15. 467 Asset Management, Lifecycle Investing & Retirement Finance
Spring 2021
Homework 2, Cost of Capital, VaR & Performance Fees
Due March 14, 2021

1. Value at Risk (VaR)

Consider a managed portfolio which has expected return of 20% per annum and return standard deviation of 60% per annum, in an economy in which the annual risk-free rate is 8%, the expected return on the market portfolio is 13% per annum, and the return standard deviation of the market portfolio is 20% per annum.

a) Determine the beta and return correlation of the managed portfolio with the market, if CAPM holds.

b) Determine the 1-year, 1%, VaR of a $1 million investment in the managed portfolio, and the 1-year, 1% VaR of a $1 million investment in the market index.

c) Determine the 2-year, 5%, VaR of a $1 million investment in the managed portfolio, and the 2-year, 5% VaR of a $1 million investment in the market index.

2. Cost of Capital and Hidden Balance Sheet Effects

A firm has $100 million of long-term (perpetual) debt with a 5% coupon rate on par value, $50 million (market value) of equity, and $50 million of pension assets. The firm's equity beta is 1.5, the expected return on the market portfolio is 15% per year, the standard deviation of the market portfolio is 20% per year, and the risk-free rate is 5% per year and stays constant through time. Assume the pension fund is fully funded and the cost of corporate debt is the risk-free rate. Treat corporate tax rate = 0%.

a) What would be your estimate of the cost of capital for the firm's operating assets, considering only the on-balance sheet assets and liabilities (neglecting the pension plan)?

b) Considering the economic balance sheet (including the pension plan), what is the cost of capital for the firm's operating assets given that:

   i. … the pension plan is fully invested in long-term risk-free bonds?

   ii. … the pension plan is fully invested in the equity market-portfolio index?

iii. … the pension plan is fully invested in long-term risk-free bonds, and enters into a swap to receive the total market index return and pay the total long-term risk-free bond return on a notional amount of $50 million? (the firm equity beta 1.5 is after entering swap position)

3. VaR of the Firm's Assets as an Approach to Risk Accounting

Consider the firm in the preceding problem. Suppose that its pension plan assets are fully invested in the equity market-portfolio index (case ii) and that the correlation between the return on its operating assets and the market portfolio return is 0.50.

a) Determine the 1-year 1% VaR of the firm's total assets (operating and pension).

b) What would be the 1-year 1% VaR of the firm's total assets if the firm replaced all its equity pension assets with long-term risk-free bonds?

c) From your answers to (a) and (b), what percentage of the firm's total risk capital is being allocated to non-operating-asset risk of the pension fund assets?