

MAFA : CA FINAL

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CA Final (2nd Group Pending)

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PORTFOLIO MANAGEMENT

Portfolio

Meaning - Analysis	Refers to collection of assets Held by an individual / institution Purely for investment purpose		
Consists of	Assets : Positive / Negative (Restricted to securities)		
Assets	Cash Bonds Stock Option Future Real assets		
Example	Mr. x holds	100 shares of Tata Tea 50 shares of Infosys 60 Debentures of ITC	Portfolio of Mr. X

Portfolio Management

Definition	A process of	Construction, Revision, Evaluation
Objective	to obtain maximum return, commensurate with the <u>risk preference</u> of the Investor.	

Risk & Return

The investor should consider always the
Risk and return
in connection with the investment

It means for Risk & Return move in the same direction
higher risk : Higher return
Less risk : Less return

Portfolio Management

Return : Types of Return

Realised rate of return

(Rate of Return)

Rate of Return : R

It is the return that the holder of return actually earns

It may be equal to/ more than / less than expected return

$$R = \frac{(P_1 - P_0) + D_1}{P_0}$$

Where, P1 Ending value of share
P0 Starting value of share
D1 Dividend at the end of one year

Analysis Should we consider the capital appreciation / depreciation especially if the asset has not been sold, as it is still notional

An investor decision not to sell and realise the gain / loss , does not in any way change the fact.

An investor can sell the shares for its cash value and immediately buy it back

Therefore such appreciation / depreciation to be considered

Expected Rate of Return : E(R)s

It is the return investors anticipate from holding a security

It helps in Decision Making

It can be computed for

Security (Based on Probability, Sum of P = 1)

Portfolio (Based on Weights, Sum of W = 1)

$$E(R) = p_1.x_1 + p_2.x_2 + \dots + P_n.x_n$$

E (R) Expected rate of return from the security

Pi Probability of the ith event

Xj Return from the security from the jth event

(if probability is not given, calculate simple average)

$$p_1 + p_2 + p_3 + \dots + p_n = 1$$

$$i, j = 1, 2, 3, 4, 5, \dots, n$$

$$E(R_p) = W_1.R_1 + W_2.R_2 + \dots + W_n.R_n$$

E (Rp) Expected rate of return from the portfolio

Wi Weight of the individual asset in the portfolio

Rj Expected rate of return of asset of portfolio

(if weights not given, just take equaly)

$$w_1 + w_2 + w_3 + \dots + W_n = 1$$

Portfolio Management

Required Rate of Return / Fair Rate of Return

It is the return that market feels appropriate for a given level of risk

NOTE :

Expected rate of return = Fair rate of return

Risk :Types of Risk

Investment
(Realised return $\neq$ Expected return) $\rightarrow$ Return $\rightarrow$ uncertain $\rightarrow$ = Risky

Investment
(Realised return = Expected return) $\rightarrow$ Return $\rightarrow$ Certain $\rightarrow$ = Riskless

Wider the possible variation from the expected return,
Greater is the uncertainty
Greater is the risk

Quantification of Risk

Risk for what	Security Portfolio	Based on Probability Based on Weights
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Analysis

Standard deviation is the deviation from arithmetic mean, and
is a measure of TOTAL RISK

arithmetical mean = Expected rate of return of security / portfolio

Decision

Lower the SD	Lower the Risk
Higher the SD	Higher the Risk

Standard deviation

Of A Security
Of return, of an investment
from expected return

$$\sigma_s = \sqrt{p_1 (x_1 - X)^2 + p_2 (x_2 - X)^2 + \dots + p_n (x_n - X)^2}$$

Standard Deviation

For the portfolio which consists of 2 securities

[Sigma]

$$\sigma_p = \sqrt{(W_x \cdot \sigma_x)^2 + (W_y \cdot \sigma_y)^2 + 2 (W_x \cdot \sigma_x) (W_y \cdot \sigma_y) \cdot r(x,y)}$$

Portfolio Management

Where,

σ_p	Risk / Std deviation of 2 security portfolio
W_x	Weight of security x in the portfolio
W_y	Weight of security y in the portfolio
σ_x	Std deviation of security x
σ_y	Std deviation of security y

$$r(x,y) = \frac{\text{Cov}(x,y)}{\sigma_x \cdot \sigma_y} \quad \text{Correlation co-efficient}$$

$\text{Cov}(x,y)$ covariance of (x,y)

$$\begin{aligned} & p_1 (x_1 - X) (y_1 - Y) \\ + & p_2 (x_2 - X) (y_2 - Y) \\ + & p_n (x_n - X) (y_n - Y) \end{aligned}$$

$r(x,y)$ Correlation of Coefficient

Lies between +1 and -1

It is the correlation between the securities in the portfolio,
i.e., the effect of one security on the other security

+1 Portfolio has maximum Risk

-1 Portfolio has Minimum Risk

Standard Deviation

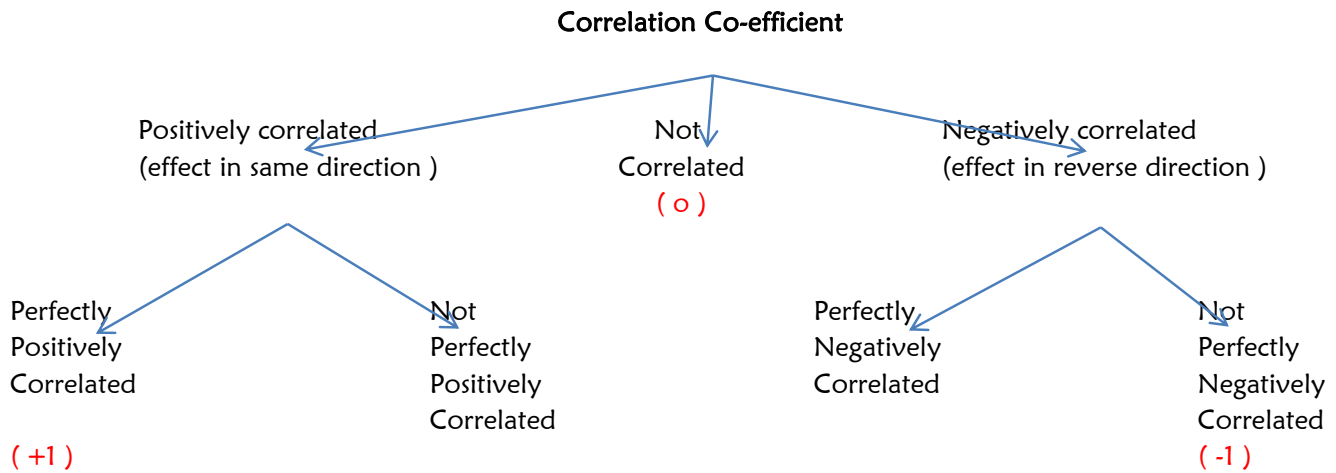
For the portfolio which consists of 3 securities

$$\sigma_p = \sqrt{(W_x \cdot \sigma_x)^2 + (W_y \cdot \sigma_y)^2 + (W_z \cdot \sigma_z)^2 + 2 (W_x \cdot \sigma_x) (W_y \cdot \sigma_y) \cdot r(x,y) + 2 (W_y \cdot \sigma_y) (W_z \cdot \sigma_z) \cdot r(y,z) + 2 (W_z \cdot \sigma_z) (W_x \cdot \sigma_x) \cdot r(z,x)}$$

Important Points

Standard deviation should be always positive

Portfolio Management



Reduction in Formula, Based on Correlation coefficient

CASE 1	<u>Perfectly positively correlated</u>	$r(x,y) = +1$
	$\sigma_p = (W_x \cdot \sigma_x) + (W_y \cdot \sigma_y)$	
CASE 2	<u>Perfectly negatively correlated</u>	$r(x,y) = -1$
	$\sigma_p = (W_x \cdot \sigma_x) - (W_y \cdot \sigma_y)$	
CASE 3	<u>Not Correlated</u>	$r(x,y) = 0$
	$\sigma_p = \sqrt{(W_x \cdot \sigma_x)^2 + (W_y \cdot \sigma_y)^2}$	

Formula Analysis

R	% age
$E(R)_s$	% age
$E(R)_p$	% age
Probability	Sums upto 1
Weights	Sums upto 1
Probability / Weights	Denoted by Decimals
σ_s	% age
σ_p	% age
$r(x,y)$	no. of Times
$Cov(x,y)$	% age

1.5% * 2.5% =	3.75%	This is applicable when finding
Risk * Risk		Correlation of coefficient

Portfolio Management

Risk Reduction

Risk reduction means

That the actual risk of a portfolio is brought down to less than the weighted average risk of the securities that constitute the portfolio

How ? Possible through Correlation coefficient

+ 1 Risk reduction - Not possible

- 1 Risk reduction - can be reduced to zero

0 to 1 Risk reduction - Possible but not to Zero

0 to -1 Risk reduction - Possible but not to Zero

Risk free security

Meaning

These securities should be highly liquid
They should be capable of generating return
with negligible variation from expected levels

It is commonly accepted that

Medium and short term Government securities - Risk free

Diversification

Diversification means investing in more than one security

Diversification is a defensive strategy

Diversification seeks only to reduce risk
not enhance return

If u want to maximise return, then identify the best security
and put all your money there

Investor Analysis

Investor always expects, the following to be Maximum

Rate of Return
Expected Rate of Return
Realised Rate of Return

Investor always, expects, the following to be Minimum

Risk of Security
Risk of Portfolio

Portfolio Management

Optimum Portfolio : Normal Method

(Portfolio in which risk is lowest)

Meaning	A portfolio, that has the <u>lowest level of variance</u> , is referred as the Optimum Portfolio
Analysis	To get the lowest level of variance, one has to get the mixture of securities in proper proportion
Goal	To get the weights of the securities in the portfolio Portfolio consists of 2 securities,
Requirement	Risk of securities, & Correlation coefficient / Covariance of 2 securities It doesn't consider the ERR, directly But it is considered indirectly, by way of Correlation coefficient / Covariance
Basic	$W_x + W_y = 1$ Therefore, While finding either W_x or W_y , the answer to be less than 1, <i>If the answer is more than 1, then apply quadratic equation</i>

$$W_x = \frac{\sigma_y^2 - \text{Cov}(x,y)}{\sigma_x^2 + \sigma_y^2 - 2 \cdot \text{Cov}(x,y)}$$

$$W_y = \frac{\sigma_x^2 - \text{Cov}(x,y)}{\sigma_x^2 + \sigma_y^2 - 2 \cdot \text{Cov}(x,y)}$$

OR

$$W_y = 1 - W_x$$

<u>Important points</u>	This formula will not apply when correlation is +1 because at this level risk reduction is not possible
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Portfolio Management

Risk Analysis

Risk can be breakdown into

Systematic Risk
Unsystematic Risk

Systematic Risk

It is also known as Portfolio risk / Market risk / Undiversifiable risk
Variation of Return in relation to other securities
Market Uncertainties
No Complete Elimination
Common to all Securities
Effect on securities is different
Yields Return

Unsystematic Risk

Also known as Diversifiable risk
Also known as Specific risk
Risk affects only to a particular security
Such a risk can, by careful efforts be reduced by way of diversification
Such risk doesn't yield return

General terminology

Risk & Return

Modification Needed

Systematic Risk & Return

Breakdown of Total Risk

Systematic Risk Market Factors
Unsystematic Risk Individual Factors

Method of Breaking

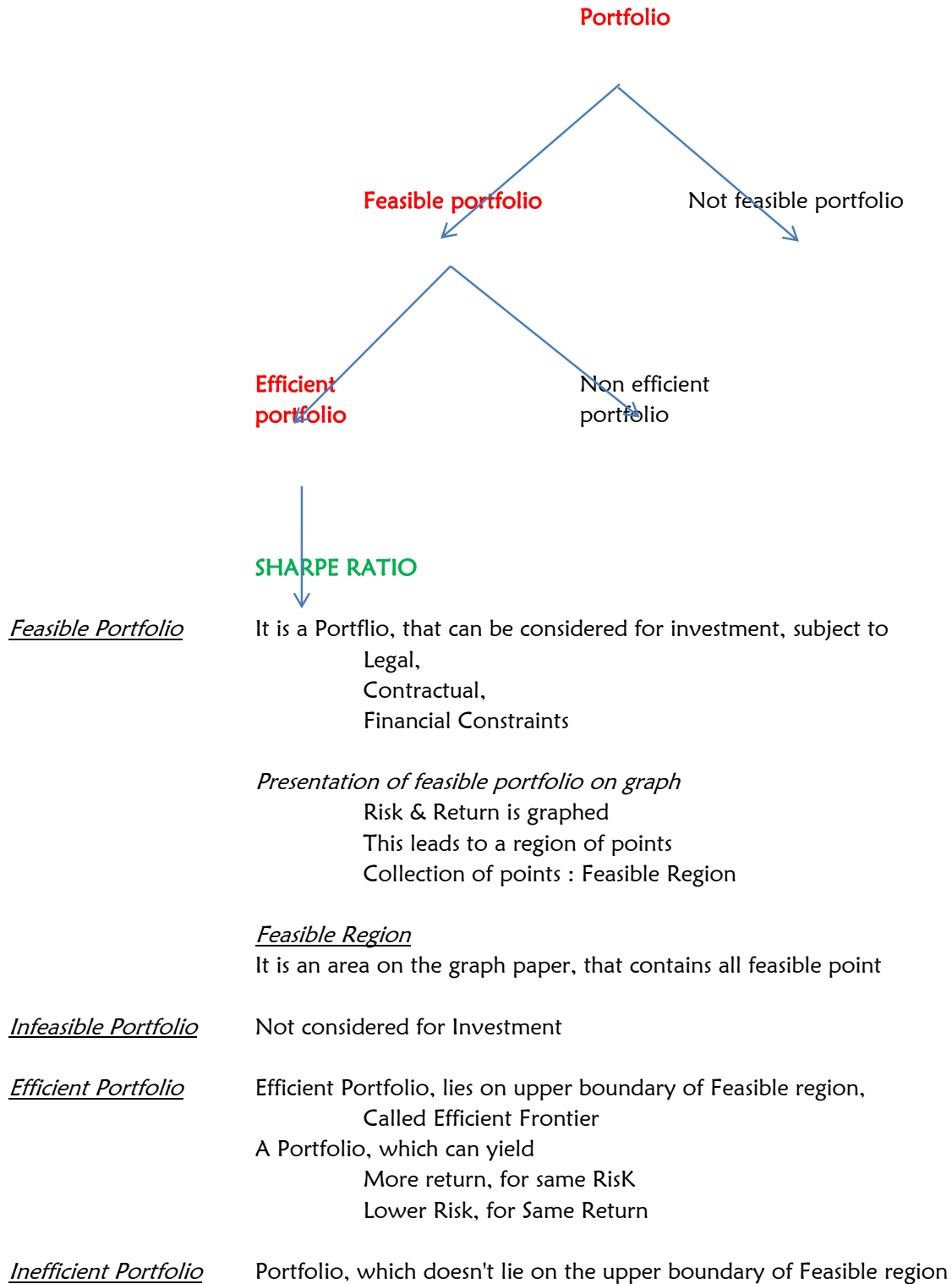
Systematic Risk	=	VOP * COD	$r_{pm}^2 \cdot \sigma_p^2$
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Unsystematic Risk	=	VOP * (1-COD)	$(1 - r_{pm}^2) \cdot \sigma_p^2$
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VOP = Variance of Portfolio / Security
COD = Coefficient of Determination = $(COC)^2$
COC = Coefficient of Correlation
COC = Between Return of Market & Portfolio

(Unsystematic Risk is always arrived at Balancing Figure)

PORTFOLIO : ANALYSIS



Portfolio Management

BEST Portfolio

Best portfolio lies among the Efficient Portfolio

Best portfolio is the portfolio, which has maximum sharpe ratio

Selection of best portfolio,

By using Sharpe Ratio

BEST PORTFOLIO = MARKET PORTFOLIO

Assumptions of Best Portfolio

Investors are aware of the Efficient Portfolio

So Investors invest only in Best Portfolio

Therefore, all the securities traded in the market
are Best portfolio

SHARPE Ratio

It is used to rank the Portfolio's among the Efficient Portfolio

Risk Premium, for, per unit of Risk Taken

For a Security

$$\text{SHARPE RATIO} = \frac{R_s - R_f}{\sigma_s}$$

For a Portfolio

$$\text{SHARPE RATIO} = \frac{R_p - R_f}{\sigma_p}$$

Decision Higher the Sharpe ratio : Better the Portfolio / security

$$\text{Risk Premium} = R_p - R_f$$

Optimum Portfolio : Quadratic Equation

Application	This should be applied when, the first method, i.e the normal Method, is a failure
Requirement	Risk of securities, Correlation coefficient / Covariance of 2 securities, & Risk of Portfolio / Diversification Gain & Some Risk of Portfolio
Steps for Solving	$W_x + W_y = 1$ Let us assume, $W_x = x$ Therefore, $W_y = (1-x)$

Portfolio Management

Then, allocate the numbers in Std deviation of Portfolio formula

While deriving the same, we will encounter with

The equation = $(a-b)^2$

$$(a-b)^2 = a^2 + b^2 - 2ab$$

Then, bring the same into equation

$$ax^2 + bx + c = 0$$

Then, apply the following formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

From the above, you will get 2 answers

One, which will be more than 1

Second, which will be less than 1

Consider the x value, which is less than 1

Diversification Gain	$\frac{\text{Risk of PF1} - \text{Risk of PF2}}{\text{Risk of PF1}}$	= %age
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If they give just Diversification gain & Risk of PF1,

We can find out risk of PF2, and from that

the proportion of securities in PF

Super Efficient Portfolio

CML : Capital Market Line

Importance of SEP

James Tobin

An investor can earn

Higher Return : compared to Efficient Portfolio

Same risk : As to Efficient Portfolio

Mechanism of SEP

The SEP to be constructed, in one of the following methods

Available Funds : Divide it into 2 portions

Invest in Market Portfolio

Invest in Risk free Rate

Available Funds & Borrowed Funds :

Invest full available funds in Market Portfolio

Borrowed Funds(@ Risk free rate) : Invest in Market PF

Relationship b/w Risk & Return Linear Relationship

Proof

Plot on Graph, Results in Straight Line : CML

Proof of CML : Return

Proportion of Market PF : x

Proportion of Risk Free Investment : (1-x)

$$\begin{aligned}\text{Return of PF} &= x.R_m + (1-x).R_f \\ &= x.R_m + R_f - R_f.x\end{aligned}$$

Return of PF	=	$R_f + x(R_m - R_f)$
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Portfolio Management

Proof of CML : Risk

Proportion of Market PF : x
Proportion of Risk Free Investment : **ZERO**

$$\sigma_p = (x \cdot \sigma_m)^2 + ((1-x) \cdot \sigma_f)^2 + 2 (x \cdot \sigma_m) ((1-x) \cdot \sigma_f) \cdot r(m,f)$$

$$\begin{aligned} \sigma_p &= x \cdot \sigma_m && \text{As risk of Rf is zero} \\ x &= \sigma_p / \sigma_m \end{aligned}$$

Substitute, the equation in Return of PF

$$\text{Return of PF} = R_f + \frac{\sigma_p}{\sigma_m} (R_m - R_f)$$

The above equation is in the form of
 $y = mx + c$

$$\begin{aligned} y &= R_p \\ c &= R_f \\ x &= \sigma_p \\ m &= \frac{(R_m - R_f)}{\sigma_m} && \text{Sharp Ratio} \end{aligned}$$

Proof other issues

$$\begin{aligned} c &= \text{Constant} = R_f \\ m &= \text{Steepest line} = \text{Sharp Ratio} \\ y &= \text{Dependent Variable} = R_p \\ x &= \text{Independent Variable} = \sigma_p \end{aligned}$$

Therefore,

Return of SEP, depends on
Risk of Portfolio

Portfolio Management

CAPM : Capital Asset Pricing Model

BETA : Analysis

Introduction

We saw 2 type of risks
Diversifiable risk, and
Undiversifiable risk

Diversifiable risk can be eliminated, by way of diversification
Undiversifiable risk cannot be eliminated

Investor is expected to diversify such diversifiable risk
as it doesn't yield any reward
Because, Market gives return only with respect to Undiversifiable risk

Beta is a measure of Undiversifiable risk

Beta of a stock indicates
the sensitivity of a stock
to the changes in the returns from the stock market (SENSEX)

IF the stock market changes by 5%
The stock with the beta of 1.2 changes by 6%

IF the stock market changes by 5%
The stock with the beta of 0.8 changes by 4%

Expected risk premium is the beta times the Market risk premium

Suppose the risk free investment is $R_f = 5\%$
That means any body can earn 5% by investing in risk free investments

Any one who invests in the stock market can earn, $R_m = 15\%$
The excess return earned over and above the risk free return is
known as Risk premium
That is $R_m - R_f : 15\% - 5\% = 10\%$

Risk premium is the additional return earned for taking the risk
over and above the risk of investing in R_f

Therefore, the market risk premium is 10%
and the Beta of the stock is 1.2
The stock/security risk premium from this stock is to be
1.2 times that is 12%

Portfolio Management

How is beta helpful	Beta of a stock is more than 1
	It is high beta stock
	Such stocks are riskier than stock market
	There movement is faster than the movement of market
	IF the market goes up, this stock goes up faster
	IF the market falls down, this stock falls faster
	Beta of a stock is Less than 1
	It is Low beta stock
	Such stocks are less riskier than stock market
	There movement is Slower than the movement of market
	IF the market goes up, this stock goes up slower
	IF the market falls down, this stock falls slower
	Beta of a stock is equal to 1 : Unity stocks
	It tends to mimic the market
What stocks to have	In a rising market (bull market)
	Have High beta stocks
	In a falling market (bear market)
	Have low beta stocks

Portfolio Management

BETA : Analysis

Meaning Beta = Sensitivity = Risk
Beta / Sensitivity is a Ratio
For change in Security Rate of Return &
Change in Market Rate of Return

Beta : Results

Beta = 1	Similar to Market Risk
Beta > 1	More than Market Risk
Beta < 1	Less than Market Risk
Beta = 0	No effect, of market risk

NEGATIVE Risk : IS Not possible

BETA Types

Beta of	Security Portfolio Market Risk free security
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CAPM : Capital Asset Pricing Model

Characteristic Line

Purpose	Determine a Theoritically appropriate price of a Asset / security
How ?	This model helps in Finding Required Rate of return RRR, can be used for Discounting future expected cash flows The PV of Cash flows obtained, is the logical price of Asset / security
Beta	Beta is measured as a sensitivity of security / portfolio rate of return in connection with changes in market rate of return

Beta of market portfolio	Always = 1
Beta of risk free security	Always = 0

Portfolio Management

Computation of Beta of security

Beta of security

$$\text{Beta of security} = \frac{\text{Change in } R_s}{\text{Change in } R_m}$$

Beta of security
(based on Characterstic line)

$$\text{Characteristic Line : } R_s = \beta_s \cdot R_m + \alpha_s$$

$$\text{Beta of security} = \frac{\text{Cov}(R_s, R_m)}{\sigma_m^2}$$

$$\text{Alpha : } R_s = \beta_s \cdot R_m + \alpha_s$$

Mean of securit̄y rate of return
Mean of market rate of return
(deteremined from past data)

Computation of Beta of Portfolio

Beta of portfolio

$$\text{Beta of portfolio} = \frac{\text{Change in } R_p}{\text{Change in } R_m}$$

Beta of portfolio

$$\text{Beta of portfolio} = \frac{\text{Cov}(R_p, R_m)}{\sigma_m^2}$$

Beta of portfolio

Weighted average beta of the securities in the portfolio

$$\text{weighted Avg B of security} = W_1 \cdot B_1 + W_2 \cdot B_2 + \dots W_n \cdot B_n$$

SECURITY MARKET LINE

(*Graphical representation of CAPM*)

Introduction

CAPM is used to determine theoretically appropriate price of an ASSET

This model gives us the Required rate of return
as a function of systematic risk

This required rate of return is used as a discounting rate
to determine the PV of future cash flow
expected from the asset

For which one should understand about the systematic risk
Systematic risk can be understood by knowing the Beta
And the Beta computation is shown above

Now we will learn about finding the REQUIRED RATE OF RETURN

Required rate of return is mandated by CAPM

Suppose the risk free investment is $R_f = 5\%$
That means any body can earn 5% by investing in risk free investments

Any one who invests in the stock market can earn, $R_m = 15\%$
The excess return earned over and above the risk free return is
known as Risk premium
That is $R_m - R_f : 15\% - 5\% = 10\%$

If the investment is as risky as the stock market, the risk premium
earned is 10%

IF the investment is 30% more risky than the market, the risk premium
earned is 13%

Therefore, the riskiness of the investment is identified by the Beta
Hence the risk premium that a stock should earn is beta times the
market risk premium
 $B_s (R_m - R_f)$

That was only the risk premium

The total return from an investment is the Risk free rate + Risk premium

Therefore

Security Return under CAPM

$$R_s = R_f + B_s (R_m - R_f)$$

Therefore

Portfolio Return under CAPM

$$R_p = R_f + B_p (R_m - R_f)$$

Portfolio Management

Development of Equation

Based on	Straight line Equation	$Y = mx + c$
y =	Dependent Variable	R_s
x =	Independent Variable	B_s
c =	Constant	R_f
m =	Slope	$R_m - R_f$

Risk premium

Security risk premium Additional return over Risk free rate of return due to acceptancy of element of risk

$$\text{Security risk premium} = (R_s - R_f)$$

$$\text{Security risk premium} = B_s (R_m - R_f)$$

Market risk premium Therefore the formula is

$$\text{Market risk premium} = (R_m - R_f)$$

$$\text{Market risk premium} = \frac{(R_s - R_f)}{B_s}$$

Treynor Ratio

This is similar to Sharp Ratio

This is used to find the best among the security / portfolio

Sharp ratio	Based on Total risk	Standard deviation
Treynor ratio	Based on Systematic Risk	Beta

Treynor Ratio	$\frac{R_s - R_f}{B_s}$
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Treynor : Sharp

Sharp	Speaks about Risk premium
Treynor	Speaks about Risk premium

Portfolio Management

Assumption : Cost of capital = Rate of Return

Cost of Capital = Company point of view

Rate of Return = Shareholders Point of view

$$\text{Cost of Equity (Ke)} = R_f + B_e (R_m - R_f)$$

$$\text{Cost of Debt (kd)} = R_f + B_d (R_m - R_f)$$

New Beta existing

Equity Beta As given in the Problem

Debt Beta It will be zero
If chance of default of payment is Nil
If the company is financially sound

If they ask expected rate of Return, apply the normal formula
If they ask required rate of return, apply CAPM formula

Computation of Rm, When the same is not given

Given If no. of securities are given
And we can find out, the rate of return of each security

Assumption All the securities = Best securities = Market securities

solution Average of all these securities will be market return

Weights of securities are not given

Assumption Equally for all securities
This can also be considered for finding, Bp

$$\text{Fact, under CAPM} \quad \text{Average rate of return of securities} = \text{Return from portfolio}$$

Average rate of return of securities

First find return of securities, under CAPM method
Find average, by giving equal weights to all securities

Return from Portfolio

First find beta of portfolio, by taking equal weights
Then apply formula under CAPM, for return of portfolio

Portfolio Management

When both R_m & R_f , is not given, How to find them

given	Rate of return of security Beta of security
Solution	apply simultaneous equation for each security

Weighted average cost of capital / OVERALL COST OF CAPITAL

Normal Method

$$\text{Cost of equity} \quad \boxed{\text{Cost of Equity (Ke)} = R_f + B_e (R_m - R_f)}$$

$$\text{Cost of debt} \quad \boxed{\text{Cost of Debt (kd)} = R_f + B_d (R_m - R_f)}$$

$$\text{Overall cost of capital} \quad \boxed{K_o = \frac{E \cdot K_e + D \cdot K_d}{E + D}}$$

Capital asset pricing method

$$\boxed{\text{Cost of Equity (Ke)} = R_f + B_e (R_m - R_f)}$$

$$\boxed{\text{Cost of Debt (kd)} = R_f + B_d (R_m - R_f)}$$

$$\boxed{\text{Overall cost of capital} = R_f + \frac{B_e \cdot E + D \cdot B_d}{E + D} (R_m - R_f)}$$

OR

$$\boxed{\text{Overall cost of capital} = R_f + B_o (R_m - R_f)}$$

$$\boxed{B_o = \frac{B_e \cdot E + D \cdot B_d}{E + D}}$$

Beta of overall cost of capital
Beta of liability

Portfolio Management

Relationship of Asset & Liability

Liability, includes	Beta of Equity Beta of debt
liability arises, due to	Investment, High Risk investment
Therefore,	<i>Beta of Asset = Beta of liability</i>

Return form Project

$$R_{\text{Project}} = R_f + B_{\text{project}} (R_m - R_f)$$

In case of multiple budgets apply, weighted average of beta

In case of levered co.

2 things are worth noting
where, beta of debt is not given, assume it to be Zero
When tax rate is given, raplace D, by $D(1-t)$