

## INVESTMENT APPRAISAL UNDER UNCERTAINTY

Uncertainty conditions are those investment environments where investment decisions have to be undertaken without full information regarding the potential project. As a result, probability (a quantitative measure of chance of a certain event happening or not happening), is attached and the expected Monetary values(EMV) as per the forecasted cash flows calculated before valuing the given investment.)

## PROBABILITY AND RISK ANALYSIS

Risk refers to the variability of the expected returns from an investment from the actual returns.

Returns refer to the actual cash flows realized from a given investment.

## TYPES OF RISKS

- I. Financial risks: -Variability in earnings attributable to the Equity shareholders as a result of using debt finance with affixed interest charge.i.e. e due to long-term borrowings, a company will always have fixed obligations of paying the periodic interest charges and the principle amount on utility even during hard economic times making liquidation to be on the looming.E.g. g Credit risks, liquidity risks, interest rate risks, forex risks and sovereign risks.
- II. Systemic/market risk: -Comprises of external factors that are beyond the firms' control and affects all firms in the industry or economy. They are non-controllable and undiversifiable. However, they can best be managed by investing in an efficient Portfolio (A portfolio consisting of risk-free assets and risky assets in optimal proportions). E.g. Inflation, political and legislative risks, industrial strikes and energy crises. It's measured by market Beta( $\beta$ )
- III. Non-systemic/Unique risk: Are risks that are caused by internal factors that are often unique to any particular firm. They are controllable through diversification which involves investing in a portfolio and not individual assets.
- IV. Operating risks: -The variability in the operating earnings as a result of incurring fixed operating costs. High fixed costs leads to a greater variability in operating incomes for any change in sales volume, thus, a higher operating income.

It measures the risk for individual projects. It's widely used in the calculation of the following variables for projects to be used in investment decision making purposes:

- I. Variance of returns( $\sigma^2$ )
- II. Standard deviation( $\sigma$ )
- III. Coefficient of Variation in returns( $CV$ )= $\sigma_j / \bar{R}_j$

## CAPITAL ASSET PRICING MODEL(CAPM)

In valuation of investments, one has to consider his assets in the portfolio as a part of his total investments. In considering the portfolio, not only returns are to be considered as in the case of single investments but their risks also.

Two plus two will not make it four in the aggregation of risks, as shown by famous author Markowitz. So the risks in a portfolio of assets will not be the total of individual risks of investments, made; it can be more or less than the total.

The objective of investor is to minimize the risk for a given return and capital market theory deals with that subject.

Capital market theory is an extension of the portfolio theory of Markowitz. The portfolio theory explains how rational investors should build efficient portfolio based on their risk-return preferences. Capital Market Asset Pricing Model (CAPM) incorporates a relationship, explaining how assets should be priced in the capital market.

As Betas differ according to the market proxy, that they are measured against, then in effect, CAPM, has not been and cannot be tested. We may recall that CAPM states that-

$$\text{Return} = \text{Risk free rate} + \text{Beta} (\text{Market Return} - \text{Risk free rate})$$

A security with a zero Beta should give a risk free return. In actual results these zero beta returns are higher than the risk free return indicating that there are some non-Beta risk factors or some left over unsystematic risk.

Besides, although, in the long-run, high Beta portfolios have provided larger returns than low-risk ones, in the short-run, CAPM Theory and the empirical evidence diverge strikingly and sometimes the relationship between risk and return may turn out to be negative which is contrary to CAPM Theory.

It can thus be concluded that CAPM Theory is a neat Theoretical exposition. The CML and SML are the lines reflecting the total risk and systematic risk elements in the portfolio analysis, respectively. But in actual world, the CAPM is not in conformity with the real world risk-return trends and empirical results have not always supported the Theory at least in the short-run.

### **Assumptions of Capital Market Theory:**

1. Investors are rational and they choose among alternative portfolios on the basis of each portfolio's expected return and standard deviation.
2. Investors are risk averse.
3. Investors maximize the utility of end of period wealth. Thus CAPM is a single period model.
4. Investors have homogeneous expectations with regard to asset return. Thus all investors will perceive the same efficient set.
5. There exist a risk-free asset and all investors can borrow and lend at this rate.
6. All assets are marketable and perfectly divisible.
7. The capital market is efficient and perfect.i.e. There is perfect competition and no single investor can influence prices, with no transactions costs, involved.

### **DEFINITION OF CAPM**

It's a single period theoretical financial model that is used in pricing risky individual assets and risky portfolios (spread of assets). It has two formulations with specific functions.I.e.

- **SECURITY MARKET LINE(SML):** It is used in evaluating individual risky assets and may be denoted mathematically as:

$$E(R_j) = R_f + \beta_j(R_m - R_f)$$

Where:

$E(R_j)$  is the expected return from an individual asset j

$\beta_j$  is the Beta measure of the market/systemic risk of asset j

$R_f$  is the risk-free rate of return, usually given as the discount rate for government securities such as government bonds and T-bills.

This formulation measures the systematic risk of individual assets (Beta measure)

Thus, the expected return on the individual risky asset depends on:

- Pure time value of money
- Reward for bearing the systemic risk/Market risk
- Amount of systemic risk

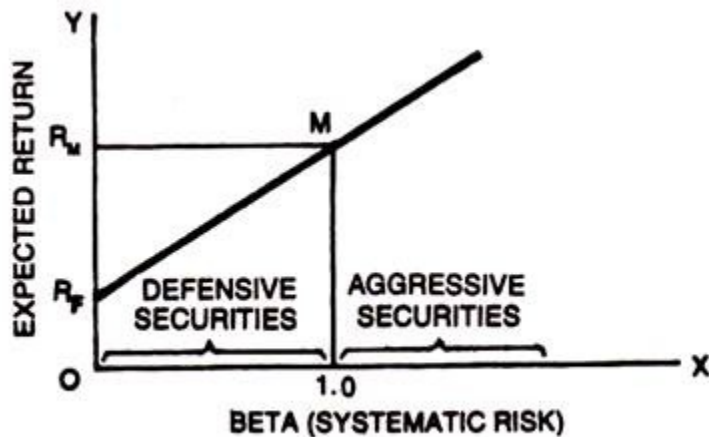
Graphical representation of SML

Fig. 3

The slope of the SML is equal to the risk premium ( $R_m - R_f$ ) and  $R_M$  is the effective market rate of returns for asset j.

- **CAPITAL MARKET LINE (CML):** It is used to evaluate risky portfolio and may be denoted mathematically as:

$$E(R_p) = R_f + \beta_p (R_m - R_f)$$

Where:

$E(R_p)$  is the expected returns from the portfolio invested in. It's calculated as:

$$E(R_p) = W_A \cdot \check{R}_A + W_B \cdot \check{R}_B + \dots + W_n \cdot \check{R}_n$$

$\beta_p (R_m - R_f)$  is the risk adjustment factor

$B_p = W_A \cdot \beta_A + W_B \cdot \beta_B + \dots + W_n \cdot \beta_n$  (represents the risk measure for a spread or class of assets)

$$\sigma_p = [W_A^2 \cdot \sigma_A^2 + W_B^2 \cdot \sigma_B^2 + 2W_A W_B \text{COV}_{ab}]^{1/2}$$

$$\text{COV}_{ab} = \sum P_i (R_A - \check{R}_A) \cdot (R_B - \check{R}_B)$$

The equation of the capital market line connecting the riskless asset with a risky portfolio is-

$$R_e = R_f + \frac{R_M - R_F}{\sigma_M} \sigma_e$$

CORRELATION CO-EFFICIENT OF RETURNS OF ASSETS A & B ( $\rho_{ab}$ ) =  $\text{COV}_{ab} / (\sigma_A \cdot \sigma_B)$

$\rho_{ab}$  ranges from -1 to +1 i.e, -1 implies that the returns are perfectly negatively correlated and hence is the best investment alternative. In contrast, +1 implies a perfectly positively correlated returns and hence is the worst investment alternative.

$$\bar{R}_j = \sum P_i \cdot R_j$$

$$\sigma_j^2 = \sum P_i \cdot (R_j - \bar{R}_j)^2$$

### CONCEPTUAL DIFFERENCE BETWEEN SML & CML

- 1) Difference in the risk measures; the standard deviation of returns ( $\sigma$ ) is the risk measure for CML while SML uses the Beta measure ( $\beta$ ).
- 2) Difference in the assets evaluated; SML evaluates individual risky assets while CML evaluates risky portfolios.
- 3) Risk premium normalization; In SML, the risk premium is normalized by the variance ( $\sigma_j^2$ ) where as in CML it's normalized by the standard deviation ( $\sigma_p$ ).

### LIMITATIONS OF CAPM

- 1) It has unrealistic assumptions with little or no application in the real investment world except the Beta measure for individual risky assets.
- 2) Diversification as a strategy for managing the non-systematic risk is not done in a planned manner in reality as the Beta measure changes from one period to another. (It's a single period model)
- 3) Beta being unstable in reality, may not truly reflect future market risks as its calculation is based on past history of the risky assets.
- 4) It does not measure the total risk of the portfolio ( $\sigma_p$ ) which has been found to be more relevant in making investment decisions, but only focuses on the Beta measure of market related risks with narrow focus on individual risky assets.
- 5) Its SML formulation is not applicable in bond analysis despite the Bonds being part of the investment portfolios. This is because bond risk rated and known by the investors beforehand and the influencing factors on the risk and return on bonds are different. (Interest rate and investors holding period/Bond duration)

## EXAMPLES:

**Illustration 1:**

ABC Ltd was considering investing in a new project. The company was provided with the following data by local suppliers regarding Projects A and B.

States	Proj.A cash flow	Probability	Proj.A cash flow	Probability
1	4000	0.1	12000	0.1
2	5000	0.2	10000	0.15
3	6000	0.4	8000	0.5
4	7000	0.2	6000	0.15
5	8000	0.1	4000	0.1

Compute the following and advice your company as the Financial analyst;

- 1) The standard deviation.
- 2) The Variance.
- 3) The individual asset co-efficient of variation.
- 4) Covariance of returns of Assets A & B.
- 5) The correlation co-efficient of returns of assets A & B.

**Illustration 2:**

ASSET	A	B	C	D	E
Beta( $\beta_j$ )	2.0	1.5	1.2	1.0	0.9
Proportion( $W_j$ )	0.30	0.20	0.20	0.20	0.10

Given that the Market returns prevailing currently stands at 20% and the risk-free rate of return is 10%, compute:

- 1) The expected return from a portfolio constituting of all the above given individual assets in the given proportions.
- 2) The market risk measure for the said portfolio.

**Illustration 3:**

The expected Returns for two firms A & B are given as follows:

Probability of states	Expected Returns on A( $R_a$ )	Expected Returns on B( $R_b$ )
0.1	-0.05	-0.10
0.4	0.10	0.15
0.3	0.25	0.10
0.2	0.30	0.18

Further details show that firm A has a total of investments in assets amounting to Kshs.75 million, which is three times the size of firm B's investments. As a survival strategy, firms A & B

merges together to form Firm C. The share of Firm A & B in the portfolio of the newly formed firm C is based on the ratio of their total assets prior to the merger.

Calculate:

- 1) The expected return and standard deviation of firm A and B before the merger. (8mks)
- 2) The Covariance ( $COV_{ab}$ ) and correlation co-efficient ( $P_{ab}$ ) between the returns for firms A and B before the merger.(4mks)
- 3) The standard deviation of returns of the two asset portfolio represented by the Firm C. (3mks)

### THE CAPITAL MARKETS THEORY

In Every economy we have a financial system that plays the integral role of channeling resources from those who own the factors of production(lenders) but lack productive investment opportunities to those with productive opportunities but lack the required resources(Borrowers). It has the following MAIN components:

- **The financial markets** (Capital markets, money markets, primary markets, secondary markets, Securities/stock exchange markets, OTC, third market and fourth market)

**Capital markets:** -where long-term finances are traded such as stocks, debentures, lease finance and mortgage finance.

**Money markets:** -where short-term finances are traded such as bank overdraft, trade credit, BOE, Government T-bills and bankers certificate of deposit.

**Primary markets:** -where new securities are issued and traded (Shares floated for the first time in the Initial Public offerings, IPO).

**Secondary markets:** -where securities that had been floated in the primary markets are subsequently issued and traded.

**Stock exchange:** -Market for the trading of long-term securities (stocks and shares) under certain fiscal base or guidelines and trade regulations.

**Over-the-Counter market(OTC):** -Market in which securities are traded outside an organized stock exchange or not within certain fiscal base.e.g. g Online option trades and FOREX trades.

**Third market:** -The trade between two institutional investors through the involvement of an intermediary such as Brokers or agents.

**Fourth market:** -The trade between two institutional investors without the involvement of an intermediary.

- Financial institutions/Intermediaries

This comprises of both the deposit-taking and lending institutions whose main functions are;

Maturity transformation: -converts short-term liabilities into long-term assets.

Risk transformation: -converts risky investments into relatively risk-free ones by lending to multiple borrowers in order to spread risks.

Convenience denomination:-Involves matching small deposits with large loans and large deposits with small loans.

#### ITS MERITS

Protects the market failure by reconciling the conflicting interests of the lenders and borrowers.

It saves costs compared to direct lending such as:

1. Helps reconcile the lenders and borrowers' preferences.
2. Helps risk-averse intermediaries optimize the risk-trade off gain by spreading the risk through lending to many people
3. Economies of scale reduces the cost of lending
4. Achievement of economies of scope since intermediaries concentrate on the demands of the lenders and borrowers and are able to enhance their products and services using the same inputs to produce different outputs.

#### ITS DEMERITS