**Unit – IV: Portfolio Theory:**

Concept of portfolio. Portfolio return and risk. Harry Markowitz’s Portfolio theory, construction of minimum risk portfolio, the single-index model. Capital market theory: Introduction of risk-free asset, Capital Market Line, Separation theorem. Capital asset pricing model (CAPM): Security Market Line. Identifying over-priced and under-priced securities. Arbitrage pricing theory (APT):

The Law of one price, two factor arbitrage pricing, Equilibrium risk-return relations. A synthesis of CAPM and APT.

##### Concept of Portfolio:

A portfolio refers to a collection of investment tools such as

1. stocks,
2. shares,
3. mutual funds,
4. bonds,
5. cash and so on, depending on the investor’s income, budget and convenient time frame.

##### What is Portfolio Management?

The art of selecting the right investment policy for the individuals in terms of minimum risk and maximum return is called as portfolio management.

Portfolio management refers to managing an individual’s investments in the form of bonds, shares, cash, mutual funds etc so that the investor earns the maximum profits within the stipulated time frame.

Portfolio management refers to managing money of an individual under the expert guidance of portfolio managers.

##### In a layman’s language, the art of managing an individual’s investment is called as portfolio management.

**Need for Portfolio Management:**

Portfolio management presents the **best investment plan** to the individuals as per their income, budget, age and ability to undertake risks.

Portfolio management **minimizes the risks** involved in investing and also increases the chance of making profits.

**Return on Portfolio:**

The expected return of a portfolio depends on the expected return of each of the security contained in the portfolio. It also seems logical that the amounts invested in each security should be important.

From the investors’ point of view, it is rarely advisable to invest the entire funds of an individual or an institution in a single security. Therefore, it is essential that each security be viewed in a portfolio context.

Each security in a portfolio contributes returns in the proportion of its investment in security. It is but natural that the expected return of a portfolio should depend on the expected return of each of the security contained in the portfolio. It is also important that amounts invested in each security should be logically decided.

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| Example:  Calculate Contribution of Each security to return and Weighted return of the portfolio of a security, from the information given below:  Security: A, B, C, D, E,  Proportion of Funds Invested in each Security Period: 20,25,20,15,20 and  Expected Return of Holding: 10%, 20%,10%,15%,15% respectively.   |  |  |  |  | | --- | --- | --- | --- | | **Security**  **(1)** | **Portion of Funds Invested in Each Security Period**  **(2)** | **Expected Return of Holding**  **(3)** | **Contribution of Each Security to Return**  **(4) = 2 x 3** | | **A** | 20 | 10% | 2.00 | | **B** | 25 | 20% | 5.00 | | **C** | 20 | 10% | 2.00 | | **D** | 15 | 15% | 2.25 | | **E** | 20 | 15% | 3.00 | | Weights = 100 Weighted Return = 14.25% | | | | |  |

**Harry Markowitz’s Portfolio Theory:**

Harry Markowitz put forward this model in 1952. It assists in the selection of the most efficient by analyzing various possible portfolios of the given securities. By choosing securities that do not 'move' exactly together, the HM model shows the investors how to reduce their risk.

The HM model is also called [Mean](http://en.wikipedia.org/wiki/Mean)-[Variance](http://en.wikipedia.org/wiki/Variance) Model due to the fact that it is based on expected returns (mean) and the [standard deviation](http://en.wikipedia.org/wiki/Standard_deviation) (variance) of the various portfolios.

Harry Markowitz made the following assumptions while developing the HM model:

1. Risk of a [portfolio](http://en.wikipedia.org/wiki/Portfolio_(finance)) is based on the variability of returns from the said portfolio.
2. An investor is risk averse.
3. An investor prefers to increase [consumption](http://en.wikipedia.org/wiki/Consumption_(economics)).
4. The investor's [utility function](http://en.wikipedia.org/wiki/Utility_function) is concave and increasing, due to his risk aversion and consumption preference.
5. Analysis is based on single period model of [investment](http://en.wikipedia.org/wiki/Investment).
6. An investor either maximizes his portfolio return for a given level of risk or maximizes his return for the minimum risk.
7. An investor is rational in nature.

To choose the best portfolio from a number of possible portfolios, each with different return and risk, two separate decisions are to be made:

1. Determination of a set of efficient portfolios.

2. Selection of the best portfolio out of the efficient set.

**Construction of Minimum Risk Portfolio:**

A portfolio that gives maximum return for a given risk, or minimum risk for given return is an efficient portfolio. Thus, portfolios are selected as follows:

(a) From the portfolios that have the same return, the investor will prefer the portfolio with lower risk, and

(b) From the portfolios that have the same risk level, an investor will prefer the portfolio with higher rate of return.

**The Single-Index Model:**

The Single-Index Model (SIM) is an asset pricing model commonly used in the finance industry to measure risk and return of a stock. The major assumption of Sharpe’s Single-Index Model is that all the Co-Variation of security returns can be explained by a single factor. This factor is called the index, hence the name ‘Single-Index Model.

In Single Index Model, risk is measured with variance. It consists of two parts: -

1. Market related risk, i.e. undiversifiable risk or systematic risk
2. Specific risk i.e. risk related to specific security.

**Total risk = Market related risk + Specific Risk.**

**Capital Market Theory:**

Capital market theory is a generic term for the analysis of securities. In terms of trade-off between the returns sought by investors and the inherent risks involved, the capital market theory is a model that seeks to price assets, most commonly, shares.

The theory of capital market deals with the following issues:

1. Initial Public Offerings
2. Role of Capital Market
3. Importance of Venture Capital in the capital market
4. Major capital markets worldwide etc.

**Introduction of Risk-Free Asset:**

Investment in Risk-Free Asset is often referred to as Risk-Free lending. Since the Markowitz’s approach involves investing for a single holding period, it means that the return of the risk-free asset is certain. If the investor purchases this asset at the beginning of the holding period, then the investor knows exactly what the value of the asset will be at the end of the holding period.

**Capital Market Line:**

Capital Market Line is a kind of graph, originating from the capital asset pricing model (CAPM).

A capital market line is a line interacting returns on no-risk investments and returns on the entire market. The difference between capital market and efficient frontier, is that the capital market line includes no-risk investments. All portfolios along the capital market line are efficient portfolios.

**Separation Theorem:**

Irving Fisher proposed the famous ‘Fisher Separation Theorem, which holds that the main goal of the firm is the **optimization** of the present value of the firm irrespective of the firm owners’ preferences.

The fishers separation theorem says that:

1. The investment choices of a firm are different from the owners’ preferences.
2. The decisions on investment are not dependent on the decision of financing.
3. The investment value of a firm is separate from the various methods such as debt, equity or cash that are needed for the financing of a project.

**Capital Asset Pricing Model (CAPM):**

The CAPM is a model for pricing an individual security or portfolio. For individual securities, we make use of the [security market line](http://en.wikipedia.org/wiki/Security_market_line) (SML) and its relation to expected return and [systematic risk](http://en.wikipedia.org/wiki/Systematic_risk) (beta) to show how the market must price individual securities in relation to their security risk class.

The SML enables us to calculate the [reward-to-risk ratio](http://en.wikipedia.org/wiki/Risk-return_spectrum) for any security in relation to that of the overall market. Therefore, when the expected rate of return for any security is deflated by its beta coefficient, the reward-to-risk ratio for any individual security in the market is equal to the market reward-to-risk ratio, thus:

\frac {E(R_i)- R_f}{\beta_{i}}  = E(R_m) - R_f   

The market reward-to-risk ratio is effectively the market [risk premium](http://en.wikipedia.org/wiki/Risk_premium) and by rearranging the above equation and solving for E(Ri), we obtain the Capital Asset Pricing Model (CAPM).

E(R_i) = R_f + \beta_{i}(E(R_m) - R_f)\,

where:

* E(R_i)~~ is the expected return on the capital asset
* R_f~ is the risk-free rate of interest such as interest arising from government bonds
* \beta_{i}~~ (the [*beta*](http://en.wikipedia.org/wiki/Beta_(finance))) is the [sensitivity](http://en.wikipedia.org/wiki/Sensitivity_and_specificity) of the expected excess asset returns to the expected excess market returns,
* E(R_m)~ is the expected return of the market
* E(R_m)-R_f~ is sometimes known as the *market premium* (the difference between the expected market rate of return and the risk-free rate of return).
* E(R_i)-R_f~ is also known as the *risk premium*

**Arbitrage Pricing Theory (APT):**

1. **The Law of one Price:**

Based on the law of one price, two items that are of the same variety cannot be sold at different prices. If they sell at a different price, arbitrage will take place in which arbitrageurs buy the good which are in cheap and sell in the one which is higher priced till all prices for the goods are equal.

1. **Two factor arbitrage Pricing:**

**Arbitrage pricing theory (APT)** is a well-known method of estimating the price of an [asset](http://www.investinganswers.com/node/2278). The theory assumes an asset's return is [dependent](http://www.investinganswers.com/node/5958) on various macroeconomic, [market](http://www.investinganswers.com/node/3609) and security-specific [factors](http://www.investinganswers.com/node/5492).

## How it works/Example:

APTis an alternative to the [capital asset pricing model (CAPM)](http://www.investinganswers.com/node/1125). Stephen Ross developed the theory in 1976.

The APT formula is:

E(rj) = rf + bj1RP1 + bj2RP2 + bj3RP3 + bj4RP4 + ... + bjnRPn

**where:**E(rj) = the asset's expected [rate of return](http://www.investinganswers.com/node/5875)

rf = the risk-free rate

bj= the sensitivity of the asset's return to the particular [factor](http://www.investinganswers.com/node/5492)

RP = the risk premium associated with the particular factor

1. **Equilibrium Risk-Return relations –**

**A Synthesis of CAPM and APT:**

APT may be more customizable than CAPM, but it is also more difficult to apply because determining which factors influence a [stock](http://www.investinganswers.com/node/5150) or portfolio takes a considerable amount of research. It can be virtually impossible to detect every influential [factor](http://www.investinganswers.com/node/5492) much less determine how sensitive the security is to a particular factor. But getting "close enough" is often good enough; in fact studies find that four or five factors will usually explain most of a security's return: surprises in inflation, GNP, investor confidence and shifts in the [yield curve](http://www.investinganswers.com/node/810).