

PART

One

Questions

COPYRIGHTED MATERIAL
<http://www.pbookshop.com>

<http://www.pbookshop.com>

Portfolio Focus and Stage of Life

Contents

- A “Balanced” Portfolio Approach May Not Last Through Retirement
 - Fixing Spending Levels (Variable Weights) and Shortfall Risk
 - Fixing Depletion Weights (Variable Spending) and Lifestyle Risk
 - Falling for Murphy’s Law of Timing Retirement
 - Drawdown Plans Are Sensitive to Longevity
- Retirement Saving versus Retirement Income: An Illustration
- Products versus Solutions

Objectives

- Why retirement income planning differs from accumulation
- The danger of drawdown plans

CHAPTER RECAP

This chapter showed that traditional portfolios, built for accumulation of wealth, frequently fail during withdrawal in retirement. In a nutshell, the problem is that traditional portfolios are designed around the principle of finding what is, on average, the best alternative—and finding the best portfolio for an individual client out of those that will not fail. These first few examples are designed to reinforce the notions that drawdown plans suffer from major weaknesses.

- When making withdrawals the order of returns matters
- The timing of retirement can have a significant impact on the likelihood of success or failure
- Unexpected shocks, even one-time shocks, can destroy a plan
- Outliving one’s assets becomes a more acute risk for an “optimized” withdrawal strategy

PROBLEMS

Our purpose here is to examine what does and does not work. For simplicity, we assume throughout this chapter that each client is at the point of retirement. A secondary purpose of these problems is to gently brush away cobwebs that you may have acquired with some refresher exercises geared to the material at hand.

Problems 1–10 refer to the following set of returns data and assume that the starting portfolio value is \$1,000,000:

<u>Period</u>	<u>Return</u>
1	10%
2	-10%
3	-10%
4	10%
5	-10%
6	-10%
7	-10%
8	-10%
9	-10%
10	-10%
11	-10%
12	-10%
13	10%
14	30%
15	30%
16	30%
17	30%
18	30%
19	30%
20	30%

1. Find the arithmetic average return over the 20-year sample period.
2. Find the geometric average return over the 20-year sample period.
3. For an accumulation portfolio, assume that the client, the Scott family, starts with \$1 million and saves an additional \$50,000 per year at the beginning of each year for each of the next 20 years. Find the value of the Scott's portfolio, assuming the return stream above, at the end of 20 years.
4. Assuming the data from Problem 3, find the geometric average of growth rate for the net increase in the Scott's portfolio value.

5. Suppose that a client, the Andrews family, wants to draw down the \$1,000,000 family portfolio by \$50,000 per year. Withdrawals will be made at the beginning of the year. If the Andrews put the remaining money in a checking account earning 2 percent, find whether the funds will last for 20 years.
6. Suppose that the breadwinner in the Petrocelli family is retiring and the family wants to draw down the \$1,000,000 portfolio by \$50,000 per year. Withdrawals will be made at the end of the period. If the Petrocellis put the money in an account comprised of the risky assets with the return stream provided in Problem 1, find whether the funds will last for 20 years or whether they come up short.
7. Another client, the Foys, have perfect foresight and know the return stream given at the start of this section will occur. To the nearest \$250, find the maximum annual withdrawal that the Foys can take from the account that will be guaranteed to last for 20 years.
8. The Howard family has \$1,000,000 and will invest in the risky portfolio given at the start of this section. They are willing to adjust their retirement lifestyle each year to make sure that the money lasts for 20 years. To achieve their goal, they will draw down the portfolio at the beginning of each year by $1/\text{the remaining number of years}$, that is, $1/20, 1/19, 1/18, \dots, 1/2, 1$. Show how much the Howard family receives in income in each year.
9. Using a flat 3 percent yield curve for Treasury securities, find the present value of a 20-year annuity that pays \$50,000 at the beginning of each period.
10. The Smiths want to make sure that they are covered. They purchase Treasury securities that will pay them \$50,000 per year and put the rest in a portfolio that has the return stream given previously. The Treasury yield curve is flat at 3 percent. They will draw down their risky account at the beginning of each period as the Howards have done in Problem 8. Find their annual income.

Research analysts have a feeling that the next period will bring returns of 40 percent. Suppose that they are correct, but that the remaining returns for periods 2–20 are as given in the table at the start of this section.

11. Find the simple sample average return for the 20-year period assuming a 40 percent return in period 1.
12. Find the geometric average return for the 20-year period assuming a 40 percent return in period 1.

13. The Tartabull family will be drawing down \$1,000,000 at \$50,000 per year at the beginning of the year. Determine whether the inclusion of a 40 percent return in period 1 is sufficient to enable a successful drawdown scheme.
14. Suppose that the information is as in Problem 13, but the withdrawals are made at the end of the year. Determine whether the inclusion of a 40 percent return in period 1 is sufficient to enable a successful drawdown scheme.
15. The Tiants are not sure how long they will live. After seeing what the Smiths had planned (Problem 10) they have decided with their adviser that they will live on \$50,000 per year, received at the beginning of the year. Their adviser will create \$50,000 in income for them using Treasury securities and will place the unallocated funds in a risky account with the returns stream as in Problems 1–9. At the end of the 20-year period, find how much they will have left over to fund potential longevity.

Use the following information for Problems 16 and 17:

Many portfolio books concentrate on the distribution of returns, which they assume to be normal. The following will help show how prices and portfolio values evolve if returns are normally distributed, how risky returns impact portfolio values, and briefly discuss the asymmetry of the distribution of portfolio values.

16. Your client, the Lonborgs have a \$1,000,000 portfolio that follows the process $V_T = V_0 e^{\left(r - \frac{\sigma^2}{2}\right)T + \sigma Z \sqrt{T}}$. They are considering whether to place their funds in a riskless asset yielding an APR of 3 percent. Find the portfolio value that would result after 20 years if they place the funds in a risk-free account. Also, find the values if they place their funds in a risky portfolio with $r = 7$ percent, $\sigma = 12$ percent, resulting in the following outcomes: Z values $Z = -1.645$, $Z = 1.645$ (corresponding to the points where 5 percent of portfolios would fall below and 5 percent would lie above if the assumed distribution is correct).
17. Suppose that you manage a \$1,000,000 for your client, the Yastrzemskis. The portfolio is designed to provide an expected return of 8 percent (continuously compounded—this works out to an APR of $e^{0.08} - 1 = 8.329$ percent) with a standard deviation of 15 percent per year. Provide the expected value of the portfolio and the dollar standard deviation sixteen years from now. Discuss why the dollar standard deviation needs to be used with care if the log returns are normally distributed.

Use the following information for Problems 18 and 19:

If we make the assumption that the logarithmic returns on a portfolio are normally distributed with the portfolio starting from a value V_0 , then we can find expected values, standard deviations, and create confidence intervals for future dates.

$$\begin{aligned}\ln(V_T) - \ln(V_0) &= \left(r - \frac{\sigma^2}{2}\right) \times T + \sigma Z \sqrt{T} \\ \Rightarrow V_T &= V_0 e^{\left(r - \frac{\sigma^2}{2}\right)T + \sigma Z \sqrt{T}}\end{aligned}$$

Where $\ln(x)$ denotes the natural logarithm of x , e is the base for the natural logarithm (roughly 2.718), T is a measure of time in years, r represents the *continuously compounded* expected return (note this is a slight change in notation from the tools section), σ is the annual standard deviation (volatility) of the portfolio, and Z is a standard normal random variable. The mean and standard deviations of such processes can be found by the following:

$$\begin{aligned}\text{Expected}[V_T] &= V_0 \times e^{rT} \\ \sigma_{V_T} &= V_0 \sqrt{e^{2rT}(e^{T\sigma^2} - 1)}\end{aligned}$$

18. The Adairs put all of their funds (also \$1,000,000) in a single U.S. Treasury strip with a yield to maturity of 4 percent per year, maturing in 16 years. Find the value of their portfolio at the end of 16 years.
19. The Joneses put all of their funds, also \$1,000,000, into a portfolio that has a mean log return of 8 percent per year and a standard deviation of 20 percent per year. Find the expected value of the Jones' portfolio and the number of standard deviations down that the portfolio would endure to end up worse off than the Adair family. Assume that the log returns are normally distributed.

<http://www.pbookshop.com>