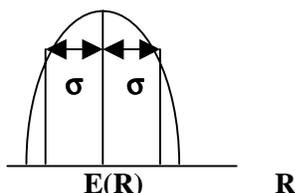


PORTFOLIO MANAGEMENT

A. INTRODUCTION

RETURN AS A RANDOM VARIABLE

- $E(R)$ = the return around which the probability distribution is centered: the expected value or mean of the probability distribution of possible returns
- σ = parameter which describes the width & shape of the distribution of possible returns



- The Flatter the Distribution, the Higher Risk Investment, the Narrower, the Lower Risk Investment
- Note: The Annualized Return on a Portfolio is NOT Normally Distributed (arithmetically) Rather, it must be continuously Compounded and requires a Log-Normal Distribution

PORTFOLIO CONSTRUCTION

- For a Two-Asset Portfolio:

$$R_P = w_1 R_1 + w_2 R_2$$

$$\sigma_P^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 COV_{1,2}$$

$$COV_{1,2} = r_{1,2} \sigma_1 \sigma_2 \rightarrow r_{1,2} \text{ is the correlation coefficient of a linear regression relating } R_s \text{ on Asset 1 with } R_s \text{ on Asset 2}$$

$$\sigma_P^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 r_{1,2} \sigma_1 \sigma_2$$

And then just Square Root the Variance to get the σ for the Portfolio

- Goal is to have lower correlation between assets in the Portfolio in order to Reduce Risk

Combining Risky Assets with a Risk-free Asset

$$R_P = R_F + [(R_R - R_F) / \sigma_R] * \sigma_P$$

- There is also the **Sharp Ratio** which is a measure of the Risk Adjusted Return of this portfolio

$$\text{Sharpe} = (\Delta R_P / \Delta \sigma_P) = [(R_R - R_F) / \sigma_R]$$

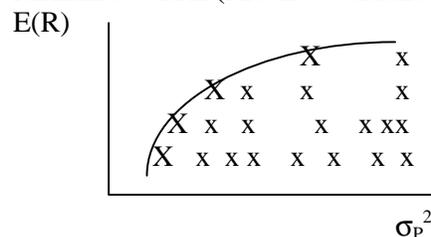
MULTI-PERIOD RISK: IMPORTANCE OF TIME-HORIZON

- The Risk associated with the average annual rate of return of an asset decreases with the square root of time

$$\sigma_{R \text{ avg. } n} = (\sigma_{R 1} / n^{1/2})$$

- As the time horizon approaches very large values, the actual average return approaches the expected average return.

MARKOWITZ (Mean – Variance) EFFICIENT FRONTIER



- All Points lying on the Efficient Frontier offer the Highest Expected Return relative to All other portfolios of comparable risk. Portfolios that lie on the efficient frontier are superior to portfolios that are located inside the frontier because they have higher return to risk ratios.
- Object of Portfolio Management: Lie on the Efficient Frontier & bear no more risk than the client is willing to take on
- 1 way is to estimate risk/return trade-off is through indifferent curves (utilities)

β AS A MEASURE OF RELATIVE RISK

- β is a more simple measure of Portfolio Risk than the Variances of the Portfolios
- Run a Regression of Returns (ignoring Dividends) relating Returns to the Market Index. This is the CHARACTERISTIC LINE of the STOCK
- α is the Value of R_S that is associated with a R_M of 0. It is the measure of Unsystematic Return
- β is the SLOPE of the CHARACTERISTIC Line
$$\beta = \text{COV}_{SM} / \sigma_M^2 = [\sigma_S \sigma_M r_{SM}] / \sigma_M^2$$
- $\sigma_{S,M}$ is the Standard Error of Estimate which measures the degree to which the Characteristic Line does NOT determine the performance of the stock relative to the market. It is a Measure of the Stock's SPECIFIC Risk.
- **Portfolios can be Analyzed just like Stocks**
- $$\beta_P = \sum w_s \beta_s = w_1 \beta_1 + w_2 \beta_2 + \dots + w_n \beta_n$$
- For Large Portfolios (30 or 40 stocks), the LAW of LARGE NUMBERS can be relied upon to Reduce Specific Risk
$$\sigma_{PM}^2 = \sum \sigma_{SM}^2 / N$$
- In a large Portfolio, about 70-90% of the Unsystematic Risk can be eliminated by Diversification

B. CAPITAL ASSET PRICING MODEL

- The Capital Market Line intersects the Efficient Frontier at a point that is Tangential to the most efficient Market Portfolio. (Capital Asset Lines Bisect the Efficient Frontier at more than 1 point)
- $$R_P = R_F + [(R_M - R_F) / \sigma_M] * \sigma_P$$
- The Capital Market Line is the relationship between the REQUIRED Rates of Return on EFFICIENT PORTFOLIOS and their Systematic Risk (σ_P)
- $$R_{S \text{ or } P} = R_F + \beta_{S \text{ or } P} (R_M - R_F)$$
- This is the Security Market Line is the relation between EXPECTED Returns on Individual Securities or Portfolios and their risk as Measured by their Covariance with the Market Portfolios or their β
- All Fairly priced assets & portfolios should lie on the SML; ONLY efficient portfolios lie on the CML
- The Linear Relationship between the Expected or Required Return & Risk is called the CAPM; it is a specific form of a general class of models called Risk Premium Models that Relate Return to Risk

Theoretical Justification for the Indexing Strategy

- Points on the security market line are better than along the efficient frontier because have better risk return ratios
- Points along the SML represent combos of only 2 portfolios: Market Portfolio & Risk-free Asset
- Investors can optimize their return/risk ratio by choosing an acceptable level of risk measured by beta and investing that percentage of their total assets in the market portfolio & the rest in the Risk Free Asset
- Therefore, do not need asset selection. Just a passive strategy of investing in the market portfolio is optimal. Mutual Fund Theory used for Indexing.

Practical Uses of CAPM

Controlling Portfolio Risk

- *For example: The R_F is 5% and the Market could decline as much as 30%. An investor does not want to risk more than a 10% loss. What Portfolio β could the Investor Accept?*

$$R_P = R_F + (R_M - R_F)\beta_P$$

$$-10 = 5 + (-30 - 5)\beta_P$$

$$\beta_P = .43$$

Thus, the ideal beta for the investor is .43 which means that he should invest 43% of his assets in the Market portfolio and 57% in the Risk Free Asset.

Security Analysis

Assumptions Behind the CAPM

Basic Conclusions of CAPM

1. Return is Linearly Related to Systematic Risk
2. The Market does not pay for accepting unsystematic risk since such risk can be avoided by employing diversification

Basic Assumptions required for CAPM

1. All investors seek an optimum portfolio on the efficient frontier so as to maximize the utility of their wealth, rather than to maximize the wealth itself. Also, the utility of wealth decreases as the level of wealth increases.
2. Information is FREELY & Simultaneously Available to All Investors. Thus, Rational Expectations hold.
3. Investor Expectations are Homogenous. They all have the same expectations regarding the expected return and risk of all assets.
4. All Investors have an Identical TIME HORIZON (to have 1 unique risk free rate)
5. Capital Markets are in Equilibrium so that all assets are properly priced with respect to their risks
6. Investors can borrow, as well as invest, at the risk free rate.
7. There are NO Taxes, Transactions costs, or restrictions on Short Sales
8. Total Asset Quantity is FIXED and all assets are fully marketable and divisible. (can ignore liquidity)

Problems with CAPM

1. Market Portfolio is Indeterminable. Hard to find a proper benchmark.
2. Risk-free Asset is Indeterminable.
3. Investment Returns tend to be skewed, rather than normally distributed; often, find low-beta stocks are undervalued, relative to CAPM, while high-beta stocks are overvalued.
4. β Tends to be Unstable over time.
5. β is a Poor Predictor of Future Performance.

C. ARBITRAGE PRICING THEORY

- A model which tries to explain a stock's return based upon FUNDAMENTAL FACTORS.
- To Qualify as a **Fundamental Factor**, a variable must possess several characteristics
 1. Important Economic Factor that enters the Valuation of ALL stocks or firms.
 2. Must have a STABLE Impact on a Firm's Value over time
 3. Must be INDEPENDENT of other Fundamental Factors
 4. Must have a VARIANCE
- Fundamental Factors that Have been suggested include
 1. REAL GDP Growth
 2. Interest Rates
 3. Inflation
 4. Equity Risk Premiums

$$R_S = R_0 + \beta_1 \Delta I + \beta_2 \Delta F_1 + \beta_3 \Delta F_2 + \dots + \beta_n \Delta F_n$$

Assumptions of APT

1. Capital Markets are perfectly competitive
2. Investors prefer more wealth to less wealth with certainty
3. Asset Returns can be related to a set of fundamental factors

Problems of APT

1. Small firms perform better than APT suggests
2. Stocks with Low Price/Book Values and Low P/Es still tend to do better than APT suggests
3. APT does not explain the January Effect
4. APT does not ID what the fundamental factors should be.

D. ARTICLES

Review of Multi-Index Models & Grouping Techniques by Elton & Gruber

- Single Index Models, like CAPM, hypothesize that the Returns between stocks are correlated because the prices of both stocks are correlated with the stock market index.
- Empiric Study does not hold that CAPM is proper, thus it mis-specifies and does not produce useful Return, Risk & Correlation estimates that would be useful to a portfolio manager

Traditional Industry Models

- Believe Industry Influences are strong & persistent
- Must find & predict tons of information
- $E(R)$ for Each Stock
- σ for Every Stock
- Degree to which every stock is affected by the Market Index
- Degree to which each stock is influenced by the industry index
- Expected return on each industry index
- Etc.

Pseudo-Industry Cluster Models

Growth Stocks

Cyclical Stocks

Stable Stocks

Oil Stocks

Mixed Models

- Rosenberg's Extended 2 tiered CAPM with 114 variables.

Fundamental Models

- Like Arbitrage Pricing Theory.
- Based upon EMT.

Review of Estimating Expected Return by Fischer Black

- To determine Optimal Asset Allocation, it is necessary to estimate the Expected Return & Risk of every Security.
- Variance is generally fairly consistent over time (historical analysis is sufficient)
- But, historical analysis is NOT a good predictor for future expected returns
- CAPM & APM are not sufficient

Asset Allocation

- Up to 90% of the differential in returns of portfolios can be explained by asset allocation
- To Make an Optimal Asset Allocation, it is Imperative to Know:
 1. The Expected Rate of Return for Each Asset Class
 2. The Estimated Risk measured by the σ of the Rate of Return of Each Asset Class
 3. Correlation between the Rates of Return of Every Asset Class
 4. Investment Objectives & Risk Constraints of Investor/Client

Estimating the Expected Rate of Return

Bonds:

YTM is not the only expected rate of return for bonds. There are 3.

1. Coupon Interest
2. Interest Earned on Re-invested Coupon Interest
3. Change in the Price of the Bond

May need to perform a Scenario Analysis with various levels of Interest Rate over the Investment Horizon

Stocks: 4 Ways

1. Historical Rates of Return
2. DDM
3. Security Market Line Approach
5. Scenario Approach

Estimating Risk

- For any Asset Class, the suitable measure of Risk is the Volatility of Returns over a given time horizon.
- There are a number of good historical studies on this.

Estimating Correlation

- Use a Correlation Matrix

Estimation of Stock Betas & the Correlation Between Pairs of Stocks

- ??

Determining the Expected Return & Risk of Portfolios

- Basic Formulas:

$$R_P = W_S R_S + W_B R_B$$

$$\sigma_P^2 = W_S^2 \sigma_S^2 + W_B^2 \sigma_B^2 + 2W_S W_B \text{COV}_{SB}$$

$$\text{COV}_{SB} = r_{SB} \sigma_S \sigma_B$$

$$\sigma_{\text{Avg. R. n}} = \sigma_{R 1} / n^{1/2} \rightarrow \text{This is for Calculating the } \sigma \text{ for Different Time Horizons}$$

Review of Equity Style: What it is & Why it Matters by Christopherson

- **Insight:** investment methodology that is unique to one portfolio manager
 - **Style:** investment methodology that is shared by a group of portfolio matters. There are 4 Basic Styles
1. **Value**
 - Consider the Current Price of a Stock Relative to some fundamental factor that determines value (earnings, dividends, cash flow, etc.) to be the crucial factor that determines its future performance.
 2. **Growth**
 - Believe long-run capital gains accrue to investors who purchase stocks of firms whose earnings grow consistently at an above average rate.
 3. **Market-oriented**
 - Accept Efficient Market Theory and construct portfolios to mirror an index. But, if have an insight, overweight or underweight towards stock/sectors in which have insight.
 4. **Small Capitalization**
 - Over the Very Long Term, small-cap stocks outperform large cap stocks. To exploit this, concentrate portfolios in small stocks.
- OVER the VERY Long Term, Value Style is the best. But, over decades, certain styles fall in & out of favor.
 - In the short term, if you want to make a pile, be in the right style
 - Since most managers are evaluated over the short term, style selection means a lot.

Review of Structuring the International Investment Process by Solnik

Two Basic Approaches to Any type of Portfolio Management

1. **PASSIVE APPROACH**, a.k.a. Indexing. Internationally, can index in a number of ways
 - Full Replication of the Chosen Index by Purchasing every security that is in the index in proper proportion. Difficult because requires a lot of purchasing.
 - Stratified Sampling, which requires that a manager purchase a representative number of securities, but not all the securities, in an index.
 - Optimization Sampling, which also attempts to select a fraction of the securities that comprise the index being replicated. But use a computer to determine which securities should be selected so as to minimize tracking errors.
 - Synthetic Replication which uses futures contracts & cash to create a synthetic investment in a global index.
 - Passive can reduce costs, but it is very difficult to construct an international portfolio
 2. **ACTIVE APPROACH**: invest in securities that manager believes will perform best
 - Asset Allocation: choose a mix of countries & currencies that is expected to produce above-average returns.
 - Security Selection: purchase the best securities in the world
 - Market timing; rotate funds away from national markets expected to be below-average and into those national markets expected to be above-average
- The Active Approach is Much Riskier
 - Much evidence supports the fact that US domestic Portfolios should be indexed, but there is less evidence to support Global Indexing.

Ways to Implement an Investment Strategy

1. **TOP-DOWN APPROACH**: decide on asset allocations and then choose individual securities
2. **BOTTOM-UP APPROACH**: decide which securities to take

There is more Correlation WITHIN Markets than between Markets; therefore the Top Down Approach is preferred Internationally

Managing Currencies

- Bottom-up Managers construct portfolios by selecting those securities in the world that they believe will produce the best returns. Currency weightings are incidental to the security selection decision.
- Some hedge the currency risk back to the domestic currency
- Some managers attempt to forecast currency movements

Global-Approach to International Investing

- Some use Quants, Others believe in Judgment
- Most Important part is the Strategic Asset Allocation (selecting the proper global benchmark)

ETC.

Large Economies of Scale in International investing