MAC 3702

APPLICATION OF FINANCIAL MANAGEMENT TECHNIQUES

STUDY UNIT 1 – ADVANCED ANALYSIS OF INFORMATION

- IN THIS STUDY UNIT WE WILL BE EXPANDING ON THE RATIO ANALYSIS CONCEPTS WE COVERED IN MAC 2602
- CHAPTERS 1, 2 AND 8 OF TEXTBOOK
- MOST OF THE SAME RATIOS WILL STILL BE EXAMINABLE BUT WE WILL BE LEARNING SOME NEW RATIOS
- IMPORTANT: ADJUSTMENTS TO MAKE BEFORE STARTING RATIOS
  - UNUSUAL ITEMS
  - INTANGIBLE AND FICTICIOUS ASSETS
  - OTHER – E.G. POST BALANCE SHEET EVENTS, OUTSTANDING JOURNALS

OBJECTIVES AND SOURCES OF FINANCIAL ANALYSIS

- THE OBJECTIVES OF FINANCIAL ANALYSIS
- THE USERS OF FINANCIAL INFORMATION AND ANALYSIS
- SOURCES OF INFORMATION REGARDING AN ORGANISATION
- THE MAIN LIMITATIONS OF FINANCIAL INFORMATION
- TECHNIQUES USED IN PERFORMING FINANCIAL ANALYSIS

THE OBJECTIVES OF FINANCIAL ANALYSIS

- THREE MAIN OBJECTIVES
  - AN EVALUATION OF AN ORGANISATION'S PROSPECTS FOR THE FUTURE
  - TO EVALUATE THE PERFORMANCE OF AN ORGANISATION'S MANAGEMENT VIA ANALYSIS OF THE FINANCIAL STATEMENTS
  - FOR INTERNAL DECISION MAKING E.G. INVESTING, CASH MANAGEMENT

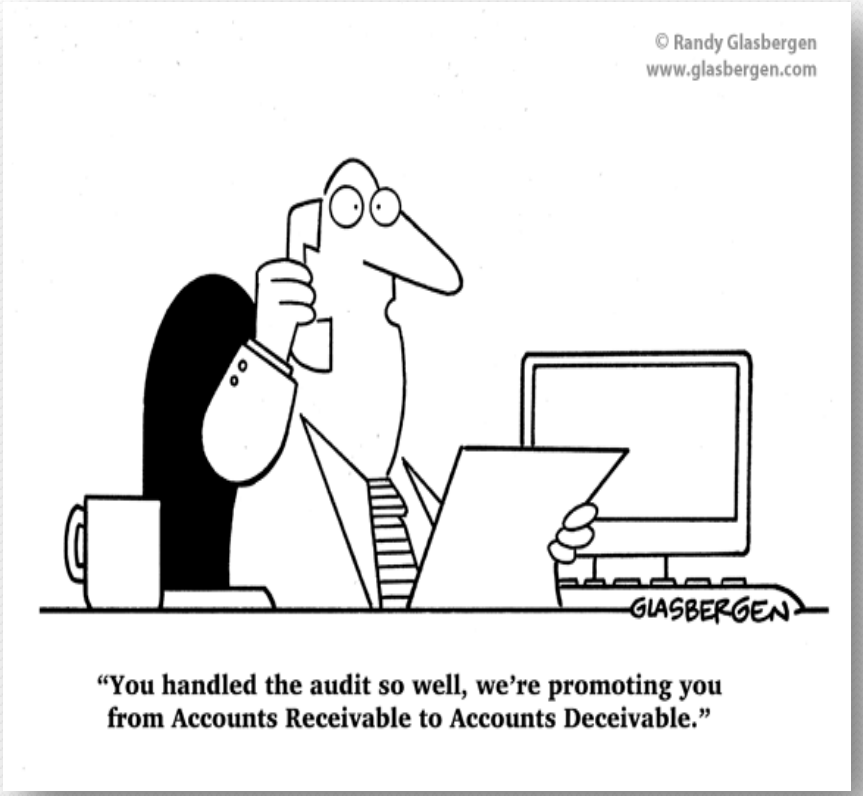
THE USERS OF FINANCIAL STATEMENTS

- CAPITAL PROVIDERS
  - GROWTH/SOLVENCY
- FINANCIAL ANALYSTS
  - RECOMMENDATIONS
- CREDITORS
  - CASH FLOWS AND LIQUIDITY
- MANAGEMENT
  - PERFORMANCE / INCOME DISTRIBUTION

- OTHER USERS
  - EMPLOYEES
  - SARS
  - INSTITUTIONS
  - AUDITORS

THE MAJOR LIMITATIONS OF FINANCIAL INFORMATION

- AUDITS HAVE LIMITATIONS
- ACCOUNTING POLICIES
- HISTORICAL COST LIMITATIONS
- REPRESENT PAST RESULTS
- FUTURE FORECASTING
  SUBJECTIVE
- FRAUD/ERROR/INCORRECT
  ACCOUNTING



TECHNIQUES USED IN PERFORMING FINANCIAL ANALYSIS

- COMPARITIVE FINANCIAL STATEMENTS
- INDEXED FINANCIAL STATEMENTS
  - THE FIRST YEAR IS ALL SHOWN AS 100%
  - ALL OTHER YEARS ARE SHOWN AS A % OF 100%
  - EASY TO SEE GROWTH AND TRENDS
- COMMON SIZE FINANCIAL STATEMENTS
  - A FIGURE IS CHOSEN AND MADE 100 %
    - E.G. TURNOVER, TOTAL ASSETS
  - EVERY OTHER FIGURE IS SHOWN AS A % OF THIS

COMMON SIZED FINANCIALS:

EXXON MOBIL CORP

(millions of dollars)	December 31, 2005		December 31, 2006	
Assets				
Current assets				
Cash and cash equivalents	$ 28,671	13.8%	$ 28,244	12.9%
Cash and cash equivalents - restricted	4,604	2.2%	4,604	2.1%
Notes and accounts receivable, net	27,484	13.2%	28,942	13.2%
Inventories				
Crude oil, products and merchandise	7,852	3.8%	8,979	4.1%
Materials and supplies	1,469	0.7%	1,735	0.8%
Prepaid taxes and expenses	3,262	1.6%	3,273	1.5%
Total current assets	$ 73,342	35.2%	$ 75,777	34.6%
Investments and advances	20,592	9.9%	23,237	10.6%
Property, plant and equipment, at cost, net	107,010	51.4%	113,687	51.9%
Other assets, including intangibles, net	7,391	3.5%	6,314	2.9%
Total assets	$ 208,335	100.0%	$ 219,015	100.0%
Liabilities				
Current liabilities				
Notes and loans payable	$ 1,771	0.9%	$ 1,702	0.8%
Accounts payable and accrued liabilities	36,120	17.3%	39,082	17.8%
Income taxes payable	8,416	4.0%	8,033	3.7%
Total current liabilities	$ 46,307	22.2%	$ 48,817	22.3%
Long-term debt	6,220	3.0%	6,645	3.0%
Postretirement benefits reserves	10,220	4.9%	13,931	6.4%
Accrued liabilities	6,434	3.1%	7,116	3.2%
Deferred income tax liabilities	20,878	10.0%	20,851	9.5%
Deferred credits and other long-term obligations	3,563	1.7%	4,007	1.8%
Equity of minority and preferred shareholders in affiliated companies	3,527	0.0% 1.7%	3,804	0.0% 1.7%
Total liabilities	$ 97,149	46.6%	$ 105,171	48.0%
Commitments and contingencies				
Shareholders' equity				
Common stock without par value	$ 4,477	2.1%	$ 4,786	2.2%
Earnings reinvested	163,335	78.4%	195,207	89.1%
Accumulated other nonowner changes in equity				
Cumulative foreign exchange translation adjustment	979	0.5%	3,733	1.7%
Postretirement benefits reserves adjustment	-		(6,495)	-3.0%
Minimum pension liability adjustment	(2,258)	-1.1%	-	
Common stock held in treasury	(55,347)	-26.6%	(83,387)	-38.1%
Total shareholders' equity	$ 111,186	53.4%	$ 113,844	52.0%
Total liabilities and shareholders' equity	$ 208,335	100.0%	$ 219,015	100.0%

NOTES:

- IT IS VERY IMPORTANT TO ALWAYS COMPARE A FIGURE OR A RATIO WITH PREVIOUS PERIODS AND SIMILAR ORGANISATION'S WITHIN THE SAME INDUSTRY
- FAILURE PREDICTION
- TREND ANALYSIS

RATIO ANALYSIS

- FINANCIAL INFORMATION PROVIDED
- GROWTH RATIOS
- RATIO ANALYSIS
- MEASURING PROFITABILITY AND PERFORMANCE
- MEASURING LIQUIDITY (SHORT-TERM)
- MEASURING SOLVENCY AND FINANCIAL CAPITAL STRUCTURE (LONG-TERM)
- MEASURING HOW THE ORGANISATION RELATES TO FINANCIAL MARKET RATIOS

INTRODUCTION AND FINANCIAL INFORMATION PROVIDED

- IN THIS SECTION WE WILL BE CALCULATING THE VARIOUS RATIOS YOU NEED TO KNOW
- A FULL STATEMENT OF FINANCIAL POSITION AND COMPREHENSIVE STATEMENT OF INCOME ARE USUALLY REQUIRED TO PERFORM RATIO ANALYSIS

RATIO ANALYSIS

"A METHOD WHEREBY FURTHER CALCULATIONS ARE PERFORMED ON FINANCIAL STATEMENTS AND IS INTENDED TO CREATE MORE MEANINGFUL INFORMATION"

- PROFITABILITY AND PERFORMANCE
- LIQUIDITY
  - TO MEET SHORT-TERM OBLIGATIONS
- SOLVENCY AND FINANCIAL STRUCTURE
  - TO MEET LONG-TERM DEBTS AND OVERALL HEALTH
- FINANCIAL MARKET
  - MAINLY IN MAC 3702

MEASURING PROFITABILITY

- GROSS PROFIT MARGIN:

  = GROSS PROFIT / REVENUE X 100

  - REASONS FOR GP % CHANGE:
    - DISCOUNTS
    - NEW PRODUCT LINES
    - THEFT/FRAUD/CONTROL
    - CHANGE OF STRATEGY / PRODUCTION COST INCREASE

- RETURN ON CAPITAL EMPLOYED:

  = NET INCOME AFTER SHORT TERM INTEREST (BEFORE TAX)
  / TOTAL SHAREHOLDERS INTEREST + LONG TERM FUNDS

- NET PROFIT MARGIN:

  = NET PROFIT / REVENUE X 100

  - PROFIT AFTER TAX, FINANCE CHARGES AND INVESTMENT INCOME

MEASURING PERFORMANCE

- RETURN ON EQUITY (ROE):

  = NET PROFIT / EQUITY X 100

  - AVERAGE EQUITY MAY BE USED

- RETURN ON ASSETS (ROA):

  = EBIT/TOTAL ASSETS X 100

  - INDUSTRY ASSET BASED LIMITATIONS AS WELL AS ASSET AGE

- DU PONT RATIO:
  - BREAKS DOWN ROA INTO A PROFIT AND ASSET TURNOVER RATE COMPONENT

= EBIT/REVENUE X REVENUE/ASSETS=EBIT/ASSETS

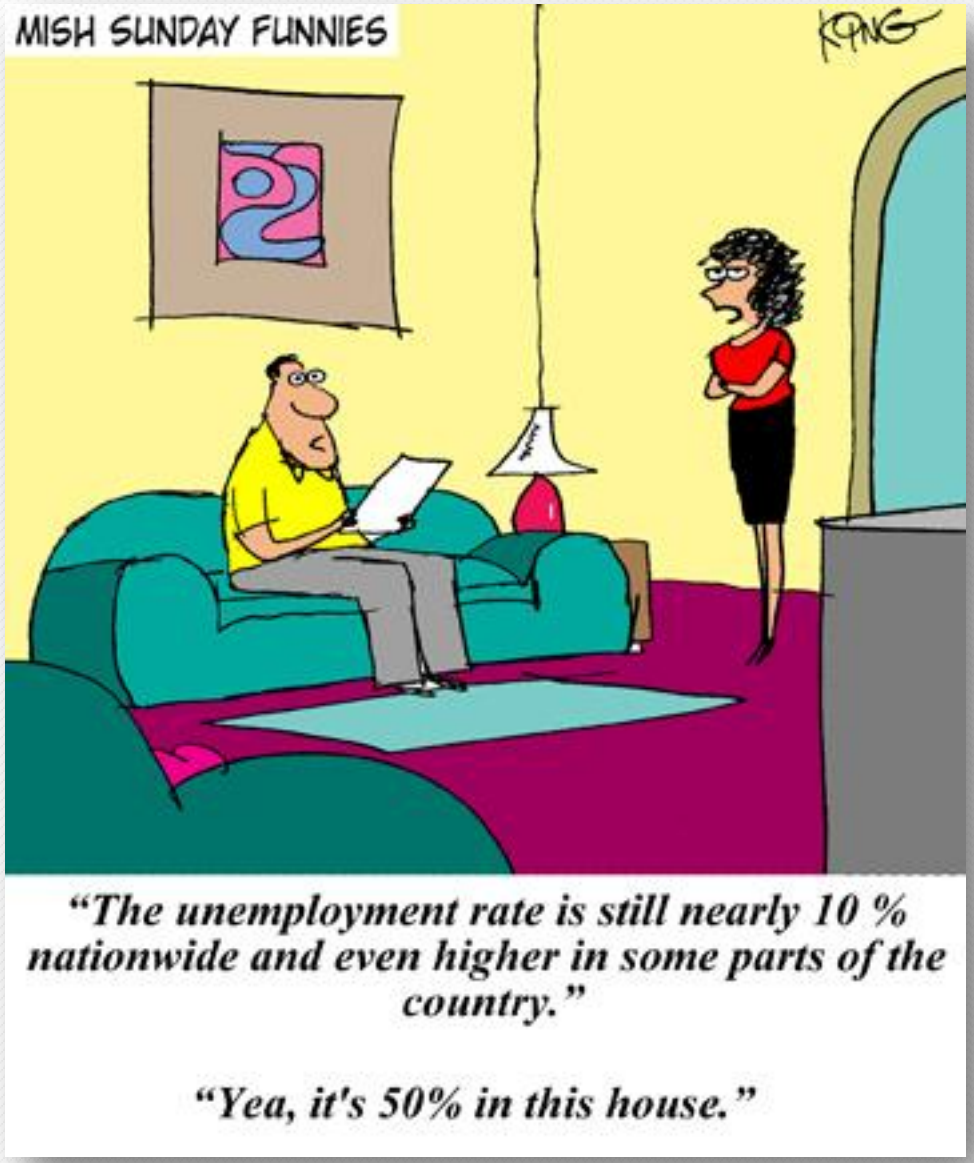
- ASSET TURNOVER:

= REVENUE / TOTAL ASSETS X 100

- EBIT PROFIT MARGIN:

  = EBIT/REVENUE

  X 100



MEASURING LIQUIDITY – SHORT TERM FUNDS

- CURRENT RATIO:

  = CURRENT ASSETS: CURRENT LIABILITIES

- LIQUID ASSET RATIO (ACID TEST OR QUICK RATIO):

  = CURRENT ASSETS *LESS* INVENTORY: CURRENT LIABILITIES

- INVENTORY DAYS:

  = **INVENTORY/COST OF SALES X 365 days (or 12 months)**

- INVENTORY TURNOVER RATIO:

  = **COST OF SALES/INVENTORY**

NOTE: THE USE OF AVERAGE FIGURES WILL PROVIDE MORE ACCURATE RATIOS. IF A COMPARITIVE YEAR IS GIVEN IT IS GENERALLY BEST TO USE AN AVERAGE. OR CONSULT QUESTION FOR GUIDANCE.

- RECEIVABLE DAYS (DEBTOR'S COLLECTION PERIOD):

  = RECEIVABLES/CREDIT SALES X 365 (or 12 months)

- PAYABLE DAYS (CREDITORS' PAYMENT PERIOD):

  =PAYABLES/CREDIT PURCHASES X365(or 12 months)

  - INCLUDE VAT WHERE POSSIBLE IN CREDITORS

- CASH CONVERSION CYCLE:

  = DAYS RECEIVABLE+DAYS INVENTORY-DAYS PAYABLE

- CASHFLOW TO TOTAL DEBT:

  = CASH FLOW FROM OPERATIONS/ TOTAL DEBT

MEASURING SOLVENCY AND FINANCIAL CAPITAL STRUCTURE (LONG-TERM FUNDS)

- INTEREST COVER RATIO:

  = EBIT / INTEREST EXPENSE

- DEBT TO EQUITY (or leverage ratio):

  = LONG TERM DEBT / EQUITY

- DEBT RATIO (or gearing ratio):

  = TOTAL DEBT / TOTAL ASSETS X 100

- TOTAL ASSETS TO TOTAL DEBT:

  = TOTAL ASSETS / TOTAL DEBT

- FINANCIAL LEVERAGE EFFECT:

  = ROE : ROA

- OPERATING LEVERAGE:

  = CONTRIBUTION / EBIT

MEASURING HOW THE ORGANISATION RELATES TO FINANCIAL MARKET RATIOS

- EARNINGS PER SHARE (EPS):

  = EARNINGS (or net profit) / NUMBER OF SHARES ISSUED

- DIVIDEND PAY-OUT RATIO:

  = DIVIDEND PER SHARE (DPS) / EARNINGS PER SHARE (EPS)

- DIVIDEND COVER RATIO:

  = EARNINGS PER SHARE (EPS) / DIVIDEND PER SHARE (DPS)

- PRICE EARNINGS RATIO:

  = SHARE PRICE / EARNINGS PER SHARE (EPS)

- EARNINGS YIELD:

  = **EARNINGS PER SHARE (EPS) / SHARE PRICE**

- DIVIDEND YIELD:

  = **DIVIDEND PER SHARE (DPS) / SHARE PRICE**

- NET ASSET VALUE(NAV):

  = **TOTAL ASSETS LESS TOTAL LIABILITIES**

FAILURE PREDICTION AND ECONOMIC VALUE ADDED (EVA)

- EVA

  = EBIT (1-TAX RATE) – (CAPITAL EMPLOYED X WACC%)

- FAILURE PREDICTION

- This is simply a prediction model based on various ratios added together => was developed by De La Rey (called K-score) for the South African economy by using an altered version of the Altman Z-score.
- Remember - anything between -0.19 and +0.2 is considered to be in the zone of ignorance => so a score below -0.19 is very bad and corrective action should be taken whereas a score above 0.2 is considered safe

Formula

$$K = -0.01662a + 0.0111b + 0.0529c + 0.086d + 0.0174e + 0.01071f - 0.06881$$

a =

- Total outside funding
  Total assets x 100

We include all long term and short term financing but exclude preference shares and minority interests. Total assets includes fixed, current and other assets => still exclude fictitious assets

b =

- Earnings before interest and tax (EBIT)
  Average total assets x 100

This is simply the ROA formula => average total assets is total assets as stated above averaged for current and prior year

c =

- Total current assets and listed investments
  Total current liabilities

Modified version of the current ratio

d =

- Earnings after tax
  Average total assets x 100

e =

- Net cash flow .
  Average total assets x 100

Cash flow is net cash flow from business activities

f =

- Closing inventory .
  Inflation adjusted total assets x 100

STUDY UNIT 2 – CAPITAL STRUCTURE:RISK AND RETURN

- CHAPTER 4 AND 5 IN TEXTBOOK
- BUILDS ON THE COST OF CAPITAL WE COVERED IN MAC 2602

CAPITAL STRUCTURE AND COST OF CAPITAL (CHAPTER 4)

- 4.1 DEBT ADVANTAGE
  - EFFECTIVELY CHEAPER
  - GEARING / E.P.S
- 4.2 DEBT DISADVANTAGE
  - FINANCIAL AND BUSINESS FAILURE
  - COMMITMENTS – INTEREST AND CAPITAL
- 4.3 FINANCIAL GEARING
  - THE PROPORTION OF DEBT COMPARED TO THE PROPORTION OF EQUITY
  - THE ABILITY TO USE BORROWED FUNDS TO INCREASE RETURNS
  - 3 RATIOS:
    - GEARING RATIO = LONG TERM DEBT/LONG TERM DEBT + EQUITY
    - DEBT OR SOLVENCY RATIO = TOTAL DEBT / TOTAL ASSETS
    - DEBT TO EQUITY = NON-CURRENT LIABILITIES TO EQUITY

EXAMPLE - EXPANSION VIA EQUITY ONLY

A BUSINESS DECIDES TO EXPAND AND BUY A NEW PLANT IN YEAR 2 FOR R 50 MILLION. IT FUNDS IT TOTALLY BY ISSUING NEW SHARES OR EQUITY. THE NEW PLANT IS ABLE TO DOUBLE PROFITS FROM R 5 MILLION TO R 10 MILLION.

YEAR 1:

	R MILLION
NET PROFIT	5
TOTAL ASSETS	50
TOTAL EQUITY	50

ROE = 10 %
ROA = 10 %

YEAR 2:

	R MILLION
NET PROFIT	10
TOTAL ASSETS	100
TOTAL EQUITY	100

ROE = 10 %
ROA = 10 %

EXAMPLE – EXPANSION VIA DEBT AND EQUITY

A BUSINESS DECIDES TO EXPAND AND BY A NEW PLANT IN YEAR 2 FOR R 50 MILLION AND FUNDS IT BY ISSUING R 30 MILLION NEW SHARES OR EQUITY AND R 20 MILLION DEBT. THE NEW PLANT IS ABLE TO DOUBLE PROFITS FROM R 5 MILLION TO R 10 MILLION.

YEAR 1:

	R MILLION
NET PROFIT	5
TOTAL ASSETS	50
TOTAL EQUITY	50

ROE = 10 %

ROA = 10 %

YEAR 2:

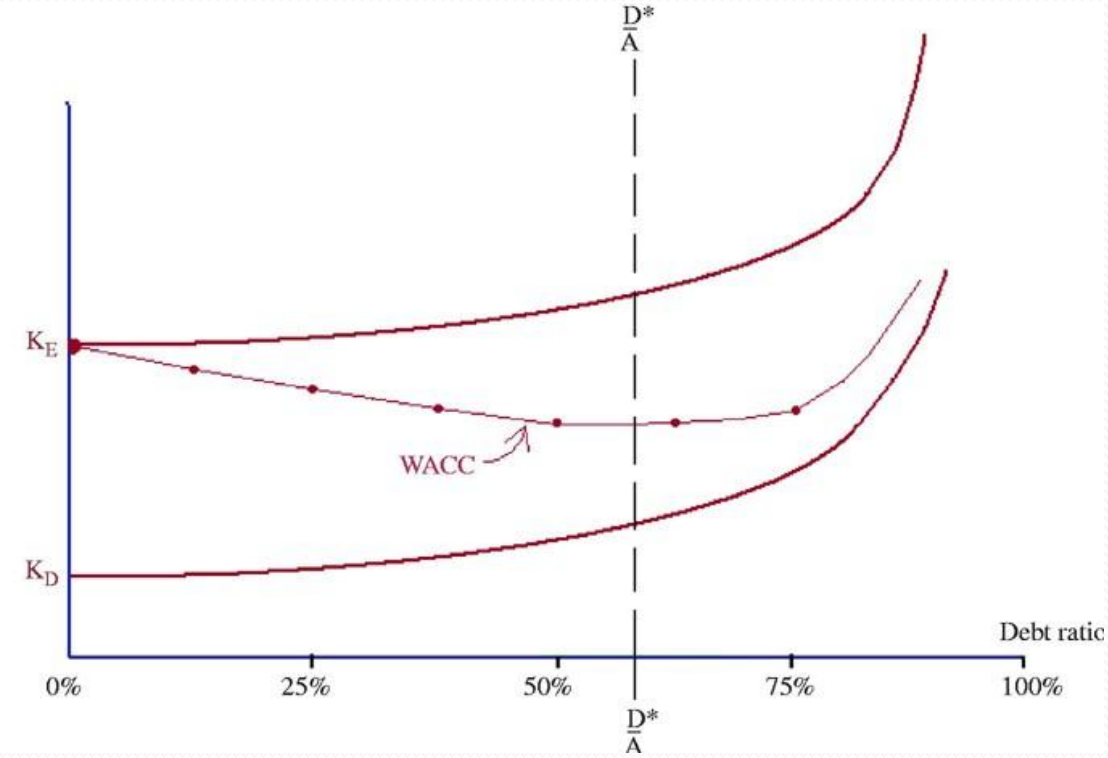
	R MILLION
NET PROFIT	10
TOTAL ASSETS	100
TOTAL EQUITY	80
TOTAL DEBT	20

ROE = 12.5 %

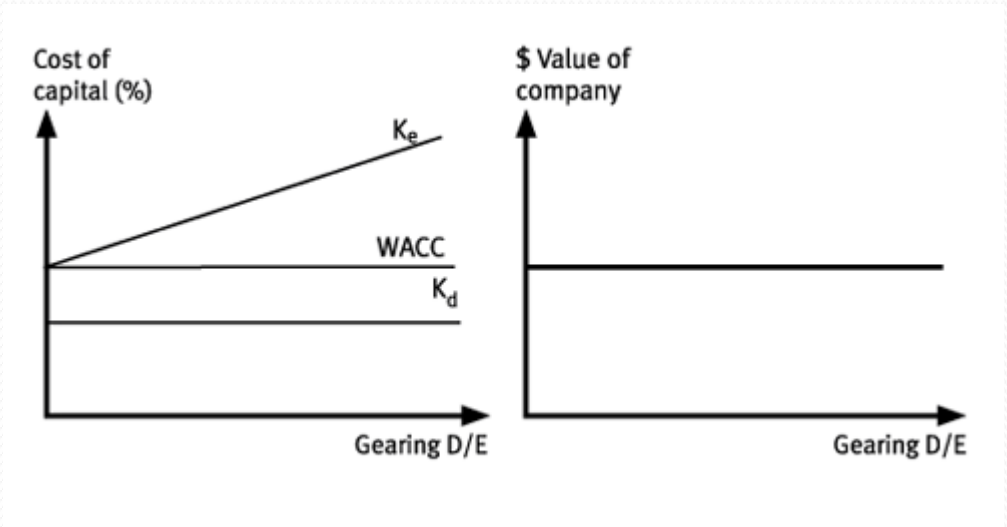
ROA = 10 %

- 4.4 DEBT AS PART OF THE CAPITAL STRUCTURE
  - SHOULD A COMPANY TAKE ON DEBT AND IF SO HOW MUCH?
  - TRADITIONAL THEORY
    - OK AS IT LOWERS COST OF FINANCE AND NOT TO MUCH DEBT IS TAKEN
  - THE MILLER AND MODIGLIANI THEORY
    - INCREASED DEBT CAUSES INCREASED BUSINESS AND FINANCIAL RISK WHICH RAISES THE COST OF EQUITY (Ke) AND THEREFORE OVERALL WACC. THEREFORE WHETHER A COMPANY TAKES ON FINANCE OR NOT IT CANNOT LOWER THE OVERALL COST OF FINANCE BELOW THE REQUIRED RETURN ASSOCIATED WITH THE BUSINESS RISK
- 4.5 COMPENSATING PROVIDERS OF CAPITAL
  - THE WACC NEEDS TO BE ACHIEVED

- 4.6 TRADITIONAL CAPITAL STRUCTURE THEORY
  - OPTIMAL CAPITAL STRUCTURE DOES EXSIST AND THE COMPANY CANNOT MAXIMISE SHAREHOLDERS WEALTH UNLESS THE OPTIMAL WACC IS ACHIEVED:



- 4.7 THE MILLER AND MODIGLIANI THEORY
  - THERE IS NO OPTIMAL CAPITAL STRUCTURE BECAUSE THE ADVANTAGE OF DEBT WOULD BE COUNTERED BY AN INCREASE IN THE COST OF EQUITY Ke
  - ASSUMPTIONS: INVESTORS RATIONAL, HAVE SIMILAR EXPECTATIONS, CAPITAL MARKETS ARE PERFECT, INFORMATION FREELY AVAILABLE, NO TRANSACTION COSTS, NO TAXATION, FIRMS CAN BE GROUPED INTO RISK CLASSES AND SAME RATE BORROWING EXSISTS.
  - Vo = Y / Ko (VALUE OF THE FIRM = (DIV + INTEREST)/WACC)

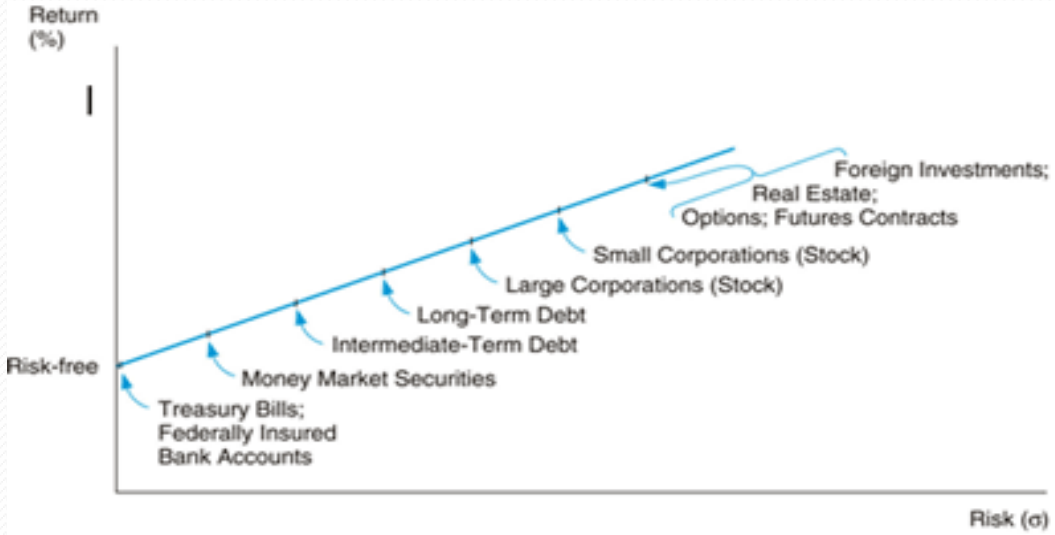


- 4.9 OPTIMAL CAPITAL STRUCTURE – TRADITIONAL WORLD
  - THE TRADITIONAL THEORY MORE RESEMBLES THE REAL WORLD
  - THEREFORE LIMITED DEBT IS OK

PORTFOLIO MANAGEMENT AND THE CAPITAL ASSET PRICING MODEL (CHAPTER 5)

- 5.1 GENERAL AND BACKGROUND
  - PORTFOLIO THEORY LOOKS AT THE GENERAL RELATIONSHIP BETWEEN RISK AND RETURN FROM AN INVESTORS POINT OF VIEW
  - PORTFOLIOS SHOULD BE SELECTED THAT PROVIDE AS MUCH RETURN WITH AS LITTLE RISK AS POSSIBLE
  - INVESTMENT CRITERIA
    - EXPECTED RETURN
    - VARIATION IN RISK – STANDARD DEVIATION
    - ASSOCIATION BETWEEN RISK AND RETURN FOR THAT AND EVERY OTHER INVESTMENT

- 5.2 THE CONCEPT OF RISK AND RETURN
  - RETURN
    - CAPITAL GROWTH
    - INCOME STREAM – DIVIDENDS AND INTEREST
    - REALISED AND EXPECTED RETURNS
  - RISK
    - UNPREDICTABILITY
    - THE CHANCE OF THE VARIATION IN THE RETURNS
    - USUALLY INVERSE RELATIONSHIP BETWEEN RISK AND RETURN
  - INVESTORS ATTITUDES TO RISK
    - RISK AVERSE AND RISK PRO



- PROBABILITIES AND EXPECTED VALUES
  - FOR A SINGLE STAND ALONE ASSET:

    $E(R) = Pi \times Ri$

    (THE EXPECTED RETURN = PROBABILITY FACTOR X RETURN)
  - FOR A PORTFOLIO OF ASSETS:

    $E(Rp) = WaE(Ra) + WbE(Rb)$

    (THE EXPECTED RETURN = PROPORTION OF STOCK “A” x EXPECTED RETURN)
  - SINGLE ASSET RISK MEASURES:

5.2.3 *Single-asset risk measures*

Balancing risk and return is important for any investor and hence it is critical to have a proper approach to portfolio risk management. To better understand the latter, the risk dynamics as applied to stand-alone assets are first explored. This requires the student to have a grasp of the concept of the **normal curve** and the statistical measures of variance, standard deviation, covariance and correlation coefficient.

The normal distribution curve

The normal curve is a symmetrical distribution of scores with an equal number of scores above and below the midpoint of the horizontal axis of the curve. Since the distribution of scores is symmetrical, the mean (the average value), median (the middle value), and mode (the most frequent value) are all at the same point. In other words, in a normal curve, the mean = the median = the mode.

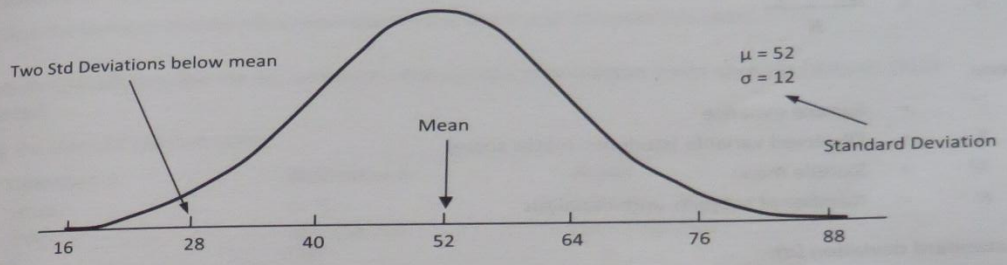


Figure 5.2: Illustrated example of the normal curve (mathematics results of a matric class)

If we divide the distribution into the standard deviation units, a known proportion of scores lies within each portion of the curve.

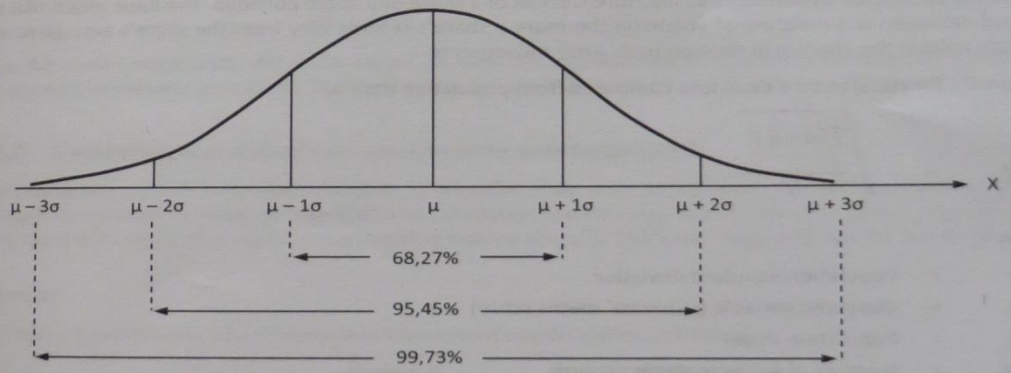


Figure 5.3: Percentages of areas under the normal curve

Interpretation: Within a random sample of say 100 pupils 68,27% of them (68 students) will have a math result of between 40 and 64 (i.e. between one standard deviation to the left and right of the mean) and 95,45% of the students (95 students) will have scores of between 28 and 76 (i.e. between two standard deviations to the left and right of the mean).

The variance: The variance and the closely-related standard deviation are measures of how dispersed (spread out) the distribution of variables (e.g. scores, points, values or results) are around the mean. In other words, they are measures of variability. The greater the dispersion, the higher the variance. The variance is computed as the average of the sum of the squared deviation of each observation from the mean.

The formula for the variance computed from population data is:

$$\sigma^2 = \frac{\sum(X-\mu)^2}{N}$$

Where:

- σ^2 = Population variance
- X = Observed variable (students' maths score)
- μ = Population mean
- N = Number of subjects under analysis

The formula for the variance computed from sample data is:

$$S^2 = \frac{\sum(X-M)^2}{N}$$

Where:

- S^2 = Sample variance
- X = Observed variable (students' maths score)
- M = Sample mean
- N = Number of subjects under analysis

The standard deviation (σ):

The standard deviation measures the spread of data around the mean value. It is useful in comparing data sets which may have the same mean but a different range. For example, the mean of the following two data sets is the same: 15, 15, 15, 14, 16 (by adding them up and dividing by 5, a mean of 15 is obtained) and 2, 7, 14, 22, 30 (by adding them up and dividing by 5, a mean of 15 is derived). However, the second is clearly more spread out (hence more risky). If a data set has a low standard deviation, the values are not widely dispersed. The standard deviation is often used by investors to measure the risk of a share or a share portfolio. The basic idea is that the standard deviation is a measure of volatility; the more a share's returns vary from the share's average return, the more volatile the share is in relation to its price movements.

The formula for the standard deviation computed from population data is:

$$\sigma = \sqrt{\frac{\sum_i(x_i-\mu)^2}{N}}$$

Where:

- σ = Population standard deviation
- x_i = Observed variable (students' maths score)
- μ = Population mean
- N = Number of subjects under analysis

The formula for the standard deviation computed from sample data is:

$$S = \sqrt{\frac{\sum_i(x_i-\mu)^2}{n-1}}$$

Where:

- S = Sample standard deviation
- x_i = Observed variable (students' maths score)
- μ = Sample mean
- n = Number of subjects under analysis

Example: Calculating the mean, variance and standard deviation from sample historic data (Ex-post)

You have observed the following returns on Memeza Limited's share price:

Year	Returns
20X7	6%
20X6	– 10%
20X5	4%
20X4	23%
20X3	12%

Required:

Calculate the average return on the share over the past five years.

Calculate the variance and standard deviation on the share over the past five years.

Solution: Calculating the mean, variance and standard deviation from sample historic data (Ex-post)

Using the Sharp EL 738 calculator:

Operation 1	Operation 2	Result
MODE	1 0	STAT 0
2ndF	M – CLR 0 0	Clear Registers
6	ENT	1
10 +/–	ENT	2
4	ENT	3
23	ENT	4
12	ENT	5
ALPHA	$\bar{x}$ =	7
ALPHA	sx =	12,04
2ndF	X^2 =	145

From the above calculations, the mean return ($\bar{x}$) over the five-year period is 7%, the variance (X^2) is 145 an the standard deviation (sx) is 12,04. Notice that the standard deviation is the square root of the variance.

5.2.4 *Comparing the risk of two stand-alone assets/projects*

In assessing the risk of stand-alone projects, a situation may arise where there is need to compare the ri among two stand-alone projects. In addition to calculating the variance and standard deviation, the coefficie of variation (CV) may prove useful in the decision making process. The latter measures the risk per R1 of retur

Example:

A company is considering two independent investment opportunities as follows:

	Project A	Project B
Investment capital	R500 000	R500 000
Project life	1 year	1 year

Estimated cashflows

Probability	Cashflow	Probability	Cashflow
0,25	600 000	0,25	200 000
0,50	700 000	0,50	800 000
0,25	800 000	0,25	1 000 000

Required:

Determine which investment the company should choose.

Solution:

The calculated mean return, standard deviation and CV are as follows:

Probability	Project A (R000s)				Project B (R000s)			
	R_A	$R_A \times P$	$(R_A - \bar{R}_A)$	$(R_A - \bar{R}_A)^2 \times P$	R_B	$R_B \times P$	$(R_B - \bar{R}_B)$	$(R_B - \bar{R}_B)^2 \times P$
25%	600	150	(100)	2 500 000	200	50	(500)	62 500 000
50%	700	350	0	0	800	400	100	5 000 000
25%	800	200	100	2 500 000	1 000	250	300	22 500 000
Expected mean ($\bar{R}_A$)		700				700		
Variance (σ^2)				5 000 000				90 000 000
Standard deviation (σ)				70,711				300
CV			(70,711 / 700)	0,10			(300 / 700)	0,43

The calculation of the expected mean return indicates that both projects yield a positive return of R700 000, or a net value of R200 000, being the difference between the return and the investment outlay of R500 000.

The standard deviation measures the dispersion around the mean. In the above example, Project A has a lower standard deviation of R70 711, which means it has a lower risk in comparison to Project B, which has a standard deviation of R300 000. This is indicated by the range of cashflows for Project A, which is between R600 000 and R800 000, whereas for Project B it is between R200 000 and R1 000 000.

The company should therefore choose Project A.

In order to compare two projects with different mean values, one must calculate the coefficient of variation (CV) which measures the risk per R1 of return, that is the CV standardises the risk per R1 of return. In the above example, the CV of Project A is only 0,10, compared to a high CV of 0,43 for Project B. To obtain the CV, one merely has to divide the standard deviation by the expected mean return.
The correct method of evaluating two separate projects or investments is to use the mean variance approach as developed by Markowitz in 1952. This states that:

(a) Given a choice of two projects (or portfolios) with the same return but different risk, an investor will choose the one with the lower risk, in this case Project A.

(b) Alternatively, where two projects (or portfolios) have the same risk but different returns, an investor will choose the one with the higher return.

5.3 Portfolio risk and return

Most investors invest in a collection of two or more assets. Such a collection of assets held by an investor is known as a portfolio. It is often assumed that a rational investor will build a portfolio that will give him or her maximum possible returns for a given risk profile remembering that the greater the returns the greater the risk. The components of the total risk of a portfolio is the systematic (market) and unsystematic (asset specific) risk. The former affects all market participants and is due to changes in economic fundamentals (e.g. interest rates, exchange rates, inflation, consumer demand, the price of oil, etc). Systematic risk cannot be eliminated or minimised by managerial intervention. The latter is associated with the basic functions of the organisation (e.g. information technology, innovation, better production processes, financing, leadership, etc). Managerial intervention can minimise this type of risk.

5.3.1 *Two-asset portfolio risk and return*

At least two shares constitute a portfolio. A two-asset portfolio is unlikely to achieve sufficient diversification of risk and can therefore not constitute an efficient portfolio. However, the principles being explored here are the same irrespective of the number of shares that comprise a portfolio. The expected return on a portfolio of two assets is explained and calculated under section 5.2. The primary objective of this sub-section is to explore ways of assessing the risk of a two-asset portfolio. The primary risk measures of a two-asset portfolio are the following –

- the portfolio variance; and

The portfolio variance:

This is a measure of the risk (volatility) of a portfolio, and it takes into consideration the combination of the variance and co-variance of each security and its proportion in that portfolio – not just the weighted average of all security variances.

There are two variations of the formula used to calculate the portfolio variance, namely:

- One that relies on the *covariance of returns* of the assets in the portfolio.
- The other that relies on the *correlation coefficient* of the returns of the assets in the portfolio.

The statistical formula for the portfolio variance based on the covariance is:

$$\sigma^2_p = W^2_x\sigma^2_x + W^2_y\sigma^2_y + 2W_xW_y \times COV_{xy}$$

Where:

σ^2_p	=	The portfolio variance
W_x and W_y	=	The proportions invested in Share X and Share Y respectively
σ^2_x and σ^2_y	=	The variance on shares X and Y respectively
Cov (x,y)	=	Covariance of X and Y

The statistical formula for the portfolio variance based on the correlation coefficient is:

$$\sigma^2_p = W^2_x\sigma^2_x + W^2_y\sigma^2_y + 2W_xW_y P_{xy}\sigma_x\sigma_y$$

Where:

σ^2_p	=	The portfolio variance
W_x and W_y	=	The proportions invested in X and Y respectively
σ^2_x and σ^2_y	=	The variance on shares X and Y respectively
σ_x and σ_y		The standard deviation on shares X and Y respectively
P_{xy}	=	The *correlation coefficient* on shares X and Y

The covariance:

The covariance is a *multi-variable* statistical measure (as opposed to *single* statistical measures such as the mean, standard deviation and variance). It is a measure of the degree to which returns on two risky assets move in tandem. A positive covariance means that asset returns move together. A negative covariance means returns move inversely. If share A's return is high whenever share B's return is high and the same can be said for low returns, then these shares are said to have a positive covariance. If share A's return is low whenever share B's return is high then these stocks are said to have a negative covariance. If the covariance is zero there is no relationship between the variables.

The statistical formula for the covariance is:

$$Cov(x,y) = P_{xy}\sigma_x\sigma_y$$

Where:

Cov (x,y)	=	Covariance of X and Y
P_{xy}	=	Correlation co-efficient of X and Y
σ_x	=	Population standard deviation of X
σ_y	=	Population standard deviation of Y

The correlation coefficient:

In probability theory and statistics, correlation (often measured as a correlation coefficient), indicates the strength and direction of a linear relationship between two random variables. The calculated value lies be- tween – 1 and + 1. Although the covariance measures the degree to which returns on two risky assets move in tandem, it does not explain the strength of the relationship.

If x and y have a strong positive linear correlation, r is close to + 1. An r value of exactly + 1 indicates a perfect positive fit. Positive values indicate a relationship between x and y variables such that as values for x increase, values for y also increase.

If x and y have a strong negative linear correlation, r is close to – 1. An r value of exactly – 1 indicates a perfect negative fit. Negative values indicate a relationship between x and y such that as values for x increase, values for y decrease.

If there is no linear correlation or a weak linear correlation, r is close to 0. A value near zero means that there is a random, nonlinear relationship between the two variables. A perfect correlation of ± 1 occurs only when the data points all lie exactly on a straight line. If $r = +1$, the slope of this line is positive. If $r = -1$, the slope of this line is negative.

The statistical formula for the correlation coefficient is:

$$P_{xy} = \frac{Cov\,(x,y)}{\sigma_x \sigma_y}$$

Where:

P_{xy} = The correlation coefficient between X and Y

$Cov\,(x,y)$ = Covariance between X and Y

σ_x = Population standard deviation of X

σ_y = Population standard deviation of Y

Example: Calculating the portfolio variance

Two shares offer the following four historical % returns:

Return X	Return Y
20%	40%
24%	12%
10%	20%
26%	24%

Required:

1 Calculate the correlation coefficient of the shares.

2 Calculate the portfolio variance.

3 Calculate the portfolio standard deviation.

Solution: Calculating the portfolio variance (based on the correlation coefficient)

The following answer is based on the financial calculator – Sharp EL738:

Operation 1	Operation 2	Result
MODE	1 1	STAT 1
2ndF	M – CLR 0 0	Clear Registers
20 (x,y) 40	ENT	Data Set = 1
24 (x,y) 12	ENT	Data Set = 2
10 (x,y) 20	ENT	Data Set = 3
26 (x,y) 24	ENT	Data Set = 4
RCL	σ_x	6,16
RCL	σ_y	10,20
RCL	r (correlation coefficient)	– 0,0318

Input the calculator variables into the formula:

Operation 1	Operation 2	Result
$W^2_x\sigma^2_x$	(0,60)(0,60) × (37,95)	13,66
$W^2_y\sigma^2_y$	(0,40)(0,40) × (104,04)	16,65
$2W_xW_yP_{xy}\sigma_x\sigma_y$	2(0,60)(0,40)(– 0,0318)(6,16)(10,20)	– 0,96
σ^2 portfolio	13,66 +16,65 – 0,96	29,35
σportfolio	Square root of 29,35	5,42

1 The correlation coefficient (r) of the shares = – 0,0318

2 The portfolio variance = 29,35

3 The portfolio standard deviation = 5,42

Interpretation:

- ☐ The correlation is negative and very weak. The variables oppose each other but the magnitude of change of one variable is not matched by the change in the other variable.
- ☐ The standard deviation of 5,42% is an indication of the risk of the portfolio. It is only useful if compared with the standard deviation of another portfolio or the standard deviation of the current portfolio if its asset composition is changed.

5.3.2 *The efficient frontier*

Investors often hold a set of portfolios. For each portfolio there is need to balance the risk of the portfolio to the expected return. Overall, the investor strives to balance the risk of all portfolios to the attendant return. To achieve this, the investor needs to select the most efficient set of portfolios in terms of the risk – return trade-off. The process of assessing the risk and return of a portfolio of say 50 shares or five sets of portfolios consisting of 50 shares each is the same as the procedure we employed in assessing the risk and return of a two asset portfolio. The portfolio selection process is as follows:

- ☐ For any level of volatility, consider all the portfolios which have the same or similar risk. From among those portfolios, select the one which has the highest expected return.
- ☐ Alternatively, for any expected return, consider all the portfolios which have the same or similar expected return. From among those portfolios, select the one which has the lowest risk.

As the number of shares in a portfolio or the number of portfolio sets increases, the resultant calculations become more complex, but can be done with the aid of appropriate computer models. Calculations for analysing portfolios that contain more than two shares are outside of the scope of this textbook.

The concept of the efficient frontier is illustrated below in Figure 5.4.

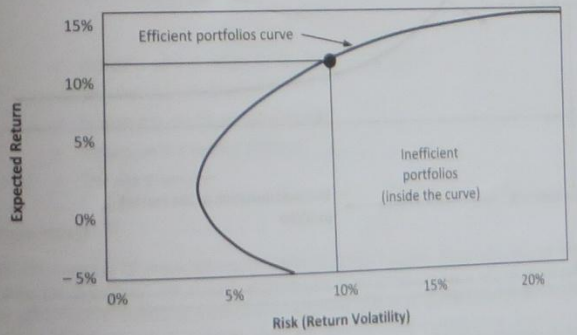


Figure 5.4: Graphic illustration of efficient frontier

Conclusion: An investor should select a portfolio that lies on the **efficient frontier curve**.

5.4 Diversification

Diversification is a strategy designed to reduce exposure to risk by combining, in a portfolio, a variety of investments, such as stocks, bonds, and real estate, which are unlikely to all move in the same direction. The goal of diversification is to reduce unsystematic risk in a portfolio. Volatility is limited by the fact that not all asset classes or industries or individual companies move up and down in value at the same time or at the same rate. Diversification reduces both the upside and downside potential and allows for more consistent performance under a wide range of economic conditions. Mathematically, the purpose of diversification is to reduce the standard deviation of the total portfolio. As you add securities, you expect the average covariance for the portfolio to decline, but not to disappear since correlations are not perfectly negative. It is thought that a portfolio of not less than 20–30 shares will approximate the market in terms of systematic risk. (Satrix's JSE top 40). But one needs a 'balanced' portfolio – avoid putting one's golden eggs in one basket. One should structure the portfolio so that some shares are positively correlated to the market (market cycles) and some are negatively correlate to it in terms of returns.

5.4.1 *Systematic versus unsystematic risk*

Total risk = Market risk (systematic) + firm-specific (unsystematic) risk

Market risk (systematic): Risk that affects all players in the market place is called 'market risk' or 'systematic risk'. Changes in economic fundamentals (interest rates, exchange rates, inflation, consumer demand, the price of key commodities such as oil, etc.). Market risk is measured by the beta co-efficient. The market (JSE) has a beta of 1, the market's riskiness relative to itself. Shares/portfolios with a beta greater than 1 (say 1,2) face a bigger risk than the market. Shares/portfolios with a beta less than 1 (say 0,8) face a smaller risk than the market.

Firm-specific (unsystematic) risk: Risk associated with the basic functions of the organisation (information technology, production processes, product-markets, innovation, financing, leadership, human skills, etc.). This is operational/business risk. Management can eliminate this risk by diversification or simply managing better.

In theory, if it were possible to eliminate firm-specific risk, the total risk facing the firm would be the market risk. In practice, however, a firm, as a going concern, is faced with a dynamic and ever changing environment and therefore cannot totally eliminate firm-specific risk but can minimise it.

A graphic illustration of total firm risk is shown in Figure 5.5 below.

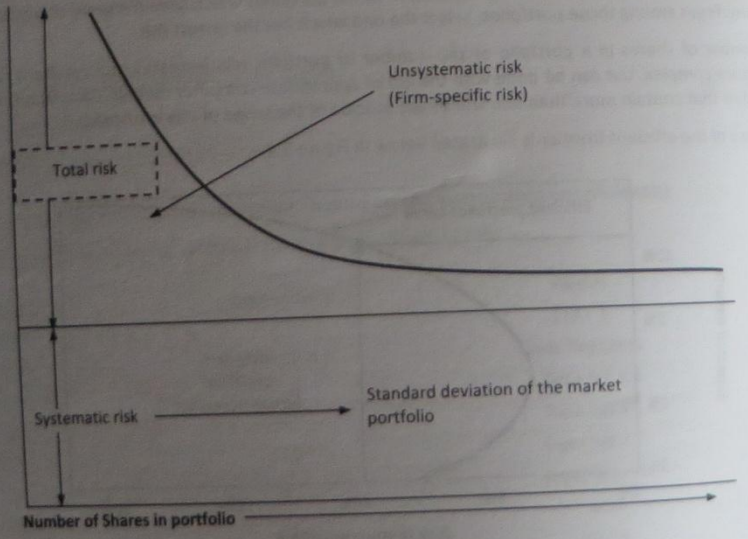


Figure 5.5: Graphic illustration of total firm risk

5.5 The securities market line (SML)

In 1958, James Tobin expanded on the work of Markowitz, by adding a risk-free asset to the analysis. This led to the notions of a super-efficient portfolio and the capital market line. With the aid of the risk-free asset, an investor could be able to better portfolios on the efficient frontier. The introduction of the risk-free asset had the following implications to an investor:

- ☐ The return required of any risky asset is determined by the prevailing level of risk-free interest rates plus a risk premium.
- ☐ Investors require returns that are commensurate with the risk level they perceive.

The security market line (SML) indicates the going required rate of return on a security in the market for a given amount of systematic risk. The SML intersects the vertical axis at the risk-free rate, indicating that any security with an expected risk premium equal to zero should be required to earn a return equal to the risk-free rate. The slope (gradient) of security market line will increase or decrease with uncertainties about the future economic outlook and/or the degree of risk aversion of investors.

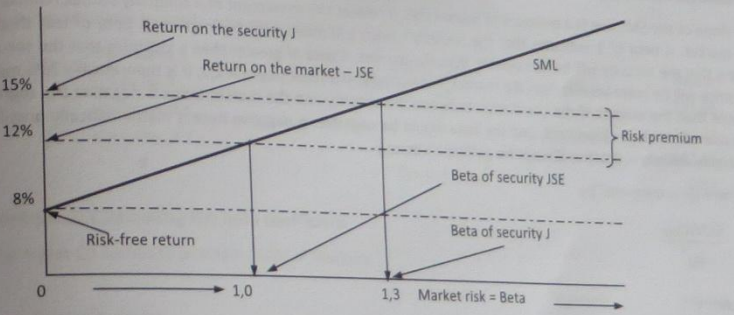


Figure 5.6: Graphic illustration of the SML (figures are imaginary)

5.6 The capital asset pricing model (CAPM)

The capital asset pricing model (CAPM) is derived from the securities market line (SML) and is based on the concept that a security's required rate of return is equal to the risk-free rate of return plus a risk premium that reflects the riskiness of the security after diversification. The key components of the CAPM are the risk-free rate of return, the beta coefficient and the market risk premium.

The following is the mathematical equation for the CAPM:

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f]$$

Where:

$E(R_i)$	=	Required rate of return on security i
R_f	=	Risk free rate of return
β_i	=	Systematic risk for security i (Beta)
$E(R_m)$	=	Return on the market portfolio
$E(R_m) - R_f$	=	The risk premium

Expected return ($E(R_i)$)

We deal with the concept of expected return under section 5.2 above. The positioning of the investor on the SML determines the investors' risk and return trade off. A risk averse investor who prefers minimal or close to zero risk has government bonds as a possible investment choice. In this situation government bonds are assumed to be free of default risk. In practice, there are instances where states have defaulted on their debt (the Russian default of 1998 is a case in point) but the probabilities of such occurrences is negligible.

The risk-free rate of return (R_f)

This is the theoretical rate of return of an investment with zero risk. The risk-free rate represents the return an investor would expect from an absolutely risk-free investment over a specified period of time. In theory, the risk-free rate is the minimum return an investor expects for any investment because he or she will not accept additional risk unless the potential rate of return is greater than the risk-free rate. In practice, however, the risk-free rate does not exist because even the safest investments carry a very small amount of risk. The yield (required return) on a ten-year government bond is often used as an approximation of the risk-free rate of return.The risk-free rate of return is the sum of two components –

- ☐ real rate of return; and
- ☐ expected inflation premium.

The inflation premium compensates investors for the loss of purchasing power due to inflation.

The beta coefficient (β_i)

The slope of the SML line is a measure of market risk. It relates the movement of a company's stock relative to the market. A beta of 1 indicates that the security's price will move with the market. A beta of less than 1 means that the security will be less volatile than the market. A beta of greater than 1 indicates that the security's price will be more volatile than the market. For example, if a stock's beta is 1,2, it is theoretically 20% more volatile than the market. If the correlation between the security and the market index is negative the regression line would slope downward, and the beta would be negative. A negative beta is mathematically possible but highly unlikely in practice (Except for gold as an asset.)

The beta (β) is measured by:

$$\frac{COVAR_{iM}}{S_M^2}$$

Where:

$COVAR_{iM}$ = The covariance of returns of stock i with those of the market

S_M^2 = The variance of market returns

Example 1: Calculating the beta coefficient

The following information relates to the return of Kwangena Limited's stock and the return on the JSE index over a five-year period:

Year	X Variable: Market Return	Y Variable: Stock Return
	$E(R_m)$	$E(R_i)$
	%	%
20X1	23,8	38,6
20X2	(7,2)	(24,7)
20X3	6,6	12,3
20X4	20,5	8,2
20X5	30,6	40,1

Solution: Calculating the beta coefficient

The following answer is based on the financial calculator – Sharp EL738

Operation 1	Operation 2	Result
MODE	1 1	STAT 1
2ndF	M – CLR 0 0	Clear Registers
23,8 (x,y) 38,6	ENT	Data Set = 1
– 7,2 (x,y) – 24,7	ENT	Data Set = 2
6,6 (x,y) 12,3	ENT	Data Set = 3
20,5 (x,y) 8,2	ENT	Data Set = 4
30,6 (x,y) 40,1	ENT	Data Set = 5
RCL	σ_x	13,52
RCL	σ_y	23,73
RCL	r (correlation coefficient)	0,91

Input the calculator variables into the formula:

Operation 1	Operation 2	Result
Cov (x,y)	$r\sigma_x\sigma_y$	291,95
Variance of X	σ_x^2	182,79
Variance of Y	$\sigma_y^2 (S_M^2)$	563,11
β	Cov (x,y)/ S_M^2	0,52

Example 2: Calculating the beta coefficient

The Arjent Co wishes to purchase 100% of Murcury.

	Arjent Co	Murcury	Market
Expected returns	10%	16%	14%
Standard deviation of returns	5%	7%	4%
Expected returns correlation with market	+ 0,3	+ 0,6	1

The risk-free rate is 6%, while the correlation between Arjent and Murcury is + 0,1.

If Murcury is taken over, it will account for 20% of the value of the new company.

i.e. Argent = 80% Murcury = 20%

Required:

(i) Calculate the beta for both Arjent and Murcury.

(ii) Calculate Arjent's existing cost of equity.

(iii) Calculate the risk and return of Arjent after accepting the takeover of Murcury.

(iv) Calculate Murcury's required return based on CAPM.

Solution:

(i) Beta = covariance with the market/variance of the market

$$\text{Arjent} = \frac{5 \times 0,3}{4} = 0,375$$

$$\text{Murcury} = \frac{7 \times 0,6}{4} = 1,05$$

(ii) Cost of equity

$$k_e = R_f + \beta_i(R_m - R_f)$$
$$= 6 + 0,375\,(14 - 6)$$
$$= 9\%$$

(iii) Risk and return

Return of Arjent after taking over Murcury

$= (0{,}8 \times 10\%) + (0{,}2 \times 16\%) = 11{,}2\%$

Risk of Arjent after the takeover:

$$\sigma_p = \sqrt{w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_Aw_BCOV_{(A,B)}}$$

$$\text{Risk} = \sqrt{(0{,}8^2 \times 5^2) + (0{,}2^2 \times 7^2) + (2 \times 0{,}8 \times 0{,}2 \times 5 \times 7 \times 0{,}1)}$$

$= 4{,}3684$

Note:
The covariance for Arjent/Murcury is not available. However, the correlation as well as the standard deviation is available.

As correlation = covariance/(standard deviation Arjent × standard deviation Murcury) then:

Covariance $= 5 \times 7 \times 0{,}1$

The weighted average risk for the new company is calculated as [80% × 5%] + [20% × 7%] = 5,4.

As expected, portfolio risk (4,3684%) is less than weighted average risk (5,4%), as the two companies have a correlation of almost zero (+ 0,1) with each other.

What is interesting to note is that despite Murcury having a higher standard deviation than Arjent, once combined, the resultant risk is less than both of their respective standard deviations.

Why?

This is significantly less than + 1 (perfect positive correlation) and hence in terms of the portfolio theory, the combination is highly advantageous.

To reconfirm – this is due to them having an almost zero correlation with each other.

(iv) Murcury's required return

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

$= 6 + 1{,}05\,(14 - 6) = 14{,}4\%$

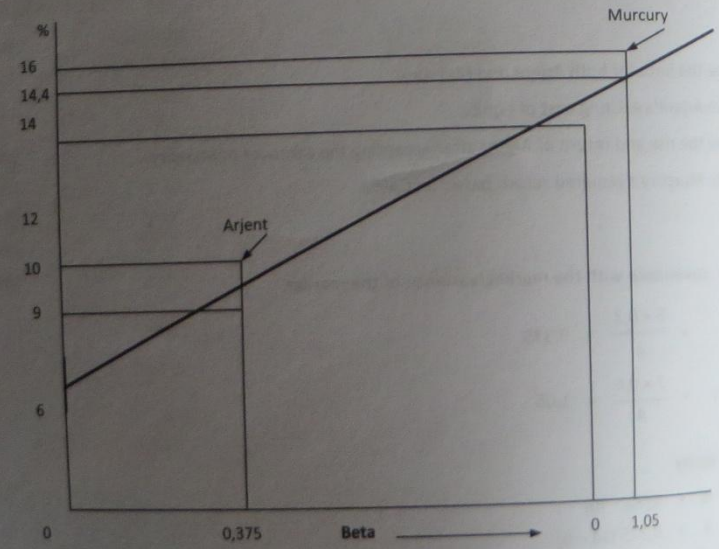


Figure 5.7: Risk/Return profile

In the above example, both Arjent and Murcury have expected returns that exceed the required return (see Figure 5.7). Both returns will drop to the SML due to market forces until the expected return equals the required return. At the moment, Murcury should be accepted, as the returns are above the SML.

Risk and return for Arjent as calculated in **(iv)** above will improve, but only in the very short-term. Market forces will bring the values into equilibrium once the information is available to the market. At the present moment, Arjent should invest in Murcury, as the share value of Murcury is less than the required market value and the return is above the market required return.

Equity versus asset betas

The **equity beta** (also called geared or levered beta) is the beta of the company that takes into account the capital structure effects (financial risk) as well as the systematic effects related to market conditions. The **asset beta** (also called ungeared or unlevered beta) is the beta of the company without the effects of the capital structure. If one was calculating the required return for an unlisted (private) company without an equity beta, one would have to use a 'proxy' beta of a similar listed company. The challenge of using the 'borrowed' equity beta is that it probably comes from a company with a different capital structure from the one we are analysing. The following steps would have to be undertaken to the proxy equity beta before we can use it:

1 Ungear the proxy beta.

2 Re-gear the proxy beta.

1 **Ungear the proxy beta:** This means removing the capital structure effects of the listed company from the proxy beta. This turns an equity beta into an asset beta. The formula to use to ungear the equity beta is the following

$$(\beta)\text{ ungeared} = (\beta)\text{ geared} \times \frac{E}{E + D(1-t)}$$

Where:

(β) geared	The equity beta **of the listed company** (The borrowed/proxy beta).
(β) ungeared	The asset beta **of the listed company** after 'stripping' it of its capital structure
E	Equity % **in listed company** (40% will be written as 40 only)
D	Debt % **in listed company** (60% will be written as 60 only)
t	The **tax rate of the public company** (40% will be written as 0,40).
	The tax rate applies to the debt (D) only.

2 **Regear the proxy beta:** This means effecting the capital structure effects of the private company on the asset beta calculated under **1** above. This turns the asset beta into an equity beta of the new firm. The formula to use to re-gear the asset beta is the following:

$$(\beta)\text{ Geared} = (\beta)\text{ ungeared} \times \frac{E + D(1-t)}{E}$$

Where:

(β) geared	The equity beta **of the private company** (target beta)
(β) ungeared	The asset beta **of the listed company** after 'striping' it of its capital structure
E	Equity % **in private company** (40% will be written as 40 only)
D	Debt % **in private company** (60% will be written as 60 only)
t	The tax rate **of the private company** (40% will be written as 0,40).
	The tax rate applies to the debt (D) only.

After undertaking the adjustments in **1** and **2** above, the proxy beta can be used in the CAPM equation in calculating the cost of equity (required rate of return) of the private company.

The risk premium

The **risk premium** is the additional return over and above the risk-free rate needed to compensate investors for assuming an average amount of risk. Its size depends on the investors' perceived risk of the stock market and

the investors' degree of risk aversion.The risk premium assigned by an investor to a given security in determining the required rate of return is a function of several different risk elements. These risk elements (premiums) include –

- ☐ maturity risk premium;
- ☐ default risk premium;
- ☐ seniority risk premium; and
- ☐ marketability risk premium.

Risk premium (R_p) = Return on the market portfolio (R_m) – Risk-free return (R_f)

5.7 CAPM applications

There are a number of significant contributions of portfolio theory to the study and practice of financial management. Two of the most important of these contributions are the following:

- ☐ It helps us understand the **relationship between risk and return**; what part of the total risk we can manage through diversification and what part we cannot.
- ☐ It is also the basis for estimating the required rate of return by equity investors (cost of equity) through the SML and the CAPM.

5.7.1 *CAPM and weighted average cost of capital (WACC)*

An equity investor in a company requires a return as compensation for the risk he/she bears for putting his/her capital at the disposal of the firm. In turn the company compensates the investor for his/her capital investment. The later compensation equals the risk-free rate of return plus a risk premium as discussed under section 5.6 above. The equity investor's required rate of return therefore equals the firms cost of equity capital. The CAPM is used in capital markets to define the required rate of return by equity investors and hence the firm's cost of equity capital.

Example: CAPM and WACC

Bulelwa Limited has 7 million ordinary shares of R1 each in issue, 5 million 6% preference shares of a par value of R1 each, 100 000 9% semi-annual bonds with a par value of R1 000 each. The shares currently sell for R30 per share and have a beta of 1,0. The preference shares are currently selling for 110 cents per share and the bonds have 15 years to maturity and currently sell for 89% of par. The market risk premium is 8%, the ten-year treasury-bonds are yielding 7% and the company's tax rate is 40%.

Required:

Calculate Bulelwa Limited's WACC

Solution: CAPM and WACC

Calculate the required rate of return by equity holders (cost of equity)

$K_e + R_f \quad \beta(Rm - R_f) = 7\% + 1{,}0\,(8\%) = 15\%$

Calculate the required rate of return by preference shareholders (cost of preference shares)

$K_p = D/P_0 = 6/110 = 5{,}45\%$

Calculate the required rate of return by bondholders (yield on the bonds)

Using the Sharp EL738:

– 890	PV	
45	PMT	[0,09 × R1 000/2]
30	N	[15 × 2]
1000	FV	

Answer: 5,23%

Calculate market values of funding sources:

Equity	=	7 m	×	R30	=	R210m
Preference shares	=	5m	×	R1,10	=	R5,10m
Bonds	=	100 000	×	R890	=	R89m

Calculate the WACC

Funding Source	Market Value Rm	Capital Structure	Cost of Source %	WA
Equity	210,00	0,69	15,00	10
Preference shares	5,10	0,02	5,45	0
Bonds	89,00	0,29	5,23	1
	304,10	1,00		11

The WACC is 11,98% (say 12%).

The calculation of the WACC was included in this section only as an illustration of the application of the CA to the estimation of the cost of equity. (See chapter 4 *Capital structure and the cost of capital* for a detai analysis of these concepts.)

5.7.2 *CAPM and the investment appraisal decision*

The discount rate for capital projects in a levered firm is the WACC. The use of the WACC to discount projects in a levered firm is on the assumption that the projects will have the same business risk as the curr portfolio of projects and that the project will not result in the alteration of the existing capital structure a hence the overall financial risk. The WACC will comprise the debt and equity component. The cost of equ could be estimated using the CAPM. In a non-levered firm the WACC will equal the cost of equity. In the lat case, the required return on projects will equal the required return by equity holders only.

Example: Project evaluation in a non-levered firm

A manufacturing company with a beta of 1,2 wishes to diversify into the food retailing business.

Quoted companies involved in food retailing have a beta of 0,9.

The market required return is 18%.

The risk-free rate is 9%.

Required:

Determine the rate at which the new project should be evaluated.

Solution: Project evaluation in a non-levered firm

When a company is not quoted or wishes to diversify, it is suitable to use the β of a similar quoted company that particular industry.

In the above example, the correct rate is calculated as:

Project required return = 9% + 0,9 (18% – 9%) = 17,1%

17,1% is the required return for any investor in this sector, based on the risk of the project relative to t overall market, and accepting that the company is all-equity.

Note: ***The CAPM measures both business and financial risk through the use of the equity beta. Therefo shareholders in an all-equity firm are only concerned with the business risk associated with a partic lar industry.***

Example: Project evaluation and the CAPM

Penholt Limited is considering investing R100 000 in one of two projects. Both projects have a life of one year only and the potential return is dependent on the following economic states:

	State 1	State 2	State 3
Probability	0,4	0,3	0,3
Net cash return: Project A	R35 000	R20 000	R0
Net cash return: Project B	R5 000	R30 000	R30 000
Net cash return from existing activities	– R20 000	R100 000	R300 000

The company has a current market value of R1 million. The Directors of Penholt believe that the risk return per R1 of current market value of their existing activities is virtually the same as those for the stock market as a whole, including general economic risk. The current risk-free rate on short-dated government investments is 10%.

Required:

Ignoring taxation, determine which of the two projects the company should accept.

Solution:

Calculating rate of return:

	State 1	State 2	State 3
Project A	35%	20%	0%
Project B	5%	30%	30%
Existing operations	– 2%	10%	30%

Expected return and standard deviation

Project A	0,35 × 0,4	=	0,14
	0,20 × 0,3	=	0,06
	0,0 × 0,3	=	0,00
			0,20

Expected return 0,20 or 20% standard deviation = 0,1449

Project B	0,05 × 0,4	=	0,02
	0,30 × 0,3	=	0,09
	0,30 × 0,3	=	0,09
			0,20

Expected return 0,20 or 20% standard deviation = 0,1225

Existing operations	– 0,02 × 0,4	=	– 0,008
	0,10 × 0,3	=	0,03
	0,30 × 0,3	=	0,09
			0,112

Expected return 0,112 or 11,2%standard deviation = 0,1327

- ☐ Both Projects A and B have the same expected return of 20%, with Project B having a lower risk in comparison to Project A.
- ☐ On this basis, it would appear that Project B should be selected.
- ☐ Using the CAPM model, one can evaluate Projects A and B using the formula:

$$R_i = R_f + \beta_i (R_m - R_f)$$

Calculate the beta for Projects A and B as follows:

Step 1 ***Calculate the covariance for Projects A and B:***

Covariance: Project A

Use the following formula:

$$(\tilde{R}_A - \bar{R}_A)\,(\tilde{R}_O - \bar{R}_O)\,P$$

Where:

$\tilde{R}_A$	Project A expected return
$\bar{R}_A$	Project A mean return
$\tilde{R}_O$	Existing operations expected return
$\bar{R}_O$	Existing operations mean return
P	Probability factor

To calculate the covariance: Project B, use the same formula as above, but replace A with B.

Covariance (R_A,R_O)	0,15 × – 0,132 × 0,4	=	– 0,00792
	0 × – 0,012 × 0,3	=	0
	– 0,20 × 0,188 × 0,3	=	– 0,01128
		=	– 0,0192

Covariance: Project B

Covariance (R_B,R_O)	– 0,15 × – 0,132 × 0,4	=	0,00792
	0,1 × – 0,012 × 0,3	=	– 0,00036
	0,1 × 0,188 × 0,3	=	0,00564
		=	0,0132

Step 2 ***Calculate beta:***

$$\beta_i = COR_{im} \quad \frac{\sigma_i}{\sigma_m}$$

Correlation of project A to existing operations

$$\text{Correlation coefficient} \quad \rho AO = \frac{COV(A,O)}{\sigma_A \sigma_O}$$

$$= -0,0192 / (0,1449 \times 0,1327)$$

$$= -0,9985$$

Correlation of project B to existing operations

$$\text{Correlation coefficient} \quad \rho BO = \frac{COV(B,O)}{\sigma_B \sigma_O}$$

$$= 0,0132 / (0,1225 \times 0,1327)$$

$$= 0,8120$$

Beta for project A

$$\beta_A = (-0,9985 \times 0,1449) / 0,1327 = -1,0903$$

Beta for project B

$$\beta_B = (0,8120 \times 0,1225) / 0,1327 = 0,7496$$

Step 3 ***Calculate required return:***

Project A return = 0,10 + [– 1,0903(0,112 – 0,1)]
= 0,10 – 0,0131
= **0,0869**

Project B return = 0,10 + 0,7496(0,112 – 0,1)
= 0,10 + 0,009
= **0,109**

Conclusion:

Although Project A has the greater amount of total risk its required return is below that of Project B. Most of the risk of Project A is eliminated due to its favourable correlation (i.e. away from + 1) with existing operations. Project A is thus preferred as it provides a better return per R1 risk.

5.7.3 Limitations in using CAPM in investment appraisal decisions

The use of CAPM in investment appraisal lies in the inherent weaknesses of the CAPM as a model for estimating the cost of equity. Some of the assumptions are as follows:

- **The CAPM is a single-period model**. Thus, when using the rate as determined from the SML to evaluate a project, one is assuming that the beta, risk-free rate and the expected market return will remain constant over the life of the project.
- **The use of the beta as a measure of systematic risk** assumes total diversification of unsystematic risk, resulting in total risk being equal to systematic risk. In practice, firms are unable to eliminate all unsystematic risk.
- **The assumption that the government bonds are risk free**, though largely true, may not be always the case. Government bonds in some instances do carry a small amount of risk (inflation is a case in point and in some countries default risk).
- **The assumption of perfect capital market:** This assumption means that all securities are valued correctly and that their returns will plot onto the SML. In the real world capital markets are clearly not perfect.
- When analysing projects in private companies there may be **difficulties in finding suitable** proxy betas, since proxy companies very rarely undertake only one business activity.

Practice questions

40 marks

Question 5–1

An investor wishes to invest in two shares that have the following risk/return profiles:

Economic State	Probability	Expected return Share A	Expected return Share B
1	0,3	2%	15%
2	0,5	10%	22%
3	0,2	12%	– 2%

The following information is available:

1 The risk-free rate is 3%.
2 The market return is 12%.
3 The standard deviation of expected market returns is 6%.
4 The covariance of Share A returns with those of the market is 25,2.
5 The covariance of Share B returns with those of the market is 39,6.

Required:

(a) Calculate the expected returns for Shares A and B; the covariance of returns between the two shares, and the correlation between Share A and Share B. ***(8 marks)***

(b) Determine the expected return of a portfolio consisting of 40% Share A and 60% Share B together with the risk of the portfolio and discuss whether you would advise the investor to purchase the portfolio. ***(5 marks)***

(c) Calculate the required return for Shares A and B according to the Capital Asset Pricing Model, and discuss whether you would advise the investor to invest in either Share A or Share B. ***(8 marks)***

(d) Illustrate your answer to (c) above by showing the position of Shares A and B in relation to the Securities Market Line. ***(4 marks)***

(e) Briefly explain why the CAPM measures return versus beta, rather than standard deviation. ***(8 marks)***

(f) Briefly describe the limitations in using the CAPM for capital budgeting decisions. ***(7 marks)***

Solution 5–1

(a) Calculate the expected returns for Shares A and B; the covariance of returns between the two shares, and the correlation between Share A and Share B.

Share A

Probability		Return		Mean	P(return – mean)^2		Variance
0,3	×	2	=	0,6	$0,3(2-8)^2$	=	10,8
0,5	×	10	=	5,0	$0,5(10-8)^2$	=	2
0,2	×	12	=	2,4	$0,2(12-8)^2$	=	3,2
				8,0	σ^2		16,0
					σ	=	4

Share B

Probability		Return		Mean	P(return – mean)^2		Variance
0,3	×	15	=	4,5	$0,3(15-15,1)^2$	=	0
0,5	×	22	=	11,0	$0,5(22-15,1)^2$	=	23,81
0,2	×	– 2	=	– 0,4	$0,2(-2-15,1)^2$	=	58,48
				15,1	σ^2		82,29
					σ	=	9,07

Expected return for investment A = 8%

Expected return for investment B = 15,1%

Covariance of returns

0,3	$(2-8)(15-15,1)$	= 0,18
0,5	$(10-8)(22-15,1)$	= 6,9
0,2	$(12-8)(-2-15,1)$	= – 13,68
		Cov – 6,6

Covariance between A and B = – 6,6

Correlation between A and B = $\frac{-6,6}{4 \times 9,07}$ = – 0,1819

(b) Determine the expected return of a portfolio consisting of 40% Share A and 60% Share B together with the risk of the portfolio and discuss whether you would advise the investor to purchase the portfolio.

Return on portfolio

$(0,4 \times 8) + (0,6 \times 15,1)$ = 12,26%

STUDY UNIT 3 – SOURCES AND FORMS OF LONG TERM FINANCE (CHAPTER 7)

- 7.2 CLASSIFICATION OF DIFFERENT FORMS OF FINANCE
  - SHORT TERM / MEDIUM TERM / LONG TERM
  - SECURED / UNSECURED
  - DEBT / EQUITY / HYBRID OR MEZZANINE
  - TAILOR MADE FINANCE
  - SOURCES OF FINANCE
    - CAPITAL (LONG TERM)
      - PRIMARY AND SECONDARY
    - MONEY MARKET (SHORT TERM)
      - BORROWERS AND LENDERS BROUGHT TOGETHER BY BANKS AND OTHER INSTITUTIONS

- 7.3 EQUITY AS A SOURCE OF FINANCE
  - SHARES OR RETAINED EARNINGS
  - REVISION OF MAC 2602
  - STOCK MARKET LISTING
  - UNDERWRITING
  - RIGHTS ISSUE
    - ISSUE IN PROPORTION TO EXSISTING SHAREHOLDERS
    - BENEFITS
      - LOWER TRANSACTION COSTS
      - SHARES OFTEN AT DISCOUNT
      - NO LOSS OF CONTROL IF ALL TAKEN UP IN ACCORDANCE
    - CAN BE SHARE PRICE DILUTION IF RIGHTS ISSUED BELOW MARKET PRICE
      - RIGHTS PRICE = 1/(N+1) x ((N x RIGHTS PRICE) + ISSUE PRICE)
        - WHERE N = NUMBER OF SHARES REQUIRED TO BUY 1 NEW SHARE
      - VALUE OF RIGHT = RIGHTS PRICE – ISSUE PRICE
  - WARRANTS
    - THE RIGHT TO BUY OR SELL A SHARE AT A FUTURE DATE AT FIXED PRE-DETERMINED PRICE
    - BENEFITS TO COMPANY
      - NO DIVIDENDS OR INTEREST, MAKES STOCK MORE ATTRACTIVE, GENERATES ADDITIONAL FUNDS

- 7.4 PREFERENCE SHARES
  - REVISION OF MAC 2602
  - HYBRID FORM OF FINANCE
- 7.5 LOAN CAPITAL
  - REVISION OF MAC 2602
  - ADVANTAGES AND DISADVANTAGES
  - DEBT COMPARED TO EQUITY

- 7.7 CRITERIA APPLIED BY PROVIDERS OF FINANCE
  - AFFORDABILITY
  - SUSTAINABILITY
  - LIQUIDITY AND CASHFLOW
  - CREDITWORTHINESS HISTORY
  - SECURITY
  - NATIONAL CREDIT ACT (NCA) REQUIREMENTS

- 7.9 THE FINANCING DECISION
  - FACTORS TO CONSIDER
    - WHAT FINANCING OPTIONS ARE THERE?
    - CAPITAL STRUCTURE
    - COST CONSIDERATIONS
    - IMPACT
    - MATCHING

- 7.11 DETERMINING THE MOST COST EFFECTIVE FORM OF FINANCE
  - THE NET PRESENT COST (NPC)
  - THE INTERNAL RATE OF RETURN (IRR)

FINANCING QUESTION TECHNIQUE:

YOUR SOLUTION WILL TAKE ON THE SAME COLUMNAR FORMAT AS CAPITAL BUDGETING

- IDENTIFY THE DIFFERENT FINANCING SOURCES
  - REGARDLESS OF WORDING ,ALL WORK THE SAME, EXCEPT **LEASE**
  - WE WILL DISCUSS THIS LATER
- EACH ONE WILL HAVE A COLUMNAR SPREASHEET NEEDED
- THE GROSS FINANCE RECEIVED WILL BE YOUR INFLOW AT THE START
- THE INSTALMENTS OR REPAYMENTS WILL BE YOUR ANNUAL OUTFLOW
- INTEREST EFFECTS:
  - IF THE INSTALMENT INCLUDES INTEREST DO **NOT** RECORD INTEREST N CASH FLOWS
  - MOST QUESTIONS WILL REQUIRE A LOAN AMORTISATION SCHEDULE TO WORK OUT INTEREST (ABOUT 6 MARKS)
  - THE INTEREST GETS TAKEN INTO ACCOUNT AS A TAX SHIELD

- DO NOT RECORD WEAR AND TEAR UNLESS YOU ARE EVALUATING A **LEASE** SCENARIO
- IGNORE ALL RECOUPMENTS AND SALES OF THE ASSET AT THE END OF THE LIFE
- ADD UP COLUMNS AND DISCOUNT BACK EXACTLY AS PER CAPITAL BUDGETING

7.13 FINANCIAL LEASE

- THIS IS THE MORE COMPLICATED VARIATION AS IT IS THE ONLY TRANSACTION WHERE OWNERSHIP DOES NOT PASS TO THE BUYER AT THE START
- IN THE LEASE EVALUATION YOU CLAIM THE FULL LEASE PAYMENT AS A TAX DEDUCTION BUT A LESSEE CANNOT CLAIM WEAR AND TEAR SO THIS NEEDS TO BE SHOWN AS AN OPPURTUNITY COST OF A TAX SAVING LOST

STUDY UNIT 4 – WEIGHTED AVERAGE COST OF CAPITAL (CHAPTERS 10, 11 AND 4)

- REVISION OF MAC 2602
  - VARIOUS COMPONENT COSTS
    - EQUITY
      - GORDON GROWTH OR CAPM
    - DEBT
    - PREFERENCE SHARES
  - EACH COMPONENT COST IS MULTIPLIED BY EACH WEIGHTING IN THE STATEMENT OF FINANCIAL POSITION AND THE TOTAL IS THE WEIGHTED AVERAGE COST OF CAPITAL (WACC)

- MAC 3702
  - MORE COMPLICATED CALCULATIONS FOR THE WACC, SPECIFICALLY FOR DEBT AND PREFERENCE SHARES

- VALUATION OF PREFERENCE SHARES AND HYBRID INSTRUMENTS
  - 10.1 REASONS FOR UNDERTAKING VALUATIONS OF PREFERENCE SHARES
    - VALUATION FOR TAX OR FINANCIAL REPORTING PURPOSES
    - BUSINESS VALUATION OR BUSINESS RESCUE
  - 10.2 VALUATION USING THE DISCOUNTED CASH FLOW METHOD
    - A CASH FLOW WORKSHEET WILL BE DRAWN UP TO VALUE, SIMILAR TO CAPITAL BUDGTING
    - RECORD INFLOW IN YEAR 0 AS FINANCE RECEIVED
    - RECORD ALL RELEVANT OUTFLOWS IN VARIOUS YEARS
      - DIVIDENDS, INTEREST, CAPITAL PAYOUT ON MATURITY, ANY PREMIUMS ON REDEMPTION
    - DISCOUNT ALL BACK TO THE PRESENT AND GET A NET PRESENT COST (NPC)

- CHAPTER 11 – BUSINESS AND EQUITY VALUATIONS
  - 11.1 SOME OF THE INTRICACIES OF VALUE
    - THE "DOTCOM" BUBBLE AND THE FINANCIAL CRISIS
    - PLATINUM SHARE DROP IN 2012
  - 11.2 REASONS FOR UNDERTAKING BUSINESS VALUATION
    - TAX OR FINANCIAL REPORTING PURPOSES
    - VALUATION TO SELL TO INVESTOR OR MERGER/ACQUSITION
    - ESTATE DUTY, SECURITY OR LOAN, INITIAL PUBLIC OFFER ETC.
  - 11.3 UNDERLYING VALUATION THEROY
    - HISTORICAL COST
    - INTRINSIC VALUE
    - MARKET VALUE
    - FAIR VALUE
    - LIQUIDATION VALUE
    - MARKET CAPITALISATION
      - NUMBER OF SHARES X PRICE PER SHARE

- VALUATION APPROACHES
  - THE REPLACEMENT COST APPROACH
  - THE MARKET COMPARABLE APPROACH
  - THE INCOME APPROACH
- VALUATION METHODOLOGIES
  - EARNINGS MULTIPLES
  - MARKET PRICE MULTIPLES
  - THE GORDON GROWTH MODEL
  - MODELS BASED ON THE FREE CASH FLOW (FCF)
  - MODELS BASED ON ECONOMIC VALUE ADDED (EVA)

- 11.4 FACTORS AFFECTING THE VALUE OF THE BUSINESS
  - RELATIONSHIP BETWEEN VALUE, RISK AND RETURN
  - THE BUSINESS MODEL APPLIED
  - THE BUSINESS VEHICLE
  - INVESTMENT IN EQUITY OR ASSETS OF A BUSINESS
  - THE LEVEL OF CONTROL
  - SHARED PUBLICLY TRADED ON A SECURITIES EXCHANGE
  - HIDDEN FACTORS (OFTEN VIA DUE DILIGENCE INVESTIGATIONS)

- VALUATION OF ORDINARY EQUITY
  - 11.5 OTHER VALUATION MATTERS
    - VALUATION FOR EITHER MANAGERIAL FINANCE OR FINANCIAL REPORTING
    - VALUATION PREMIUMS AND DISCOUNTS
      - MINORITY, CONTROL OR MARKETABLITY DISCOUNTS/PREMIUMS
    - GENERALLY ACCEPTED VALUATION STANDARDS AND VALUATION REPORT
  - 11.6 DISCUSSION OF CERTAIN VALUATION METHODS AND MODELS
    - PRICE OF RECENT INVESTMENT
    - EARNINGS MULTIPLES
    - MARKET PRICE MULTIPLES
    - THE GORDON GROWTH MODEL (P = D1/R-G)
    - MODELS BASED ON THE FREE CASH FLOW
    - MODELS BASED ON EVA/MVA
    - INTRINSIC VALUE OR NET ASSETS

STUDY UNIT 5: ADVANCED CAPITAL BUDGETING (CHAPTER 6

- INTRODUCTION
  - A TECHNIQUE FOR MANAGEMENT TO EVALUATE THE FEASIBILITY OF LONG-TERM CAPITAL INVESTMENTS

- BASIC METHODS
  - **Payback Method**
    - Cost of project / annual cash flow
  - **The average accounting rate of return Method**
    - = W/ 1/2I x 100 -> The average annual profit per year for the whole period / Investment (x ½) x 100
  - **Internal Rate of Return Method**
    - The rate which makes the NPV of a project equal = 0
    - Easy on a financial calculator but in this course will need to interpolate
  - **The Net Present Value Method**
    - Discount back all the projects flows at the cost of capital using Present Values

6.3 TECHNIQUE FOR SOLVING NPV AND IRR QUESTIONS

- ALL LONG EXAM QUESTIONS EFFECTIVELY WILL ASK THE STUDENT TO DRAW UP A DETAILED COLUMNAR ANALYSIS TO SOLVE THE CAPITAL BUDGETING PROBLEM
- YOU WILL USE THIS FORMAT FOR BOTH NPV AND IRR
- E.G.

Rate	20%				
Mining	y0	y1	y2	y3	y4
New Eqpt	(275,000)				
Wrkg Cap	(100,000)				
New Road				(40,000)	
Salvage					65,000
Net Rev		120,000	120,000	120,000	120,000
Less Dep		(52,500)	(52,500)	(52,500)	(52,500)
Op CF		**67,500**	**67,500**	**27,500**	**132,500**
Add back Dep		52,500	52,500	52,500	52,500
Rel WC					100,000
Net CF	**(375,000)**	**120,000**	**120,000**	**80,000**	**285,000**
NPV	**(7,928)**				

- THE BASIC MODEL IS FAIRLY EASY TO IMPLEMENT, BUT WHAT MAKES CAPITAL BUDGETING COMPLEX IS THE VARIATIONS (THE DIFFERENT STUDY UNITS IN YOUR GUIDE) WHICH CAN BE INCORPORATED
- ESSENTIALLY YOUR SOLUTIONS WILL TAKE ON THE SAME COLUMNAR FORMAT BUT WILL BE VERY DIFFERENT IN TERMS OF VARIATIONS
- WE FIRST NEED TO UNDERSTAND THE BASIC NPV/IRR MODEL, AND THEN WE CAN LOOK AT THE VARIOUS UNISA MODULAR COMPONENTS AND VARIATIONS THAT CAN BE CONTAINED IN ANY GIVEN QUESTION

BASIC NPV COLUMNAR TECHNIQUE

- Most questions you need to evaluate TWO investment options

- Each option needs an NPV/cash flow table AND a taxable income table, effectively giving you FOUR tables required (plenty of marks). You can do the taxable income as a side working in smaller questions or just do it on the face of the cash flow table

- Start by identifying the two investment options, you can then draw up one of the projects cash flows/NPV table and sourcing the relevant figures:
  - Initial Investment
  - Annual Income
  - Working capital in and out
  - Tax paid
  - Wear and tear (only on the tax table, don't put on the cash flow table)
  - Proceeds / Recoupment at the end of the capital items

VARIOUS MODULE / STUDY UNIT COMPONENTS THAT MAY BE INCORPORATED INTO A QUESTION:

- Is it a straight expansion option or a replacement option?
  - This is the most important and also most complex issue
  - The expansion is easy but if the question involves replacement you will have to:
    - Account for the exsisting assets oppurtunity cost
    - The oppurtunity gain/cost of keeping the old asset
    - Take care in getting the correct time frames for each asset

- Are the projects the same lifespan?
  - If not you will have to do an annualised NPV at the end

- Do any of the flows have probabilities attached?
  - If so, you need to do a weighted average flow

- Is there inflation ?
  - If there is you will need to increase the cash flows by inflation over the years
  - $(1+ m) = (1 + r)(1+ i)$
  - In easier terms, nominal rate = real rate x inflation rate

- Working Capital requirements?
  - When doing the NPV, this will be a outflow at start of project and an inflow at end of project
  - This figure will either be given to you or in very rare cases a schedule may need to be done

FINALISING YOUR CAPITAL BUDGETING SOLUTION:

- WHEN YOU HAVE DRAFTED ALL THE COLUMNS AND RECORDED ALL RELEVANT FIGURES YOU ARE NOW IN A POSITION TO FINALISE:
  - ADD UP ALL THE COLUMNS TO GET A TOTAL CAH INFLOW OR OUTFLOW FOR EACH YEAR
  - IDENTIFY THE DISCOUNT RATE TO BE USED AND RECORD THIS RELEVANT FACTOR UNDERNEATH YOUR GROSS AMOUNT FROM ABOVE
  - TABLE A, B OR A NORMAL CALCULATOR CAN BE USED
  - MULTIPLY THE GROSS AMOUNT BY THE FACTOR
  - RECORD THIS REDUCED OR DISCOUNTED FIGURE BELOW
  - ADD UP ALL DISCOUNTED FLOWS AND RECORD THE FINAL NPV

- INTERPOLATION:
  - INTERPOLATION IS THE SAME AS THE ABOVE EXCEPT YOU WILL BE DOING A DOUBLE NPV WITH THE RATES GIVEN AND THEN INTERPOLATING

OTHER:

- Capital Rationing
  - Divisible vs. Non Divisible Projects
  - Independent and mutually exclusive Projects
  - You need to work out Profitability Index and rank Projects
  - PI = PV / Initial Investment

- 6.8 Qualitative Factors
  - Reliability/lifespan
  - Spare parts
  - Guarantees
  - Technological obsolescence
  - Suppliers, quality of materials and output
  - Growth
  - Capital intensive vs. labour intensive
  - Labour and skilled staff
  - Environmental, ethical and social issues
  - Governments and legislation