we conclude?

First, even over a long 40 year investment period, market returns are variable and uncertain. Note that 1/3 of our samples fall outside of the bad-to-good range, which itself is quite a wide range. Second, if we define "economic security" to mean "reasonable expectation of no decrease in standard of living after retirement," it looks like a savings rate of 15% in our particular example works rather well. It even succeeds with "bad" returns, and it comes close even with the worst sample returns. With average returns, our standard of living actually goes up quite a bit after retirement. 10% works only if we get well above average returns. 20% and 25% seem excessive and would be an inefficient trade-off of present versus future consumption unless we assume that we want a significantly higher standard of living after retirement than before retirement, or we take a very conservative position and protect ourselves against truly horrible market returns, a total collapse of the social security system, or some other major financial disaster.

Please note once again that the assumptions we made are all critically important. They can and do vary from one person's situation to another person's situation. Varying them affects our results significantly. This is only one example using one set of assumptions for an imaginary person.

References

[1] Zvi Bodie and Robert C. Merton. *Finance*. Prentice-Hall, preliminary edition, 1998.