Investments

Session 6. Practical Issues in Portfolio Management

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Outline

I. Portfolio Strategies

- Buy & Hold
- Constant Mix
- Constant-Proportion Portfolio Insurance
- Option-Based Portfolio Insurance
- Quantitative Market-Timing Models

II. Other Practical Issues

- Constraints on Portfolios
- International Diversification

III. Investments Styles and Types of Funds Available

- Passive Fund Management Styles
- Active Fund Management Styles
- Alternative Investments

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Outline

Buy-and-Hold Strategy

- Characterized by an initial mix (e.g., 60/40 stocks/bills) that is bought and then held.
- No matter what happens to relative values, no rebalancing is required.
- The portfolio's value is *linearly* related to that of the stock market.
- Portfolio value will never fall below the value of the initial investment in bills.
- Upside potential is unlimited.
- *[Diagram in class]*

Constant-Mix Strategies

- Maintain an exposure to stocks that is a constant proportion of wealth.
- Dynamic strategies: whenever the relative values of assets change, purchases and sales are required to return to the desired mix.
- Rebalancing to a constant mix requires the purchase of stocks as they fall in value, and sale of stocks as they rise in value.
- *Concave* payoff curve *[Diagram in class].*
- Concave strategies will perform well when there are reversals in stock returns.
- *[Example in class]*

Constant-Proportion Strategies

- Constant-proportion strategies take the following form

$$\text{Dollars in stocks} = \text{m(Assets-Floor)} \quad (1)$$

where m is a fixed multiplier.

- Three special cases:
  1. If $m > 1$, the strategy is called the constant-proportion portfolio insurance strategy (CPPI).
  2. If $m = 1$, $\mathit{floor} =$ value of bills, this strategy is the buy-and-hold strategy.
  3. If $0 < m < 1$, $\mathit{floor} = 0$, the strategy is the constant-mix strategy.
- Sell stocks as they fall and buy stocks as they rise.
- In a bear market, the portfolio, will do as well as the floor. In a bull market, the CPPI will do very well.
- *Convex* payoff curve *[Diagram in class].*

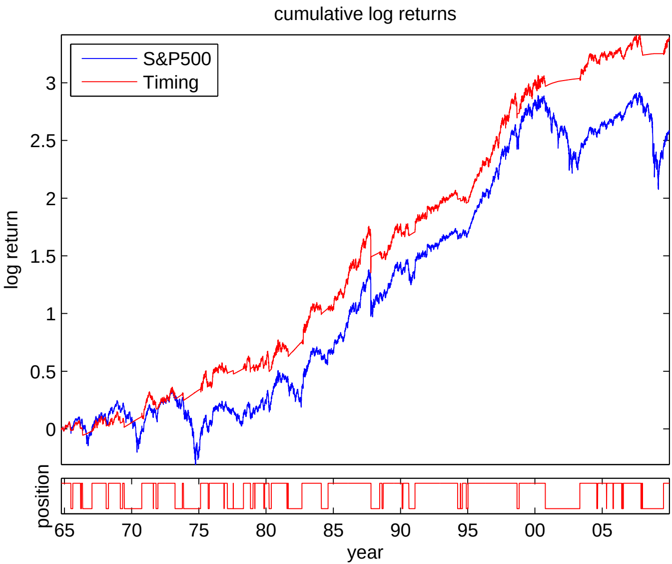
Constant-Proportion Strategies (cont.)

- In a flat market, a CPPI strategy will do relatively poorly, while constant-mix strategies will perform well.
- *[Simulation example in class].*

OBPI

- Start by secifying an investment horizon and a desired floor value at that horizon.
- The OBPI strategy consists of a set of rules designed to give the same payoff at the horizon as would a portfolio composed of bills and call options.
- One instant prior to the horizon, OBPI involves investing entirely in bills if the asset equals the floor, and entirely in stocks if the asset exceed the floor.
- With more than just one an instant to go before "expiration", we use option pricing formulas to find amounts invested in stocks and bills.
- OBPI strategies are "sell stock as they fall...". They must thus provide *convex* payoff diagrams *[Diagram and example in class].*

Trend Following



Outline

Constraints

- So far, we assumed that any optimal portfolio could be held.
- In practice, this will not be the case. Examples:
  - In many countries, short-selling is forbidden.
  - For pension funds, there is an upper limit on the proportion that can be invested in a given stock.
- How can we incorporate these kind of constraints in our portfolio analysis?
- To make things as intuititve as possible, let us take our investor seeking to maximize expected utility $V\left(\mu_p, \sigma_p^2\right) = \mu_p - \frac{a}{2}\sigma_p^2$. Formally, his problem is

$$\max_w w'\mu - \frac{a}{2} w'\Sigma w \quad s.t. \quad w'\mathbf{1} = 1, w \geq w_L, w \leq w_U \tag{2}$$

Constraints (cont.)

- To solve this problem, we rewrite the constrained problem as an unconstrained one using the Lagrangian

$$L = w'\mu - \frac{a}{2}w'\Sigma w + \lambda\left(1 - w'\mathbf{1}\right) + \phi_L'\left(w - w_L\right) + \phi_U'\left(w_U - w\right) \quad (3)$$

  This is the same as what we usually did, except that we have incorporated the inequality constraints as well.

- The Kuhn-Tucker optimality conditions are

$$\begin{aligned}
\frac{\partial L}{\partial w} &= \mu - a\Sigma w - \lambda\mathbf{1} + \phi_L - \phi_U = 0 \\
\frac{\partial L}{\partial \lambda} &= 1 - w'\mathbf{1} = 0 \\
\frac{\partial L}{\partial \phi_L} &= w - w_L \geq 0, \quad \phi_L \geq 0, \quad \phi_L'\left(w - w_L\right) = 0 \\
\frac{\partial L}{\partial \phi_U} &= w_U - w \geq 0, \quad \phi_U \geq 0, \quad \phi_U'\left(w_U - w\right) = 0 \quad (4)
\end{aligned}$$

Constraints (cont.)

- Thus, for assets for which the lower bound ω_L is binding, $\phi_L > 0$, meaning that the marginal utility of this asset is less than λ, you would want do reduce your holdings. Conversely, for assets for which the upper bound ω_U is binding, $\phi_U > 0$ and marginal utility exceeds λ, you would like to increase your holdings.
- There is a neat iterative procedure to solve this problem:
  1. Start with a feasible allocation (one that satisfies all the constraints and such that the sum of holdings is 1).
  2. For this allocaiton w, compute marginal utility from increasing asset holdings, $\mu - a\Sigma w$ (we can ignore λ here).
  3. Find the asset i with $\omega_i > \omega_{Li}$ that has the lowest marginal utility and the asset j with $\omega_j < \omega_{Uj}$ that has the highest marginal utility.
  4. If the difference in marginal utility between the best and the worst asset exceeds a certain level, increase the holding of asset j, decrease that of asset i, compute the new portfolio w and goto step 2. Otherwise, optimization is complete.

Constraints (cont.)

- This recipe is almost all we need to write an optimizer, except for two things: how to determine the initial allocation and how much of the holdings of assets i and j to swap.
- For the initial allocation, we could enter it "by hand". But we can also compute one automatically. There are several ways to do this. One which is simple and works well is the following:
  1. Make sure that $w_L \leq w_U$, $w_L'\mathbf{1} < 1$, and $w_U'\mathbf{1} > 1$. Otherwise, either there is no solution satisfying the constraints or the solution is already known.
  2. Set
  $$w = w_L + \frac{1 - w_L'\mathbf{1}}{w_U'\mathbf{1} - w_L'\mathbf{1}}(w_U - w_L) \tag{5}$$
  (note that $w'\mathbf{1} = 1$ and that all the constraints are satisfied.)

Constraints (cont.)

- In order to determine the amount by which we should reduce the holding of the worst asset and increase that of the best asset, remember that we are trying to increase expected utility by increasing our holding of j and reducing our holding of i.
- Therefore, we will change holdings from w to $w + cs$. Here, s is a N-vector telling us which holding we will increase and which holding we will reduce, i.e. containing $+1$ at position j, -1 at position i and zero elsewhere; c is the size of the increase/decrease.
- Our problem is to determine c. To do this, let us compare the utility in the new allocation, $w + cs$, with that in the old one, w:

$$\Delta V = (w + cs)' \mu - \frac{a}{2} (w + cs)' \Sigma (w + cs) - \left(w' \mu - \frac{a}{2} w' \Sigma w \right) \quad (6)$$

- Simplifying,

$$\Delta V = cs' \mu - \frac{a}{2} \left(c^2 s' \Sigma s + 2cs' \Sigma w \right) \quad (7)$$

Constraints (cont.)

- To find the maximum increase in utility, differentiate ΔV with respect to c to get

$$\frac{\partial \Delta V}{\partial c} = s'\mu - as'\Sigma w - acs'\Sigma s = 0 \tag{8}$$

- Therefore, our tentative value for c is given by

$$c = \frac{s'\mu - as'\Sigma w}{as'\Sigma s} \tag{9}$$

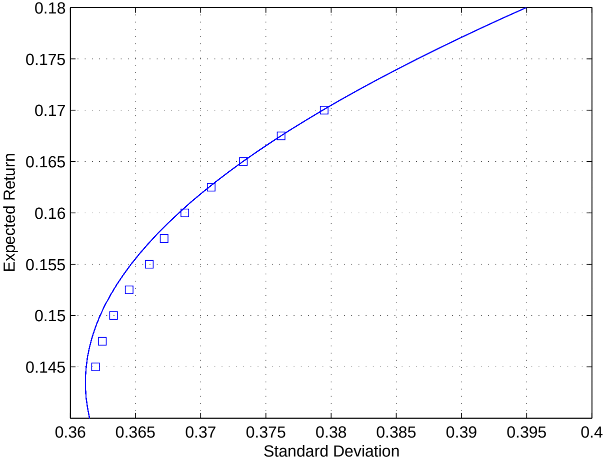
- Incorporating the constraints on holdings, we have

$$c = \min\left(\frac{s'\mu - as'\Sigma w}{as'\Sigma s}, \omega_{Uj} - \omega_j, \omega_i - \omega_{Li}\right) \tag{10}$$

Constraints (cont.)

- Graphically, there will be a difference between the constrained and the unconstrained efficient set (in the example $\mu = \begin{bmatrix} 0.1 & 0.2 & 0.15 \end{bmatrix}'$,
$\Sigma = \begin{bmatrix} 0.2 & 0.1 & 0.05 \\ 0.1 & 0.2 & 0.1 \\ 0.05 & 0.1 & 0.3 \end{bmatrix}$, $w_L = \begin{bmatrix} 0.3 & 0.3 & 0.3 \end{bmatrix}'$,
$w_U = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}'$):

Constraints (cont.)



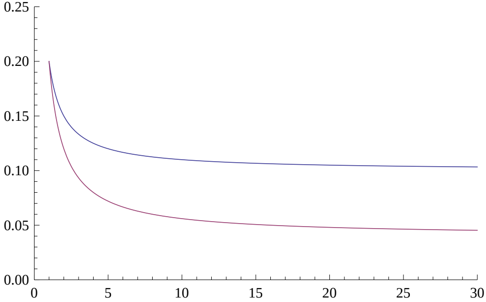
International Diversification

- Correlation in returns between countries is much lower than correlation between stock returns within a country. Consider the following data from Solink for the period 1971-1998 (International Investments, 4th ed.):

Country	F	D	I	NL	SP	CH	GB	US
France	1							
Germany	0.61	1						
Italy	0.44	0.4	1					
Netherlands	0.61	0.69	0.38	1				
Spain	0.43	0.42	0.42	0.43	1			
Switzerland	0.60	0.67	0.35	0.69	0.39	1		
United Kingdom	0.54	0.44	0.34	0.64	0.35	0.54	1	
U.S.A.	0.45	0.38	0.26	0.59	0.33	0.48	0.52	1

International Diversification (cont.)

- As a result, for a given level of expected return, the risk of a stock portfolio can be further reduced by considering international stocks. Solnik (JF 1974) has shown that the residual risk by diversifying across U.S. stocks only is 27% of intial risk, whereas international diversification can reduce it to 11.7%.



International Diversification (cont.)

- When considering international stocks, it is important to take *exchange rate risk* into account.
- Suppose that exchange rate risk is not hedged. How should portfolio optimization be performed?
- Things can actually be done in the usual way, but all returns, variances and covariances must be translated in the home currency.
- Let R_m denote the return on the foreign market (or stock) and R_s the return on the foreign currency. Then, the return on the foreign market translated in home currency, R_f, is given by $R_f = R_m + R_s + R_m R_s \approx R_m + R_s$. For expected returns,

$$\mu_f \approx \mu_m + \mu_s \tag{11}$$

International Diversification (cont.)

- Similarly, let σ_m denote the standard deviation of returns on the foreign market, σ_s the exchange rate volatility and $\rho_{m,s}$ the correlation coefficient between the two. Then, the risk of the foreign market when returns are translated in home currency, σ_f, is given by

$$\sigma_f = \sqrt{\sigma_m^2 + 2\rho_{m,s}\sigma_s\sigma_m + \sigma_s^2} \tag{12}$$

- Since the two risks are not perfectly correlated, $\sigma_f < \sigma_m + \sigma_s$.
- Over short periods of time, exchange rate risk can dominate capital gains or losses on the foreign market.
- Over long periods of time, however, exchange rate risk is small compared to market risk on the foreign markets. This is because the correlation between currencies is low and currencies tend to be mean-reverting.

International Diversification (cont.)

- The consequence is that the country of domicile affects the expected returns and risk from international diversification (so, if you are an asset manager, you should think about which currency your customer is consuming in before deciding how to invest).
- Suppose you want to decide wether to invest in a number of foreign markets or not. This can be done by letting each of the countries (including the domestic country) be one asset in your decision problem and solving it as usual.
- Your vector of expected returns would be

$$\mu = \begin{bmatrix} \mu_d & \mu_{f1} & \dots & \mu_{fK} \end{bmatrix}' \qquad (13)$$

where μ_d denotes expected return on domestic stocks, $\mu_{fk} = \mu_{mk} + \mu_{sk}$ expected return in foreign country k.

International Diversification (cont.)

- The variance-covariance matrix of returns would be

$$\Sigma = \begin{bmatrix} \sigma_d^2 & \rho_{d,f1}\sigma_d\sigma_{f1} & \ldots & \rho_{d,fK}\sigma_d\sigma_{fK} \\ \rho_{d,f1}\sigma_d\sigma_{f1} & \sigma_{f1}^2 & \ldots & \rho_{f1,fK}\sigma_{f1}\sigma_{fK} \\ \ldots & & & \\ \rho_{d,fK}\sigma_d\sigma_{fK} & \rho_{f1,fK}\sigma_{f1}\sigma_{fK} & \ldots & \sigma_{fK}^2 \end{bmatrix} \quad (14)$$

- Then, you could solve for the optimal risky portfolio

$$w = \frac{1}{a}\Sigma^{-1}(\mu - R1) \quad (15)$$

  A positive weight indicates you should invest in a given market, a negative weight that you should short it (of course, short-sale constraints can be accounted for here as well).

- As was noted when we discussed multi-factor models, industry facors are an important determinant of the covariation in stock returns.

International Diversification (cont.)

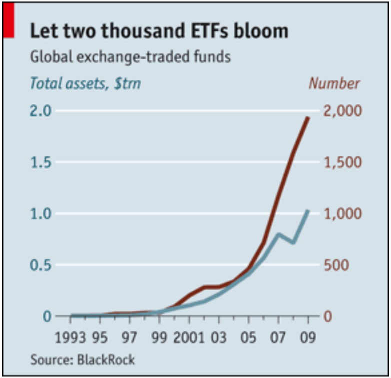
- A controversial issue that arises in the context of international investments is the extent to which industry sectors matter for asset allocation or whether one would do "well enough" by diversifying across countries.
- Most studies come to the conclusion that little of the variation in country index returns can be explained by their industrial composition.
- Thus, most of the benefits of diversification can be achieved by diversifying across countries; also diversifying across industries only brings a minor additional reduction in portfolio risk.

Outline

Tracker Funds and ETFs

- Index tracking is a version of the buy and hold strategy that eliminates diversifiable risk.
- It is virtually impossible to be exactly indexed at all times $\Rightarrow$ tracking error (due to addition and deletion of securities that constitute the index, collection of dividends, infusion of new contributions). Transaction costs will also eat into the performance figures.
- Exchange traded funds (ETFs) are basically index funds that are listed on exchanges, and trade like stocks.
- ETFs can track every type of equity or bond index. Both institutional and retail investors can invest in ETFs. They can be used to implement sector rotation and sector allocation strategies and to adjust sector or country exposure.
- Tracker funds and ETFs have grown in popularity worldwide, especially after periods of time when actively managed funds underperformed their indices. See next graph from *The Economist*, January 2010 .

A Fast-Growing Asset Class



Active Investing

- Within the active fund management segment of portfolio management, fund managers pursue a variety of investment techniques known as styles of investing.
- Some popular styles:
  - *Value investing:* stock that trade at low multiples of price to measures of fundamental value. In recent years value stocks have concentrated in established, stable industries, such as manufacturing utilities and food.
  - *Growth investing*: companies with strong growth expectations. They commonly trade at prices that are high relative to current earnings, dividends, or book values.
  - *Large-cap*: the biggest companies, also known as blue chips. Large-cap investors prefer safety.
  - *Small-cap*: companies with small market capitalizations.Small-cap investors hope for relatively good performance.

Hedge Funds and Private Equity

- The object of alternative invseting (or absolute return investing) is to target an absolute return range and not returns relative to a predermined index.
- While traditional funds are organized around styles, hedge funds are organized around strategies:
  - Non-directional strategies, commonly reffered to as "market neutral" strategies. Do not depend on the direction of any specific market movement. Examples include fixed income arbitrage, event-driven, merger arbitrage.
  - Directional strategies, designed to take advantage of broad market movements. Examples include macro, emerging markets, short selling.
- Private equity funds invest in securities which are not publicly traded. Types of private equity investing include leveraged buyouts, venture capital investments, distressed debt investments.

Hedge Funds

The Economist, January 2010: Hedge funds made their biggest gains in a decade last year, according to the Hedge Fund Research Index, an industry benchmark. Funds returned an average 20% in 2009, having had their worst year ever in 2008. Investors withdrew $131 billion from hedge funds last year, but the healthy gains made on the money left in meant that assets under management increased to $1.6 trillion. That was $193 billion more than at the end of 2008, though still below the 2007 peak. Around 2,000 hedge funds have closed since the financial crisis started but an estimated 9,000 remain worldwide. Investors were charged less than the "two-and-twenty" benchmark: management fees averaged 1.6% of assets. Incentive fees were 19.2%.

Outline

1. Brentani, Christine, *Portfolio management in Practice,* 2004, Elsevier
   - Provides an overview of the day-to-day aspects with which a portfolio manager must be concerned.
2. Perold and Sharpe, *Dynamic Strategies for Asset Allocation*, FAJ 1988
   - Analysis of different investment strategies.