Department of Finance, Risk Management and Banking
School of Management Sciences

INVESTMENTS: An Introduction

Only Study guide for INV2601

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CONTENTS

MODULE AIM

The aim of the module is to equip you with the necessary knowledge and skills to perform investment analysis and portfolio management.

THE LEARNING OUTCOMES OF THIS MODULE

On completion of this module you should:

- have an overall view of the investment setting and the portfolio management process
- understand the organisation and functioning of the securities market in South Africa
- know about the developments in investment theory
- understand the concept and apply the principles of the time value of money
- know the basic security valuation principles and practices
- understand that fundamental analysis is a three-step process consisting of the evaluation of the economy, industry and individual company
- be able to apply basic valuation principles to value a company
- know the basic principles related to technical analysis
- understand the fundamentals of fixed-interest securities
- be able to apply basic valuation principles to value fixed-interest securities
- understand the basics of derivative instruments and their application
- know the important aspects related to the construction and management of a portfolio
- be able to evaluate portfolio management
- understand the functioning of the foreign exchange market

OVERVIEW OF THE MODULE

Investment is the commitment of funds to one or more assets that will be held over a period of time in order to derive future payments that will compensate the investor for the time the funds are committed, the expected rate of inflation and the uncertainty of the future payments. Investment management is concerned with the management of an investor's wealth, which is the sum of current income and the present value of all future income.

There are a variety of investment opportunities, ranging from real assets (such as real estate, diamonds, precious metals and coins made of precious metals, art and collectibles) to financial assets and marketable securities. Financial assets are paper (or electronic) claims on some issuer, such as the government or a company. Marketable securities are financial assets that are easily and cheaply tradeable in organised markets, such as the Johannesburg Securities Exchange (JSE Ltd) or the SA Futures Exchange (SAFEX).

EFFECTIVE LEARNING

Investment management may be a totally new area of study for students who have not had any previous exposure to this field of study. These students, especially, might have to spend a fair amount of time working through the study material before fully under-

standing all the topics covered. It is important to test whether you understand the ideas presented in each study unit, since each study unit contains crucial knowledge that forms the basis for the following study units. You can test your understanding in the following simple ways:

- Identify the important ideas in the section and then try to explain them to someone else.
- Try to predict what questions you could be asked about this section.
- Work thoroughly through the textbook examples and construct your own examples to illustrate the ideas and calculations presented in the section.
- Answer both the self-assessment questions in the textbook and the assessment questions at the end of each study unit in this study guide.

If you make written responses to each of these activities, you will be able to check your answers and your reasoning by referring to the textbook and/or the study guide. Self-assessment is one of the most effective ways of learning.

THE PRESCRIBED TEXTBOOK

The prescribed textbook for Investment Management is:

> ***Investment Management*** – 3rd edition (2009)
>
> **Johan Marx (editor)**
>
> Van Schaik Publishers, Pretoria

Each study unit in the study guide represents a chapter of the prescribed book. Detailed learning outcomes are given at the start of each study unit to help you to prepare for the examination. The assessment questions are aimed at improving your practical application of knowledge and should be mastered before the examination. The prescribed textbook also contains self-assessment questions and solutions at the end of each chapter.

TUTORIAL LETTERS

Tutorial Letter 101 contains important general information about academic and administrative matters, and about assignments and their due dates. The purpose of tutorial letters is to give you feedback on the assignments and to provide information about the examination and any other aspects that may arise during the study period. Tutorial Letter 201 contains the suggested solutions to the assignments.

ICONS USED IN THIS STUDY GUIDE

	**Learning outcomes**. The learning outcomes indicate what aspects of the particular topic or study units you have to master and demonstrate that you have mastered them.
	**Key concepts.** The key concepts icon draws your attention to certain keywords or concept that you will come across in the topic or study unit.
	**Activity**. The activity icon refers to activities that you must do in order to develop a deeper understanding of the learning material.
	**Feedback.** The feedback icon indicates that you will receive feedback on your answers to the self-assessment activities.
	**Assessment.** When you see the assessment icon you will be required to test your knowledge, understanding and application of the material you have just studied.
	**Study.** The study icon indicates which sections of the prescribed book or the learning guide you need to study and internalise.

MODULE FRAMEWORK

Topic		Study unit			Chapter
1 THE INVESTMENT BACKGROUND	→	1	The investment setting	→	1
		2	Organisation and functioning of securities markets		2
		3	Developments in investment theory		3
		4	The time value of money		4
		5	Valuation principles and practices		5
		6	Fundamental analysis		6
2 EQUITY ANALYSIS	→	7	Industry analysis	→	7
		8	Company analysis		8
		9	Company valuation		9
		10	Technical analysis		10
3 THE ANALYSIS OF FIXED INTEREST SECURITIES	→	11	Fundamentals of the analysis of fixed interest securities	→	11
		12	Valuation of fixed interest securities		12
4 PORTFOLIO MANAGEMENT	→	13	An introduction to derivative instruments	→	13
		14	Portfolio management		14
		15	Evaluation of portfolio management		15
5 FOREIGN EXCHANGE	→	16	Foreign exchange management	→	16

Topic 1

THE INVESTMENT BACKGROUND

AIM

Topic 1 serves as an introduction to your study of investment management.

The topic starts off by explaining the investment setting. The investment setting defines concepts such as wealth, investment, speculation and gambling, and discusses the following fundamental principles of investment:

- time value of money
- risk versus return
- diversification

It also explains the significance of asset allocation and highlights the organisation and functioning of securities markets, as well as the use of security market indicator series for the evaluation of market performance.

In this topic we also look at the developments in investment theory, particularly those pertaining to the measurement of risk and return, and the way in which the required rate of return can be linked to risk. The capital asset pricing model (CAPM) and the arbitrage pricing theory (APT) are explained.

Valuation is based on the above-mentioned estimates of risk and required rate of return. The various models that can be used for the valuation of different kinds of financial assets (such as bonds, preference shares and ordinary shares) are explained.

This topic also lays the foundation for the rest of the module by explaining the **first step** in the three-step, top-down valuation process of fundamental analysis. Fundamental analysis is the process of analysing the macroeconomic, industry-specific and company-specific factors that will influence the value of all financial assets.

Scientific investment decisions require diligent, independent and objective fundamental analysis.

TOPIC LEARNING OUTCOMES

Once you have worked through this topic, you should be able to:

- explain the investment setting
- explain the organisation and functioning of securities markets

- explain the developments in investment theory
- apply time-value-of-money concepts and calculations
- explain the valuation principles and practices regarding shares, preference shares and bonds
- discuss fundamental analysis and understand its importance

TOPIC CONTENT

Study unit 1

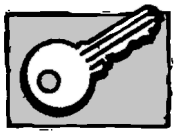
The investment setting

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- explain the concept of required rate of return and discuss the components of an investor's required rate of return
- differentiate between the real risk-free rate of return and the nominal risk-free rate of return and calculate both return measures
- explain the risk premium, the associated fundamental sources of risk, and why these sources are complementary to systematic risk
- comprehend the trade-off between risk and return (risk/return principle)
- calculate historical returns by means of the holding period return and holding period yield
- calculate the expected return for an individual investment
- calculate the variance and standard deviation for an individual investment
- calculate the coefficient of variation as a measure of risk per unit of return
- explain diversification and its effect on the systematic risk of a portfolio
- define asset classes and distinguish between various kinds of asset classes
- distinguish between unit trusts, investment trusts and hedge funds as investment alternatives
- explain the benefits, constraints and costs of international diversification
- explain the investment management process



KEY CONCEPTS

Asset classes
Callability risk
Coefficient of variation
Convertibility risk
Currency risk
Diversification
Equity
Expected return
Holding period return
Holding period yield
Inflation
International diversification
Investment management
Investment policy
Liquidity risk
Nominal rate of return
Portfolio strategy
Real assets
Real rate of return
Required rate of return
Return
Risk premium
Standard deviation
Systematic risk

Financial assets	Non-systematic risk	Time value of money
Financial risk	Performance	Total risk
Fixed income securities	Political risk	Variance

OVERVIEW

This study unit introduces some of the basic terminology used in investment management. It also introduces the risk-return principle, that is, the higher the risk, the higher the required return will be. One of the distinguishing features of risk, as opposed to uncertainty, is that it is measurable. It can be measured using statistical measures such as variance, standard deviation and the coefficient of variation.

Study chapter 1 of the prescribed book.

ACTIVITY

Your rate of return expectations for the shares of Gray Disc Company during the next year are:

GRAY DISC COMPANY

Possible rate of return %	Probability %
–10	25
00	15
10	35
25	25

(a) Calculate the expected return [$E(R_i)$] on this investment, the variance of this return (σ^2), and its standard deviation (σ).
(b) Under what conditions can the standard deviation be used to measure the relative risk of two investments?
(c) Under what conditions must the coefficient of variation be used to measure the relative risk of two investments?

Your rate of return expectations for Kayleigh Computer Company during the next year are:

KAYLEIGH COMPUTER COMPANY	
Possible rate of return %	**Probability %**
–60	15
–30	10
–10	5
20	40
40	20
80	10

(d) Calculate the expected return [$E(R_i)$] on this investment, the variance of this return (σ^2), and its standard deviation (σ).

(e) On the basis of expected return [$E(R_i)$] alone, discuss whether Gray Disc or Kayleigh Computer is preferable.

(f) On the basis of expected return (σ) alone, discuss whether Gray Disc or Kayleigh Computer is preferable.

(g) Calculate the coefficients of variation (CVs) for Gray Disc and Kayleigh Computer and discuss which share return series has the greater relative dispersion.

FEEDBACK

(a) $\text{Expected Return} = \sum\left[\left(\text{Probability of Return}\right)\times\left(\text{Possible Return}\right)\right]$

$$E(R_{GDC}) = \sum_{t=1}^{n} P_i[R_i]$$
$$= \left[(0{,}25\times -0{,}10)+(0{,}15\times 0{,}00)+(0{,}35\times 0{,}10)+(0{,}25\times 0{,}25)\right]$$
$$= \left(-0{,}025+0{,}00+0{,}035+0{,}0625\right)$$
$$= 0{,}0725 = 7{,}25\%$$

$$\sigma^2 = \sum_{i=1}^{n} P_i\left[R_i - E\left(R_i\right)\right]^2$$
$$= \begin{bmatrix}(0{,}25)(-0{,}10-0{,}0725)^2+(0{,}15)(0{,}00-0{,}0725)^2\\ +(0{,}35)(0{,}10-0{,}0725)^2+(0{,}25)(0{,}25-0{,}0725)^2\end{bmatrix}$$
$$= \left(0{,}0074+0{,}0008+0{,}0003+0{,}0079\right)$$
$$= 0{,}0164$$

$$\sigma = \sqrt{0{,}0164} = 0{,}128$$

(b) Standard deviation can be used as a good measure of relative risk between two investments that have the same expected rate of return.

(c) The coefficient of variation must be used to measure the relative variability of two investments if there are major differences in the expected rates of returns.

(d) $$E(R_{KCC}) = \begin{bmatrix} (0{,}15 \times -0{,}60) + (0{,}10 \times -0{,}30) + (0{,}05 \times -0{,}10) \\ + (0{,}40 \times 0{,}20) + (0{,}20 \times 0{,}40) + (0{,}10 \times 0{,}80) \end{bmatrix}$$
$$= (-0{,}09 - 0{,}03 - 0{,}005 + 0{,}08 + 0{,}08 + 0{,}08)$$
$$= 0{,}115 = 11{,}50\%$$

$$\sigma^2 = \begin{bmatrix} (0{,}15)(-0{,}60 - 0{,}115)^2 + (0{,}10)(-0{,}30 - 0{,}115)^2 + (0{,}05)(-0{,}10 - 0{,}115)^2 \\ + (0{,}40)(0{,}20 - 0{,}115)^2 + (0{,}20)(0{,}40 - 0{,}115)^2 + (0{,}10)(0{,}80 - 0{,}115)^2 \end{bmatrix}$$
$$= (0{,}07668 + 0{,}01722 + 0{,}00231 + 0{,}00288 + 0{,}01624 + 0{,}04692)$$
$$= 0{,}16225$$

$$\sigma = \sqrt{0{,}16225} = 0{,}403$$

(e) Based on [$E(R_i)$] alone, Kayleigh Computer Company's shares are preferable because of the higher return available.

(f) Based on standard deviation alone, Gray Disc Company's shares are preferable because of the likelihood of obtaining the expected return.

(g) $$CV = \frac{\sigma}{E(R)}$$
$$CV_{GDC} = \frac{0{,}128}{0{,}0725} = 1{,}77$$
$$CV_{KCC} = \frac{0{,}403}{0{,}115} = 3{,}50$$

Based on CV, Kayleigh Computer Company's return has approximately twice the relative dispersion of Gray Disc Company's return. GDC has less risk per unit of expected return than KCC.

ASSESSMENT

(1) Answer the self-assessment questions at the end of chapter 1 in the prescribed book.

(2) Additional assessment questions:

(a) Assume the expected rate of inflation is 6% and the real risk-free rate is 7%. Calculate the nominal risk-free rate of return (NRFR).

(b) What is a warrant?

(c) Name the fundamental principles of investing.

(d) Given the following information, calculate the

(i) expected return

(ii) standard deviation of the returns

(iii) coefficient of variation (CV)

Possible outcomes	Probability (%)	Return (%)
Pessimistic	25	13
Most likely	50	15
Optimistic	25	17

(e) On February 1, you bought 100 shares at R34 a share and a year later you sold them for R39 a share. During the year, you received dividends of R1,50 per share. Calculate your HPR and HPY on this investment.

(f) On August 15, you bought 100 shares at R65 a share and a year later you sold them for R61 a share. During the year, you received dividends of R3 per share. Calculate your HPR and HPY on this investment.

(g) The rates of return calculated in (e) and (f) are nominal rates of return. Assuming that the rate of inflation during the year was 4 percent, calculate the real rates of return on these investments.

(h) the annual holding period of an investment that was held for six years is minus (–) 14 percent. The ending value of this investment was R11 200. The beginning value is closest to.

(1) R12 768
(2) R13 023
(3) R24 584
(4) R27 682

(i) Which of the following statements is FALSE?

(1) Hedge funds are not allowed to advertise.
(2) Unit trusts are managed by fund managers whose payment is dependent on whether investors have a gain or lose in their portfolio.
(3) Hedge funds have a private pool of investment capital limited to the partners.
(4) Investment trusts have the freedom to invest in accordance with the investment strategy of the trust.

(j) The expected return [E_x] for Share X and the standard deviation [δ_y] of returns for Share Y are:

Bear market	Normal market		Bull market
Probability	0.2	0.5	0.3
Share X	–20%	18%	50%
Share Y	–15%	20%	10%

	E_x	δ_y
(1)	16%	22%
(2)	16%	13%
(3)	20%	24%
(4)	20%	13%

(k) Calculate the standard deviation of Investment Z.

Investment Z	Probability	Return
Boom	0.2	15%
Normal	0.3	10%
Recession	0.5	7%

(1) 1.74%
(2) 3.04%
(3) 9.26%
(4) 9.50%

(l) A share has a beta of 1.1 and a standard deviation of 15.67%. It also has an expected return of 14.02%. Calculate the coefficient of variation [CV].

(1) 0.01
(2) 0.08
(3) 0.89
(4) 1.12

(m) What type of risk/s does a portfolio that is not well-diversified have?

(1) systematic risk
(2) non-systematic risk
(3) liquidity risk
(4) systematic and non-systematic risk

Answers to additional assessment questions

(a) $$NRFR = \left[\left(1 + RRFR\right)\left(1 + EI\right) - 1\right] \times 100$$
$$= \left[\left(1{,}07 \times 1{,}06\right) - 1\right] \times 100 = 13{,}47\%$$

(b) Warrants are derivative securities that give the holder the right to buy a stated number of the ordinary shares of the issuing company at a specific price, called the exercise price, during the life of the warrant. Warrants (call warrants only) are issued by a company whose own ordinary shares are the underlying asset. Upon exercise, new shares are issued by the company, diluting the value of existing shares. This is in contrast to covered warrants (call, put and exotic warrant structures), which are issued by large financial institutions over the shares of other companies. No new shares are issued.

(c) The fundamental principles in investing are the time value of money, risk and return, and diversification.

(d) (i)

Possible outcomes	Probability (%) P	Return (%) k	Weighted value (Pxk)
Pessimistic	25	13	(0.25x13) = 3.25%
Most likely	50	15	(0.50x15) = 7.50%
Optimistic	25	17	(0.25x17) = 4.25%
Expected return E(k) (3,25 + 7,50 + 4,25)			**15%**

(ii)

k %	E(k) %	k–E(k) %	[k–E(k)]²	P %	Px[k–E(k)]²
13	15	–2	4	25	1
15	15	0	0	50	0
17	15	2	4	25	1
Variance					2
Standard deviation (σ) √2					**1,4142**

(iii) $CV = \frac{\sigma}{E(k)} = \frac{1,4142}{15} = 0,094$

(e) $HPR = \frac{\text{Ending value of investment (including cash flows)}}{\text{Beginning value of investment}}$

$= \frac{39 + 1,50}{34} = 1,1912$

$HPY = (HPR - 1) \times 100 = (1,1912 - 1) \times 100 = 19,12\%$

(f) $HPR = \frac{\text{Ending value of investment (including cash flows)}}{\text{Beginning value of investment}}$

$= \frac{61 + 3}{65} = 0,9845$

$HPY = (HPR - 1) \times 100 = (0,9846 - 1) \times 100 = -1,54\%$

(g) $\text{"Real" Rate of Return (e)} = \left[\left(\frac{\text{HPR}}{1 + \text{Rate of Inflation}}\right) - 1\right] \times 100$

$= \left[\frac{1,1912}{1,04} - 1\right] \times 100 = 14,54\%$

$\text{"Real" Rate of Return (f)} = \left[\left(\frac{\text{HPR}}{1 + \text{Rate of Inflation}}\right) - 1\right] \times 100$

$= \left[\frac{0,9845}{1,04} - 1\right] \times 100 = -5,33\%$

(h)

Annual HPY = $HPR^{1/N}$

(1–0.14) = $HPR^{1/6}$

0.86 = $HPR^{1/6}$

HPR = 0.86^6

HPR = 0.4046

$$\text{HPR} = \frac{\text{Ending value}}{\text{Beginning value}}$$

$$0.4046 = \frac{11\ 200}{\text{Beginning value}}$$

$$\text{Beginning value} = \frac{11\ 200}{0.4046}$$

(4) = R27 682

(i) (2) Unit trusts are managed by fund managers who are paid regardless of whether investors gain or lose.

(j) $E_x = 0.20(-20) + 0.5(18) + 0.3(50)$

$= -4 + 9 + 15$

$= 20\%$

$E_y = 0.2(-15) + 0.5(20) + 0.3(10)$

$= -3 + 10 + 3$

$= 10\%$

$\delta_y = \sqrt{0.2(-15 - 10)^2 + 0.5(20 - 10)^2 + 0.3(10 - 10)^2}$

$= \sqrt{125 + 50 + 0}$

$= 13\%$

(4) $E_x = 20\%$ $\delta_y = 13\%$

(k) $E_z = 0.2(15) + 0.3(10) + 0.5(7)$

$= 3 + 3 + 3.5$

$= 9.50\%$

$= \sqrt{0.2(15 - 9.5)^2 + 0.3(10 - 9.5)^2 + 0.5(7 - 9.5)^2}$

$= \sqrt{0.2(30.25) + 0.3(0.25) + 0.5(6.25)}$

$= \sqrt{6.05 + 0.08 + 3.13}$

$= \sqrt{9.26\%}$

(2) $\delta_z = 3.04\%$

(l) $$\text{Coefficient of variation (CV)} = \frac{\text{Standard deviation } (\sigma)}{\text{Expected return (Er)}}$$

$$= \frac{15.67\%}{14.02\%}$$

(4) CV = 1.12

(m) (4) Systematic and non-systematic risk

- Systematic risk includes general economic conditions ie, the impact of monetary and fiscal policies, inflation and political and other events that affects all firms.
- Non-systematic risk relates to events that affect individual companies eg implementation of strategies on innovation, market development and other activities unique to an individual firm.
- Systematic risk remains whether a portfolio is formed or not. The only risk a well-diversified portfolio has is systematic risk. Hence contribution of any security to the risk of a portfolio constitutes its systematic risk.

SUMMARY

Chapter 1 of the prescribed book has introduced you to some of the basic terminology used in investment management. The required rate of return, risk, time value of money, diversification and the overall investment process have been explained in brief. We will elaborate on these concepts as we work through the prescribed book. In the next study unit we look at the characteristics of a well-functioning securities market and the exchanges responsible for trading equity, fixed-interest securities and derivatives in South Africa.

Study unit 2

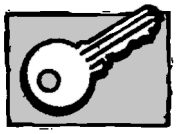
Organisation and functioning of securities markets

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- describe the characteristics of a well-functioning securities market
- distinguish between exchange markets, over-the-counter markets and other related markets
- distinguish between primary and secondary capital markets, and explain how secondary markets support primary markets
- compare and contrast the characteristics of South African securities markets, including membership and types of orders
- contrast equity market indices and bond market indices
- distinguish among the composition and characteristics of the three predominant weighting schemes used in constructing market indices
- explain the major changes that have occurred in global securities markets



KEY CONCEPTS

AltX
Bond Exchange of South Africa
Bond market indices
Equally weighted
Equity market indices
External efficiency
Fourth market
FTSE/JSE
Global securities market
Information
Initial public offerings (IPOs)
JSE Limited
Limit order
Liquidity
Listing criteria
Margin transactions
Market
Market indices
Market order
Market structures
Over-the-counter market (OTC)
Price continuity
Price weighted
Primary markets
Satrix
Secondary markets
Short sale
South African Futures Exchange
Special orders
Stop loss order
TALX
Third market
Trading system
Transaction costs
Value weighted
Weighting schemes
Yield-X

OVERVIEW

In this study unit we look at the characteristics of a well-functioning securities market. A distinction is made between primary and secondary markets and we are introduced to the market structures relating to the different types of transactions and the trading system. The South African exchanges are introduced and market indices are explained.

Study chapter 2 of the prescribed book

ACTIVITY

Go onto the JSE Limited website and link to the other exchanges listed. Record the web-addresses and provide a brief description of the function and purpose of each exchange.

Address: http://www.jse.co.za
Click on: Links (left-hand side menu)
Select: AltX, SAFEX and Yield-X alternately

FEEDBACK

AltX

Address: http://www.altx.co.za

AltX plays a vital role within the JSE by providing smaller companies not yet able to list on the JSE Main Board with a clear growth path and access to capital. Expected benefits from listing and trading on this exchange include the following:

For companies:

- Access to long-term investment capital for development of the business;
- Access to a central trading facility thereby providing liquidity;
- The ability to realise value through an effective price discovery mechanism;
- Improved image amongst suppliers, customers, staff and other stakeholders due to the prestige associated with being a listed entity; and
- The opportunity to use the issue of shares as consideration for an acquisition.

For investors:

- The opportunity to diversify share portfolios by investing in a wide range of high-growth small and medium sized companies; and
- Increased confidence due to the knowledge that **AltX** is regulated by the JSE, which provides substantial investor protection.

For the South African economy:

- Growth of the economy by providing growth opportunities to small and medium sized companies; and
- Promotion of black economic empowerment in South Africa.

SAFEX

Address: http://www.jse.co.za/trade/deivative-market/equity-derivatives

In South Africa the development of formal, exchange traded derivative instruments started in 1987 when Rand Merchant Bank (RMB) initiated trades in five equity index and bond futures contracts. The South African Futures Exchange (Safex) was founded in September 1988 as a result of this RMB initiative. In 1989, SAFEX was officially licensed as a derivative market through the Financial Markets Control Act and SAFEX was officially opened on 10 August 1990.

Since then, SAFEX has developed in size and stature. In January 1995, they launched an Agricultural Markets Division (AMD) where futures contracts in beef, wheat, sunflower and maize are traded. On 1 July 2001, SAFEX was taken over by the JSE Securities Exchange, thereby creating a more effective, single securities exchange where both underlying financial assets such as equity shares can be traded, as well as derivatives based on such assets.

Yield-X

Address: http://www.saderivatives.co.za/Page 2010.aspx?ID=YXInfo

In most major markets in the world, exchange-traded interest rate derivatives form a significant portion of a healthy and vibrant market. This is not the case in South Africa, where SAFEX interest rate products have enjoyed limited success.

In an attempt to identify issues, the JSE consulted with market participants, during which time it became evident that the underlying causes were numerous and diverse and that tinkering on the periphery would not solve the problems.

During the consultative process, many market participants suggested that the JSE should initiate a totally separate environment for the trading, clearing and settling of all interest rate products. In so doing the JSE would create a "one-stop yield shop" for a wide range of interest rate products.

After careful investigation, the JSE decided to effect such a new system and the concept of Yield-X was born.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 2 in the prescribed book.

(2) Additional assessment questions:

(a) Define *market* and briefly discuss the characteristics of a good market.

(b) Define *liquidity* and discuss the factors that contribute to it. Give examples of a liquid and an illiquid asset, and discuss why they are considered liquid and illiquid.

(c) Define a primary and secondary market for securities and discuss how they differ. Discuss why the primary market is dependent on the secondary market.

(d) Briefly define each of the following terms and give an example:

(i) Market order

(ii) Limit order

(iii) Short sale
(iv) Stop-loss order

(e) If you place a stop-loss order to sell 100 shares of ABSA at R55 when the current price is R62, how much will you receive for each share if the price drops to R50?

(1) Close to R50
(2) Close to R55
(3) Close to R62
(4) Won't sell because the price is too low

(f) Which one of the following orders is most useful to short sellers who want to limit their potential losses?

(1) Limit order
(2) Restricted order
(3) Limit-loss order
(4) Stop-buy order

Answers to additional assessment questions

(a) A market is a means whereby buyers and sellers are brought together to aid in the transfer of goods and/or services. While it generally has a physical location, it need not necessarily have one. Secondly, there is no requirement of ownership by those who establish and administer the market. They need only provide a cheap, smooth transfer of goods and/or services for a diverse clientele.

A good market should provide accurate information on the price and volume of past transactions, and current supply and demand. Clearly, there should be rapid dissemination of this information. Adequate liquidity is desirable so that participants may buy and sell their goods and/or services rapidly, at a price reflecting the supply and demand. The costs of transferring ownership and middleman commissions should be low. Finally, the prevailing price should reflect all available information.

(b) Liquidity is the ability to sell an asset quickly at a price not substantially different from the current market price, assuming no new information is available. A share of Anglo American PLC (ANG) is very liquid, while an antique would be a fairly illiquid asset. A share of ANG is highly liquid since an investor could convert it into cash within a fraction of a percentage point of the current market price. An antique is illiquid since it is relatively difficult to find a buyer, and then you are uncertain as to what price the prospective buyer would offer.

(c) The primary market in securities is where new issues are sold by companies to acquire new capital via the sale of bonds, preferred shares or common shares. The sale typically takes place through an investment banker.

The secondary market is simply trading in outstanding securities. It involves transactions between owners after the issue has been sold to the public by the company. Consequently, the proceeds from the sale do not go to the company, as is the case with a primary offering. Thus the price of the security is important to the buyer and seller.

The functioning of the primary market would be seriously hampered in the absence of a good secondary market. A good secondary market provides liquidity to an investor if he or she wants to alter the composition of his or her portfolio from securities to

other assets (i.e. house, etc.). Thus, investors would be reluctant to acquire securities in the primary market if they felt they would not subsequently have the ability to sell the securities quickly at a known price.

(d) (i) Market order

A market order is an order to buy/sell a share at the most profitable ask/bid prices prevailing at the time the order is matched/executed on an electronic exchange or reaches the exchange floor (open outcry system). A market order implies that the investor wants the transaction completed quickly at the prevailing price. Example: I read good reports about Harmony and I'm certain the share will go up in value. When I call my broker and submit a market buy order for 100 shares of Harmony, the prevailing asking price is R100,30. Total cost for my shares will be R10 030 + commission.

(ii) Limit order

A limit order specifies a maximum price that the individual will pay to purchase a share or the minimum he/she will accept to sell it. Example: ABSA is selling at R98,50 – I would put in a limit buy order for one week to buy 100 shares at R97.

(iii) Short sale

A short sale is the sale of shares that are not currently owned by the seller with the intent of purchasing them later at lower prices. This is done by borrowing the shares from another investor through a broker. Example: I expect SAB to go to R125 – I would sell the shares short at R135,53 and expect to replace them when the price gets to R130. This option/strategy is not freely available in all countries (e.g. South Africa) and even then restrictions are imposed related to the timing, percentage of the proceeds available to the investor and margin requirements.

(iv) Stop-loss order

A stop-loss order is a conditional order whereby the investor indicates that he or she wants to sell a share when the price drops to a specified price, thus protecting himself or herself from a large and rapid decline in price. Example: I buy Murray and Roberts Holdings (M&R HLD) at R30 and put in a stop-loss at R27 that protects me from a major loss if it starts to decline.

(e) (2) The stop-loss ensures a selling price close to R55.

(f) (4) The stop-buy sets a certain buy-back price to limit the potential loss from a short-sale.

SUMMARY

This study unit has provided you with a clearer understanding of the functioning and structure of the securities markets in South Africa. In the next study unit we will have a look at the developments in investment theory.

Study unit 3

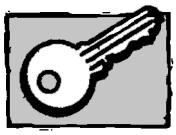
Developments in investment theory

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- define and discuss an efficient capital market
- describe and contrast the forms of the efficient market hypothesis (EMH)
- explain the implications of share market efficiency for fundamental analysis and technical analysis
- discuss the implications of efficient markets for the portfolio management process and the role of the portfolio manager
- explain the rationale for investing in index funds
- define risk aversion
- list the Markowitz Portfolio Theory's assumptions about individuals' investment behaviour
- describe the efficient frontier and explain the implications for incremental return as an investor assumes more risk
- define the security market line (SML) and discuss the factors that cause movements along, changes in the slope of, and shifts of the security market line
- list the assumptions of the capital market theory
- explain what happens to the expected return, standard deviation of returns, and possible risk-return combinations when a risk-free asset is combined with a portfolio of risky assets
- identify the market portfolio and describe the role of the market portfolio in the formation of the capital market line (CML)
- define systematic risk and unsystematic risk, and explain why an investor should not expect to receive additional return for assuming unsystematic risk
- describe the capital asset pricing model (CAPM), draw a diagram of the security market line (SML) and define beta (β)
- calculate and interpret, using the SML, the expected return on a security, and evaluate whether the security is undervalued, overvalued or properly valued
- describe the arbitrage pricing theory (APT)



KEY CONCEPTS

Arbitrage pricing theory (APT)
Asset pricing models
Beta (β)
Capital asset pricing model
Capital market line
Capital market theory
Efficient market
Efficient frontier
Efficient market hypothesis
Fundamental analysis
Investment theory
Markowitz Portfolio Theory
Overvalued
Properly/fairly valued
Risk aversion
Risk and return
Risk-free asset
Security market line (SML)
Semi-strong EMH
Standard deviation
Strong-form EMH
Systematic risk
Technical analysis
Undervalued
Unsystematic risk
Weak-form EMH

OVERVIEW

Valuation requires an estimate of expected returns and a determination of the risk involved.

We start this study unit by explaining the concept of efficient capital markets, which hypothesises that security prices reflect the effect of all information. We also consider why markets should be efficient, how the hypothesis may be tested, the results of tests and the implications of the results for those engaged in fundamental and technical analysis, as well as portfolio management.

The Markowitz theory provides the first rigorous measure of risk for investors and shows one how to select alternative assets to diversify and reduce the risk of a portfolio. Markowitz also derives a risk measure for individual securities in the context of an efficient portfolio.

This study unit also outlines several major developments in investment theory that have influenced the way in which risk is specified and measured in the valuation process. The emphasis falls on the capital asset pricing model (CAPM) and the arbitrage pricing theory (APT), and some background on risk and asset valuation is provided.

Study chapter 3 of the prescribed book.

ACTIVITY

Explain the security market line (SML) and capital market line (CML) in detail.

FEEDBACK

The Markowitz efficient frontier and capital market line (CML)

Efficient portfolios are the set of portfolios with the maximum expected return at a given

risk or, conversely, the set of portfolios with the minimum risk at a given level of expected rate of return. The set of all the efficient portfolios that can be created from a group of diversified investment possibilities is called the **efficient frontier**.

Because diversification can reduce the risk of a portfolio that contains different assets, the efficient frontier will usually contain only **portfolios**. **Individual assets** cannot have their risk reduced by diversification.

An example of an efficient frontier is shown in figure 3.1. Every portfolio that lies on the efficient frontier has either a higher rate of return for equal risk, or a lower risk for an equal rate of return than some portfolio beneath the frontier. Thus, we would say that portfolio A dominates portfolio C because it has an equal rate of return but substantially less risk. Similarly, portfolio B dominates portfolio C because it has equal risk but a higher expected rate of return. No portfolio on the efficient frontier can dominate any other portfolio on the efficient frontier. All of these portfolios have different return and risk measures, with expected rates of return that increase with higher risk.

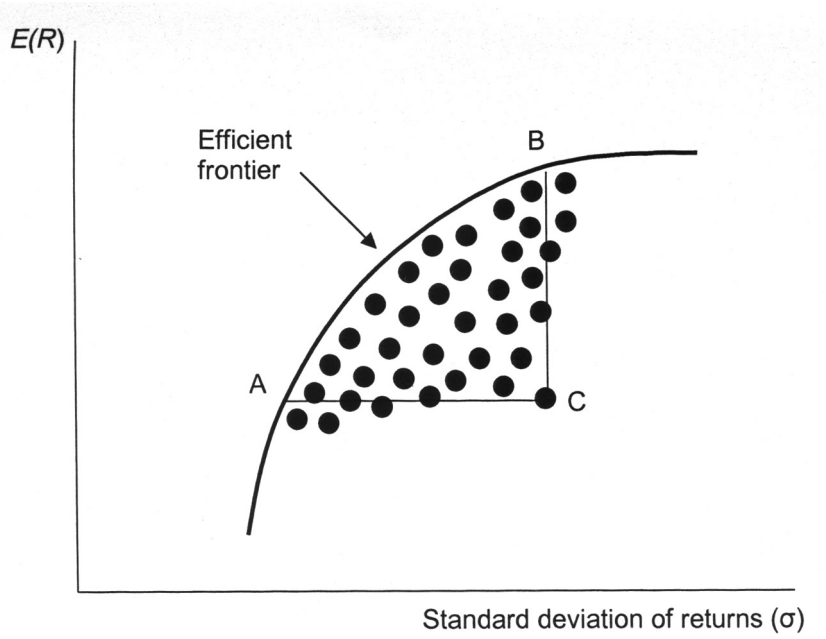


FIGURE 3.1

Efficient frontier for alternative portfolios

Let us see what happens to the average rate of return when you combine a risk-free asset with a portfolio of risky assets such as those that exist on the efficient frontier. The expected rate of return for a portfolio of risky assets is the weighted average rate of return of these assets. The expected rate of return for a portfolio that includes a risk-free asset is also the weighted average of these assets.

Adding a risk-free asset to the risky assets on the efficient frontier leads to a more desirable set of investment opportunities, which in turn lead to a straight line called the **capital market line (CML)**. Investing all your money in a risk-free asset will give a standard deviation of 0. In figure 3.2 such an investment would lie at point R on the CML. Adding risky assets to the investment would result in a movement along the CML. At the point of tangency, (*m*), lies the market portfolio, which includes all risky assets. Because the market portfolio includes all risky assets, it is a completely diversified portfolio, which means that all risk unique to individual assets in the portfolio is diversified away.

Definition: The Capital Market Line (CML)

The CML is a risk-return for efficient portfolios. The CML states that the required rates of return for portfolios are a positive linear function of the portfolios' standard deviation (or total risk).

In the case of the SML, risk is measured by means of beta (systematic or non-diversifiable risk), whereas, in the case of the CML, risk is measured by means of standard deviation (total risk).

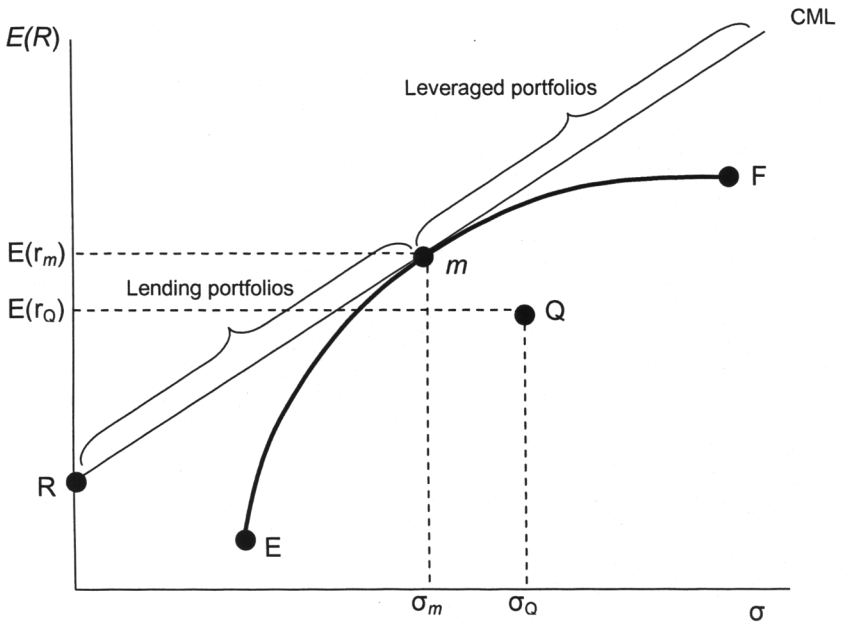


FIGURE 3.2

Lending and borrowing (or leveraged) portfolios on the CML

Lending and borrowing (or leverage) portfolios on the CML

The portfolios along the CML between points R and *m* are **lending portfolios**. The set of portfolio possibilities along line R–*m* dominates all portfolios on the original efficient frontier (E*m*F) below point *m*. For example, you could attain a risk and return combination between R and point *m* by investing a portion of your investment funds in the risk-free asset (that is, **lending** money at the risk-free rate) and the remains of your investment funds in the risky portfolio at point *m*.

The portfolios above point *m* along the CML are leveraged, that is, they are **borrowing portfolios**. These portfolios were constructed by borrowing at a fixed interest rate and investing the borrowed funds in the risky portfolio *m*. Borrowing more money leverages the portfolio farther out on the CML and increases the investor's risk exposure.

The capital asset pricing model and security market line (SML)

Total risk of a security consists of two parts: non-diversifiable risk (systematic risk) and diversifiable risk (unsystematic risk). The **beta coefficient** is used to measure non-diversifiable (systematic risk), and **standard deviation** is the measure for total risk. Unsystematic risk

is the type of risk that is unique to individual assets in a portfolio and can be diversified away. Systematic risk is defined as the variability in all risky assets caused by macroeconomic variables which cannot be diversified away.

The basic theory that links together risk and return for all assets is called the **capital asset pricing model (CAPM)**. The CAPM links together **non-diversifiable risk** and return for all assets.

> ***Definition: The Capital Asset Pricing Model (CAPM)***
>
> The CAPM is a linear relationship in which required rate of return *k* from an asset is determined by that asset's non-diversifiable (or systematic, or beta) risk.

When the **CAPM ($k_j = R_F + [b_j \times (k_m - R_F)]$)** is depicted graphically, it is called the **security market line (SML)**. The SML will, in fact, be a straight line. It reflects for each level of non-diversifiable risk (beta) the required return in the marketplace. In the graphs of the SML, risk as measured by beta, b, is plotted on the x-axis, and required returns, k, are plotted on the y-axis.

The following three changes with respect to the SML will be discussed in short:

- a movement along the SML
- changes in the slope of the SML
- the parallel shift of the SML

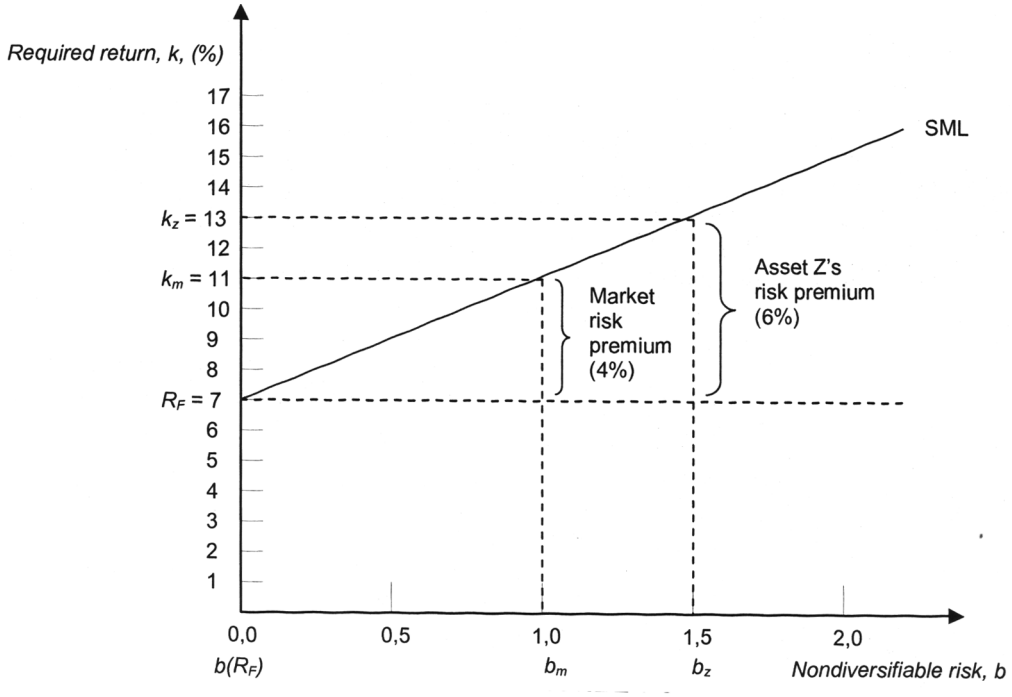


FIGURE 3.3

Movement along the SML

A movement along the SML is caused by a change in the beta. Assume that the risk-free rate, R_F, was 7% and the market return, k_m, was 11%. Since the beta associated with k_m is 1 and with R_F is 0, the SML can be plotted by using these two coordinates. Looking at figure 3.3 and using the beta for asset Z, b_z, of 1.5, the required return for b_z is 13%.

It should be clear that for assets with a beta greater than 1, the risk premium is greater than that for the market, and so is the return. For assets with betas less than 1, the risk premium is less than that for the market and so is the return.

Changes in the slope of the SML are caused by changes in the market risk premium. The slope of the SML reflects the general risk preferences of investors in the marketplace. The slope of the SML reflects the degree of risk aversion: the steeper the slope, the greater the degree of risk aversion, since a higher level of return would be required for each level of risk as measured by beta.

The result can be seen in figure 3.4. Note that although asset Z's risk as measured by beta does not change, its required return has increased due to the increased risk aversion reflected in the market risk premium, which rose from 4% to 7%. It should now be clear that greater risk aversion results in higher required returns for each level of risk, whereas a reduction in risk aversion would cause the required return for each level of risk to decline.

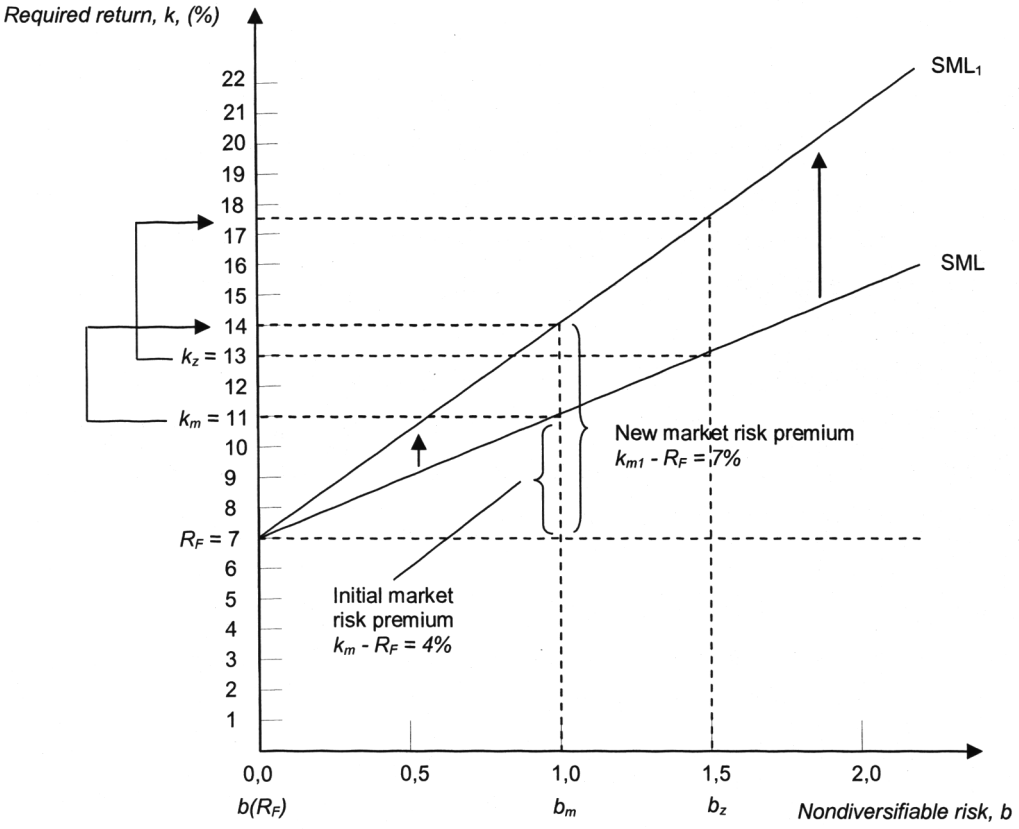


FIGURE 3.4

Changes in the slope of the SML

The parallel shift of the SML is caused by an increase (upward shift of SML) or decrease (downward shift of SML) in inflation, which will result in changes in the nominal risk-free rate.

Figure 3.5 graphically depicts the situation. It shows that a 3% increase in inflation results in a parallel shift upwards by a vertical distance of 3% in the SML. The required return on all assets rises by 3%. Note that a rise in the inflation from, say 5% to 8%, causes the risk-free rate to rise from 7% to 10% and the market return to increase from 11% to 14%. The SML therefore shifts upwards by 3%, causing the required return on all risky assets such as asset Z to rise by 3%, from 13% to 16%. Thus, a given change in inflation will be fully

reflected in a corresponding change in the returns of all assets as reflected graphically in a parallel shift of the SML.

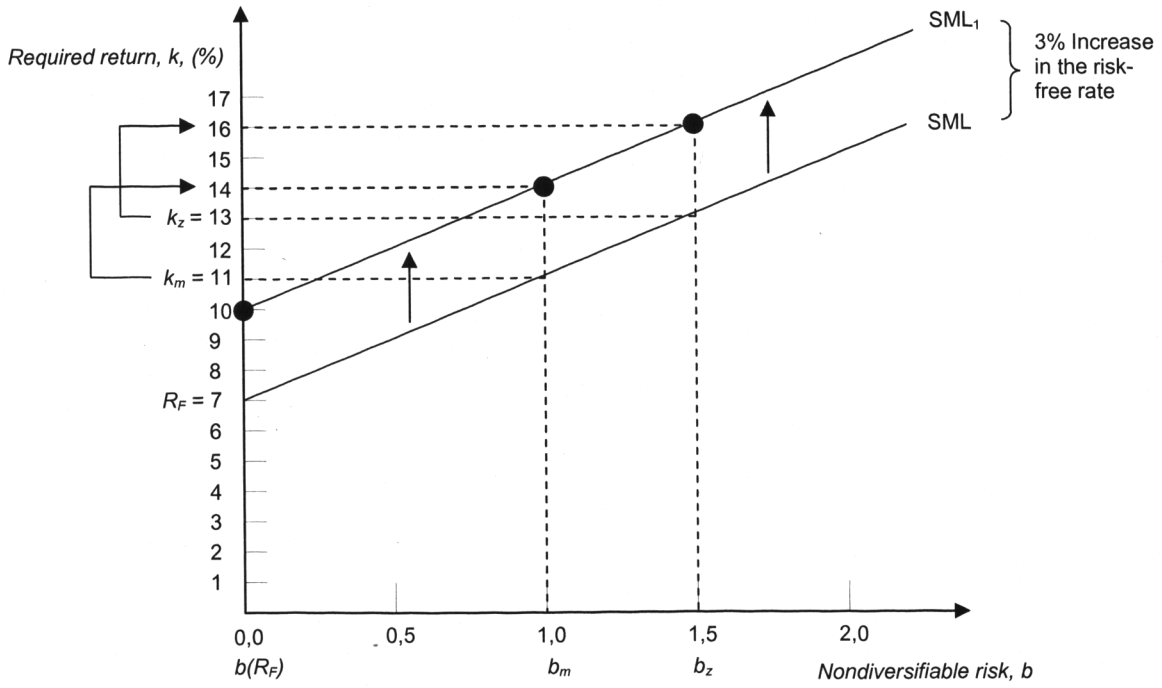


FIGURE 3.5

Parallel shift of the SML

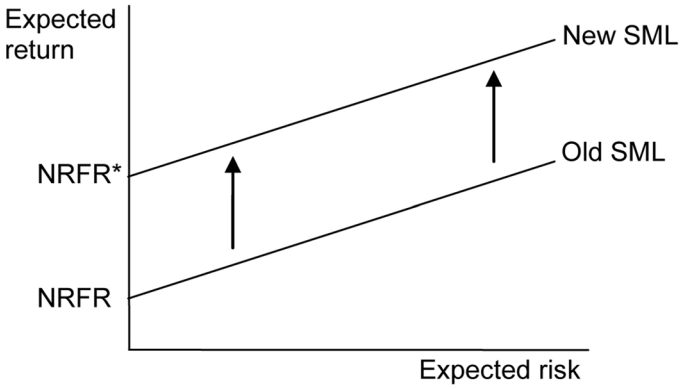
ACTIVITY

Assume the long-run growth rate of the economy increased by 1% and the expected rate of inflation increased by 4%. What would happen to the required rates of return on government bonds and common shares? Show graphically how the effects of these changes would differ between these alternative investments.

FEEDBACK

Both changes cause an increase in the required return on all investments. Specifically, an increase in the real growth rate will cause an increase in the economy's risk-free rate because of a higher level of investment opportunities. In addition, the increase in the rate of inflation will result in an increase in the nominal risk-free rate. Because both changes affect the nominal risk-free rate, they will cause an equal increase in the required return on all investments of 5%.

The graph should show a parallel shift upward in the capital market line of 5%.

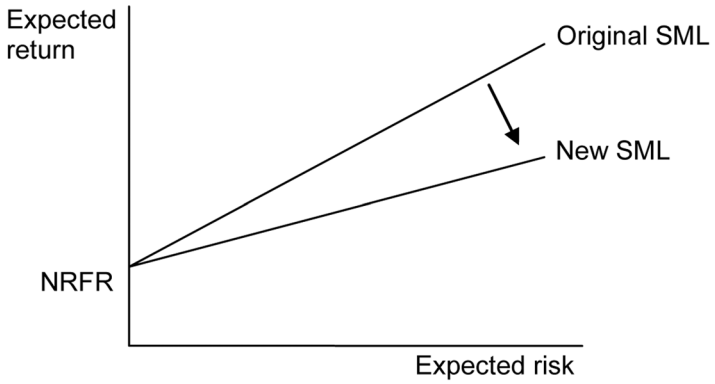


ACTIVITY

You see in the *Finance Week* that the yield spread between Baa corporate bonds and Aaa corporate bonds has gone from 350 basis points (3.5%) to 200 basis points (2%). Show graphically the effect of this change in yield spread on the SML and discuss its effect on the required rate of return for common shares.

FEEDBACK

Such a change in the yield spread would imply a change in the market risk premium because, although the risk levels of bonds remain relatively constant, investors have changed the spreads they demand to accept this risk. In this case, because the yield spread (risk premium) has declined, this implies a decline in the slope of the SML as shown in the following graph.



ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 3 in the prescribed book.

(2) Additional assessment questions:

(a) Define *Markowitz diversification*.
(b) What is meant by the term *abnormal rate of return*?
(c) List and briefly discuss the *three* forms of the efficient market hypothesis.
(d) List and discuss the role of a portfolio manager in a perfectly efficient market.
(e) Two portfolios (V and W) consist of the following assets:

	PORTFOLIO V		PORTFOLIO W	
ASSET	**Proportion (%)**	**BETA**	**Proportion (%)**	**BETA**
1	10	1,65	10	0,80
2	30	1,00	10	1,00
3	20	1,30	20	0,65
4	20	1,10	10	0,75
5	20	1,25	50	1,05

Calculate the betas of these two portfolios and state which portfolio's return is more responsive to changes in the market.

(f) Calculate the required rate of return of asset A, which has a beta of 1,5. The risk-free rate of return is found to be 7% and the return on the market portfolio of assets is 11%.

(g) What would the required rate of return for asset G be if an investor estimated the risk-free rate of return to be 4% and the market price of risk to be 1,1 for interest rate risk and 0,9 for purchasing-power risk. Furthermore, suppose that asset G has 40% more than the average amount of the interest rate risk factor combined with an average amount of purchasing-power risk of 1,0.

(h) The required annual rate of return for a company is 14.6%. The risk free rate of return is 11% per annum, and the estimated return of the market is 15%. The beta of this company is

(1) 0.40
(2) 0.90
(3) 1.00
(4) 1.30

(i) Your broker has advised you that he believes that the shares of a company is going to rise from R20 to R23 per share over the next year. You know that the annual return on the ALSI has been 11.25% and the 90-day treasury rate is 4.75% per annum. If the beta for this company is 0.95, will you purchase the share?

(1) Yes, because it is overvalued.
(2) No, because it is overvalued.
(3) No, because it is undervalued.
(4) Yes, because it is undervalued.

(j) The estimated rate of return of Company C is 22.60%. The beta is 1.6 and the standard deviation is 13%. The expected rate of return of the market is 19%. The risk free rate of return is 11%, Company C is ... .

(1) overvalued by 1.20%
(2) undervalued by 1.20%
(3) overvalued by 8.40%
(4) properly valued

(k) The variance of the market is 0.9. The Covariance of the Glen Co and the market is 0.49. Calculate the beta of the share.

(1) 0.54
(2) 0.56
(3) 1.04
(4) 1.84

(l) The Markowitz efficient frontier represents that set of portfolios (of risky investments) that have the ..... (a) ..... returns for every given level of risk, or the ..... (b) ..... risk for every level of return.

	a	b
(1)	Maximum	Maximum
(2)	Maximum	Minimum
(3)	Minimum	Maximum
(4)	Minimum	Minimum

(m) The efficient frontier represents

(a) only portfolios
(b) a portfolio of risky assets
(c) a set of portfolios with a maximum expected rate of return to a given risk
(d) single assets

(1) a, b, d
(2) a, b, c
(3) d, b, c
(4) a, b, c and d

(n) Which one of the following is not a systematic risk factor?

(1) interest rate risk
(2) market risk
(3) business risk
(4) inflation risk

Answers to additional assessment questions

(a) Markowitz diversification is an analytical procedure that involves combining assets that are less than perfectly positively correlated in order to form an efficient portfolio.

(b) Abnormal rate of return is the amount by which a security's return differs from the expected rate of return based upon the market's rate of return and the security's relationship with the market.

(c) The notion that share prices already reflect all available information is referred to as the efficient market hypothesis (EMH). It is common to distinguish among three versions of the EMH: the weak, semi-strong, and strong forms. These versions differ by their treatment of what is meant by "available information".

The *weak-form* hypothesis asserts that share prices already reflect all information that can be derived from studying past market trading data. Therefore, "technical analysis" and trend analysis, etc are fruitless pursuits. Past share prices are publicly available and virtually costless to obtain. If such data ever conveyed reliable signals about future share performance, all investors would have learned to exploit such signals.

The *semi-strong* form hypothesis states that all publicly available information about the prospects of a firm must be reflected already in the share's price. Such information includes, in addition to past prices, all fundamental data on the firm, its product, its management, its finances, its earnings, etc that can be found in public information sources.

The *strong-form* hypothesis states that share prices reflect all information relevant to the firm, even including information available to company "insiders". This version is an extreme one. Obviously, some "insiders" do have access to pertinent information long enough for them to profit from trading on that information before the public obtains it. Indeed, such trading – not only by the "insiders" themselves, but also relatives and associates – is illegal.

For weak-form or semi-strong forms of the hypothesis to be valid, the strong-form version is not required to hold. If the strong-form version were valid, however, both the semi-strong and the weak-form versions of efficiency would also be valid.

(d) Even in an efficient market, a portfolio manager would have the important role of constructing and implementing an integrated set of steps to create and maintain appropriate combinations of investment assets. Listed below are the necessary steps in the portfolio management process.

(i) The client is counselled to help him or her determine appropriate objectives and identify and evaluate constraints. The portfolio manager together with the client should specify and quantify risk tolerance, required rate of return, time horizon, tax considerations, income needs, liquidity, legal and regulatory constraints, and any unique circumstances that will impact or modify normal management procedures/goals.

(ii) Capital market expectations are monitored and evaluated. Relevant considerations such as economic, social and political conditions/expectations are factored into the decision-making process in terms of the expected risk/reward relationship for the various asset categories. Different expectations may lead the portfolio manager to adjust a client's systematic risk level even if markets are efficient.

(iii) The above steps are decisions derived from or implemented through portfolio policy and strategy setting. Investment policies are set and implemented through the choice of optimal combinations of financial and real assets in the marketplace – ie, asset allocation. Under the assumption of a perfectly efficient market, shares would be priced fairly, eliminating any added value by specific security selection. It might be argued that an investment policy which stresses diversification is even more important in an efficient market context, because the elimination of specific risk becomes extremely important.

(iv) Market conditions, relative asset category percentages and the investor's circumstances are monitored.

(v) Portfolio adjustments are made as a result of significant changes in any or all relevant variables.

(e) $$Beta_V = \left[(0{,}10 \times 1{,}65) + (0{,}30 \times 1{,}00) \times (0{,}20 \times 1{,}30) + (0{,}20 \times 1{,}10) + (0{,}20 \times 1{,}25)\right]$$
$$= 1{,}20$$

$$Beta_W = \left[(0{,}10 \times 0{,}80) + (0{,}10 \times 1{,}00) \times (0{,}20 \times 0{,}65) + (0{,}10 \times 0{,}75) + (0{,}50 \times 1{,}05)\right]$$
$$= 0{,}91$$

Portfolio V's beta is 1,20 and portfolio W's beta is 0,91. These values make sense, since portfolio V contains relatively high-beta assets and portfolio W contains relatively low-beta assets. Clearly portfolio V returns are more responsive to changes in market returns and therefore more risky than those of portfolio W.

(f) Capital asset pricing model (CAPM)

$$k_A = 7 + 1{,}5(11 - 7) = 13\%$$

(g) Arbitrage pricing theory (APT)

$$k_G = 4 + (1{,}1 \times 1{,}4) + (0{,}9 \times 1{,}0) = 6{,}44\%$$

(h) Required return = $r_f + \beta (k_m - r_f)$

$14.6 = 11 + \beta(15 - 11)$

$\beta = \frac{14.6 - 11}{4}$

(2) $\beta = 0.90$

(i) Required rate of return = 4.75 + 0.95(11.25 – 4.75)

= 4.75 + 6.175

=10.925%

HPR $= \frac{23}{20} - 1 \times 100$

= (1.15 – 1) – 100

Estimated rate of return (HPR) = 15%

Required rate of return < Estimated rate of return.

10.925% < 15%.

Therefore, the share is undervalued

(4) Yes, you will purchase the share because it is undervalued

(j) Required return (k) = $r_f + \beta (k_m - r_f)$

= 11% + 1.6(19 – 11)

= 11% + 12.80%

= 23.80

Estimated rate of return = 22.60%

Required rate of return > Estimated rate of return.

23.80% > 22.60%

23.80% – 22.60% = 1.20%

Therefore, the share is overvalued.

(1) The share is overvalued by 1.20%.

(k) beta (β) = $\frac{\text{Covariance (glen co. and market)}}{\text{Variance of market}}$

$\beta = \frac{0.49}{0.90}$

(1) $\beta = 0.54$

(l) (2) maximum returns and minimum risk

(m) (2) a, b, c. Only portfolios; a portfolio of risky assets and a set of portfolios with a maximum expected rate of return to a given risk.

(n) (3) business risk

SUMMARY

In this study unit we discussed the investment theories underlying investment analysis and portfolio management. The efficient market hypothesis, the Markowitz efficient frontier and Modern Portfolio Theory are fundamental to the study of investments. The capital asset pricing model and arbitrage pricing theory, used to determine the return required on investments dependent on the risk involved and overall market return, were introduced. In the following study unit we look at the very important concept of time value of money. You should fully understand these principles and master all the calculations before continuing with the other study units.

Study unit 4

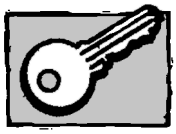
The time value of money

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- explain an interest rate as the sum of a real risk-free rate, expected inflation and premiums that compensate investors for distinct types of risk
- define and calculate nominal and effective rates
- calculate and interpret the effective annual rate, given the stated annual interest rate and the frequency of compounding
- solve time value of money problems (TVM) when compounding periods are other than annual
- calculate the present value (PV) of a perpetuity
- calculate and interpret the future value (FV) and PV of a single sum of money, ordinary annuity, annuity due, or a series of uneven/mixed cash flows
- draw a time line, specify a time index and solve problems involving the time value of money as applied, for example, to mortgages (loan amortisation) and savings for college tuition or retirement (deposits to accumulate a future sum)
- show and explain the connection between present values, future values and series of cash flows
- determine growth rates
- calculate and interpret the net present value (NPV) and the internal rate of return (IRR) of an investment



KEY CONCEPTS

Amortisation
Annual compounding
Annuity
Compounding frequency/interval
Continuous compounding
Effective interest rates
Future value
Growth rates
Internal rate of return (IRR)
Intra-year compounding
Net present value (NPV)
Nominal interest rates
Perpetuity
Present value
Series of cash flows
Single amount

OVERVIEW

In this study unit we explain the difference between nominal and effective interest rates and the way in which the compounding interval has an effect on the outcome of these rates.

The calculations of future and present values are also discussed. We look at three variations of future and present value techniques, as well as calculations that are used to determine the net present value and internal rate of return are explained.

Study chapter 4 of the prescribed book.

ACTIVITY

Solve the following five annuity-type TVM calculations using a financial calculator:

FEEDBACK

Determine how much money you will have at the end of five years if you deposit R1 000 annually at the *beginning of each* of the five years into a savings account paying 7% annual interest.

HP10B	
Input	**Function**
Begin mode	☐ BEG/END
1 000	PMT
7	I/YR
5	N
	FV
	6 153.29

Sharp EL733	
Input	**Function**
Begin mode	☐ BEG/END
1 000	PMT
7	I/YR
5	N
	COMP
	FV
	6 153.29

You want to determine the maximum that you should pay to purchase an annuity. You require a minimum return of 8% on an investment, and the annuity consists of cash flows of R700 per year for five years.

[End mode] PMT 700; I/YR 8; N 5; PV? R2 794,90

A person wishes to determine the equal annual beginning-of-year deposits required to accumulate R20 000 at the end of five years given an interest rate of 6%.

[Begin mode] FV 20 000; I/YR 6; N 5; PMT? R3 347,10

Calculate the equal annual end-of-year payments necessary to amortize a R6 000 loan over four years at 10%.

[End mode] PV 6 000; I/YR 10; N 4; PMT? R1 892,82

You can borrow R2 000 to be repaid in equal annual end-of-year amounts of R514,15 for the next five years. Calculate the interest rate on this loan.

[End mode] PMT –514,15; PV 2 000; N 5; I/YR? 9%

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 4 in the prescribed book.

(2) Additional assessment questions (assume annual compounding unless stated otherwise):

(a) You have decided to invest R100 in a savings account paying 8% interest compounded semi-annually. If you leave your money in the account for two years, what amount will you have at the end of year two?

(b) If the nominal interest rate is 8%, calculate the effective interest rate when interest is compounded:

(i) annually
(ii) semi-annually
(iii) quarterly

(c) Find the present value of R1 700 to be received eight years from now, assuming an 8% annual interest rate.

(d) A company has had the offer of receiving the following mixed stream of cash flows over the next five years:

Year	Cash flow
1	R400
2	R800
3	R500
4	R400
5	R300

If the firm earns 9% on its investments, what is the most it should pay for this opportunity?

(e) The equal annual beginning of year deposits required to accumulate R20 000 at the end of six years given an interest rate of 5%, are

(1) R2 800.33

(2) R2 940.35
(3) R3 347.10
(4) R3 547.93

(f) Gareth will receive an annuity of R4 000 a year for ten years. The first payment is to be received five years from today. At a 9% discount rate, the value of the annuity today is:

(1) R16 700
(2) R18 186
(3) R25 700
(4) R30 000

(g) Gold Resources Ltd has a required rate of return of 10%. They invest R20 000 with ABC Capital and can earn the following annual cash flows over the next 5 years.

Years	Cash inflow
	R
1	4 000
2	7 000
3	9 000
4	12 000
5	16 000

Calculate the NPV of the investment and determine the investment decision that should be taken as a result.

	NPV	Investment decision
	R	
(1)	–34 314	Investment is not acceptable
(2)	–14 314	Investment is not acceptable
(3)	14 314	Investment is acceptable
(4)	54 314	Investment is acceptable

Answers to additional assessment questions

(a) $FV = 100 \times \left(1 + \frac{0{,}08}{2}\right)^{2\times 2} = R116{,}99$

(b) (i) 8%

(ii) $i_{eff} = \left(1 + \frac{i_{nom}}{n}\right)^{n} - 1 = \left[\left(1 + \frac{0{,}08}{2}\right)^{2} - 1\right] \times 100 = 8{,}16\%$

(iii) $i_{eff} = \left(1 + \frac{i_{nom}}{n}\right)^{n} - 1 = \left[\left(1 + \frac{0{,}08}{4}\right)^{4} - 1\right] \times 100 = 8{,}24\%$

(c) $PV = \frac{1\,700}{1{,}08^{8}} = R918{,}46$

(d) $PV = \frac{400}{1{,}09} + \frac{800}{1{,}09^{2}} + \frac{500}{1{,}09^{3}} + \frac{400}{1{,}09^{4}} + \frac{300}{1{,}09^{5}} = R1\,904{,}76$

(e)

HP10B	
Input	**Function**
Begin mode	☐ BEG/END
20 000	FV
6	N
5	I
	PMT
(1)	**R2 800.33**

(f)

HP10B	
Input	**Function**
Begin mode	☐ BEG/END
4 000	PMT
10	N
9	I/YR
	PV
	R27 980.99

HP10B	
Input	**Function**
End mode	☐ BEG/END
–27 980.99	FV
5	N
9	I/YR
	PV
(2)	**R18 186**

(g)

HP10B	
Input	**Function**
–R20 000	CF_0
R4 000	CF_1
R7 000	CF_2
R9 000	CF_3
R12 000	CF_4
R16 000	CF_5
10%	I/YR
	NPV
	R14 314

(3) NPV R14 314 Investment is acceptable as it is greater than 0.

SUMMARY

This is a very important study unit as it relates to all the calculations performed in this course. Understanding the concept of time value of money will go a long way towards helping you understand and apply the valuation principles presented in following study units. The next study unit will introduce you to the principles and practices used in valuing ordinary equity shares, preference shares and bonds.

Study unit 5

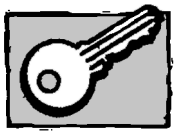
Valuation principles and practices

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- differentiate between par value, market value, book value and fair (intrinsic) value
- identify the required input variables for valuation purposes
- explain the components of an investor's required rate of return (ie the real risk-free rate, the expected rate of inflation and a risk premium)
- calculate the growth rate (g), incorporating the return on equity (ROE) and the earnings retention rate (RR)
- determine the value of a bond
- approximate and calculate the yield to maturity (YTM) of a bond
- calculate the value of preference shares and common shares using the various dividend discount models (ie no-growth, constant-growth, two-stage and three-stage models)
- use relative valuation models (ie P/E ratio, P/BV ratio, P/S ratio and P/CF ratio) for ranking shares of similar firms or firms from the same sector
- determine the value of investment trusts using the net asset value (NAV) method
- explain the determinants of the value of warrants



KEY CONCEPTS

Approximate yield
Bond
Book value
Cash flows
Constant growth model
Discount rate
Dividend discount models (DDM)
Exercise price
Fair (intrinsic) value
Growth rate
Intrinsic value
Investment trusts
Market price
Market value
Net asset value
No growth model
Ordinary shares
Par value
Preference shares
Price/book value
Price/cash flow
Price/earnings
Price/sales
Relative valuation models
Required return
Retention rate (RR)
Return on equity (ROE)
Three-stage DDM
Time to maturity
Timing
Two-stage DDM
Valuation
Warrants
Yield to maturity

OVERVIEW

Valuation refers to the process of finding the fair (intrinsic) value of an asset. In this study unit we focus on the valuation of financial assets, such as preference shares, ordinary shares, investment trusts and warrants. We also explain various models that can be used to determine the fair (intrinsic) value of the above-mentioned financial assets.

Some investors follow a "stock-picking" approach to investments. This involves using the valuation models and comparing the intrinsic value with the market value. The investment is regarded as undervalued if the intrinsic value exceeds the market value, and as overvalued if the market value exceeds the intrinsic value. The stock-picking approach therefore does not involve fundamental analysis.

Study chapter 5 of the prescribed book.

Net Asset Value

The Net Asset Value (NAV) per share is the available shareholders' funds divided by the number of shares in issue. The shareholders' funds are the net value of all the company's assets having deducted liabilities.

If the share price of an investment trust is lower than the NAV per share, the trust is *trading at a discount*. The discount is shown as a percentage of NAV. This may represent a good *buying opportunity*. If the share price of an investment trust is higher than the NAV per share, the trust is *trading at a premium*. The premium is shown as a percentage of the NAV. This may represent a good *selling opportunity*.

ACTIVITY

Assume Genbel Ltd has issued 143 380 ordinary shares and that the firm's shares are trading at **R10** each. The firm's total assets amount to R2 800 000 and its total liabilities to R850 000. Further assume that investment trust companies similar to Genbel normally trade at a discount of 20% to NAV.

FEEDBACK

The NAV of Genbel shares is calculated as follows:

$$NAV = \frac{\text{Total assets} - \text{Total liabilites}}{\text{Number of issued shares}} = \frac{2\,800\,000 - 850\,000}{143\,380} = R13{,}60$$

The shares are trading at R10 per share, representing a discount of R(13.60–10) = R3.60 p/s.

Therefore, the shares are trading at a discount of 26,47% (3,60/13.60) to NAV, compared to similar companies trading at a discount of only 20% to NAV.

At a NAV of 13,60 and a discount of 20% regarded as the norm, the share should trade at R(13.60x0,80) = R10.88 and not R10 per share.

The NAV indicates that the share is undervalued and offers an opportunity to buy.

ACTIVITY

Lonfin Ltd has issued 10 million ordinary shares, and the firm's shares are trading at R5.50 each. The firm's total assets amount to R100 million and its total liabilities to R60 million. Further assume that investment trust companies similar to Lonfin normally trade at a **premium** of 20% to NAV.

FEEDBACK

The NAV of Lonfin shares is calculated as follows:

$$NAV = \frac{\text{Total assets} - \text{Total liabilites}}{\text{Number of issued shares}} = \frac{100 - 60}{10} = R4$$

The shares are trading at R5.50 p/s, representing a discount of R(5,50–4) = R1.50 p/s.

Therefore, the shares are trading at a premium of 37.5% (1,5/4) to NAV, compared to similar companies trading at a premium of only 20% to NAV.

At a NAV of 4 and a premium of 20% being regarded as the norm, the share should trade at R(4x1.2) = R4.80 and not at R5.50 per share.

The NAV indicates that the share is overvalued and offers an opportunity to sell.

ASSESSMENT

(1) Answer the self-assessment questions at the end of chapter 5 in the prescribed book.

(2) Additional assessment questions:

   (a) What are three key inputs when calculating the present value of any asset?
   (b) A firm has a return on equity of 16%. The dividend payout ratio (DPR) of this firm is 25%. What is the growth rate of this firm?
   (c) Approximate the yield to maturity for a bond that pays an 8% coupon rate annually on its R1 000 face value, matures in 4 years and is selling for R967.59.
   (d) Consider a share that has an annual cash dividend of R5 per share for next year and an average growth rate of 2% per year in its cash dividends. Assume that this share is in a risk class requiring a 10% per year rate of return to attract investors. Calculate this share's present value by using the constant growth dividend discount model (DDM).
   (e) A share is expected to pay a dividend of R1 one year from now with growth at 5% thereafter. In the context of a dividend discount model, the share is correctly priced today at R10. Determine the value of the share two years from now according to the single stage, constant growth dividend model, if the required return is 15%.

(f) Calculate the fair (intrinsic) value of a share with a constant earning of R1 per share and a required rate of return of 10%.

(g) A firm has issued 20 million ordinary shares. The firm's total liabilities amount to R120 million and the total assets amount to R200 million. The firm's shares are trading at R6 each. Investment trust companies similar to this firm normally trade at a premium of 20% to net asset value (NAV). Calculate the NAV of this firm and relate it to its market price.

(h) A company issued 8.5% preference shares at R80 each. Determine the intrinsic value of a preference share, assuming a 6.5% required rate of return.

(1) R 94.12
(2) R104.62
(3) R123.08
(4) R130.77

(i) An investor in Fun Ltd's ordinary share expects it to pay annual cash dividends of R2.00 and R2.30 per share during the next two years. This investor plans to sell the share for R33 at the end of the second year, after collecting the two dividends. Fun Ltd's required rate of return is 10%. Calculate the present value of this share.

(1) R25.00
(2) R30.99
(3) R33.60
(4) R37.30

(j) A company has a beta of 1.3, while the market return equals 18% and the risk-free rate of return equals 12%. The company is expected to pay a dividend of R10.89 next year, with no further growth anticipated. Determine the value of the firm's ordinary shares

(1) R36.25
(2) R55.00
(3) R60.50
(4) R90.75

(k) A firm has a current price of R40 a share, an expected growth rate of 11% and expected dividend per share (D_1) of R2. Given its risk, you have a required rate of return for the share of 12%. Your expected rate of return and investment decision is as follows:

(1) 14% – do not buy
(2) 16% – do not buy
(3) 14% – buy
(4) 16% – buy

(l) The following information on a company is available:

Return on equity (ROE)	18%
Required rate of return	12%
Expected earnings (E_1)	R7 per share
Expected dividends (D_1)	R3.85
Market price	R95

The current value per share of this company is closest to

(1) R96.70
(2) R97.70
(3) R98.70
(4) R99.70

(m) Themba Modise is an analyst of Investment Holdings. He collected information about Fin Ltd.

A retention ratio of 40% is projected to continue into the future. ROE is 12% and it has a beta of 1.2. The risk free rate is 6% and the expected market return is 11%.
If Themba believes next year's earnings (E_1) will be R4.00 per share, what value should be placed on this share?

(1) R22.64
(2) R26.67
(3) R33.33
(4) R45.45

Answers to additional assessment questions

(a) cash flows, timing and the discount rate

(b) $$g = ROE \times RR = ROE \times (1 - DPR)$$
$$= 16 \times (1 - 0{,}25) = 12\%$$

(c) $$AY = \frac{I + (M - DB_0)/n}{(M + DB_0)/2} = \frac{80 + (1000 - 967{,}59)/4}{(1000 + 967{,}59)/2} = 8{,}96\%$$

(d) $$P_0 = \frac{D_1}{k - g} = \frac{5}{(0{,}10 - 0{,}02)} = R62{,}50$$

(e) $$P_0 = \frac{D_1(1 + g)^2}{k - g} = \frac{1(1{,}05)^2}{(0{,}15 - 0{,}05)} = R11{,}03$$

(f) $$V = \frac{E}{k} = \frac{1}{0{,}10} = R10$$

(g) $$NAV = \frac{\text{Total assets} - \text{Total liabilites}}{\text{Number of issued shares}} = \frac{200 - 120}{20} = R4$$

The shares are trading at R6 per share, representing a premium of R(6–4) = R2 per share.

Therefore, trading at a premium of 50% (2/4) to NAV, compared to similar companies trading at a premium of only 20% to NAV.

At a NAV of 4 and a premium of 20% regarded as the norm, the share should trade at R(4x1,2) = R4.80 and not R6 per share.

The NAV indicates that the share is overvalued and offers an opportunity to sell.

(h) $V_p = \frac{D_p}{kp}$

$D_p = 0.085 \times R80$

$= R6.80$

$= \frac{6.80}{0.065}$

(2) = R104.62

(i) Two-stage dividend discount model:

$D_1 = R2.00$

$D_2 = R2.30$

$P_2 = R33$

Required rate of return (k) = 10%

$$\text{Value of the share} = \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{P_2}{(1+k)^2}$$

$$= \frac{2.00}{(1.10)^1} + \frac{2.30}{(1.10)^2} + \frac{33}{(1.10)^2}$$

$$= 1.8182 + 1.9008 + 27.2727$$

(3) V = R30.99

(j) No-growth model: $V = \frac{E}{k}$

Required return $(k) = r_f + \beta (k_m - r_f)$

$= 12 + 1.3 (18 - 12)$

$= 12 + 7.80$

$= 19.80\%$

$V = \frac{10.89}{0.198}$

(2) = R55

(k) $E(r) = \frac{D_1}{Po} + g$

$= \frac{2}{40} + 0.11$

$= 0.05 + 0.11$

$= 16\%$

(4) The expected rate of return is 16%, which is greater than the required rate of return of 12%. Therefore you should buy the share.

(l) Payout ratio $= \frac{D_1}{E1}$

$= \frac{3.85}{7} = 55\%$

Retention ratio = 1 – payout ratio

= 1 – 0.55

= 45%

Growth (g) = Retention ratio × ROE

= 0.45 × 8%

= 10%

Required rate of return (k) = 12%

$Po = \frac{D_1}{k - g}$

$= \frac{3.85}{0.12 - 0.081}$

$= \frac{3.85}{0.039}$

(3) Po = R98.70

(m) Retention ratio (RR) = 40%

ROE = 12%

Growth (g) = RR × ROE

= 0.4 × 12%

= 4.80%

Required return $= r_f + \beta (k_m - r_f)$

$= 6 + 1.2 (11 - 6)$

$= 6 + 6$

= 12%

E_1 = R4.00

D_1 = payout ratio × E_1 Where payout ratio = 1 – retention ratio

= 1 – 0.40

= 0.60

D_1 = 0.60 × R4.00

= R2.40

$Po = \frac{D_1}{k - g}$

$= \frac{2.40}{0.12 - 0.048}$

$= \frac{2.40}{0.072}$

(3) Po = R33.33

SUMMARY

In this study unit you were introduced to the basic valuation principles and practices applied in other chapters of the prescribed book. Next, we look at the process employed to discover undervalued securities, namely fundamental analysis, featuring the three-step valuation approach.

Study unit 6

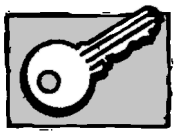
Fundamental analysis

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- define fundamental analysis
- explain the three-step valuation process (top-down approach to the security valuation process) and its underlying logic
- explain the three methods which may be used for economic forecasting
- explain the key macro-economic variables which need to be analysed for the purpose of fundamental analysis
- explain briefly the concept of industry analysis
- explain briefly the concept of company analysis



KEY CONCEPTS

Balance of payments
Budget deficit
Company analysis
Consumer price index (CPI)
Economic forecasting
Exchange rates
Forecasting models
Fundamental analysis
Gross domestic product (GDP)
Gross national product (GNP)
Industry analysis
Inflation
Interest rates
Leading economic indicators
Macroeconomic analysis
Market signals
Production price index (PPI)
Repo rate
Reserve requirements
Three-step valuation process
Top-down approach
Unemployment rates

OVERVIEW

Fundamental analysis refers to the three step, top-down approach to investment decisions. In this study unit we explain these steps by means of macroeconomic analysis and its relationship to industry and company analysis.

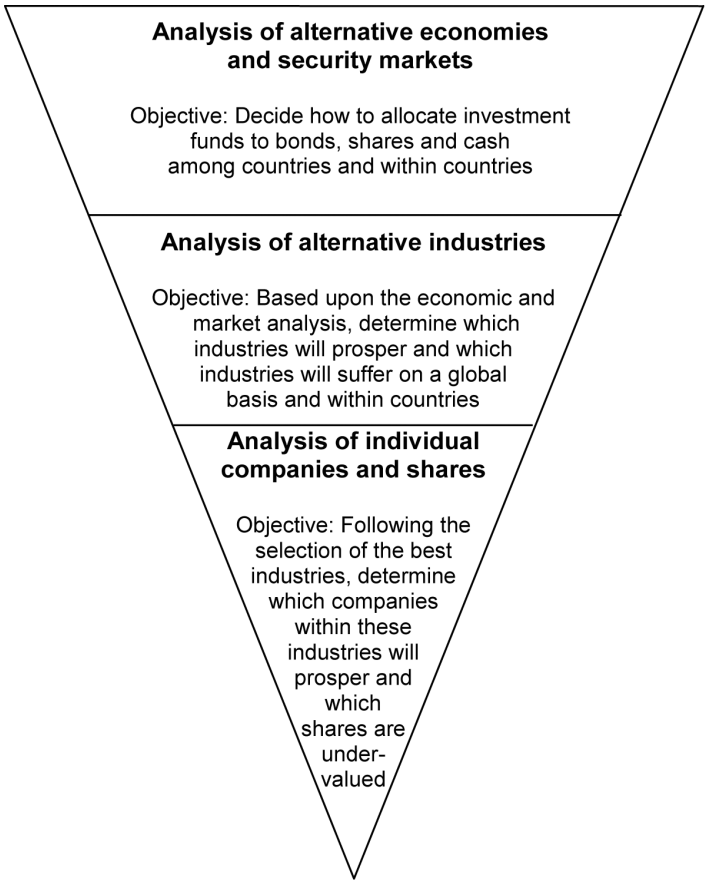


FIGURE 6.1

Three-step valuation process of fundamental analysis

In this study unit the top part of figure 6.1, namely the analysis of macroeconomic factors is discussed. As mentioned earlier, this is the first step in fundamental analysis. The second step (industry analysis) in chapter 7 of the prescribed book, and the third step (company analysis) in chapters 8 and 9 of the prescribed book, will be discussed in topic 2, study units 7, 8 and 9.

Study chapter 6 of the prescribed book.

ACTIVITY

Discuss the difference between the top-down and bottom-up approaches. What is the major assumption that causes the difference in these two approaches?

FEEDBACK

The top-down valuation process begins by examining the influence of the general economy on all firms and the security markets. The next step is to analyse the various

industries in light of the economic environment. The final step is to select and analyse the individual firms within the superior industries and the common shares of these firms. The top-down approach thus assumes that the first two steps (economy-market and industry) have a significant influence on the individual firm and its shares (the third step). In contrast, the bottom-up approach assumes that it is possible to select investments (ie firms) without considering the aggregate market and industry influences.

ACTIVITY

Go onto the website of the South African Reserve Bank (http://reservebank.co.za), Statistics South Africa (http://www.statssa.gov.za) and other relevant bodies to find the latest macroeconomic data.

Browse through these websites and try to find information on the gross domestic product (GDP), interest rates, inflation rate, budget deficit, balance of payments, exchange rates and unemployment rate.

FEEDBACK

Indicator	***Value***	***Latest period***
Real GDP growth rate	–3.0%	*Jun, 2009*
Gross saving as % of GDP	16.5%	*Jun, 2009*
Foreign debt as % of GDP	25.9%	*2008*
National government balance as % of GDP (Fiscal year)	–0.6%	*Dec, 2008*
Current account balance (R millions, seasonally adjusted at annual rate)	–73105.00	*Jun, 2009*
M3	0.58	*Nov, 2009*
Claims on the domestic private sector	–1.59	*Nov, 2009*
Import cover (weeks)	20.71	*Jun, 2009*

Source: SARB

Reserve Bank Quarterly Bulletin No 254, December 2009

The global economy, reflecting the impact of sustained fiscal and monetary stimulation on an unprecedented scale displayed clear signs of revival in the third quarter of 2009. Following three consecutive quarters of contraction, South Africa's **real gross domestic product** resumed positive growth in the third quarter of 2009.

The weakness in economic activity was reflected in **employment levels**, which contracted significantly during the year to the third quarter of 2009. Formal job losses were concentrated in the private sector, whereas employment in the public sector continued to rise, thereby moderating the impact of cyclical forces.

Price inflation slowed significantly against the background of an economy operating significantly below capacity, with greater price discipline further reinforced by subdued credit extension and a significant appreciation of the external value of the rand. In October 2009 the targeted rate of consumer price inflation slowed to 5,9 per cent – the first time it fell within the target range of 3 to 6 per cent after a period of 30 months in which it continuously exceeded the target.

With the global economy showing signs of recovery, South African export volumes edged higher while the upward trend in the international prices of gold, platinum and other export commodities gave further support to export revenues in the third quarter of 2009. At the same time, the volume of merchandise imports declined slightly as real gross domestic expenditure inched lower. A moderate increase in net service, income and current transfer payments to the rest of the world and a marginal deterioration in the terms of trade were recorded simultaneously. Reflecting these offsetting forces, the deficit on the current account of the balance of payments remained broadly unchanged from the second to the third quarter of 2009 at levels slightly above 3 per cent of gross domestic product.

With international investors' appetite for investment in emerging-market economies improving further, the financial account of the **balance of payments** registered a further sizeable surplus in the third quarter of 2009. Foreign portfolio investors significantly raised their holdings of South African equities during the quarter concerned.

The overall size of the banking sector's balance sheet stagnated over the past year, reflecting subdued economic conditions, low business and consumer confidence, and increased caution on the side of the banks in the extension of loans. Over the twelve months to October 2009, bank loans and advances to the domestic private sector contracted slightly in nominal terms, while the twelve-month rate of growth in the M3 **money supply** was barely positive. However, in recent months a number of banks have adopted less stringent criteria than before in the evaluation of certain types of loan applications.

The Monetary Policy Committee (MPC) of the South African Reserve Bank (the Bank) started reducing the **repurchase rate** in December 2008 and by mid-2009 had reduced the policy rate by a cumulative total of 450 basis points. In August 2009 the MPC, mindful of the large output gap that reinforced the view that inflation would moderate further, reduced the repurchase rate by a further 50 basis points to 7 per cent …

Government's strong anti-cyclical fiscal stance was reconfirmed in the October 2009 *Medium Term Budget Policy Statement* with the announcement of a projected 2009/10 **budget deficit** of 7,6 per cent of gross domestic product, roughly double the estimate of the deficit contained in the February *Budget Review*. The intensity of the recession and resultant contraction in tax revenue gave rise to the larger deficit, which could be afforded for a while because the government had worked down its indebtedness during the preceding economic upswing, thereby creating fiscal room for manoeuvre to be used in difficult times.

(Our emphasis)

Source: SARB

Main key indicators:

- **CPI** November 2009 = +5,8% y/y
- **PPI** November 2009 = –1,2% y/y
- **GDP** 3rd quarter 2009 +0,9% q/q
- **Unemployment** 24.5% 3rd Quarter 2009
- **Population** (Census 2001) 44,8 million Night of October 9–10, 2001
- **Population** (Mid-year estimate) 49,32 million Mid-2009

Source: StatsSA

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 6 in the prescribed book.
(2) Additional assessment questions:

(a) Provide a summary of what fundamental analysis involves.
(b) Describe the differences between fundamental and technical analysis.
(c) A restrictive monetary policy leads to

(1) higher taxes, decreased consumption and higher imports
(2) lower interest rates, increased consumption and higher net exports
(3) higher interest rates, decreased consumption and higher net exports
(4) lower interest rates, increased consumption and an appreciation of the domestic currency

Answers to additional assessment questions

(a) Fundamental analysis involves a process consisting of:

- an analysis of the macroeconomic environment (aggregate market analysis)
- industry analysis
- company analysis and valuation

The aim of fundamental analysis is to identify companies that are offering value. A share offers value when its intrinsic value is higher than the market value.

An investment analyst would have to decide on a forecast period and focus on factors that will influence the profitability of companies. The first step in a top-down approach would be the analysis of the macroeconomic environment.

- The analysis of the macroeconomic environment

Most of the systematic risk factors have their origin in the macroeconomic environment. The systematic risk factors influence the various industries and firms to a greater or lesser extent. Examples of macroeconomic factors are the fiscal policy (such as changes in tax legislation) and monetary policy (such as changes in interest rates).

An important aspect of the macroeconomic environment for the purpose of fundamental analysis is to estimate the gross domestic product (GDP). GDP measures national economic activity generated domestically.

GDP could be analysed in terms of the business cycle. The business cycle refers to the fluctuations in the general level of economic activity. The business cycle may be approaching an expansion, peak, contraction, recession or depression

during the forecast period. During an expansion GDP grows rapidly, business sales increase and unemployment declines. During a peak most businesses are functioning close to full capacity and real GDP is growing rapidly. During contraction the sales of most businesses are declining, real GDP grows at a slow rate or declines and unemployment increases. A recession may be regarded as a period during which real GDP has declined for at least two successive quarters. A depression may be regarded as a prolonged and severe recession.

From the GDP estimate it should be possible to determine the contribution or share of each industry. GDP is generally indicative of industry sales although the exact relationship will vary between industries.

- Industry analysis

Future years' sales can be predicted by projecting:

– industry sales as a whole by taking the projections of macro-economic conditions and industry characteristics into account, and
– the firm's market share based on an evaluation of the strengths and weaknesses of competitors within an industry.
– Various techniques may be used for industry analysis, such as:

  - industry competitiveness (using Porter's model)
  - industry life cycles
  - input-output analysis
  - statistical techniques (for example regression analysis), which may be used for the above-mentioned projections.

- Company analysis and valuation

Company analysis should enable the investment analyst to distinguish between good companies and good shares. A company may have good growth prospects, but if this is already recognised in its share price, then one has not found a good share to invest in.

The final step in fundamental analysis would be to select and apply appropriate valuation models to determine the range within which the share should be trading.

(b) Difference between fundamental and technical analysis.

Fundamental analysis	**Technical analysis**
Macroapproach (top-down) studying the macroeconomic situation, the industry and the individual company	Microapproach, looking at the company first, then industry and finally the economic prospects
Future orientated, but includes financial statement analysis in order to determine certain relationships for prediction purposes	Uses past performance to predict future movements
Uses mainly economic data	Uses market data

Fundamental analysis	Technical analysis
Price adjustments (in reaction to new information) are abrupt due to the random nature of information received	Gradual adjustments (based on the assumption that information filters gradually into the market).
Assumes a strong form of market efficiency	Assumes a weak form of market efficiency
Believes share prices move in a random manner as new information becomes available	Believes that share prices move in trends

(c) (3) Higher interest rates, decreased consumption and higher net exports

SUMMARY

This study unit explained the first step of fundamental analysis. The second step, industry analysis, in chapter 7 of the prescribed book and the third step, company analysis and valuation, in chapters 8 and 9 of the prescribed book, will be discussed in topic 2, study units 7, 8 and 9.

Topic 2

EQUITY ANALYSIS

AIM

The aim of this topic is to explain the second (industry analysis) and third (company analysis) steps of fundamental analysis and to discuss technical analysis.

The value of any security lies at the heart of investing and constructing a portfolio consistent with risk-return objectives. Only once the intrinsic value has been determined can it be compared with the market value in order to determine if the asset is under- or overvalued.

The theory and practice of estimating the value of equity investments are explained.

TOPIC LEARNING OUTCOMES

Once you have worked through this topic, you should be able to:

- explain industry analysis as the second step in fundamental analysis
- explain company analysis and company valuation as the third step in fundamental analysis
- explain technical analysis

TOPIC CONTENT

Study unit 7: Industry analysis
Study unit 8: Company analysis
Study unit 9: Company valuation
Study unit 10: Technical analysis

Study unit 7

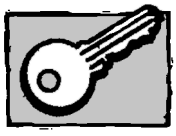
Industry analysis

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- explain the effect of the global economy on local industries
- explain the effect of exchange rates on imported and domestically produced goods
- relate the importance of the domestic economy and macroeconomic environment to industry analysis
- explain how the business cycle may influence industry sectors
- define cyclical indicators and explain the significance and use of each
- explain the methods used in determining the reference turning point of the business cycle in South Africa
- define an industry and industry analysis
- elaborate on the sensitivity of a company's earnings to the business cycle with reference to sales, operating leverage and financial leverage
- describe the industry life cycle and identify an industry's stage in its life cycle
- describe the five determinants of competition (Michael Porter's industry forces model)
- define and elaborate on the three competitive strategies (ie strategic groups, Porter's generic competitive strategies and SWOT analysis)



KEY CONCEPTS

Bargaining power
Business cycles
Coincident indicators
Competitive forces
Competitive strategies
Composite business cycle
Consolidation stage
Cost leadership
Differentiation
Diffusion index
Domestic economy
Exchange rates
Focus strategy
Generic strategies
Global economy
Industry
Industry analysis
Industry forces model
Industry life cycle
Lagging indicators
Leading indicators
Maturity stage
New entrants
Reference turning point
Relative decline
Rivalry
Start-up stage
Statistical results
Strategic groups
SWOT analysis

OVERVIEW

Industry analysis forms part of fundamental analysis and extends investment analysis by studying the influence of macroeconomic forces on particular industries. It also provides the investment analyst with information about the competitive forces that will have an impact on the risk and return of companies in these industries.

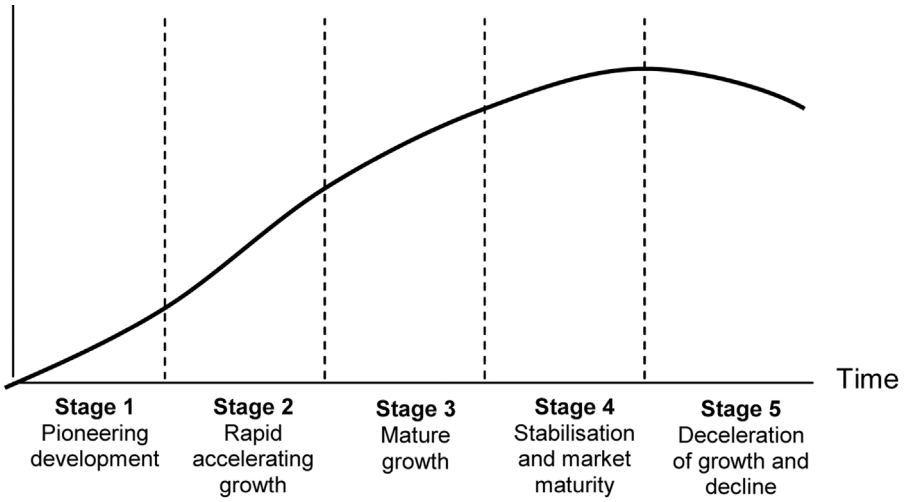
In this study unit we look at the role of competitive forces in an industry, such as rivalry in the industry, the threat of new entrants, the bargaining power of suppliers and customers, as well as the threat of substitute products. Competitive strategies such as cost leadership and differentiation are also explained.

Study chapter 7 of the prescribed book.

ACTIVITY

Discuss an alternative industry life cycle model to the one presented on pages 94 and 95 of the prescribed book.

FEEDBACK



(1) *Pioneering development.* During this start-up stage, industry experiences modest sales growth and very small or negative profit margins and profits. The market for the industry's product or service during this time is small, and the firms involved incur major development costs.

(2) *Rapid accelerating growth.* During this rapid growth stage, a market develops for the product or service and demand becomes substantial. The limited number of firms in the industry faces little competition, and individual firms experience substantial backlogs. The profit margins are very high. The industry builds its productive capacity as sales grow at an increasing rate as the industry attempts to meet excess demand. High sales growth and high profit margins that increase as firms become more efficient cause industry and firm profits to explode. During this phase, profits can grow at over 100% a year as a result of the low earnings base and the rapid growth of sales and net profit margins.

(3) *Mature growth.* The success in stage 2 has satisfied most of the demand for the industry goods or services. Thus, future sales growth may be above normal but it no longer accelerates. For example, if the overall economy is growing at 8%, sales for this industry might grow at an above normal rate of 15% to 20% a year. Also, the rapid growth of sales and the high profit margins attract competitors to the industry, which causes an increase in supply and lower prices, which means that the profit margins begin to decline to normal levels.

(4) *Stabilisation and market maturity.* During this stage, which is probably the longest phase, the industry growth rate declines to the growth rate of the aggregate economy or its industry segment. During this stage, investors can estimate growth easily because sales correlate highly with an economic series. Although sales grow in line with the economy, profit growth varies by industry because the competitive structure varies by industry and by individual firms within the industry because the ability to control costs differs among companies. Competition produces tight profit margins, and the rates of return on capital (e.g. return on assets, return on equity) eventually become equal to or slightly below the competitive level.

(5) *Deceleration of growth and decline.* At this stage of maturity, the industry's sales growth declines because of shifts in demand or growth of substitutes. Profit margins continue to be squeezed and some firms experience low profits or even losses. Firms that remain profitable may show very slow rates of return on capital. Finally, investors begin thinking about alternative uses for the capital tied up in this industry.

Although these are general descriptions of the alternative life cycle stages, they should help you identify the stage your industry is in, which should in turn help you estimate its potential sales growth. Obviously, everyone is looking for an industry in the early phases of stage 2 and hopes to avoid stage 4 or stage 5. Comparing the sales and earnings growth of an industry to similar growth in the economy as a whole should help you identify the industry's stage within the industrial life cycle.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 7 in the prescribed book.

(2) Additional assessment questions:

(a) Assume all the firms in a particular industry have consistently experienced similar rates of return. Discuss what this implies regarding the importance of industry analysis and company analysis for this industry.

(b) Discuss the contention that differences in the performance of various firms within an industry limit the usefulness of industry analysis.

(c) Discuss the impact of the threat of substitute products on the steel industry's profitability.

(d) Discuss at what stage in the industry life cycle you would like to discover an industry. Justify your decision.

(e) Assume the industry you are analysing is in the fourth stage of the industrial life cycle. How would you react if your industry-economic analysis predicted that sales per share for this industry would increase by 20%? Discuss your reasoning.

(f) Give an example of an industry in stage 2 of the industrial life cycle.

(g) An industry is currently growing at twice the rate of the overall economy. New competitors are entering the industry and the formerly high profit margins have begun to decline. The life cycle that best characterises this industry is

(1) mature growth

(2) pioneering development
(3) rapid accelerating growth
(4) stabilisation and market maturity

(h) Which of the following is TRUE about the focus competitive strategy?

(1) Price reduction can protect new entrants.
(2) Perceived quality insulates company from threats.
(3) Customer loyalty protects new entrants and substitute products.
(4) New product features are only added after the market demands them.

Answers to additional assessment questions

(a) A greater emphasis must be placed upon industry analysis when the performances of the individual firms cluster around the industry performance. In contrast, once the industry performance is estimated, the need for individual firm analysis is reduced since all firms will behave similar to the industry.
(b) Disagree. Although studies have shown a significant dispersion of individual firm performance within a given industry, they have also found that the industry component could partially explain individual firm performance. Although the strength of the industry component varies among industries, industry analysis is an important step before proceeding to the company analysis. The important implication is that individual company analysis would be relatively more important for industries where individual company returns were widely dispersed. The point is that the dispersion among companies within industries indicates a need for company analysis after industry analysis.
(c) A substitute product for steel would limit the prices that firms in that industry could charge. The degree of limitation would depend on how close the substitute product was in price and function to steel.
(d) As an investor, you would like to discover a firm which is just entering the rapid accelerating growth stage. During this stage, a firm will experience high sales growth, high profit margins and little competition.
(e) The fourth stage of the industrial life cycle is stabilisation and market maturity. During this stage, sales grow in line with the economy. If sales per share for an industry in this stage of the life cycle were predicted to increase by 20%, this would imply a growth rate of the aggregate economy of 20%. A sales growth rate of 2% is high for an industry in the fourth stage of the industrial life cycle.
(f) An industry that experienced the kind of explosive growth characteristics of stage two (rapid accelerating growth) was the internet-related industry in the late 1990s.
(g) (1) mature growth
(h) (3) Customer loyalty protects new entrants and substitute products.

SUMMARY

This study unit focused on the second step in the fundamental analysis process, namely industry analysis. Having determined the most promising industry, we now have to identify the company expected to outperform within that industry. Study unit 8 will introduce you to the financial statements of a company and the financial ratios and information derived from those statements.

Study unit 8

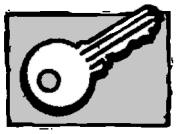
Company analysis

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- distinguish between capital costs and operational/revenue costs
- describe the format of the income statement and describe the components of net income
- describe the format and the components of the balance sheet and the format, classification and use of each component of the statement of shareholders' equity
- identify the types of important information for investment decision making presented in the statement of cash flows
- classify a particular transaction or item as cash flow from (1) operations, (2) investing or (3) financing
- distinguish between statistical analysis, subjective analysis and ratio analysis
- calculate, interpret and discuss the uses of measures of a company's liquidity, debt management (solvency), asset management (operating performance/activity), profitability and market value
- calculate and interpret the various components of the company's return on equity using the DuPont model
- define leasing, state the advantages of leasing and distinguish between operating leases and capital leases



KEY CONCEPTS

Asset management ratios
Balance sheet
Capital lease
Cash flow
Cash flow statement
Debt management ratios
DuPont model
Financing cash flows
Income statement
Investment cash flows
Liquidity ratios
Market value ratios
Operating cash flows
Operating lease
Profit
Profitability ratios
Ratio analysis
Return on equity
Solvency ratios
Statistical analysis
Subjective analysis

OVERVIEW

Financial statements are a major source of information about a company's shares and/or debentures. In this study unit, we look at the income statement, the balance sheet, the statement of changes in equity and the cash flow statement as financial statements. This is followed by a discussion of the financial ratios used to answer important questions about a firm's profitability, liquidity, risk profile and growth potential. The financial statements of a firm are intended to reflect the financial position of that firm. The financial statements consist of four basic statements:

- income statement
- balance sheet
- statement of changes in equity
- statement of cash flows

Study chapter 8 of the prescribed book.

ACTIVITY

Construct a basic framework for each of the financial statements of a firm.

FEEDBACK

Income statement

The income statement provides a financial summary of the firm's operating results during a certain period, usually the financial year. The income statement measures the flows of revenues and expenses during an interval of time.

Framework of the INCOME STATEMENT

Revenue (Sales)
Cost of sales

Gross profit
Other operating income
Selling, general and administrative expenses
Other operating expenses

EBITDA *(Earnings before Interest, Tax, Depreciation and Amortisation)*
Depreciation and amortisation

Profit from operations (Operating income)
Non-operating income and expenses

EBIT *(Earnings before Interest and Taxes)*
Finance cost (interest paid)

Profit before tax (PBT/EBT)
Income tax expense

Profit after tax (PAT/EAT)
Minority interest

Net profit from ordinary activities
Extraordinary items
Net profit for the year (Net income – NI)

Balance sheet

The balance sheet is a summary of the firm's financial position on a given day, usually the last day of the financial year. The date of the balance sheet is the last day of the period covered by or relating to the income statement.

Framework of the BALANCE SHEET

ASSETS

Non-current assets

Property, plant and equipment
Goodwill
Investments

Current assets

Inventories
Trade and other receivables
Cash and cash equivalents

TOTAL ASSETS

EQUITY AND LIABILITIES

Capital and reserves

Issued capital

– Ordinary shares
– Preference shares

Non-distributable reserves
Distributable reserves
Accumulated profits/retained earnings

Minority interest

Non-current liabilities
Debentures
Long-term loans

Current liabilities

Trade and other payables
Bank overdraft
Tax payable
Shareholders for dividend

TOTAL EQUITY AND LIABILITIES

Statement of changes in equity (retained earnings)

The statement of changes in equity reconciles the net income earned during a certain year, less any dividends paid, with the change in accumulated profits between the total of a particular year and that of the previous year.

Framework of the STATEMENT OF CHANGES IN EQUITY

	Ordinary shares	Preference shares	Non-distributable reserves	Distributable reserves	Accumulated profits	TOTAL
Balance (beginning)						
Net profit for the year						
Ordinary dividend						
Preference dividend						
Transfer to/from reserves						
Issue/redemption of shares						
Balance (ending)						

The cash flow statement

The cash flow statement is required to show the flow of cash through the firm's business affairs. The form and extent of a cash flow statement will depend largely on the circumstances of the individual firm, ie, the kind of industry in which the firm is operating and the risk involved. In general, the cash flow statement would include the following items:

- cash generated by operating activities, namely:
  - — cash generated from operations
  - — investment income
  - — changes in the non-cash components of working capital, for example, changes in inventory or accounts receivable
- cash expended on interest and tax
- cash expended on rewards to shareholders
- changes in cash arising from financing activities which relate to cash in long-term debt in the capital structure and to the issuing of shares to raise long-term funds

Framework of the CASH FLOW STATEMENT

Cash flow from operations (CFO)	+/-	xx
Cash flow from investing (CFI)	+/-	yy
Cash flow from financing (CFF)	+/-	zz
Equals change in the cash account	=	Cash
Plus beginning of period cash	+	Beginning cash
Equals ending cash balance	=	Ending cash

Cash flow from operations – Direct method

Step 1:	Net sales	
	+/–	Changes in accounts receivable
	+	Other cash collections (interest and dividends)
	=	**Cash collections** and other receipts
Step 2:	Cost of goods sold	
	+/–	Changes in inventory
	+/–	Changes in accounts payable
	=	**Direct cash inputs** and costs
Step 3:	Cash expenses (other cash flows)	
	+	Cash taxes paid
	+	Cash interest paid
	=	**Other cash outflows** and costs

Cash flow from operations using the direct method is a summary of steps 1 – 3.

CFO =	+	Step 1: Cash collections
	–	Step 2: Direct cash inputs
	–	Step 3: Other cash outflows
	=	**Cash flow from operations**

Cash flow from operations – Indirect method

Net income

Adjusted for:

+ Non-cash expenses or losses

– Non-cash revenues or gains (eg depreciation)

Adjust for changes in working capital:

+ Decreases in operating asset accounts (*source*)

– Increases in operating asset accounts (*use*)

+ Increases in operating liability accounts (*source*)

– Decreases in operating liability accounts (*use*)

= **Cash flow from operations**

Cash flow from investing

Capital expenditures for long-term assets

Proceeds from the sale of assets

Investments in joint ventures/affiliates/securities (long term)

Cash flow from financing

Additional debt (short/long term) and equity financing

Dividends paid (flows through changes in equity statement)

Additional debt (short/long term) and equity financing

Dividends paid (flows through changes in equity statement)

The purpose of the cash flow statement is to provide interested parties with information on the sources and uses of all financial resources during a financial period or year. The most important reason for drawing up the cash flow statement is to provide a clearer picture of a firm's liquidity position. The following table provides a simple guide to determining what a source of cash and what a use of cash are.

Source of cash	Use of cash
Decrease in any asset	Increase in any asset
Increase in any liability	Decrease in any liability
Earnings before interest and tax (EBIT)	Operating loss (-EBIT)
Depreciation	Cash dividends paid
Issuing of shares	Taxation paid

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 8 in the prescribed book.

(2) Additional assessment questions:

(a) Use the following information for questions (i) to (iv):

Roberts Manufacturing Balance Sheet December 31, 2006 (R'000)			
Cash	200	Accounts payable	205
Receivables	245	Notes payable	425
Inventory	625	Other current liabilities	115
Total current assets	1 070	Total current liabilities	745
Net non-current assets	1 200	Long-term debt	420
		Common equity	1 105
TOTAL ASSETS	2 270	TOTAL LIABILITIES AND EQUITY	2 270

Roberts Manufacturing Income Statement for the year ended December 31, 2006 (R'000)	
Sales	2 400
Cost of goods sold	1 834
Gross profit	556
Selling expenses	175
General and administrative expenses	216
Earnings before interest and taxes (EBIT)	175
Less: Interest expense	35
Earnings before taxes (EBT)	140
Less: Taxes (30%)	42
NET INCOME (NI)	98

(i) Calculate the liquidity ratios, that is, the current ratio and the quick ratio.
(ii) Calculate the asset management ratios, that is, the inventory turnover, fixed asset turnover, total asset turnover, and average collection period.
(iii) Calculate the debt management ratios, that is, the debt and time-interest earned ratios.
(iv) Calculate the profitability ratios, that is, the gross profit margin, net profit margin, return on total assets and, return on equity.

(b) Use the following information for questions (i) to (iii):

Income statement items	2006	2004
Sales	16 000	8 000
Depreciation and amortization	300	200
Interest expense	480	200
Operating expense	2 000	1 200
Gross profit margin	40%	50%
Tax rate	30%	35%

Balance sheet items	2006	2004
Accounts payable	1 000	500
Accounts receivable	1 500	1 000
Accumulated profits	4 000	2 000
Cash	500	1 000
Inventory	2 000	1 000
Long-term loans	2 000	1 000
Ordinary shares	3 000	3 000
Property, plant and equipment	8 000	4 000
Short-term loans	2 000	500

(i) The DuPont formula defines the net return on shareholder's equity (ROE) as a function of the following components:

- net profit margin (NPM)
- total asset turnover (TAT)
- financial leverage multiplier (FLM)

Calculate *each* of the *three* components listed above for 2004 and 2006, and calculate the return on equity (ROE) for 2004 and 2006, using all three components. Briefly discuss the impact of the changes in total asset turnover and financial leverage on the change in ROE from 2004 to 2006.

(ii) Calculate the firm's cash conversion cycle (ccc) for 2004 and 2006 and comment on the effect of the change from 2004 to 2006.

(iii) Calculate *two* debt management ratios for 2004 and 2006 and state the impact on the firm's exposure to financial risk due to the change from 2004 to 2006.

(c) An analyst gathered the following information about a company:

- 2008 net sales R10 000 000
- 2008 net profit margin 5.0%
- 2009 expected sales growth 15.0%
- 2009 expected profit margin 5.4%
- 2009 expected ordinary shares outstanding 120 000

The analyst's estimate of the company's 2009 earnings per share should be closest to

(1) R3.26
(2) R3.72
(3) R3.83
(4) R4.17

(d) Use the information below to calculate the Return on Equity (ROE).

Total asset turnover	1.20
Interest burden	1.90
Equity multiplier	2.02
Net profit margin	15%
Tax burden	0.50

(1) 14.25%
(2) 18.18%
(3) 34.20%
(4) 36.36%

Answers to additional assessment questions

(a) (i) Liquidity ratios

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = \frac{1\,070}{745} = 1{,}44\text{x}$$

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}} = \frac{1\,070 - 625}{745} = 0{,}60\text{x}$$

(ii) Asset management ratios

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Inventory}} = \frac{1834}{625} = 2{,}93\text{x}$$

$$\text{Fixed asset turnover} = \frac{\text{Sales}}{\text{Net fixed assets}} = \frac{2\,400}{1\,200} = 2{,}00\text{x}$$

$$\text{Total asset turnover} = \frac{\text{Sales}}{\text{Total assets}} = \frac{2\,400}{2\,270} = 1{,}06\text{x}$$

$$\text{RCP} = \frac{\text{Accounts receivable}}{\text{Sales}/365} = \frac{245}{2\,400/365} = 37{,}26 \text{ days}$$

(iii) Debt management ratios

$$\text{Debt ratio} = \frac{\text{Total debt}}{\text{Total assets}} = \frac{1165}{2\,270} = 0{,}51\text{x}$$

$$\text{TIE ratio} = \frac{\text{EBIT}}{\text{Interest}} = \frac{175}{35} = 5{,}00\text{x}$$

(iv) Profitability ratios

$$\text{Gross profit margin} = \frac{\text{Gross profit}}{\text{Sales}} = \frac{566}{2\,400} = 23{,}58\%$$

$$\text{Net profit margin} = \frac{\text{Net income}}{\text{Sales}} = \frac{98}{2\,400} = 4{,}08\%$$

$$\text{ROA} = \frac{\text{Net income}}{\text{Total assets}} = \frac{98}{2\,270} = 4{,}32\%$$

$$\text{ROE} = \frac{\text{Net income}}{\text{Common equity}} = \frac{98}{1105} = 8{,}87\%$$

(b) Income statement and balance sheet

Income Statement Items	2006	2004
Sales	16 000	8 000
Cost of goods sold	9 600	4 000
Gross profit	6 400	4 000
Operating expense	2 000	1 200
EBITDA	4 400	2 800
Depreciation and amortization	300	200
EBIT	4 100	2 600
Interest expense	480	200
EBT	3 620	2 400
Tax	1 086	840
EAT/NI	2 534	1 560

Balance Sheet Items	2006	2004
Non-current assets	8 000	4 000
Current assets	4 000	3 000
Inventory	2 000	1 000
Receivables	1 500	1 000
Cash	500	1 000
TOTAL ASSETS	12 000	7 000
Capital and reserves (Equity)	7 000	5 000
Shares	3 000	3 000
Accumulated profits	4 000	2 000
Non-current liabilities	2 000	1 000
Current liabilities	3 000	1 000
Payables	1 000	500
Short-term loans	2 000	500
Total liabilities	5 000	2 000
TOTAL EQUITY AND LIABILITIES	12 000	7 000

(i) DuPont components and ROE

$$\text{NPM}_{2004} = \frac{\text{Net income}}{\text{Sales}} = \frac{1\ 560}{8\ 000} = 19{,}50\%$$

$$\text{NPM}_{2006} = \frac{2\ 534}{16\ 000} = 15{,}84\%$$

$$\text{TAT}_{2004} = \frac{\text{Sales}}{\text{Total assets}} = \frac{8\ 000}{7\ 000} = 1{,}14\text{x}$$

$$\text{TAT}_{2006} = \frac{16\ 000}{12\ 000} = 1{,}33\text{x}$$

$$FLM_{2004} = \frac{\text{Total assets}}{\text{Equity}} = \frac{7\,000}{5\,000} = 1{,}40\text{x}$$

$$FLM_{2006} = \frac{12\,000}{7\,000} = 1{,}71\text{x}$$

$$\begin{aligned} ROE_{2004} &= NPM \times TAT \times FLM \\ &= \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Equity}} \\ &= 19{,}50 \times 1{,}14 \times 1{,}40 \\ &= 31{,}20\% \end{aligned}$$

$$\begin{aligned} ROE_{2006} &= 15{,}84 \times 1{,}33 \times 1{,}71 \\ &= 36{,}20\% \end{aligned}$$

Higher financial leverage and more efficient asset turnover resulted in an improved return on equity in spite of a lower net profit margin (2006). Increased leverage translates into increased financial risk [see question (iii) – debt management ratios].

(ii) Cash conversion cycle

$$RCP_{2004} = \frac{\text{Accounts receivable}}{\text{Sales}/365} = \frac{1\,000}{8\,000/365} = 45{,}63 \text{ days}$$

$$PPP_{2004} = \frac{\text{Accounts payable}}{\text{CoGS}/365} = \frac{500}{4\,000/365} = 45{,}63 \text{ days}$$

$$ITP_{2004} = \frac{\text{Inventory}}{\text{CoGS}/365} = \frac{1\,000}{4\,000/365} = 91{,}25 \text{ days}$$

$$\begin{aligned} ccc_{2004} &= RCP + ITP - PPP \\ &= (46 + 91 - 46) \\ &= 91 \text{ days} \end{aligned}$$

$$RCP_{2006} = \frac{1\,500}{16\,000/365} = 34{,}22 \text{ days}$$

$$PPP_{2006} = \frac{1\,000}{9\,600/365} = 38{,}02 \text{ days}$$

$$ITP_{2006} = \frac{2\,000}{9\,600/365} = 76{,}04 \text{ days}$$

$$\begin{aligned} ccc_{2006} &= (34 + 76 - 38) \\ &= 72 \text{ days} \end{aligned}$$

All three ratios decreased, resulting in a decrease in the length of time it takes to turn the firm's investment into cash. Although high cash conversion cycles are considered to be undesirable, one should also review each component individually (relative to industry standards) to determine for instance if the firm's credit policy is too rigorous (hampering sales), etc.

(iii) Debt management ratios

$$\text{Debt/Equity}_{2004} = \frac{\text{Total liabilities}}{\text{Equity}} = \frac{2\ 000}{5\ 000} = 0{,}40\text{x}$$

$$\text{Debt/Equity}_{2006} = \frac{5\ 000}{7\ 000} = 0{,}71\text{x}$$

$$\text{TIE}_{2004} = \frac{\text{EBIT}}{\text{Interest}} = \frac{2\ 600}{200} = 13\text{x}$$

$$\text{TIE}_{2006} = \frac{4\ 100}{480} = 8{,}54\text{x}$$

$$\text{Debt}_{2004} = \frac{\text{Total liabilities}}{\text{Total assets}} = \frac{2\ 000}{7\ 000} = 0{,}29\text{x}$$

$$\text{Debt}_{2006} = \frac{5\ 000}{12\ 000} = 0{,}42\text{x}$$

The firm's financial risk has increased [confirmed by the increase in financial leverage – see question (i)] as indicated by a higher debt ratio and debt/equity ratio, as well as declining interest coverage.

(c) EPS $= \dfrac{\text{Net profit}}{\text{Number of shares}}$

2009 net sales = R10 000 000 × (1-0.15)

= R8 500 000

Net profit = 2009 Net profit margin × 2009 net sales

= 0.054 × R8 500 000

= R459 000

$= \dfrac{459\ 000}{120\ 000}$

(3) EPS = R3.83

(d) ROE = Net profit margin × Total asset turnover × Equity multiplier

= 15% × 1.2 × 2.02

(4) ROE = 36.36%

SUMMARY

In this study unit we looked at the financial statements of a company. Various ratios were calculated and from those we concluded the financial status and prospects of the company. In the next study unit we show how to put a value on the shares of a company using various growth models as well as relative valuation techniques.

Study unit 9

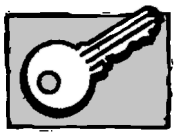
Company valuation

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- explain and distinguish between investment styles (eg growth share or earnings momentum, value investing)
- explain the use of measures of value added in company valuation
- define economic profit
- discuss economic value added (EVA)
- discuss cash value added (CVA) and the concept of strategic investments
- contrast the CVA and EVA models
- discuss market value added (MVA)
- explain the earnings multiplier model
- calculate the future earnings per share for a company using the earnings multiplier model
- estimate earnings per share for an industry
- discuss the use of dividend discount models (DDM) to value growth shares
- determine the value of a company using the constant growth dividend discount model
- explain and apply four alternative growth models (eg two-stage, H-model, three-stage and growth duration) in the valuation of companies
- discuss the advantages and limitations of dividend discount models
- explain the various relative valuation ratios which analysts use to evaluate equity investments (ie price/earnings, dividend yields, price/sales, price/asset value, price/cash flow)



KEY CONCEPTS

Cash value added (CVA)
Dividend discount models
Dividend yield
Earnings momentum
Earnings multiplier model
Earnings per share
Economic profit
Economic value added (EVA)
Growth duration model
Growth share
H-model
Investment styles
Market value added (MVA)
Measures of value added
Price/asset value ratio
Price/cash flow ratio
Price/earnings ratio
Price/sales ratio
Relative valuation ratios
Strategic investments
Three-stage DDM
Two-stage DDM
Value investing

OVERVIEW

This study unit starts with a discussion of the difference between a company and its shares. Fundamental analysis may lead one to conclude that a company has sound prospects. However, if these prospects are already fully reflected in the share price, then the share in question is not that promising.

Company analysis and valuation are two separate but interdependent activities. In this study unit we consider various techniques which provide insight into the economic success of a firm and its management, such as economic value added (EVA).

The goal of company analysis and valuation is to select one of the best companies in a superior industry during particular market conditions.

This study unit applies the basic principles of valuation to the valuation of ordinary shares. Two general approaches to the valuation of ordinary shares are provided, namely discounted cash flow models and relative valuation ratios.

Study chapter 9 of the prescribed book.

ACTIVITY

Discuss the contention that, in a completely competitive economy, there would never be a true growth company.

FEEDBACK

If companies in a perfectly competitive economy see a particular firm achieving returns which are consistently above risk-based expectations, these companies are expected to enter that particular industry or market and eventually drive prices down until the returns are consistent with the inherent risk. In other words, the competition would not allow the continuing existence of excess return investments and competition would therefore negate such growth. The computer/information technology industry is a good example of increased competition resulting in lower profit margins. The theory implies that in truly competitive environments, a true growth company is a temporary classification.

ACTIVITY

The value of an asset is the present value of the expected returns from the asset during the holding period. An investment will provide a stream of returns during this period, and it is necessary to discount this stream of returns at an appropriate rate to determine the asset's present value. The constant growth dividend discount model (Gordon model) is a valuation model which is frequently used. Identify the three factors that must be estimated for any valuation model and explain why these estimates are more difficult to derive for common equity shares than for bonds. In addition, explain the principal problem involved in using a dividend valuation model to value (1) companies whose operations are closely correlated with economic cycles, (2) companies that are of very

large (giant) size and are maturing, (3) companies that are of small size and are growing rapidly, assuming all companies pay dividends.

FEEDBACK

The three factors that must be estimated for any valuation model are as follows:

- *The expected stream of earnings*, which is specified for bonds in terms of interest (coupon) and principal payments, but is uncertain for common equity shares as dividends are not contractual or precisely predictable.
- *The time pattern of expected returns*, which is specified for bonds, in terms of semi-annual interest payments and principal payments at maturity, but is uncertain for common equity shares because, although dividends may be paid annually, a share is in effect "perpetual". The maturity value of a bond is known, while the sale price for shares involves an estimate of earnings in that year and the price earnings ratio (P/E) that will then prevail, employing the concept of a terminal P/E.
- *The required rate of return on the investment adjusted for risk*, which is uncertain for both equity and bonds. For bonds, this generally depends upon the prevailing risk-free rate. For equity shares, given the security market line prevailing at a point in time and an estimate of the share's beta with the market portfolio of risky assets, it is possible to derive the return that should be required for the investment.

The problem with using a dividend valuation model is that growth is a changing phenomenon and cannot be projected to infinity. Constant growth in dividends is unrealistic for a company that is subject to cyclical swings in its business. Maturing companies might be experiencing a slowing in the rate of growth of dividends. Although some such companies maintain dividend growth by increasing the payout ratio, this is a short term occurrence. Small, rapidly growing companies are not able to sustain above average rates of growth indefinitely.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 9 in the prescribed book.

(2) Additional assessment questions:

(a) Under what conditions would you use a two- or three-stage dividend discount model rather than the constant growth model?

(b) You are told that a company retains 80% of its earnings and its earnings are growing at a rate of about 8% a year versus an average growth rate of 6% for all firms. Discuss whether you would consider this a growth company.

(c) Specify the major components for the calculation of economic value added and describe what a positive EVA signifies.

(d) You have been reading about the Maddy Computer Company (MCC), which currently retains 90% of its earnings (R5 a share this year). It earns an ROE of almost 30%. Assuming a required rate of return of 14%, how much would you pay for MCC on the basis of the earnings multiplier model? Discuss your answer. What would you pay for Maddy Computer if its retention rate were 60% and its ROE were 19%?

(e) Gentry Can Company's (GCC) latest annual dividend of R1.25 was paid yesterday and maintained its historic 7% rate of growth. You plan to purchase

the share today because you believe that the dividend growth rate will increase to 8% for the next three years and the selling price for the share will be R40 per share at the end of that time.

(i) How much should you be willing to pay for the GCC share if you require a 12% return?
(ii) What is the maximum price you should be willing to pay for the GCC share if you believe that the 8% growth rate can be maintained indefinitely and you require a 12% return?
(iii) If the 8% rate of growth is achieved, what will the price be at the end of the third year, assuming the conditions in (ii)?

(f) Micro Corporation just paid dividends of R2 per share. Assume that over the next three years dividends will grow as follows; 5% next year, 15% in year two and 25% in year 3. After that growth is expected to level off to a constant growth rate of 10% per year. The required rate of return is 15%. Calculate the intrinsic value using the multistage model.

(1) R43.66
(2) R49.30
(3) R59.56
(4) R66.40

Answers to additional assessment questions

(a) The constant growth DDM assumes that (1) dividends grow at a constant rate, (2) the constant growth rate will continue for an infinite period and (3) the required rate of return (k or r) is greater than the infinite growth rate (g). Therefore, the constant growth DDM cannot be applied to the valuation of shares for growth companies because the high growth of earnings for the growth company is inconsistent with the assumptions of the infinite period constant growth DDM model. A company cannot permanently maintain a growth rate higher than its required rate of return, because competition will eventually enter this apparently lucrative business, which will reduce the firm's profit margins and therefore its ROE and growth rate. Therefore, after a few years of exceptional growth (a period of temporary supernormal growth) a firm's growth rate should decline. Eventually its growth rate is expected to stabilise at a level consistent with the assumptions of the infinite period.

(b) Above average earnings growth is a characteristic of a growth company. Additionally, a rather high retention rate of 80% implies that the firm will have the resources to take advantage of high-return investment opportunities. These factors lend support to classifying the firm as a growth company. However, as a result of the high retention rate, investors will continue to require a high return on investment. Only if the firm can continue to achieve returns above its cost of capital will the firm continue to be classified as a growth company.

(c) The major components of EVA include the firm's net operating profit less adjusted taxes (NOPLAT) and its total cost of capital (in rand) including the cost of equity. A positive EVA implies that NOPLAT exceeds the cost of capital and that value has been added for shareholders.

(d)

Required rate of return (k)	14%
Return on equity (ROE)	30%
Retention rate (RR)	90%
Earnings per share (EPS)	R5,00

Growth rate $(g) = ROE \times RR = 30 \times 0{,}90 = 27\%$

$$P/E = \frac{D/E}{k - g} = \frac{(1 - 0{,}90)}{(0{,}14 - 0{,}27)}$$

Since the required rate of return (k) is less than the growth rate (g), the earnings multiplier cannot be used (the answer is meaningless).

However, if the ROE = 19% and the RR is 60%, then

Growth rate $(g) = ROE \times RR = 19 \times 0{,}60 = 11{,}4\%$

$$P/E = \frac{D/E}{k - g} = \frac{(1 - 0{,}60)}{(0{,}14 - 0{,}114)} = 15{,}38 \times$$

Next year's earnings are expected to be $E_0(1 + g) = (5{,}00 \times 1{,}114) = R5{,}57$;

therefore $P_0 = P/E \times E_1 = 15{,}38 \times 5{,}57 = R85{,}69$

Thus, you will be willing to pay up to R85,69 per share for Maddy Computer Company shares.

(e) (i) Required rate of return (k) 12%

Growth rate of dividends (g) 8%

$$P_0 = \frac{1{,}25(1{,}08)}{1{,}12} + \frac{1{,}25(1{,}08)^2}{(1{,}12)^2} + \frac{1{,}25(1{,}08)^3}{(1{,}12)^3} + \frac{40}{(1{,}12)^3}$$

$$= R31{,}96$$

(ii) $$P_0 = \frac{D_0(1 + g)}{k - g} = \frac{1{,}25(1{,}08)}{(0{,}12 - 0{,}08)} = R33{,}75$$

(iii) Assuming all the above assumptions remain the same, the price at the end of year 3 will be:

$$P_3 = \frac{D_0(1 + g)^4}{k - g} = \frac{1{,}25(1{,}08)^4}{(0{,}12 - 0{,}08)} = R42{,}52$$

(f) Three-stage dividend discount model:

$D_0 = 2.00$
$D_1 = 2.00(1.05) = 2.10$
$D_2 = 2.00(1.05)\ (1.15) = 2.415$
$D_3 = 2.00(1.05)\ (1.15)\ (1.25) = 3.0188$
$D_4 = 2.00(1.05)\ (1.15)\ (1.25)\ (1.10) = 3.3206$

Required rate of return = k = 15%; Growth rate = g = 10%

Value of the share:

$$= \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \left\{ \frac{D_4}{(k-g)} \right\} \frac{}{(1+k)^3}$$

$$= \frac{2.10}{(1.15)^1} + \frac{2.415}{(1.15)^2} + \frac{3.0188}{(1.15)^3} + \left\{\frac{\frac{3.3206}{(0.15-0.10)}}{(1.15)^3}\right\}$$

$$= \frac{2.10}{1.15} + \frac{2.415}{1.3225} + \frac{3.0188}{1.5209} + \frac{66.4120}{1.5209}$$

$$= 1.8261 + 1.8261 + 1.9849 + 43.6663$$

2. = R49.30

SUMMARY

This study unit wraps up the fundamental analysis process. We started off by examining the domestic economy, finding the industry most likely to do well and we concluded by identifying the company in this industry expected to outperform. Placing a value on the shares of this company, determining whether it was under- or overvalued, was the last step in this process. We will now turn our attention to technical analysis either as an alternative to fundamental analysis or as a way to complement and affirm its conclusions.

Study unit 10

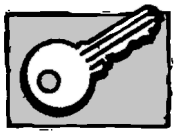
Technical analysis

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- list and explain the underlying assumptions of technical analysis
- identify and discuss the basic charts used in technical analysis (ie line, bar and volume bar charts)
- discuss various indicators used to anticipate future price movements (ie price fields, volume, open interest, support and resistance, linear regression, trend lines, supply and demand)
- explain the price fields defining a security's price and volume
- discuss the rules for interpreting open interest
- discuss price, volume and open interest interpretations related to both rising and declining markets
- discuss the interpretation and merits of moving averages as an analytical tool
- contrast leading and lagging indicators
- discuss the assumptions underlying Dow Theory
- discuss the application of the overbought/oversold oscillator in technical analysis
- discuss the application of the absolute breadth index in technical analysis
- discuss the application of the breadth thrust in technical analysis
- discuss line studies as an analytical tool (ie support, resistance, trend, Fibonacci arcs and retracements)
- discuss market indicators with reference to the different categories
- explain the use of the relative strength index and positive volume index as market indicators
- list and explain the challenges to technical analysis



KEY CONCEPTS

Absolute breadth index
Bar charts
Breadth thrust
Charts
Linear regression
Market indicators
Minor trend
Moving averages
Resistance lines
Reversal signal
Secondary trend
Supply

Demand
Dow Theory
Indicators
Lagging indicators
Leading indicators
Line charts
Open interest
Overbought/oversold oscillator
Price fields
Price volume index
Primary trend
Relative strength index
Support lines
Time element
Trend lines
Volume
Volume bar charts

OVERVIEW

Technical analysis is the examination of past price movements to forecast future price movements and may be viewed as an alternative or supplement to fundamental analysis. All the determinants of price including fundamental, economic, political and psychological factors are supposedly reflected in the current market price. Technical analysts (chartists) rely almost exclusively on charts for their analysis, using a company's share price and volume history in various mathematical calculations (technical indicators) to predict future behaviour for the market as a whole and for individual shares. Market timing (predicting market movements) is considered a critical success factor for active trading, and technical analysis is consequently employed to determine the optimum time to buy and sell shares (sell high and buy low).

Study chapter 10 of the prescribed book.

John Murphy's Ten Laws of Technical Trading

Behind the charts and graphs and mathematical formulas used to analyse market trends are some basic concepts that apply to most of the theories employed by today's technical analysts. We will page through chapter 10 in light of the ten basic laws of technical trading as identified by John Murphy, StockCharts.com's Chief Technical Analyst. These laws are designed to help explain the whole idea of technical trading for the beginner and to streamline the trading methodology for the more experienced practitioner. They define the key tools of technical analysis and how to use them to identify buying and selling opportunities. The ten laws follow below, as outlined by Murphy at http://www.stockcharts.com/education/TradingStrategies/MurphysLaws.html.

1 Map the Trends

Study long-term charts. Begin a chart analysis with monthly and weekly charts spanning several years. A larger scale *map of the market* provides more visibility and a better long-term perspective on a market. Once the long-term has been established, then consult daily and intra-day charts. A short-term market view alone can often be deceptive. Even if you only trade the very short term, you will do better if you're trading in the same direction as the intermediate and longer-term trends.

2 Spot the Trend and Go With It

Determine the trend and follow it. Market trends come in many sizes – long-term,

intermediate-term and short-term. First, determine which one you're going to trade and use the appropriate chart. Make sure you trade in the direction of that trend. Buy dips if the trend is up. Sell rallies if the trend is down. If you're trading the intermediate trend, use daily and weekly charts. If you are day-trading, use daily and intra-day charts. But in each case, let the longer-range chart determine the trend, and then use the shorter-term chart for timing.

3 Find the Low and High of It

Find support and resistance levels. The best place to buy a market is near support levels. That support is usually a previous reaction low. The best place to sell a market is near resistance levels. Resistance is usually a previous peak. After a resistance peak has been broken, it will usually provide support on subsequent pullbacks. In other words, the old "high" becomes the new "*low*". In the same way, when a support level has been broken, it will usually produce selling on subsequent rallies – the old "low" can become the new "high".

4 Know How Far to Backtrack

Measure percentage retracements. Market corrections up or down usually retrace a significant portion of the previous trend. You can measure the corrections in an existing trend in simple percentages. A fifty percent retracement of a prior trend is most common. A minimum retracement is usually one-third of the prior trend. The maximum retracement is usually two-thirds. Fibonacci retracements of 38% and 62% are also worth watching. During a pullback in an up-trend, therefore, initial buy points are in the 33% to 38% retracement area.

5 Draw the Line

Draw trend lines. Trend lines are one of the simplest and most effective charting tools. All you need is a straight edge and two points on the chart. Up trend lines are drawn along two successive lows. Down trend lines are drawn along two successive peaks. Prices will often pull back to trend lines before resuming their trend. The breaking of trend lines usually signals a change in trend. A valid trend line should be touched at least three times. The longer a trend line has been in effect, and the more times it has been tested, the more important it becomes.

6 Follow that Average

Follow moving averages. Moving averages provide objective buy and sell signals. They tell you if an existing trend is still in motion and help confirm a trend change. Moving averages do not tell you in advance, however, that a trend change is imminent. A combination chart of two moving averages is the most popular way of finding trading signals. Some popular futures combinations are 4-day and 9-day moving averages, 9-day and 18-day, 5-day and 20-day. Signals are given when the shorter average line crosses the longer. Price crossings above and below a 40-day moving average also provide good trading signals. Since moving average chart lines are trend-following indicators, they work best in a trending market.

7 Learn the Turns

Track oscillators. Oscillators help identify overbought and oversold markets. While moving averages offer confirmation of a market trend change, oscillators often help warn us in advance that a market has rallied or fallen too far and will soon turn. Two of the most popular are the Relative Strength Index (RSI) and Stochastics. They both work on a scale of 0 to 100. With the RSI, readings over 70 are overbought while readings below 30 are oversold. The overbought and oversold values for Stochastics are 80 and 20. Most traders use 14-days or weeks for stochastics and either 9 or 14 days or weeks for RSI. Oscillator divergences often warn of market turns. These tools work best in a trading market range. Weekly signals can be used as filters on daily signals. Daily signals can be used as filters for intra-day charts.

8 Know the Warning Signs (not covered in the prescribed book, refer to Sharenet chart)

Trade MACD. The Moving Average Convergence Divergence (MACD) indicator (developed by Gerald Appel) combines a moving average crossover system with the overbought/oversold elements of an oscillator. A buy signal occurs when the faster line crosses above the slower and both lines are below zero. A sell signal takes place when the faster line crosses below the slower from above the zero line. Weekly signals take precedence over daily signals. An MACD histogram plots the difference between the two lines and gives even earlier warnings of trend changes. It's called a "histogram" because vertical bars are used to show the difference between the two lines on the chart.

9 Trend or Not a Trend (not covered in the prescribed book, refer to Sharenet chart)

Use ADX. The Average Directional Movement Index (ADX) line helps determine whether a market is in a trending or a trading phase. It measures the degree of trend or direction in the market. A rising ADX line suggests the presence of a strong trend. A falling ADX line suggests the presence of a trading market and the absence of a trend. A rising ADX line favours moving averages; a falling ADX favours oscillators. By plotting the direction of the ADX line, the trader is able to determine which trading style and which set of indicators are most suitable for the current market environment.

10 Know the Confirming Signs

Include volume and open interest. Volume and open interest are important confirming indicators in futures markets. Volume precedes price. It's important to ensure that heavier volume is taking place in the direction of the prevailing trend. In an up-trend, heavier volume should be seen on up days. Rising open interest confirms that new money is supporting the prevailing trend. Declining open interest is often a warning that the trend is near completion. A solid price up-trend should be accompanied by rising volume and rising open interest.

Technical analysis is a skill that improves with experience and study.

ACTIVITY

Read the following excerpts from **More About Sharenet**, to be found at http://www.sharenet.co.za/v3/about.php

> "Sharenet was founded in 1988 as Network Information Services cc, by Anthony Walker, as a registered vendor of JSE share prices to the public on a subscription basis. Sharenet initially used the Beltel system introduced by Telkom as a platform for conveying real time share prices, but in response to the potential it saw in the Internet, was quick to modify its systems, and by 1995 had moved its access online, becoming the first vendor of JSE prices via the Internet."
>
> "Since then Sharenet has constantly improved its service and as a result has retained its position as the leading provider of financial information to the consumer market. It is on this platform, that Sharenet has developed its transactional capabilities and significant market share."
>
> "The site www.sharenet.co.za is by far the most accessed financial and investment site in the country, serving in excess of 2.5 million impressions per month. The company delivers a wide range of investment and share price information through the site and operates its own highly sophisticated proprietary developed online trading infrastructure."

Go onto the following website to look at Sharenet's *Java Technical Analysis Charts Free Version*.

Address: http://www.sharenet.co.za/charts/

Click on: Help (top right-hand corner)

Find the indicators referred to in the prescribed book (chapter 10) and John Murphy's Ten Laws of Technical Trading on the Sharenet display, and look at the descriptions provided.

Click on: Back (return to previous screen)

Choose a company code (follow the instructions) and play around with the various indicator selections to note the effects and changes on the chart.

FEEDBACK

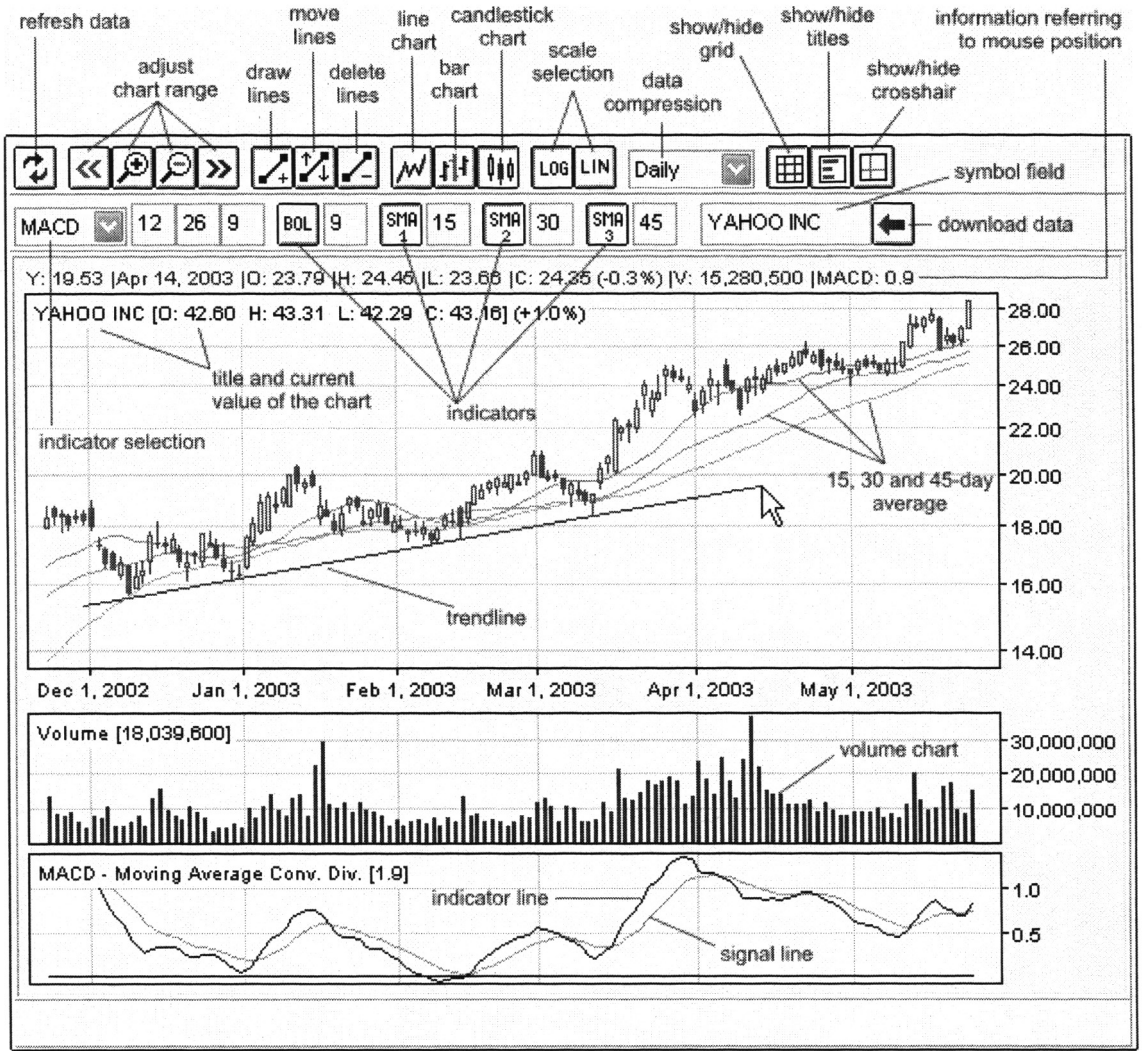
The following screen will appear, showing and explaining the indicators available on this chart. Many of these indicators are also referred to in the prescribed textbook. You can return (click on "back") to the previous screen, choose a company code (follow the instructions) and play around with the various indicator selections to note the effects and changes.

Note that Sharenet Support doesn't offer any advice or explanation in regard to Technical Analysis. We do however highly recommend the following book.

Technical Analysis from A to Z

This revised edition provides a basic overview of technical analysis for readers who are new to the subject, explaining what technical analysis with regard to trading actually entails.

It presents 102 technical indicators with detailed explanations and how to go about using them.



Details

(1) Displaying charts

To display a given chart enter a share code or name into the symbol field and press [ENTER] key.

(2) Working with indicators

To display technical indicators select them using options available in the second toolbar. Indicator parameters can be adjusted using text fields to the right of an indicator. Enter desired parameter value and press [ENTER] key, to apply the new parameter.

(3) Chart customization

Using the options available in the first toolbar, you can set a chart type, a scale, data compression or adjust the amount of data displayed.

(4) Working with trend lines and formations

You can draw lines on the chart using a mouse. Press the left mouse button and drag the mouse to draw a line. To move or delete existing lines, first click on the "move lines" or "delete lines" button, and then use the mouse.

The following indicators are available

These descriptions are only a guide to provide some insight into their use.

- **Accumulation Distribution** (**AD**) − variation of OBV, assess the cumulative flow of money into and out of a security by relating volumes and price movements.
- **Bollinger Band** (**BOL**) bands − are wide when prices are volatile
- **Chaikin Oscillator** (**ChO**) − moving average oscillator based on the Accumulation/ Distribution indicator.
- **Commodity Channel Index** (**CCI**) − measures the change of a security's price from its statistical mean.
- **Moving Average Convergence Divergence** (**MACD**) − relationship between 26 day and 12 day exponential moving average (EMA) with a 9 day EMA plotted on top of it as a trigger line to show potential buy/sell opportunities. Sell when MACD falls bellow trigger line, buy when MACD goes above the trigger line.
- **Momentum** (**MTM**) − measures price change over a given time period.
- **Money Flow Index** (**MFI**) − momentum indicator showing strength of money flowing into and out of a stock. If price trends higher and MFI lower (or vice versa), a reversal may follow. Stock likely to be at the top when MFI is greater than 80 and bottom when MFI is less than 20.
- **Negative Volume Index** (**NVI**) − attempts to identify bull markets on the theory that when volumes increase uninformed investors are following like sheep, while when volumes are lower informed investors are at work. Thus it shows what the informed investors are doing. In Stock Market Logic, Norman Fosback points out that the odds of a bull market are 95 out of 100 when the NVI rises above its one-year moving average. The odds of a bull market are roughly 50/50 when the NVI is below its one-year average.
- **On Balance Volume** (**OBV**) − momentum indicator relating volume to price moves. If the stock ends up, volume total is added to the cumulative total, if stock ends down days volume is subtracted. Rising OBV is a sign of informed investors buying.
- **Positive Volume Index** (**PVI**) − opposite of the NVI. Shows what un-informed investors are doing. When PVI is above its moving average indicates bull market, bear market when below.

- **Price Oscillator**r (**POS**) − shows variation between moving averages.
- **Price and Volume Trend** (**PVT**) − momentum indicator relating volume to price moves (similar to OBV), but adding or subtracting only a percentage of the days volume (using the % move up or down). Thus it seems to be a more accurate reflection than OBV. Look for PVT trending higher while prices trend lower. A strong price increase could follow.
- **Rate of Change** (**ROC**) − percentage difference between current price and price x days ago. The default here is to show both the 5 day and 9 day ROC. As prices increase, the ROC rises and as prices fall, the ROC falls. The greater the change in prices, the greater the change in the ROC.
- **Relative Strength Index** (**RSI**) − price oscillator that ranges between 0 and 100. Divergence with the price is used to hint for a reversal. Default is to show a 14 day RSI, drawing a line at 30 and 70 as RSI usually tops above 70 and bottoms below 30.
- **Simple Moving Average** (**SMA1, SMA2, SMA3**) − average price over x days. Investors typically buy when a security's price rises above its moving average and sell when the price falls below its moving average.
- **Stochastic** (**STS**) − display as 2 lines, the orange line (called %D) is a moving average of the main blue line (called %K). Buy when either %K or %D falls below 20 and then rises back above that level. Similarly, sell when the either line rises above 80 and then falls back below. Another pattern to look for when timing trades is buy when the %K line rises above the %D line or sell when the %K line falls below the %D line. Be on the lookout for divergences, if prices are making a series of new highs and the Stochastic Oscillator fails to surpass its previous highs, the indicator typically will provide the clue as to where prices will soon head.
- **Trend Deviation** (**TRD**)
- **TRIX Index** (**Trix**) − Trix is a momentum indicator that displays the percent rate-of-change of a triple exponentially smoothed moving average of the security's closing price. It is designed to keep you in trends equal to or shorter than the number of periods you specify. Trix crossing above the zero line is a potential buy signal and a closing below the zero line is a potential sell signal. Divergence between price and TRIX can also indicate significant turning points in the market.
- **Ultimate Oscillator** (**ULT**) − uses weighted sums of three oscillators, each of which uses a different time period expressed as a single line plotted between 0 and 100, with oversold territory below 30 and overbought territory above 70.
- **Volatility Ratio** (**VLT**)
- **Volume Oscillator** (**VOS**) − uses the difference between two moving averages of volume to determine if the overall volume trend is increasing or decreasing.
- **Williams Accumulation Distribution** (**WAD1**) − used to determine if the marketplace is controlled by buyers (accumulation) or by sellers (distribution). Williams recommends trading this indicator based on divergences: Distribution of the security is indicated when the security is making a new high and the A/D indicator is failing to make a new high. Accumulation of the security is indicated when the security is making a new low and the A/D indicator is failing to make a new low.
- **Williams %R** (**%R**) − momentum indicator that measures overbought/oversold levels. –80 to –100% indicate that the security is oversold while values in the 0 to –20% range suggest that it is overbought. An interesting phenomena of the %R indicator is its uncanny ability to anticipate a reversal in the underlying security's price. The indicator almost always forms a peak and turns down a few days before the security's price peaks and turns down. Likewise, %R usually creates a trough and turns up a few days before the security's price turns up.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 10 in the prescribed book.

(2) Additional assessment questions:

(a) Technical analysts believe that one can use past price changes to predict future price changes. How do they justify this belief?

(b) Indicate some disadvantages of technical analysis.

(c) Describe the Dow Theory and its three components. Which component is most important? What is the reason for the intermediate reversal?

(d) Explain the reasoning behind a support level and a resistance level.

(e) What is the purpose of computing a moving average line for a share? Describe a bullish pattern using a moving average line and the volume of trading. Discuss why this pattern is bullish.

(f) Discuss why most technicians follow several technical rules in an attempt to derive consensus.

(g) When technical analysts say a share has "good relative strength', they mean the

(1) ratio of the price of the share to a market index has trended upward
(2) recent trading volume in the share has exceeded the normal trading volume
(3) total return on the share has exceed the total return on other shares in the same industry
(4) share has performed well compared with other shares in the same risk category as measured by beta

(h) Based on technical analysis a share should be bought if

(1) the moving average line declines and crosses the share price line
(2) the moving average line increases and crosses the share price line
(3) the overbought-oversold (OB-OS) line starts to increase from its maximum negative value
(4) alternative 2 and 3 above

(i) The Dow Jones Industrial Average has all of the following characteristics as a share market index except

(1) it is price weighted
(2) it is dominated by just a few companies
(3) companies having share splits are weighted less heavily
(4) it is affected equally by changes in low and high priced shares

(j) Which of the following is not a component outlined by Charles Dow (Dow Theory)?

(1) Tertiary moves which are simply the daily fluctuations. The chartist should plot an asset's price or the market average each day in order to trace the primary and secondary trends.
(2) Primary trends, which are long-term movements, commonly called bear or bull markets.
(3) Bar charts have one vertical bar representing each day's price movements.
(4) Secondary movements, which last only a few months.

Answers to additional assessment questions

(a) The principal contention of technicians is that share prices move in trends that persist for long periods of time. Because these trends persist they can be predicted by analysing past prices.

(b) The disadvantages of technical analysis are as follows:

(1) Past price patterns may not be repeated in the future.
(2) The intense competition of those using the trading rules may render a specific technique useless.
(3) The trading rules require a great deal of subjective judgement.
(4) The values that signal action are constantly changing.

(c) The Dow Theory contends that share prices move in waves. Specifically, these waves may be grouped into three categories based upon the period of the wave:

(1) major trends for long periods (tides)
(2) intermediate trends (waves)
(3) short-run movements for very short periods (ripples)

The major trend (the tide) is most important to investors. An intermediate reversal occurs when some investors decide to take profits.

(d) A support level is a price range where considerable demand is expected, while a resistance level is a price range where a large supply is expected. Support and resistance levels exist due to the behaviour of a number of investors who are closely monitoring the market and will trade quickly at attractive price levels. Specifically, a support level occurs after a share has increased in price, followed by a brief period of profit-taking at which time some investors who did not get in on the first round, decide to take to opportunity to get in. A resistance level occurs after a share has declined, and when it experiences a recovery some investors who missed selling at a price peak take the opportunity to sell.

A price-break through a resistance level on strong volume would be considered very bullish. This is because as the price rises to the target set by investors, the supply increases, usually causing the price increase to reverse. Thus, a price breakthrough on strong volume would be bullish because it would mean the excess supply had dissipated.

(e) A moving average line indicates the major trend of a security's price. When daily prices break through the long-term trend from below on heavy volume it is considered a bullish action. The move above the trend line may indicate a new upward change in the trend.

(f) Technicians recognise that there is no single technical trading rule that is correct all the time – even the best ones miss certain turns or give false signals. Also, various indicators provide different information for alternative segments of the market. Therefore, you do not want to depend on any one technique, but should rather look at several and derive consensus.

(g) (1) ratio of the price of the share to a market index has trended upward

(h) (4) alternative 2 and 3 above

(i) (4) It is affected equally by changes in low and high priced shares.

(j) (3) Bar charts have one vertical bar representing each day's price movements.

SUMMARY

The chapter in the prescribed textbook is by no means a comprehensive and exhaustive coverage of technical analysis. It is merely an introduction to the underlying assumptions and some of the different techniques related to this complicated and challenging topic. The actual application and interpretation of the various indicators and charts fall outside the scope of this module. We now move on to the analysis and valuation of fixed-interest securities.

Topic 3

THE ANALYSIS OF FIXED INTEREST SECURITIES

AIM

Topic 3 promotes a basic understanding of fixed-interest securities such as bonds. The valuation of bonds and the measurement of risk through duration are explained.

TOPIC LEARNING OUTCOMES

Once you have worked through this topic, you should be able to:

- discuss the features and determinant factors of fixed-interest securities
- evaluate the risks and returns of fixed-interest securities such as bonds
- compare and select bonds in constructing a portfolio to suit specific outcomes and circumstances

TOPIC CONTENT

Study unit 11: Fundamentals of the analysis of fixed interest securities
Study unit 12: Valuation of fixed interest securities

Study unit 11

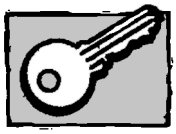
Fundamentals of the analysis of fixed interest securities

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- describe the basic characteristics/features of a bond (eg maturity, par value, coupon rate)
- calculate the holding period return (HPR) of a bond
- explain the risks associated with investing in bonds (eg interest rate risk, yield curve risk, call and prepayment risk, reinvestment risk, credit risk, liquidity risk, exchange-rate risk, inflation risk, volatility risk and event risk)
- identify the bond indices available in South Africa and explain their uses
- describe the different types of international bonds (eg foreign bonds and Eurobonds)
- describe bonds with embedded options (eg callable bonds and putable bonds)
- describe zero-coupon bonds
- describe variable rate bonds
- define an asset-backed security
- describe a mortgage-backed security



KEY CONCEPTS

Asset-backed
Bond indices
Bonds
Coupon interest
Embedded options
Face value
Holding period return
International bonds
Market price
Mortgage-backed
Rating agencies
Risk exposures
Structured securities
Time to maturity
Variable rate bonds
Yield to maturity
Zero-coupon bonds

OVERVIEW

Chapter 11 of the prescribed book focuses on the basic characteristics of bonds, bond risk exposures and the types of bonds available in the market. In the following chapter we look at the pricing of bonds and the determination of zero rates and forward rates. It is important to examine and understand the basic characteristics of the most common interest rate instrument, the bond. The following section also applies to study unit 12 *(Valuation of fixed interest securities)*.

Study chapter 11 of the prescribed book.

ACTIVITY

Go onto the Bond Exchange of South Africa (BESA) website and download the pdf-file, Introduction to bonds. Read this file in conjunction with chapters 11 and 12 of the prescribed book.

Address: http://www.bondexchange.co.za
Click on: Instruments
Select: Bonds
Click on: Introduction to bonds (select from Document Downloads)
Save as pdf file

FEEDBACK

This PDF document titled "An introduction to bond pricing in layman's terms" refers to the terminology and topics covered in chapters 11 and 12. The following is an excerpt from this document:

> A bond can simply be described as a long-term loan. Most people will have borrowed money at some stage in their lives and will have paid interest on the amount that they borrowed. When a person lends or invests money he or she is giving up the opportunity to convert those funds into goods and services immediately which must be compensated for. The concept of interest is the basis of how the borrower compensates the lender for the amount borrowed.
>
> Furthermore the lender faces uncertainty with respect to when the money is repaid. This uncertainty is called risk, which has to be included in the compensation amount. There are several types of risks the lender will face; some of these risks are:
>
> - Inflation
> - Default of the borrower. Default is the failure of the borrower to repay the debt for reasons that are not technical or temporary but usually as a result of bankruptcy.
> - Government policy e.g. taxation on interest etc
> - The amount of time to repay the debt i.e. the longer the period, the higher the compensation one would require.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 11 in the prescribed book.
(2) Additional assessment questions:

(a) Identify the three most important determinants of the price of a bond. Describe the effect of each.
(b) Given a change in the level of interest rates, discuss how two major factors will influence the relative change in price for individual bonds.
(c) Why should investors be aware of the trading volume for bonds in their portfolio?
(d) What is the purpose of bond ratings?
(e) Discuss the differences between a foreign bond (eg a Samurai) and a Euro-bond (eg Euroyen) issue.

Answers to additional assessment questions

(a) The three factors affecting the price of a bond are coupon, yield and term to maturity. The relationship between price and coupon is a direct one – the higher the coupon, the higher the price. The relationship between price and yield is an inverse one – the higher the yield the lower the price, all other factors held constant. The relationship between price and maturity is not so clearly evident. Price changes resulting from changes in yields will be more pronounced the longer the term to maturity.
(b) For a given change in the level of interest rates, two factors that will influence the relative change in bond prices are the **coupon** and **maturity** of the issues. Bonds with longer maturity and/or lower coupons will respond most vigorously to a given change in interest rates. Other factors likewise cause differences in price volatility, including the call features, but these factors are typically much less important.
(c) An investor should be aware of the trading volume for a particular bond because a lack of sufficient trading volume may make it impossible to sell the bond in a timely manner. As a result, prices may vary widely while the investor is trying to change his or her position in the bond.
(d) Bond ratings provide a very important service in the market for fixed income securities because they provide the fundamental analysis for hundreds of issues. The rating agencies conduct extensive analysis of the intrinsic characteristics of the issue to determine the default risk for the investor and inform the market of the analyses through their ratings.
(e) The difference between a foreign bond and a Eurobond can be defined as a difference in issuer and the market in which they are issued. For example, a foreign bond in Japan (eg a Samurai) is denominated in the domestic currency (yen) and is sold in the domestic market (Japan), but is sold by non-Japanese issuers. On the other hand, a Eurobond (eg a Euro-DM) is denominated in the domestic currency (Deutsche Mark) but is sold outside the domestic country in a number of international markets. International syndicates typically underwrite these bonds. The relative size of these two markets varies by country.

SUMMARY

This chapter has provided an introduction to fixed interest securities, specifically bonds. In the next study unit, we look at the pricing valuation (pricing and risk assessment) of fixed interest.

Study unit 12

Valuation of fixed interest securities

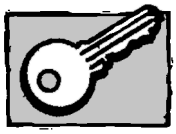
CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- explain the sources of return from investing in a bond (ie coupon interest payments, capital gain/loss, reinvestment income)
- calculate the traditional yield measures for fixed-rate bonds (ie nominal yield, current yield, yield to maturity, yield to call)
- describe the fundamental principles of bond valuation
- calculate the value of a bond given the expected annual or semi-annual cash flows and the appropriate single (constant) discount rate
- explain how the value of a bond changes if the discount rate increases or decreases
- calculate the change in value that is attributable to the rate change
- explain how the price of a bond changes as the bond approaches its maturity date
- calculate the change in value that is attributable to the passage of time
- identify the relationship among a bond's coupon rate, the yield required by the market and the bond's price relative to par value (ie discount, premium or equal to par)
- distinguish between the alternative definitions of duration (Macaulay, modified and effective)
- explain why effective duration is the most appropriate measure of interest rate risk for bonds with embedded options
- describe why duration is best interpreted as a measure of a bond's sensitivity to changes in interest rates
- calculate and interpret the duration (Macaulay, modified and effective) of a bond, given information about how the bond's price will increase or decrease for given changes in interest rates
- calculate the approximate percentage price change for a bond, given the bond's duration and a specified change in yield
- discuss the convexity measure of a bond and estimate a bond's percentage price change given the bond's duration and convexity and a specified change in interest rates
- describe a yield curve and the different yield curve shapes observed
- explain the basic theories of the term structure of interest rates (ie pure expectations theory, liquidity preference theory and market segmentation theory)
- describe the implications of each theory for the shape of the yield curve
- calculate spot/zero-coupon interest rates by means of the bootstrap method

- calculate forward rates from a series of zero rates
- calculate a bond's value using spot rates
- discuss forward rate agreements (FRAs) and calculate an FRA payoff



KEY CONCEPTS

Bond prices
Bootstrapping
Callable bonds
Convexity
Coupon
Current yield
Duration
Effective duration
Forward rate agreements
Forward rates
Interest rates
Liquidity preference
Macaulay duration
Modified duration
Nominal yield
Price-yield
Pure expectations
Realised return
Reinvestment
Segmented market
Spot rates
Valuation
Volatility
Yield curve theories
Yield to call
Yield to maturity
Yield-maturity

OVERVIEW

In this study unit we explain the valuation of fixed-interest securities. This includes a discussion of how one values a bond using a single discount rate or spot rates from the theoretical spot curve. We also consider the factors that influence yields on bonds and the volatility of bond returns. This includes a discussion of duration. Duration is important in active and passive bond portfolio management. A related concept, bond convexity, and its impact on bond price volatility are also explained.

Study chapter 12 of the prescribed book.

Determining treasury zero rates

A spot rate over a period of time can be defined as the yield to maturity on a single end-of-period cash flow value. Calculating the spot rate entails a process called "stripping" or "bootstrapping" of bonds. The stripping of bonds allows the separation or stripping of each of the cash flow components (coupon interest payments and face value) of a bond to be traded as separate and independent bonds. Bonds are thus stripped of their cash flows and sold as separate and individual "zero-coupon" bonds. The ability to recreate these separate, independent cash flow strips through bootstrapping opens up a significant arbitrage trading opportunity.

Consider a bond that has a set of coupon and final face value cash flows that can be replicated using a combination of individual zero-coupon bonds. If each of the independent zero-coupon bonds is similar to each of the corresponding bond's cash flows, the reconstructing of those cash flows can offer an arbitrage profit if differences exist between the two sets of instruments. To remove such arbitrage action, the present

value of all coupon and face value cash flows from the original bond should equal the sum of the present values of the collective group of independent zero-coupon bonds.

Since the yield to maturity of the original, conventional bond would by definition have equated to the price of the bond, it follows that the yield to maturity comprises a series of overriding rates of interest. The yield to maturity itself is actually often regarded as an average rate of return, comprising this set of superseding rates of interest. When traditional bonds are used to estimate spot rates, these rates are the outcome to this theoretical arbitrage-free argument that generates the theoretical spot rates. The following example illustrates the calculation of these spot rates:

ACTIVITY

By using the following data, determine the equivalent spot rates (zero-coupon rates) using the bootstrapping method. All bonds have a face value of R100 and semi-annual coupon payments.

Bond	Maturity	Annual coupon	Coupon per Period	Price	Yield to Maturity
A	0,5 years	10%	R5,00	R99,06	12%
B	1 year	15%	R7,50	R99,11	16%
C	1,5 years	12%	R6,00	R92,41	18%

Bond value or price $= \left[\frac{CPN}{(1+ytm/2)^1} + \frac{CPN}{(1+ytm/2)^2} + \ldots\ldots + \frac{CPN+FV}{(1+ytm/2)^t}\right]$

FEEDBACK

Bond A: $\left[\frac{5+100}{(1+i)^1}\right] = 99{,}06$

$$(1+i)^1 = \frac{105}{99{,}06}$$
$$= 1{,}06$$
$$i = 0{,}06$$

Therefore, the 1-year spot rate = (0,06 x 2) = 12%

Bond B: $\left[\frac{7{,}5}{(1{,}06)^1} + \frac{7{,}5+100}{(1+i)^2}\right] = 99{,}11$

$$(1+i)^2 = \frac{107{,}5}{(99{,}11-7{,}08)}$$
$$= 1{,}1680$$
$$1+i = (1{,}1680)^{1/2}$$
$$i = 0{,}0808$$

Therefore, the 2-year spot rate = (0,0808 x 2) = 16,15%

Bond C: $\left[\frac{6}{(1{,}06)^1}+\frac{6}{(1{,}0808)^2}+\frac{6+100}{(1+i)^3}\right]=92{,}41$

$$(1+i)^3=\frac{106}{(92{,}41-5{,}66-5{,}14)}$$

$$=1{,}2988$$

$$1+i=(1{,}2988)^{1/3}$$

$$i=0{,}0911$$

Therefore, the 3-year spot rate = (0,0911 x 2) = 18,21%

Notes on calculations:

- The 1-year spot rate will always be equal to the appropriate yield to maturity, in this instance 12%.
- Semi-annual compounding was used in this example, and we therefore had to
  - divide the yield to maturity (ytm) and coupon payments (CPN) by 2
  - multiply the maturity/time period (t) by 2
  - multiply the calculated spot/zero-coupon rate (i) by 2

Forward rates

Using the spot rate curve calculated above, we can now deduct a further interest rate referred to as the forward rate. The forward rate is simply the market's consensus of future interest rates and is used by institutions that would want to fix a certain rate of interest some time in the future.

To calculate a forward rate, assume, for example, that an investor wants to invest R100 for a one-year period. The investor has the following spot (market) rate alternatives:

- Invest in a *one-year* zero coupon bond yielding a spot rate of 10,50 per cent.
- Invest in a *six-month* zero coupon bond yielding a spot rate of 10,30 per cent. After six months the investor will have to reinvest in another *six-month* zero coupon bond. The spot rate for this additional six-month period is currently unknown.

If both alternatives will provide the same return, the investor will be indifferent in his or her choice of investment. Given that we know the spot rates of the six-month and one year bonds, we can deduce that the forward rate (the six month rate six months from today) is the rate that equates the rand interest return between the two alternatives. Investing R100 in either of the two bonds will yield the following rand returns:

	One-year bond	**Six-month bond**
Time to maturity	2 periods	1 period
Investment amount	R100	R100
Annualised spot rate	10.50%	10.30%
Ending investment value	**R110.78 ***	**R105.15 ****

[* $100\times\left(1+0.105/2\right)^2$; ** $100\times\left(1+0.103/2\right)^1$]

In order for the investor to be indifferent in his or her choice between the two alternatives, he or she should be able reinvest the R105,15 and end up with exactly R110,78 at the end of the one-year period. The rate at which he or she should be able to accomplish this is the forward rate, which is calculated as follows:

Financial calculator

HP10B	
Input	**Function**
110.78	FV
–105.15	PV
1	N
	I/YR
	5.3543

Sharp EL733	
Input	**Function**
110.78	FV
–105.15	PV
1	N
	COMP
	I/YR
	5.3543

The annualised six month rate six months from today = (5.3543 x 2) = 10.71%

Manually: $\frac{110,78}{105,15} = 1,0535 \rightarrow \left[\left(1,0535 - 1\right) \times 100\right] \times 2 = 10,71\%$

Or you simply could have used this formula (annual/semi-annual/quarterly compounding):

$$R_F = \frac{\left(1 + R_{t+1}\right)^{t+1}}{\left(1 + R_t\right)^{t}} - 1$$

$$R_F = \frac{\left(1 + 0,105/2\right)^{2}}{\left(1 + 0,103/2\right)^{1}} - 1 = 0,0535$$

The annualised six month rate six months from today = (5.3501 x 2) = 10,70%*

(* difference due to rounding errors)

ACTIVITY

Using the following data, determine the forward rates between years one and two and years two and three:

Bond	**Maturity**	**Zero-coupon Yield to Maturity**
A	1 year	8,300%
B	2 years	9,247%
C	3 years	9,787%

FEEDBACK

1-year forward rate (current spot rate)

$i = 8{,}30\%$

1-year forward rate 1 year from now (between years one and two)

$$\left[\left(\frac{(1+0{,}09247)^2}{(1+0{,}083)^1}\right)-1\right]\times 100 = 10{,}20\%$$

1-year forward rate 2 years from now (between years two and three)

$$\left[\left(\frac{(1+0{,}09787)^3}{(1+0{,}09247)^2}\right)-1\right]\times 100 = 10{,}88\%$$

Theories of the term structure of interest rates

- *Expectations theories*
  - — Pure (unbiased) expectations theory

    Forward rates are solely a function of expected future spot prices.

  - — Biased expectations theories
    - ▪ *Liquidity premium*

      Forward rates reflect investor's expectations of future rates plus a *liquidity premium* (positively related to maturity) to compensate them for exposure to interest rate risk (price risk – bond sold before maturity; reinvestment risk – rate at which cash flows can be reinvested over investment horizon).

    - ▪ *Preferred habitat*

      Also proposes that forward rates represent expected future spot rates plus a premium, but it *does not* support the view that this premium is directly related to maturity. The existence of an imbalance between *supply and demand* for funds in a given maturity range will induce lenders and borrowers to shift from their *preferred habitats* (maturity range) to one that has the opposite imbalance. They, however, require to be compensated (risk premium) for the exposure to interest rate risk.

- *Market segmentation theory*

  Similar to the preferred habitat theory in that it proposes that lenders and borrowers have preferred maturity ranges. Some investors, however, have restrictions (either legal or practical) on their maturity structure and will therefore not be enticed to shift out of their preferred maturity ranges. That means the shape of the yield curve is completely determined by the *supply and demand* for securities within each maturity segment. This implies that rates for a given maturity band will be determined *independently* of those for all other maturity bands. Theory can be used to *explain any shape of the yield curve*.

Bond price volatility and duration

Duration is by far the most widely used measure of bond price volatility. Basically, it shows how the price of a bond is likely to react to different interest rate environments. A

bond's duration and its price volatility are directly related – ie the longer the duration, the more price volatility there is in a bond. Duration is a measure of a bond's sensitivity to a 1% change in interest rates. This measure is often referred to as *effective duration*. It can be used with either non-callable, callable bonds or bonds with any type of embedded option. Another way to measure duration is to use what is known as *modified duration*. This measure is found by first computing a bond's *Macaulay duration*, and then adjusting it for the bond's yield to maturity (ytm). Modified duration is the same as (equal to) effective duration for bonds without any embedded options. Modified duration does not work for bonds with embedded options.

ACTIVITY

Calculate the following bond's Macaulay duration:

Face value: R1 000
Time to maturity: 2 years (thus, n = 4)
Coupon payment: 12% per annum (thus, R60 per six month period)
Yield to maturity: 14% per annum (thus, 7% per six month period)
Price: R966.13*

Financial calculator

HP10B	
Input	**Function**
1 000	FV
60	PMT
7	I/YR
4	N
	PV
	966.13

Sharp EL733	
Input	**Function**
1 000	FV
60	PMT
70	I/YR
4	N
	COMP
	PV
	966.13

FEEDBACK

(1)	(2)	(3)	(4)	(5)
Time period	**Cash flows**	**Present value at 7%**	**(3) ÷ price**	**(1) x (4)**
1	R60	R56.07	0.0580	0.0580
2	R60	R52.41	0.0543	0.1085
3	R60	R48.98	0.0507	0.1521
4	R1 060	R808.67	0.8370	3.3481
Total		R966.13*	1.0000	3.6667

* Macaulay duration = 3.6667 ÷ 2 = 1.83 years

The duration measurement has the following characteristics:

- The duration of a normal coupon-paying bond is always less than its time to maturity. because duration assigns weights to the coupon payments. It would then follow that the duration of a zero-coupon bond would be equal to the time to maturity of the bond since there are no coupon payments.
- There is an inverse relationship between duration and coupon rates and between duration and yield to maturity.
- There is a positive relationship between duration and time to maturity.

ACTIVITY

Using the previously calculated Macaulay duration, determine the bond's modified duration.

FEEDBACK

In the previous example, we measured the Macaulay duration at 1.83 years. From this we can calculate the modified duration as follows:

$$D_{\text{mod}} = \frac{1.83}{\left(1 + 0{,}14/2\right)} = 1{,}71\ years$$

ACTIVITY

Use the bond information as above and calculate the effective duration of this bond.

FEEDBACK

$$\text{Effective duration} = \frac{V_- - V_+}{2V_0\left(\Delta y\right)}$$

where: V_- = estimated price if yield decreases by a given amount, Δy

V_+ = estimated price if yield increases by a given amount, Δy

V_0 = initial observed price

Δy = change in required yield in decimal form

	V_-	V_0	V_+
FV	1 000	1 000	1 000
PMT	60	60	60
I	6.5	7	7.5
N	4	4	4
PV?	982.87	966.13	949.76

$$\text{Effective duration} = \frac{982{,}87 - 949{,}76}{2(966{,}13)(0{,}01)} = 1{,}71$$

Effective duration will equal modified duration provided the bond has no embedded options. One cannot apply the modified duration calculation to a bond that is callable or putable. Effective duration, on the other hand, may be used in all circumstances.

The duration effect

With the help of the modified duration measure, we can now deduce to what extent price and yield will influence each other, since it was found that price movements would vary proportionally with modified duration for small changes in yields.

Approximate *percentage* change in price due to duration:

$$\%\Delta P = (-)\left(D_{effective}\right)(\Delta y)$$

where: % Δ P = percentage change in price of bond

Δ y = yield change (basis points ÷ 100)

Note the negative sign in the equation – it's there because bond prices and yields move in opposite directions (inverse relationship).

ACTIVITY

In the previous example we measured the modified duration at 1.71 years. Suppose we want to see what the influence of an increase of 20 basis points (0.20%) in the yield to maturity of the bond will be on the price of the bond.

FEEDBACK

$$\%\Delta P = (-)(1{,}71)(0{,}20) = -0{,}3420\%$$

This would imply that the price of the bond would decrease by 0.3420% or R3.30 (966.13 x 0.00342) to R962.83 if the yield to maturity were to increase by 20 basis points.

Alternatively:

Estimated price of bond = R966.13 x [1+ (–0.00342)] = R962.83

Actual price of bond = R962.82 (FV = 1 000; PMT = 60; N = 4; I/YR = 7.1)

Note in the above calculations that the estimated price change differs from the actual price change. For *large changes in yield*, that's a very common behavioural characteristic of duration – that is, for wide swings in yield (of 50 to 100 basis points or more), duration tends to *underestimate the increase in price* that occurs with a decrease in yield, and *overestimate the decrease in price* that comes with an increase in yield. That's not the case, however, with very small changes in yield (of 10 to 25 basis points or so); under those conditions, the estimated and actual price changes are equal (or very close) to one another,

as in the example. This phenomenon is referred to as the *convexity effect*, and fortunately, the amount of convexity in a bond can be measured and *used to supplement duration* in order to achieve a more accurate estimate of the change in price.

Convexity

While a precise calculation of convexity involves the use of calculus (convexity is the second derivative of the price function with respect to yield), we can generate an approximate measure of convexity as follows:

$$\text{Convexity} = \frac{V_- + V_+ - 2V_0}{2V_0(\Delta y)^2}$$

where: V_- = estimated price if yield decreases by a given amount, Δy

V_+ = estimated price if yield increases by a given amount, Δy

V_0 = initial observed price

Δy = change in required yield in decimal form

ACTIVITY

A bond has the following characteristics. Calculate the convexity of the bond taking into account a 1% change in the yield to maturity.

Face value: R100

Time to maturity: 2 years

Coupon payments: 10% per annum (thus R5 per six-month period)

Yield to maturity: 12% per annum (thus 6% per six-month period)

Price: R96.5349

FEEDBACK

	V_-	V_0	V_+
FV	100	100	100
PMT	5	5	5
I	5.5	6	6.5
N	4	4	4
PV?	98.2474	96.5349	94.8613

$$\text{Convexity} = \frac{98{,}2474 + 94{,}8613 - 2(96{,}5349)}{2(96{,}5349)(0{,}01)^2} = 2{,}0168$$

[The convexity is shown as 4.03 on page 212 but that should be divided by two → 2.02]

The convexity effect

$$\%\Delta P = \text{Convexity}(\Delta y)^2$$

where: % Δ P = percentage change in price of bond

Δ y = yield change in decimal form

Percentage change in price

By combining duration and convexity, we can obtain a far more accurate estimate of the percentage change in the price of a bond, especially for large swings in yield. That is. you can account for the amount of convexity embedded in a bond by *adding the convexity effect to duration*, as follows:

$$\%\Delta P = \text{Duration effect} + \text{Convexity effect}$$
$$= (-)\left(D_{effective}\right)(\Delta y) + \text{Convexity}(\Delta y)^2$$

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 12 in the prescribed book.

(2) Additional assessment questions:

(a) Explain the relationship between the yield to maturity, coupon rate and price of a bond.

(b) Calculate the realised compound yield of the following bond:

Time to maturity	12 years
Coupon rate	13% (semi-annual payments)
Face value	R1 000
Yield to maturity	15.50%
Market price	R865.60
Reinvestment rate	9%

(c) You are estimating the interest rate risk of a 14% semi-annual coupon bond with 6 years to maturity. The bond is currently trading at par. Use a 25 basis point change in yield to compute the effective/modified duration.

(d) Suppose that the bond in question (c) is callable at par today. Using a 25 basis point change in yield, calculate the bonds effective duration assuming that its price cannot exceed 100.

(e) Referring to the bond in question (d), suppose that the bond is option-free. Calculate its convexity value (again use a 25bp change in yield).

(f) Suppose that you determine that the modified duration of a bond is 7.87. Estimate the percentage change in price due to duration, given that yields decrease by 110 basis points.

(g) Suppose that you have found the convexity of a bond to be 57.3. Estimate the convexity effect if yields decrease by 110 basis points.

(h) Assume you are looking at a bond that has an effective duration of 10.5 and a convexity of 97.3. Using both of these measures, find the estimated percentage change in price for this bond, given market yields are expected to decline 200 basis points.

(i) You purchased an annual interest coupon bond one year ago that now has 6 years remaining until maturity. The coupon rate of interest was 10% and the par value was R1 000. At the time of purchase, the yield to maturity was 8%. The amount that you paid for this bond one year ago was:

(1) 1. R1 057.50
(2) 2. R1 075.50
(3) 3. R1 088.50
(4) 4. R1 104.13

(j) Bond E has a par value of R1 000 000 and matures in 0 years. It is callable in 12 years by the issuer at a call price of R1 268 000. It has coupon payments of 8% per annum (semi-annual).

(1) 4.26%
(2) 4.56%
(3) 8.53%
(4) 9.12%

Use the information below to answer questions k and l below.

A firm's outstanding bond issue has 8 years remaining until maturity. The bond was issued with a 6.5% coupon rate (paid quarterly) and a par value of R1 000. The required rate of return is 4.25%.

(k) What is the current value of this bond?

(1) R433.15
(2) R860.50
(3) R1 149.94
(4) R1 151.92

(l) Determine the bond's value in one year if the required return is 7%.

(1) R970.14
(2) R1 031.15
(3) R1 035.81
(4) R972.52

(m) A 5-year, 6% coupon bond pays interest semi-annually and sells for R958.42. The effective duration of this bond is closest to

(1) 4.03
(2) 4.11
(3) 4.17
(4) 4.23

(n) A 12-year, 10% semi-annual coupon bond (R1 000 par value) is priced at a yield to maturity (YTM) of 8%. The convexity adjustment with a 150 basis point decrease in yield is closest to

(1) R4.21
(2) R6.53
(3) R9.47
(4) R9.86

(o) Consider a bond portfolio manager who expects interest rates to decline and has to choose between the following two semi-annual bonds.

- Bond A 10 years to maturity with a 5% coupon and yielding 5%
- Bond B 10 years to maturity. priced at R918.24 to yield 4%

(1) Bond B because it has a lower coupon rate
(2) Bond A because it has a higher coupon rate
(3) Bond B because it has a lower yield to maturity
(4) Bond A or Bond B because the maturities are the same

(p) The following information is for Bond D.

Yield to maturity	13%
Coupon rate	10%
Coupon payments	Semi-annual
Time to maturity	3.5 years
Market price	R901 375
Face value	R1 000 000

Given a reinvestment rate of 15%, calculate the realised compounded yield of Bond D.

(1) 4.33%
(2) 13.83%
(3) 17.66%
(4) 18.56%

(q) Assume that you purchase a 3-year R1 000 par value bond, with an 8% coupon and a yield of 10%.

After the purchase the bond, one-year interest rates are as follows:

Year 1 = 10%
Year 2 = 8%
Year 3 = 6% (these are the reinvestment rates)

Calculate the realised compound or horizon yield if you hold the bond to maturity, interest paid annually.

(1) 7.28%
(2) 8.37%
(3) 9.76%
(4) 10.67%

(r) Suppose the current 6 year spot rate is 8% and the current 5 year spot rate is 7%. What is the one year forward rate in five years?

(1) 11.58%
(2) 13.14%
(3) 14.65%
(4) 15.14%

(s) The current 1 year spot rate is 6%, the current 2 year spot is 9.2% and the current 3 year spot rate is 14%. Calculate the forward rate two years from now.

(1) 4.58%
(2) 19.05%
(3) 24.23%
(4) 30.00%

(t) For an option free bond, what are the convexity adjustments on the value of the approximate bond price change with regards to an increase in yield and a decrease in yield respectively?

Increase in yield	Decrease in yield
(1) Decrease in value	Increase in value
(2) Increase in value	Increase in value
(3) Decrease in value	Decrease in value
(4) Increase in value	Decrease in value

Answers to additional assessment questions

(a) Coupon rate = Yield to maturity, then Market price = Face value
Coupon rate > Yield to maturity, then Market price > Face value
Coupon rate < Yield to maturity, then Market price < Face value

(b) Step 1: PMT 65
N 24
I/YR 4.5 (reinvestment rate of 9%)
FV? 2 709.80

Step 2: R(1 000 + 2 709.80) = R3 709.80

Step 3: FV 3 709.80
PV –865.60
N 24
I/YR? 12.50% (6.25 x 2)

(c) Effective/modified duration

	V_-	V_0	V_+
FV	100	100	100
PMT	7	7	7
I	6.875	7	7.125
N	12	12	12
PV?	100.9995	100	99.0137

$$\text{Effective duration} = \frac{100{,}9995 - 99{,}0137}{2(100)(0{,}0025)} = 3{,}97$$

[Note that the interest changes by 25bp, therefore (14–0.25) = 13.75 → 6.875 etc.]

(d) Effective duration (callable at par)

$$\text{Effective duration} = \frac{100 - 99{,}0137}{2(100)(0{,}0025)} = 1{,}97$$

(e) Convexity

$$\text{Convexity} = \frac{100{,}9995 + 99{,}0137 - 2(100)}{2(100)(0{,}0025)^2} = 10{,}58$$

(f) Duration effect

$$\%\Delta P = (-)(7{,}87)(-1{,}10\%) = 8{,}657\%$$

(g) Convexity effect

$$\%\Delta P = 57{,}3(0{,}011)^2 = 0{,}0069 = 0{,}6933\%$$

(h) Combined effect

$$\%\Delta P = \text{Duration effect} + \text{Convexity effect}$$
$$= \left[(-)(10{,}5)(-2\%)\right] + \left[97{,}3(0{,}02)^2\right]$$
$$= (21 + 3{,}89)\%$$
$$= 24{,}89\%$$

(i)

HP10B	
Input	**Function**
1 000	FV
100	PMT
7	N
8	I/YR
	PV
4.	**R1 104.13**

(j)

HP10B	
Input	**Function**
1 268 000	FV
–1 000 000	PV
40 000	PMT
26	N
	I/YR
4.	**4.5587% ×2 = 9.12%**

(k)

HP10B	
Input	**Function**
1 000	FV
16.25	PMT
32	N
1.0625	I/YR
	PV
4.	**R1 151.92**

(l)

HP10B	
Input	**Function**
1 000	FV
16.25	PMT
28	N
1.75	I/YR
	PV
4.	**R972.52**

(m)

HP10B	
Input	**Function**
1 000	FV
-958.42	PV
30	PMT
10	N
	I/YR
4.	**3.5% ×2 = 7%**

	V_-	V_0	V_+
FV	1 000	1 000	1 000
PMT	30	30	30
N	10	10	10
I	3	3.5	4
PV	1 000	958.42	918.89

$$\text{Effective duration} = \frac{(V-) - (V+)}{2V_0(\Delta y/100)}$$

$$= \frac{1\,000 - 918.89}{2 \times 958.42 \times 0.01}$$

4. $= 4.23$

(n) *Effective convexity* $= \dfrac{(V-) + (V+) - 2(V_0)}{2\,(V_0)\,(\Delta y/100)^2}$

	V_-	V_0	V_+
FV	1 000	1 000	1 000
PMT	50	50	50
N	24	24	24
I	3.25	4	4.75
PV	1 288.546	1 152.47	1 035.35

$$= \frac{1288.546 + 1035.35 - (2 \times 1152.47)}{2 \times 1152.47 \times 0.015^2}$$

$$= \frac{18.956}{0.51859}$$

$$= 36.553$$

$$\Delta P = V_0 \times \text{convexity} \times (\Delta y/100)^2$$

$$= 1152.47 \times 36.553 \times (0.015)^2$$

3. $= R9.47$

(o) Bond B

HP10B	
Input	**Function**
1 000	FV
–918.24	PV
20	N
2	I/YR
	PMT
	R15 × 2 =R30

1. = 3% coupon. Choose Bond B because it has a lower coupon rate.

(p) Step 1: Calculate the future value of the coupon payments reinvested.

HP10B	
Input	**Function**
50 000	PMT
7	N
7.5	I/YR
	FV
	R439 366.09

Step 2: Add the face value of the bond to the future value of the coupon payments.

= R1 000 000 + R439 366.09

= R1 439 366.09

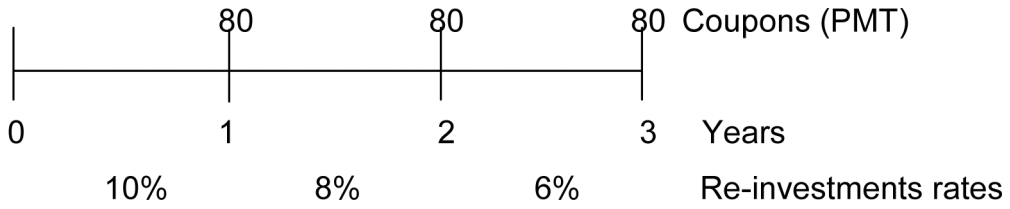
Step 3: Calculate the actual yield received

HP10B	
Input	**Function**
1 439 366.09	FV
– 901 375	PV
7	N
	I/YR
	6.9148 × 2 = 13.83%

2.

(q)

HP10B	
Input	**Function**
1 000	FV
80	PMT
3	N
10	I/YR
	PV
Market price	**R950.263**



Step 1: Calculate the future value of the coupon payments reinvested.

= 80(1.08)(1.06) + 80(1.06) + 80

= 91.584 + 84.80 + 80

= R256.384

Step 2: Add the face value of the bond to the future value of the coupon payments.

= R1 000 + R256.384

= R1 256.384

Step 3: Calculate the actual yield received.

HP10B	
Input	**Function**
1 256.384	FV
–950.263	PV
3	N
	I/YR
3.	**9.76%**

(r) Forward rate $= \frac{1.08^6}{1.07^5}$

$= \frac{1.5869}{1.4026}$

$= 1.1314$

$= (1.1314 - 1) \times 100$

2. $= 13.14\%$

(s) Forward rate $= \frac{1.14^3}{1.092^2}$

$= \frac{1.4815}{1.1925}$

$= 1.2423$

$= (1.2423 - 1) \times 100$

3. $= 24.23\%$

(t) 4. Increase in yield: Increase in value Decrease in yield: Decrease in Value

This is because the price change due to an increase in yield is smaller than the price change due to a decrease in yield for option-free bonds.

SUMMARY

In this study unit we have determined spot rates (bootstrapping/stripping) calculated forward rates and discussed the theories offered to explain the shape of the yield curve. We have calculated the duration and convexity of a bond in order to compare and select between different bonds in constructing a portfolio of bonds suited to the prevailing and expected interest rate environment. All the previous study units have been leading up to the topic to follow – portfolio management. In this topic we are introduced to derivative instruments (used to manage risk and alter portfolio composition), the basics for constructing a portfolio and the measurement of the performance of these portfolios.

Topic 4

PORTFOLIO MANAGEMENT

AIM

The key to portfolio management is the enhancement of return whilst simultaneously reducing risk by means of diversification and/or derivatives. This topic provides you with a general overview of the field of derivatives, including the derivative markets and market participants, and the basic concepts of forwards, futures, options and swaps. We introduce the criteria for security selection in constructing a portfolio and measure the performance of a portfolio.

TOPIC LEARNING OUTCOMES

Once you have worked through this topic, you should be able to:

- use derivatives to manage risk or enhance portfolio return
- construct and manage a portfolio

TOPIC CONTENT

Study unit 13: An introduction to derivative instruments
Study unit 14: Portfolio management
Study unit 15: Evaluation of portfolio management

Study unit 13

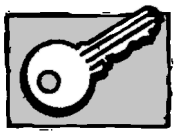
An introduction to derivative instruments

CONTENTS

LEARNING OUTCOMES

Once you have worked through this unit, you should be able to:

- define a derivative and differentiate between exchange-traded and over-the-counter derivatives
- define a forward commitment, identify the types of forward commitments and describe the basic characteristics of forward contracts, futures contracts and swaps
- define a contingent claim and identify the types of contingent claims
- describe the basic characteristics of options and distinguish between an option to buy (call) and an option to sell (put)
- discuss the purposes and criticisms of derivative markets
- explain the concept of arbitrage and the role it plays in determining prices and in promoting market efficiency
- describe how a futures position may be closed out (i.e. offset) prior to expiration
- define initial margin, maintenance margin, variation margin and settlement price
- describe how a futures contract can be terminated by close-out at expiration, delivery, an equivalent cash settlement or an exchange-for-physicals
- identify the basic elements and describe the characteristics of option contracts
- define European option, American option, moneyness, payoff, intrinsic value and time value
- explain how payoffs are determined
- identify the minimum and maximum values of European options and American options
- calculate put-call parity for European options
- describe the characteristics of swap contracts and explain how swaps are terminated
- define currency swaps and calculate and interpret the payments on a currency swap
- define a plain vanilla interest rate swap and calculate and interpret the payments on an interest rate swap
- determine the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the strategies of buying and selling calls and puts, and explain each strategy's characteristics
- determine the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the covered call strategy and the protective put strategy, and explain each strategy's characteristics



KEY CONCEPTS

Arbitrage
Call option
Clearinghouse
Covered call
Currency swap
Derivatives
European options
Forward options
Futures contracts
Futures price
Hedge ratio
Interest rate swap
Long
Margins
Marking-to-market
Open interest
Option bounds
Option delta
Option premium
Option pricing
Payoff
Protective put
Put option
Put-call parity
Risk management
Risk profiles
Short
Swaps
Volume

OVERVIEW

A major development in the field of investments has been the creation and development of new financial instruments and the introduction of derivatives such as futures, options and swaps. Derivatives afford investors an opportunity of adjusting the risk-return characteristics of their portfolios.

In this study unit we explain derivative instruments. We also look at the key aspects of futures contracts such as futures pricing, arbitrage, speculation versus hedging, volume, open interest, marking to market, the clearinghouse, closing a futures position, the zero sum game and how the hedge ratio is determined.

Options are then discussed and the differences between call and put options and between an American and a European option are highlighted. We also consider the factors that determine an option premium, and we explain put-call parity and the combining of options in order to achieve a covered call strategy or a portfolio insurance strategy. The study unit concludes with a discussion of interest rate swaps and currency swaps, and the underlying principle of comparative advantage.

Study chapter 13 of the prescribed book.

Derivative market terms and concepts

Arbitrage

It is important to understand the concept of *arbitrage* and the *no-arbitrage* principle. Arbitrage refers to the opportunity to make a risk-less profit with no investment. Theoretically, markets are said to be efficient, alluding to the fact that quoted security prices supposedly impound all relevant information. This excludes the possibility of arbitrage in utilising disparate pricing in the same or different markets. Since any observed pricing errors would be instantaneously corrected, any quoted prices must be free of all known errors. The no-arbitrage opportunity assumption is the basic requirement for rational prices in

the financial markets. Arbitrage and efficient markets enabled the evolution of the option and futures pricing models as presented in the textbook and study guide.

> *Arbitrage* is the simultaneous buying and selling of identical or related securities (commodity or financial) in the same (spot or futures) or different (spot and futures) markets resulting in a profit through a discrepancy in the pricing of these securities as quoted on various formal and over-the-counter (OTC) exchanges. The immediate nature of the transaction affords the investor a risk-less profit without the transfer of money. This will result in the fair and/or equal pricing of identical/related securities across and within markets. An *arbitrageur* is a person who engages in arbitrage.

Markets

The *spot market*, also called cash market, is a market for buying or selling commodities or securities for immediate delivery and for cash payment at the price prevailing at the time of sale.

The *futures market*, also called forward or derivative market, is a market in which contracts for future delivery of a commodity or a security are bought or sold at a predetermined price (date of contract) and settlement/payment is deferred until maturity/expiration of contract.

The *over-the-counter market*, sometimes referred to as the unlisted market, facilitates transactions across the desk of interested parties, or frequently using computer terminals (electronically) and telephones. The OTC market permits the parties to innovate in accordance with their needs (tailor-made contracts).

Any organization, association or group that provides or maintains a marketplace where securities or commodities can be traded is referred to as an exchange, representing the *formal market*. These markets are highly regulated and trade in standardised instruments. The formal exchanges in South Africa are the JSE Securities Exchange, the South African Futures Exchange (SAFEX) and the Bond Exchange of South Africa (BESA).

Marking to market records the price or value of a security, portfolio, or account on a daily basis in order to calculate profits and losses or to confirm that margin requirements are being met. The clearinghouse sets and maintains the margins as required when trading futures contracts.

The *primary market* is the market for new securities issues. In the primary market the security is purchased directly from the issuer. This differs from the secondary market.

The *secondary market*, also called aftermarket, is a market in which an investor purchases a security from another investor rather than the issuer, subsequent to the original issuance in the primary market.

A *bear market* (opposite of bull market) is a prolonged period in which prices fall, accompanied by widespread pessimism. If the period of falling stock prices is short and immediately follows a period of rising share prices, it is instead called a correction. Bear

markets usually occur when the economy is in a recession and unemployment is high, or when inflation is rising quickly. Analogous to this is being *bearish* (opposite of bullish) and therefore believing that a particular security, sector, or the overall market is about to fall.

A *bull market* (opposite of bear market) represents a prolonged period in which investment prices rise faster than their historical average. Bull markets can happen as a result of an economic recovery, an economic boom, or investor psychology/sentiment. Related to this is being *bullish* (opposite of bearish), thus believing that a particular security, sector, or the overall market is about to rise.

Tradeable assets

A *commodity* is a physical substance, such as food, grains, or metals, which is interchangeable with another product of the same type, and which investors buy or sell, either in the spot commodity market or through futures contracts. The price of the commodity is subject to supply and demand. Risk is actually the reason exchange trading of the basic agricultural products began. For example, a farmer risks the cost of producing a product ready for market at sometime in the future because he or she does not know what the selling price will be.

A *financial security/instrument* is a general term for any written instrument having monetary value or evidencing a monetary transaction. These securities provide a mechanism for investment in the financial markets and include equity (shares), fixed-income securities (debt/bonds), share indexes, forwards, futures, options, swaps and currencies.

Derivative contracts

A forward contract or *forward* is an over-the-counter market transaction in which a seller agrees to deliver a specific security to a buyer at some point in the future. Unlike futures contracts (which occur through a clearing firm), forward contracts are privately negotiated and are not standardised. Further, the two parties must bear each other's credit risk, which is not the case with a futures contract. Also, since the contracts are not exchange-traded, there is no marking to market requirement, which allows a buyer to avoid almost all capital outflow initially (though some counter-parties might set collateral requirements). Given the lack of standardisation in these contracts, there is very little scope for a secondary market in forwards.

A futures contract or *futures* is a standardised, transferable, exchange-traded contract that requires delivery of a commodity, bond, currency, or share index at a specified price, on a specified future date. Unlike options, futures convey an obligation to buy. The risk to the holder is unlimited, and because the payoff pattern is symmetrical, the risk to the seller is unlimited as well. Monetary values lost and gained by each party on a futures contract are equal and opposite. In other words, futures trading is a zero-sum game. Futures contracts are forward contracts, meaning they represent a pledge to make a certain transaction at a future date. The exchange of assets or cash settlement occurs on the date specified in the contract. Futures are distinguished from generic forward contracts in that they contain standardised terms, trade on a formal exchange, are regulated by overseeing agencies, and are guaranteed by a clearinghouse (SAFEX Clearing Company (Pty) Ltd – SAFCOM).

Also, in order to ensure that payment will occur, futures have a margin requirement that must be settled daily.

An option contract or *option* is the right, but not the obligation, to buy (call option) or sell (put option) a specific amount of a given share, commodity, currency, index, or bond at a specified price (the strike price) during a specified period of time. Each option has a buyer, called the holder, and a seller, known as the writer. If the option contract is exercised, the writer is responsible for fulfilling the terms of the contract. While the holder's upside potential is unlimited, the potential loss is limited to the price paid to acquire the option. When an option is not exercised, it expires with no shares changing hands and the money spent to purchase the option is forfeited. Options, like shares, are therefore said to have an asymmetrical payoff pattern. For the writer, the potential loss is unlimited unless the contract is covered, meaning that the writer already owns the security underlying the option. Options are most frequently used as either leverage or protection. As leverage, options allow the holder to control equity in a limited capacity for a fraction of what the shares would cost. The difference can be invested elsewhere until the option is exercised. As protection, options can guard against price fluctuations in the near term because they provide the right to acquire the underlying share at a fixed price for a limited time. Risk is limited to the option premium (except when writing options for a security that is not already owned). However, the costs of trading options are higher on a percentage basis than trading the underlying share. In addition, options are very complex and require a great deal of observation and maintenance.

An option contract that gives the holder the right to buy a certain quantity of an underlying security from the writer/seller of the option at a specified price (the strike or exercise price) up to a specified date (the expiration date) is referred to as a *call option* or call. Alternatively an option contract that gives the holder the right to sell a certain quantity of an underlying security to the writer/seller of the option at a specified exercise price up to the specified expiration date is known as a *put option* or put.

A *swap* is defined as an exchange of cash flows based on a notional principal amount according to specified terms. The two most common types of swaps are an interest rate swap, in which one party agrees to pay a fixed-interest rate in return for receiving a floating-interest rate from another party, and a currency swap, in which parties swap principal amounts and interest on different currencies. Closely related to swaps is a *forward rate agreement* (FRA), which is an agreement to pay or receive, on an agreed future date, the difference between an agreed interest rate and the interest rate actually prevailing on that date, based on a notional principal amount. The difference is that the FRA is applied to a single period and a swap to cash flows over several periods. A swap is therefore considered to be a series of forward rate agreements.

Financial engineering is the process of researching and developing new financial products and services that would meet customer needs and prove profitable. Financial institutions use financial engineering to create complex derivative instruments, combining or carving up existing instruments to create new financial products.

Primary trading strategies

A *covered call* involves the selling of a call option while simultaneously holding an equivalent position in the underlying security. This is an attempt to take advantage of a neutral or declining share. If the option expires unexercised, the writer keeps the premium. Should the holder exercise the option, the share must be delivered, but, because the writer already owns the stock, risk is limited. This is the opposite of an uncovered call, when the writer sells a call for a share that he or she does not already own, a dangerous strategy with unlimited risk. Covered calls relate to one of the uses of derivatives, namely *income generation*. Writing calls to generate income is especially popular during a flat period in the market or when prices are trending downward.

A *protective put* offers protection against a decline in the share price of the underlying security. This constitutes the purchase of a put option for an underlying security that is already owned by the holder of the option and relates to the primary use of derivatives, namely hedging.

Description of forward and futures contracts

A *forward contract* is a privately negotiated contract between two parties. The contract is negotiated in the present and gives the contract holders both the right and the full legal obligation to conduct a transaction at a specific future time involving a specific quantity and type of asset at a predetermined price. The purchaser/buyer (long position) of the contract is to receive delivery of the good and pay for it, while the seller (short position) of the contract promises to deliver the good and receive payment. This is in contrast to a spot market contract which is an agreement between two parties to buy or sell an asset for immediate delivery and payment. The forward contract provides predictability to market participants since it is known in advance what price (determined at the initial time of the contract) will be paid for an asset.

The *futures contract* is an extension of the forward contract, with one major difference being that futures contracts have formalised and standardised characteristics. The standardised characteristics specified under the contract include a specification of the asset, contract size, and where and when it can be delivered. A futures contract is thus not just a contract between two parties; it becomes a tradeable financial instrument regardless of whether the underlying asset happens to be gold, maize, dollars or stocks.

> A futures contract is a forward contract that has been highly standardised and closely specified.

Differences between forward and futures contracts

- Forwards are private contracts (OTC) and do not trade on an organised exchange
- Futures trade on organised exchanges (South Africa – SAFEX)
- Forwards are unique contracts satisfying the needs of the parties involved
- Futures are highly standardised (specification of the quantity, quality, delivery date, and delivery mechanism)

- Forwards have default risk (the seller may not deliver, and the buyer may not accept delivery)
- Futures trade on an organised exchange and performance is guaranteed by the exchanges' clearinghouse (South Africa – SAFCOM)
- Forwards require no cash transactions until the delivery date
- Futures require marking to market (traders required to post margin – good faith money that supports the trader' promise to fulfil his/her obligation)
- Forwards are usually not regulated – self regulated
- Futures trade on organised exchanges regulated by government
- Forwards (tailor-made) have little secondary market trading
- Futures (standardise – exchange traded) have active secondary market trading

Regardless of the institutional differences, forwards and futures are very similar contracts and are priced by identical economic principles.

Different types of futures contracts

This chapter describes the fundamental characteristics (specifications) of futures contracts but does little towards explaining the practical reasons and uses of futures contracts. The difference between hedgers and speculators was discussed in the previous study unit. The following table summarises, from a hedger's perspective, how the different types of futures contracts can be used:

Type of futures contract	Reason/s for taking a long position	Reason/s for taking a short position
Equity index futures	Covering a short selling exposure *	Hedge total portfolio against downward prices
Individual equity share futures	Covering a short selling exposure *	Hedge individual shares against downward prices
Interest rate futures	Hedge a floating rate loan against an increase in interest rates	Hedge a floating rate loan against a decrease in interest rates
Bond futures	Buyer of bond hedge against a decrease in interest rates (increase in the price of bond)	An issuer (seller) of bonds hedge against an increase in interest rates
Bond index futures	Buyer of a bond portfolio hedge against a decrease in interest rates	An issuer (seller) of a bond portfolio hedge against an increase in interest rates
Commodity/agricultural futures	Buyer of commodities hedge against price increases	Producer of commodities hedge against a decrease in prices

* Short selling involves selling securities or underlying assets that are not owned.

ACTIVITY

Go onto the JSE's futures market (SAFEX) website and note the derivative products that are available on individual equities (single stocks).

Address: http://www.jse.co.za/trade/derivative-market/equity-derivatives
Click on: ``Single Stock Futures'' (on the right-hand side of the screen)
Individual Equity Futures
Scroll down and note the specifications and underlying shares/stocks

FEEDBACK

These are futures on individual shares, and differ from the index futures in that the settlement at expiry requires physical delivery as opposed to cash settlement.

Contract specifications for individual equity futures

Underlying instrument	Specified individual equities/stocks
Contract size	100 times the share price
Expiry date	Third Thursday of March, June, September and December, or the previous business day if it is a public holiday
Settlement method	Physically settled. Position holders must elect a stock broker to facilitate the physical settlement
Tick value (minimum movement)	R1 (1 cent per share)
Expiry valuation method	Based on the arithmetic average share price as calculated by the JSE between the hours of 14h01 and 15h40 on the expiry date

The following table summarises, from a speculator's perspective, how the different types of futures contracts can be used:

Type of futures contract	Reason/s for taking a long position	Reason/s for taking a short position
Equity index futures	The speculator believes that the there will be an upward (favourable) movement in the equity market and that, in general, the prices of shares will increase	The speculator believes that there will be a downward (unfavourable) movement in the equity market and that, in general, the prices of shares will decrease
Individual equity share futures	The speculator believes that there will be an upward (favourable) movement in the prices of individual shares	The speculator believes there will be a downward (unfavourable) movement in the prices of individual shares

Type of futures contract	Reason/s for taking a long position	Reason/s for taking a short position
Interest rate futures	The speculator believes that market interest rates will increase	The speculator believes that market interest rates will decrease
Bond futures	The speculator believes that market interest rates will decrease	The speculator believes that market interest rates will increase
Bond index futures	The speculator believes that market interest rates will decrease	The speculator believes that market interest rates will increase
Commodity/agricultural futures	The speculator believes that the prices of commodities will increase	The speculator believes that the prices of commodities will decrease

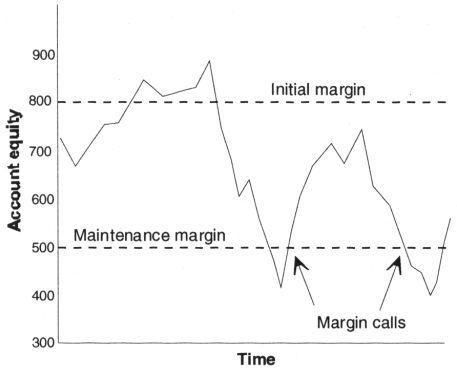
Margins

The futures exchange calculates profits or losses on each open futures contract position on a daily basis by a process known as "marking-to-market". This process involves averaging out the closing bid and offer prices quoted on the futures exchange for every open futures contract at the end of the day. These average bid and offer prices are then compared with the bought or sold prices executed by each party on their contracts. The so called mark-to-market profits are then calculated and credited or debited to each account accordingly. To manage risk and to avoid default risk exposure, no futures participant is permitted to build up large unrealised losses. Any loss incurred must be paid for as it occurs, that is on a daily basis. To ensure that this takes place, a margin system is used.

In order to arrive at an appropriate margin percentage value for a futures contract, the futures exchange estimates the maximum amount that each participant could reasonably lose on the individual futures contract from one day to the next. The futures participant is required to lodge with the futures exchange, in cash, a margin equal to this maximum potential daily loss, and this is known as the initial margin. In South Africa, this margin is between 5 per cent and 10 per cent of the value of the futures contract, and is in essence a "good faith" deposit.

The initial margin is payable when the futures contract is initially entered into. This margin account then earns interest at a money-market-related interest rate, and the balance is returned to the investor when the contract is eventually closed out.

The operation of margins



There are three types of margin. The first deposit is called the *initial margin*. Initial margin must be posted before any trading takes place. Initial margin is fairly low and equals about one day's maximum price fluctuation. The margin requirement is low because at the end of every day there is a *daily settlement* process called marking-the-account-to-market. In *marking to market*, any losses for the day are removed from the trader's

account and any gains are added to the trader's account. If the margin balance in the trader's account falls below a certain level (called the *maintenance margin*), the trader will get a *margin call* and have to deposit more money (called the *variation margin*) into the account to bring the account back up to the initial margin level.

The clearinghouse

Consistency on the part of both buyers and sellers is a prerequisite for an efficient and actively traded futures market. If speculators and hedgers knew that the other participants could simply default on their contracts and that their only resort would be legal action, futures markets would simply never function efficiently. Every buyer and seller in the futures market must thus be confident that every futures contract will be honoured, thereby eliminating default risk.

In order to create this certainty, a futures exchange clearinghouse becomes a party to each and every contract and thereby guarantees performance. The South African Futures Exchange (SAFEX) has its own independent clearinghouse, SAFCOM (South African Clearing Company). SAFCOM is a non-profit organisation designed to provide efficient service to the market and to market participants. All purchases and sales are matched in the futures market so that ownership can pass to the buyer and payment to the seller without undue delay; this ensures default-free transactions.

SAFCOM undertakes this matching process and acts like an insurance company, since it saves part of the fees it collects in an insurance fund. Should one party to a futures contract then default, the clearinghouse will pay, from its insurance fund, any costs needed to carry out the contract. This process ensures the liquidity and exchangeability of futures contracts.

Hedging

- Short hedge (pp 241, 242)

  A *short hedge* involves a short position in a futures contract and is appropriate when the hedger already owns (long) an asset and expects to *sell* it at some time in the future. Exposure to fluctuating prices is eliminated, or at least reduced. (*Note: If you're long the underlying, then use a short hedge. If you're short the underlying, then use a long hedge.*)

- Long hedge (pp 241, 242)

  A *long hedge* involves a long position in a futures contract and is appropriate when a company knows it will have to *purchase* a certain asset in the future and wants to lock in a price now. This is also referred to as an *anticipatory hedge* since the company anticipated a need for a certain commodity and locked in the price for that future purchase. In both cases the hedger has essentially purchased insurance against unfavourable market volatility.

- Cross-hedging

  A *cross-hedge* is a hedge in which the hedge vehicle (the futures contract) is not perfectly correlated with the underlying exposure that is being hedged.

- Basis risk
  - Reasons
    - Hedged asset not the same as underlying asset
    - Uncertainty as to the exact date when the asset has to be bought or sold
    - Futures contract closed out well before the expiration date
  - Basis = Spot price of the asset to be hedged minus the Futures price of the contract used
    - *Strengthening of the basis* – spot price increases more than futures price
    - *Weakening of the basis* – futures price increases more than spot price

ACTIVITY

Go onto the JSE Securities Exchange website and take a look at the information provided on the FTSE/JSE Africa Index Series.

Address: http://www.jse.co.za

Click on: Financial Data (on the left-hand side of the screen)

FTSE/JSE – FAQ (frequently asked questions)

Choose Index Series from the alternatives listed

Scroll down the different topics and look at the questions and answers on this series

FEEDBACK

What is a tradeable index?

A tradeable index is one on which a derivative product exists. This derivative product is then traded on the JSE's futures market (SAFEX).

Are all the indices of the FTSE/JSE Africa Index Series tradeable?

No, not all the indices are tradeable.

The FTSE/JSE Africa Tradeable Indices consist of:

- FTSE/JSE Africa TOP 40

  The top forty companies which are constituents of the FTSE/JSE Africa All Share Index, ranked by full market capitalisation

- FTSE/JSE Africa RESI 20

  The top twenty companies which are constituents of the Resources economic group ranked by full market capitalisation

- FTSE/JSE Africa INDI 25

  The top 25 companies which are constituents of either the Basic Industrial or General Industrial economic groups ranked by full market capitalisation

- FTSE/JSE Africa FINI 15

  The top 15 companies which are constituents of the Financial economic group, ranked by full market capitalisation

- FTSE/JSE Africa FINDI 30

  The top 30 companies which are constituents of either the Financial, Basic Industrial or General Industrial economic groups ranked by full market capitalisation (although this index is calculated, there are currently no derivatives based upon this calculation)

- FTSE/JSE Africa GLDX

  All companies which are constituents of the FTSE/JSE Africa All Share Index and the Gold Mining sub-sector.

- Minimum variance hedge ratio

  The *hedge ratio* is the ratio of the size of the position taken in futures contracts to the size of the exposure. A one-to-one hedge may not always be optimal since the beta of the hedge vehicle does not match the beta of the underlying portfolio to be hedged. The goal of risk-minimization hedging is to minimize the variance of the hedged position. The hedge ratio that accomplishes this goal is:

$$\text{HR} = \frac{\text{covariance between the futures and the portfolio}}{\text{variance of the futures}} = \frac{\text{cov}_{FS}}{\sigma^2} = \rho\frac{\sigma_S}{\sigma_F}$$

Forward/futures price

The pricing of forwards/futures is important and this must be taken into consideration when entering into such a contract. Both parties involved in the contract must understand their future commitment and they must realise the implications of entering into the contract. When determining the price of a future/forward, we calculate what is called the fair value (see page 243).

Terminology

- Short selling – selling an asset that is not owned
- Cash-and-carry – the total cost of carrying a good forward in time
- Arbitrage – the possibility to generate a risk-less profit without investment
  - The relationship between the forward/futures price (F_0) and the spot price (S_0)
    $F_0 = S_0(1+r)^T$ or with continuous compounding $F_0 = S_0e^{rT}$
  - *Cash-and-carry arbitrage* ($F_0 > S_0e^{rT}$)
    - Sell futures
    - Borrow money
    - Buy spot

— *Reverse cash-and-carry arbitrage* ($F_0 < S_0 e^{rT}$)

- Short spot
- Invest money
- Purchase futures

The determination of forward and futures prices is derived from the principle of arbitrage. This is an important concept since arbitrage ensures that the theoretical futures price will equal the actual market price for the contract. The following is a more detailed discussion of this important pricing principle.

Arbitrage

Arbitrageurs are market participants who take advantage of small price differentials of similar products in different markets. When futures and spot prices move temporarily out of line with each other over a very short term, market traders will buy in the lower-priced market and simultaneously sell in the higher priced market to generate a risk-less profit. This strategy guarantees that futures prices are correctly priced in relation to current spot prices. Through this price determination, arbitrage therefore, also guarantees that futures contracts provide an effective hedge for spot risk exposures. The following example illustrates how arbitrage profits will correct market inefficiencies.

ACTIVITY

Given a current spot market price of R50 and a risk-free interest rate of 10% per annum, calculate the price of a six-month futures contract. Describe the scenario with an actual futures price of R55 and R50 respectively.

FEEDBACK

$$F_0 = S_0 e^{rT}$$

$$F_0 = 50e^{\left[0{,}10\times(6/12)\right]} = R52{,}56$$

Arbitrage scenario 1: Futures price = R55

In this case, the actual futures price of R55 is higher than the theoretical futures price of R52.56. An arbitrageur would follow the following strategy:

- *Cash-and-carry arbitrage* ($F_0 > S_0 e^{rT}$)
  - Sell/short futures → Asset sold six months forward
  - Borrow money → R50 @ 10% interest for six months
  - Buy/long spot → Pay R50 on the spot market
- *Six months later*
  - Repay loan of R52,56 (R50 + 10% interest for 6 months)
  - Deliver asset under futures contract and receive R55

By following this cash-and-carry arbitrage strategy, a risk free profit of R2,44 (R55 – R52,56) would be made.

Arbitrage scenario 2: Futures price = R50

In this case, the actual futures price of R50 is lower than the theoretical futures price of R52.56. An arbitrageur would follow the following strategy:

- *Reverse cash-and-carry arbitrage* ($F_0 < S_0 e^{rT}$)
  - — Sell/short spot → Receives R50 from short sale
  - — Invest proceeds → R50 @ 10% interest for six months
  - — Buy/long futures → Asset bought six months forward
  - — *Six months later*
    - Take delivery of asset (return shorted asset) and pay R50
    - Collect investment of R52,56 (R50 + 10%)

By following this reverse cash-and-carry arbitrage strategy, a risk free profit of R2,56 (R52,56 – R50) would be made.

From the scenarios above one can see that arbitrage will always be possible if the actual futures prices in the market does not equal their corresponding theoretical prices. As traders use arbitrage to exploit market inefficiencies, prices start moving to their theoretical values, thereby eliminating any arbitrage opportunity and ensuring that futures are correctly priced.

ACTIVITY

Go onto the JSE's futures market (SAFEX) website and note the derivative products that are available on tradeable indices.

Address: http://www.jse.co.za/trade/derivative-market/equity-derivatives

Click on: ``Equity Index Futures''

``Contract Specifications''

Scroll down the tables and identify the relevant derivatives

FEEDBACK

Contract specifications for equity index futures	
Underlying instrument	An equity index: Top 40, Resi 20, Indi 25, Fini 15, Findi 30 or GLDX
Contract size	10 times the index level
Expiry date	Third Thursday of March, June, September and December, or the previous business day if it is a public holiday
Settlement method	Cash
Tick value (minimum movement)	One index point (R10)
Expiry valuation method	Based on the arithmetic average of the index as calculated by the JSE between the hours of 14h01 and 15h40 on the expiry date

Options

Option contracts are instruments which give the buyer the right – but without the obligation – to buy or sell shares, bonds, currencies, commodities or any other form of security at a certain price, usually on or before a certain date. A distinction can be made between a call option, which is an option to buy an asset, and a put option, which is an option to sell an asset.

Option contracts were defined earlier as contracts that give the buyer or holder of the contract the right to buy or sell underlying securities at a certain price, on or before a certain date. In the case of option contracts the seller or writer of the contract has an obligation to honour his or her obligation. The choice (the right to exercise) thus lies with the holder of the contract. This is in contrast to futures and forward contracts, where parties are obliged to buy or sell an asset.

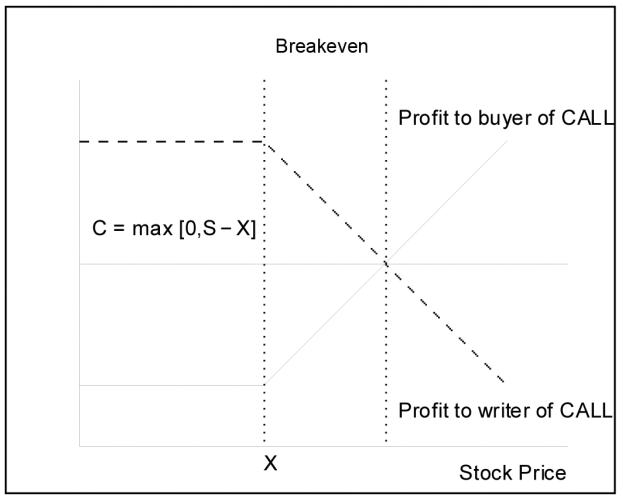
This distinction between the types of futures derivatives is important, since it gives the option contract buyer/holder a distinct advantage over the futures contract holder, the forward contract holder and even the option writer/seller. The option holder will exercise his or her option (i.e. take up the rights obtained under the option) only if it is profitable to do so. The maximum possible loss, which can be incurred by the holder of an option is limited, but the potential profit is unlimited.

You need to develop an understanding of the mechanics of option contracts, just as you have had to with the other instruments dealt with thus far. These instruments are relatively simple in principle, but their pricing involves complex calculations. These instruments are exchange-traded (on the Traded Options Market or TOM), or may be traded over-the-counter. As with forwards, the over-the-counter contracts are a greater credit risk and are less liquid, since these contracts are tailor-made to suit the needs of the contracting parties.

Option types, positions and pay offs

Buy or sell a call option

The *intrinsic value* of a call at expiration is the greater of (S–X) or 0. The call holder will only exercise the option when the stock's price exceeds the strike price.



Buyer of call

Potential profit: unlimited

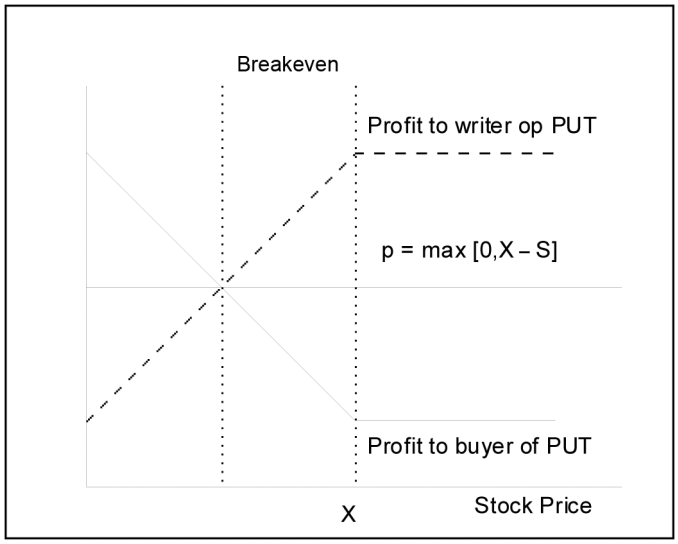
Seller of call

Potential profit: premium

Breakeven point = strike price + premium

The sum of the profits between the buyer and seller of the call is always zero; thus, options trading is a *zero-sum game*.

Buy or sell a put option



The *intrinsic value* of a put option at expiration will be the greater of (X – S) or 0. The put holder will only exercise the option when the strike price exceeds the stock's price.

Buyer of put

Potential profit: Strike price less premium

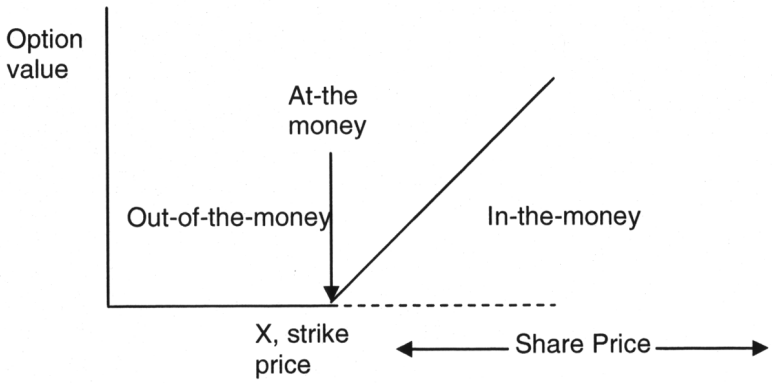
Seller of put

Potential profit: premium

Breakeven point = strike price – premium

Puts (like calls) are a zero-sum game.

Moneyness



When the stock's price is below the strike price, a call option is *out-of-the-money*; when the stock's price equals the strike price, a call option is *at-the-money*; when the stock's price is above the strike price, a call option is *in-the-money*. The reverse is true for put options.

Trading strategies involving options

Strategies involving a single option and a stock

- Covered call
  - — Buying the underlying security and selling a call option
  - — Generate additional portfolio income while underlying stock price remains unchanged
  - — Same structure as a short put

- Protective put *(portfolio insurance or hedged portfolio)*
  - — Long position in the underlying security and buying a put option
  - — Insuring your stock position on the downside while still enjoying the upside potential
  - — Same structure as a long call

Swaps

A swap is an agreement between two parties to exchange future cash flows (based on a notional principal amount) at specified times in the future according to certain pre-

determined rules. It is an extremely effective tool for hedging interest rate risk, where a floating rate liability (risk exposure) can be converted to a fixed rate liability. This is the youngest of the major derivative classes, with the first interest rate swap taking place between IBM and the World Bank in 1981. The growth of the swaps since the early 1980s makes them one of the most important derivative instruments. It is important that you be able to discuss and design both interest rate and currency swaps.

- A *swap* is a contract between two counterparties to exchange cash flows at regular intervals over a specified period of time. There are two basic types of swaps:
  - *Interest rate swaps*, in which the counterparties exchange cash flows in a single currency, tied to a fixed interest rate and/or floating-market interest rates.
  - *Currency swaps*, in which the counterparties exchange cash flows in two different currencies, tied to fixed interest rate and/or floating-market interest rates.

- The traditional motivation for swaps was to reduce borrowing costs by exploiting *comparative advantages* in segregated capital markets. But as global capital markets have become more integrated and more competitive, interest savings available from this type of arbitrage have all but disappeared. However, swaps can be used to efficiently manage interest rate and currency exposure by:
  - Converting fixed-rate assets into floating rate assets
  - Creating hybrid fixed/floating-rate debt

- In a *plain-vanilla interest rate swap*, one party (the *pay-fixed party*) pays a fixed-interest rate and receives a floating rate based on LIBOR from the *receive-fixed party*. Interest payments are made on a net basis and no principal is exchanged.
- The simplest kind of currency swap arises when each party pays a fixed rate of interest on the currency it receives. The *fixed-for-fixed currency swap* involves three different sets of cash flows:
  - At the initiation of the swap the two parties actually exchange cash. Typically, the motivation for the currency swap is the actual need for funds denominated in a different currency. This differs from the interest rate swap in which both parties deal in a single currency and can pay the net amount.
  - The parties make periodic interest payments to each other during the life of the swap agreement, and these payments are made in full without netting.
  - At the termination of the swap, the parties again exchange the principal.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 13 in the prescribed book.

(2) Additional assessment questions:

(a) The fair value of a futures contract is derived from the spot price of the security and the risk-free interest rate. List and briefly describe five additional factors that may influence the price of a futures contract.

(b) The price of a European call option that has a strike price of R30 and expires in six months is R2. The underlying share price is R29 and the risk-free rate of interest is 10%. Using put-call-parity, what is the price of a European put option that expires in six months and has a strike price of R30?

(c) Jake Gray, CFA, believes he has identified an arbitrage opportunity for a commodity as indicated by the information given in the following table.

Commodity Price and Interest Rate Information

Spot price for commodity	R120
Futures price for commodity expiring in 1 year	R125
One-year interest rate	8%

The theoretical futures price is calculated as:

(1) R110.40
(2) R120.00
(3) R125.00
(4) R129.60

(d) The following actions will realise an arbitrage profit.

(1) Buy futures; short spot; borrow money
(2) Buy futures; sell spot; borrow money
(3) Buy futures; long spot, invest proceeds
(4) Buy futures; short spot; invest proceeds

(e) A one-year call option has a strike price of R55, expires in 6 months, and has a price of R5.04. If the risk-free rate is 5% and the current share price is R50, what should the corresponding put be worth?

(1) R5.04
(2) R6.08
(3) R7.42
(4) R8.71

(f) A 3 month European call option with a strike price of R70 sells at a premium of R6.00. It has a risk free rate of 8% and a current share price of R73. Using the put call parity, what is the equivalent value of the European put option.

(1) R1.67
(2) R3.00
(3) R4.43
(4) R10.37

(g) You wish to obtain an exposure to a specific share. Suppose that you buy a call with a strike price of R70 and a price of R6.75. Calculate the effective price paid to purchase the share if the price after 35 days is R65.

(1) R58.25
(2) R71.75
(3) R76.75
(4) R81.75

(h) Assume that you have purchased a call option with a strike price of R60 for R5. At the same time you purchase a put option on the same share with a strike price of R60 for R4. If the share is currently selling for R75 per share, calculate the profit or loss from this option strategy.

(1) –R9
(2) R6
(3) R10
(4) R1

(i) Which strategy offers protection in case of a decrease in the market by ensuring that the downside risk of a price decrease is hedged?

(1) Buying a call
(2) Buying a put
(3) Covered call
(4) Portfolio insurance

(j) Which of the following statements are correct?

(a) American options can only be exercised at expiration
(b) European options can be exercised on or before expiration
(c) Most options issued are American options
(d) American options prices will be equal or greater than European options

(1) All of the above
(2) None of the above
(3) (a) and (b) only
(4) (c) and (d) only

(k) Which one of the following statements is true?

(1) The premium of the call option is inversely related to the share price
(2) The premium of the call option does not depend on the volatility of the underlying share
(3) Option prices are not affected by market interest rates
(4) The premium of the call option is inversely related to the strike/ exercise price

(l) Which of the following correctly describes the position of a put writer?

(1) The put holder has the obligation to sell the optioned securities to the writer of the put option
(2) The put buyer has the right to require the writer to purchase the optioned securities at a preset price
(3) The put writer usually wants to sell the optioned securities
(4) The put writer is paid a premium by the option exchange

Answers to additional assessment questions

(a) Factors apart from the spot price and risk-free rate that may influence the futures price:

- Transportation costs – depending on the underlying commodity (white maize delivered at registered silos)
- Restrictions on short selling – limited access to proceeds
- Storage limitations – some soft commodities have a limited storage life
- Interest compounding – compounding frequency (i.e. annual, semi-annual, continuous etc.)
- Convenience yield – benefit of holding a non-income producing asset increases the futures price
- Differential borrowing and lending rates – borrow money at a higher rate Interest rate swap

(b) Put-call parity

$$S + p = c + X(1+r)^{-T}$$

$$p = c + X(1+r)^{-T} - S$$

$$= 2 + 30(1{,}10)^{-(6/12)} - 29$$

$$= R1{,}60$$

(c) $F = S(1 + r)^T$

$= 120\ (1.08)^1$

(4) = R129.60

(d) The theoretical or fair value (R129.60) exceeds the actual market price (R125). The futures contract is available at a cheap price, therefore:

(4) Buy futures contract, sell spot and invest proceeds (reverse cash and carry arbitrage).

(e) Put-call parity

$$S + p = \frac{X}{(1 + r)^T} + c$$

$$50 + p = \frac{55}{(1.05)^{0.5}} + 5.04$$

$$p = \frac{55}{1.0247} + 5.04 - 50$$

$$p = 53.6742 + 5.04 - 50$$

(4) p = R8.71

(f) Put-call parity

$$S + p = \frac{X}{(1 + r)^T} + c$$

$$73 + p = \frac{70\ldots}{(1.08)^{0.25}} + 6$$

$$p = \frac{70}{1.0194} + 6 - 73$$

$$p = 68.6678 + 6 - 73$$

(1) p = R1.67

(g) At a spot of R65 the call will not be exercised. Share bought in spot market at R65.

Effective cost = R65 + R6.75

(2) = R71.75

(h) X = 60; S = 75; c = 5; p = 4

Profit/Loss = S – X – c – p

Profit/Loss = 75 – 60 – 5 – 4

(2) Profit = R6

(i) (4) Portfolio Insurance

(j) (4) (c) and (d)

(k) (4) The premium of the call option is inversely related to the strike/exercise price

(l) (2) The put buyer has the right to require the writer to purchase the optioned securities at a preset price

SUMMARY

In this study unit you have learned how to calculate the forward/futures prices and perform arbitrage. We have discussed options and their basic payoff structures and looked at two trading strategies. The comparative advantage argument and cash flows for both interest rate and currency swaps were illustrated.

Study unit 14

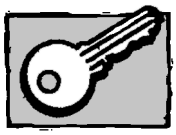
Portfolio management

CONTENTS

LEARNING OUTCOMES

Once you have worked through this unit, you should be able to:

- discuss the different phases in the life cycle of an investor (ie accumulation, consolidation and spending)
- discuss the objectives regarding the risk and return of the portfolio (ie capital preservation, capital appreciation and/or current income)
- discuss the constraints faced by investors (ie liquidity, time horizon, tax concerns, legal and regulatory requirements, unique needs and personal preferences)
- distinguish between individual and institutional objectives and constraints
- explain asset allocation and its importance to portfolio performance
- explain the importance of diversification
- discuss the determination of the asset mix, referring to policy and tactical asset allocation
- explain portfolio construction, referring to the measuring of risk and return
- calculate the expected return for an individual security and a portfolio of securities
- calculate the expected standard deviation for an individual security and a portfolio of securities
- explain and calculate the covariance and the correlation between assets
- determine the optimal asset allocation for a two-security portfolio
- distinguish between two equity portfolio management strategies (ie active and passive)
- describe the various active management strategies related to equity portfolios (e.g. intrinsic valuation, relative valuation, technical valuation)
- describe the various passive management strategies related to equity portfolios (e.g. buy-and-hold, indexing)
- distinguish between two fixed interest-bearing security portfolio management strategies (ie active and passive)
- describe the various active management strategies related to fixed interest-bearing security portfolios (e.g. interest rate anticipation, credit analysis, yield spread analysis, bond swaps)
- illustrate the merits of a proposed bond swap transaction
- describe the various passive management strategies related to fixed interest-bearing security portfolios (eg buy-and-hold, indexing)



KEY CONCEPTS

Active management
Asset allocation
Asset mix
Bond swaps
Buy-and-hold
Capital appreciation
Capital preservation
Consolidation phase
Constraints
Correlation
Covariance
Current income
Expected return
Fixed interest-bearing
Indexing
Interest rate anticipation
Intrinsic valuation
Legal and regulatory
Life cycle
Liquidity
Objectives
Passive management
Policy asset allocation
Portfolio construction
Portfolio risk
Relative valuation
Spending phase
Standard deviation
Tactical asset allocation
Tax concerns
Technical valuation
Time horizon
Unique/personal preferences
Yield spread analysis

OVERVIEW

Portfolio management refers to the combination of assets in order to achieve a certain risk-return profile.

In this study unit we look at the objectives and constraints of portfolio management. The life cycle of an investor has an influence on the types of investments an investor should make. Asset allocation is the key to portfolio performance. We also explain the calculation of portfolio risk as well as return.

We then go on to discuss the management of both equity and fixed-interest bearing portfolios, and we look at the three major active management styles for equity portfolios, namely market-timing, theme selection and share selection. Indexing is also covered.

The study unit explains how a portfolio consisting of fixed interest securities may be managed. A distinction is made between passive and active management styles. Active management strategies includes interest rate anticipation, valuation analysis, credit analysis, yield spread analysis or bond swaps, whereas passive portfolio management strategies include a simple buy-and-hold strategy and indexing.

Study chapter 14 of the prescribed book.

ACTIVITY

Discuss how an individual's investment strategy may change as he or she goes through the accumulation, consolidation, spending and gifting phases of life.

FEEDBACK

Typically investment strategies change during an individual's lifetime. In the accumulating phase, the individual is accumulating net worth to satisfy short-term needs (eg house and car purchases) and long-term goals (eg retirement and children's education). In this phase, the individual is willing to invest in moderately high-risk investments in order to achieve above-average rates of return.

In the consolidating phase, an investor has paid off many outstanding debts and typically has earnings that exceed expenses. In this phase, the investor is becoming more concerned with long-term needs of retirement or estate planning. Although the investor is willing to accept moderate portfolio risk, he/she is not willing to jeopardize the "nest egg".

In the spending phase, the typical investor is retired or semi-retired. This investor wishes to protect the nominal value of his or her savings, but at the same time must make some investments for inflation purposes.

The gifting phase is often concurrent with the spending phase. The individual believes that the portfolio will provide sufficient income to meet expenses, plus a reserve for uncertainties. If an investor believes there are excess amounts available in the portfolio, he or she may decide to make "gifts" to family and friends, institute charitable trusts, or establish trusts to minimise estate taxes.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 14 in the prescribed book.

(2) Additional assessment question:

The following are the monthly rates of return for Madison Corporation and for Sophie Electric during a six-month period:

Month	Madison Corporation	Sophie Electric
1	–0,04	0,07
2	0,06	–0,02
3	–0,07	–0,10
4	0,12	0,15
5	–0,02	–0,06
6	0,05	0,02

Calculate the following:

(a) average monthly rate of return for each share
(b) standard deviation of returns for each share
(c) covariance between the rates of return
(d) the correlation coefficient between the rates of return

What level of correlation did you expect? How did your expectations compare with the calculated correlation? Would these two shares offer a good opportunity for diversification? Why or why not?

(e) A portfolio is made up of share A and share B. Share A has a standard deviation of 24% and has a weight of 40% in the portfolio. Share B on the other hand has a standard deviation of 11% and a weight of 60% in the portfolio. The correlation of share A and share B is 0.7. Calculate the standard deviation of the portfolio.

(1) 13.42%
(2) 14.97%
(3) 40.79%
(4) 41.33%

(f) Calculate the standard deviation of both securities.

Probability of occurrence	**Security A**	**Security B**
50%	12%	10%
25%	10%	11%
25%	8%	9%

(1) A 0.71 B 1.66
(2) A 0.85 B 1.66
(3) A 1.71 B 1.66
(4) A 1.66 B 0.71

(g) Calculate the correlation between the two securities.

(1) 0.21
(2) 0.35
(3) 0.42
(4) –0.21

(h) Calculate the portfolio risk if the investment is 50/50 in A and B.

(1) 1.030%
(2) 0.770%
(3) 0.087%
(4) 0.910%

(i) An investor wishes to construct a portfolio of a 30% allocation to a share index and a 70% allocation to a risk free asset. The return on the risk free asset is 4.5% and the expected return on the share index is 12%. The standard deviation of returns on the share index is 6%. Calculate the expected standard deviation of the portfolio.

(1) 1.80%
(2) 3.60%
(3) 4.20%
(4) 6.00%

(j) The standard deviation of return is 0.45 for share X and 0.7 for share Z. The covariance between the returns of X and Z is 0.295. The correlation between X and Z is:

(1) 0.42
(2) 0.66
(3) 0.94
(4) 1.08

(k) The correlation coefficient of Portfolio X's returns and the market's returns is –0.95, and the correlation coefficient of Portfolio Y's returns and the market's returns is 0.70. Which of the following statements best describes the levels of portfolio diversification?

(1) Both Portfolio X and Portfolio Y are well diversified.
(2) Both Portfolio X and Portfolio Y are poorly diversified.
(3) Portfolio X is well diversified and Portfolio Y is poorly diversified.
(4) Portfolio X is poorly diversified and Portfolio Y is well diversified.

(l) Shares A, B and C each have the same expected return and standard deviation. The following table shows the correlation between the returns on these shares.

Correlation of Share Returns			
	Share A	**Share B**	**Share C**
Share A	+1.0		
Share B	+0.9	+1.0	
Share C	+0.1	–0.4	+1.0

Given these correlations, the portfolio from these shares having the l*owest* risk is a portfolio

(1) equally invested in shares A and B
(2) equally invested in shares A and C
(3) equally invested in shares B and C
(4) totally invested in share C

(m) An analyst makes the following estimates.

Rate of Return			
Scenario	**Probability**	**Share I**	**Share J**
1	50%	30%	20%
2	50%	10%	–10%

Based on these data, the covariance between the rates of return of Share I and Share J is

(1) –0.050
(2) +0.050
(3) +0.015
(4) +0.200

Answer to additional assessment question

(a) $$\overline{R}_{Madison} = \frac{(-0{,}04 + 0{,}06 - 0{,}07 + 0{,}12 - 0{,}02 + 0{,}05)}{6} = 0{,}0167 = 1{,}67\%$$

$$\overline{R}_{Sophie} = \frac{(0{,}07 - 0{,}02 - 0{,}10 + 0{,}15 - 0{,}06 + 0{,}02)}{6} = 0{,}01 = 1{,}00\%$$

(b) $$\sigma^2_{Madison} = \begin{bmatrix} (-0{,}04 - 0{,}0167)^2 \\ +(0{,}06 - 0{,}0167)^2 \\ +(-0{,}07 - 0{,}0167)^2 \\ +(0{,}12 - 0{,}0167)^2 \\ +(-0{,}02 - 0{,}0167)^2 \\ +(0{,}05 - 0{,}0167)^2 \end{bmatrix} = 0{,}0257 \div 6 = 0{,}0043$$

$$\sigma^2_{Sophie} = \begin{bmatrix} (0{,}07 - 0{,}01)^2 \\ +(-0{,}02 - 0{,}01)^2 \\ +(-0{,}10 - 0{,}01)^2 \\ +(0{,}15 - 0{,}01)^2 \\ +(-0{,}06 - 0{,}01)^2 \\ +(0{,}02 - 0{,}01)^2 \end{bmatrix} = 0{,}0412 \div 6 = 0{,}0069$$

$$\sigma_{Madison} = \sqrt{0{,}0043} = 0{,}0655 = 6{,}5490\%$$

$$\sigma_{Sophie} = \sqrt{0{,}0069} = 0{,}0829 = 8{,}2865\%$$

(c) $$Cov_{Mad/Sop} = \begin{bmatrix} (-0{,}04 - 0{,}0167)(0{,}07 - 0{,}01) \\ +(0{,}06 - 0{,}0167)(-0{,}02 - 0{,}01) \\ +(-0{,}07 - 0{,}0167)(-0{,}10 - 0{,}01) \\ +(0{,}12 - 0{,}0167)(0{,}15 - 0{,}01) \\ +(-0{,}02 - 0{,}0167)(-0{,}06 - 0{,}01) \\ +(0{,}05 - 0{,}0167)(0{,}02 - 0{,}01) \end{bmatrix} = 0{,}0222 \div 6 = 0{,}0037$$

(d) $$r_{Mad/Sop} = \frac{Cov_{Mad/Sop}}{\sigma_{Madison}\sigma_{Sophie}} = \frac{0{,}0037}{(0{,}0655 \times 0{,}0829)} = 0{,}68$$

One should have expected a positive correlation between the two shares, since they tend to move in the same direction(s). Risk can be reduced by combining assets that have low positive or negative correlations, which is not the case for Madison Corporation and Sophie Electric.

(e) Portfolio standard deviation (δ_p)

$= \sqrt{[w_A^2 \times \delta_A^2] + [w_B^2 \times \delta_B^2] + [2 \times w_A \times w_B \times r_{AB} \times \delta_A \times \delta_B]}$

$= \sqrt{[0.24^2 \times 0.4^2] + [0.11^2 \times 0.6^2] + [2 \times 0.4 \times 0.6 \times 0.7 \times 0.24 \times 0.11]}$

$= \sqrt{[0.0576 \times 0.16] + [0.0121 \times 0.36] \times [2 \times 0.0044]}$

$= \sqrt{[0.0092 + 0.0044 + 0.0088]}$

$= \sqrt{0.0224}$

$= 0.1497 \times 100$

2. $\delta_p = 14.97\%$

(f)

E_A $= 0.5\ (12) + 0.25\ (10) + 0.25\ (8)$

$= 10.50\%$

E_B $= 0.5\ (10) + 0.25\ (11) + 0.25\ (9)$

$= 10.00\%$

δ_A $= \sqrt{0.5\ (12 - 10.5)^2 + 0.25\ (10 - 10.5)^2 + 0.25\ (8 - 10.5)^2}$

$= \sqrt{1.125 + 0.0625 + 1.5625}$

$= \sqrt{2.75}$

$= 1.66$

δ_B $= \sqrt{0.5\ (10 - 10)^2 + 0.25\ (11 - 10)^2 + 0.25\ (9 - 10)^2}$

$= \sqrt{0 + 0.25 + 0.25}$

$= \sqrt{0.50}$

$= 0.71$

(4) A 1.66 B 0.71

(g) Correlation (r) $= \text{Covariance}_{A,B} \div (\delta_A \times \delta_B)$

Where $\text{Covariance}_{A,B}$ $= \sum \text{probability} \times (\text{return}_A - k_A) \times (\text{return}_B - k_B)$

$= 0.5(12–10.5)(10–10) \times 0.25(10–10.5)(11–10) \times 0.25(8–10.5)(9–10)$

$= 0 + - 0.125 + 0.625$

$= 0.50$

$r_{A,B}$ $= 0.50 \div (1.66 \times 0.71)$

$= 0.50 \div 1.1786$

(3) $r_{A,B}$ $= 0.42$

(h) Portfolio standard deviation (δ_p)

$= \sqrt{[W_A^2 \times \delta_A^2] + [W_B^2 \times \delta_B^2] + [2 \times W_A \times W_B \times r_{AB} \times \delta_A \times \delta_B]}$

W_A $= 0.5$ $W_B = 0.5$ $r = 0.4242$ $\delta_A = 1.66$ $\delta_B = 0.71$

$= \sqrt{[0.5^2 \times 1.66^2] + [0.5^2 \times 0.71^2] + [2 \times 0.5 \times 0.5 \times 0.42 \times 1.66 \times 0.71]}$

$= \sqrt{[0.6889 + 0.126 + 0.2475]}$

$= \sqrt{1.0624}$

(1) $\delta_p = 1.030\%$

(i) Portfolio standard deviation (δ_p)

$= \sqrt{[W_{SI}^2 \times \delta_{SI}^2] + [W_{RFA}^2 \times \delta_{RFA}^2] + [2 \times W_{SI} \times W_{RFA} \times r_{SI,RFA} \times \delta_{SI} \times \delta_{RFA}]}$

A risk free asset has no risk therefore its standard deviation [δ_A] is 0. The only remaining part of the above formula will be $= \sqrt{[W_{SI}^2 \times \delta_{SI}^2]}$ because the other two parts of the formula will be cancelled off to 0.

Portfolio standard deviation (δ_p) $= \sqrt{[W_{SI}^2 \times \delta_{SI}^2]}$

$\delta_p = \sqrt{[0.3^2 \times 6^2]}$

$= \sqrt{[0.09 \times 36]}$

$= \sqrt{3.24}$

(1) $\delta_p = 1.80\%$

(j) Correlation (r) $= \text{Covariance}_{X,Y} \div (\delta_X \times \delta_Y)$

$r = 0.295 \div (0.45 \times 0.7)$

$= 0.295 \div 0.315$

$= 0.94$

(3) $r = 0.94$

(k) (3) Portfolio X is well diversified and Portfolio Y is poorly diversified

Portfolio X has a correlation coefficient of –0.95 which means it is well diversified hence low risk. Portfolio Y, on the other hand, has a correlation coefficient of 0.70 which means it is poorly diversified thus a higher risk.

(l) (3) Equally invested in shares B and C

The portfolio that will be equally invested in shares that have the lowest correlation i.e. a correlation that is close to –1 will have the lowest risk. This is because that portfolio will be the most diversified. A portfolio that is equally invested in B and C will have the lowest correlation of shares (–0.4) compared to the other correlations of share returns.

(m) $\text{Covariance}_{I,J} = \sum\text{probability} \times (\text{return}_I - k_I) \times (\text{return}_J - k_J)$

$E_I = 0.5(0.3) + 0.5(0.1)$

$= 0.15 + 0.05$

$= 0.20$

$E_J = 0.5(0.2) + 0.5(-0.1)$

$= 0.10 + 0.05$

$= 0.05$

$\text{Covariance}_{I,J} = 0.5(0.3 - 0.2)(0.2 - 0.05) + 0.5(0.1 - 0.2)(-0.1 - 0.05)$

$= 0.0075 + 0.0075$

$= +0.015$

(3) $\text{Covariance}_{I,J} = +0.015$

SUMMARY

In this study unit we have looked at determining the risk and return of a portfolio. The importance of diversification and the correlation of assets included in a portfolio were emphasised. Different portfolio management strategies were also discussed. The following study unit will show you how to measure the performance of a portfolio.

Study unit 15

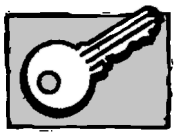
Evaluation of portfolio management

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- discuss the fundamental issues in performance measurement
- explain and calculate Treynor's performance index
- explain and calculate Sharpe's performance index
- explain and calculate Jensen's performance index
- compare the traditional methods (Treynor, Sharpe and Jensen) for calculating risk-adjusted portfolio performance
- explain performance attribution analysis with reference to:
  - total return calculations
  - evaluation of performance fees
  - benchmark portfolios
  - measurement of allocation effect
  - measurement of selection effect



KEY CONCEPTS

Allocation effect	Performance fees	Total return
Attribution analysis	Performance measurement	Treynor's performance index
Benchmark	Selection effect	
Jensen's measure	Sharpe's performance index	

OVERVIEW

In this study unit we look at the fundamental issues in performance measurement. Various risk-adjusted portfolio performance models are reviewed, such as those of Sharpe, Treynor and Jensen. Performance attribution analysis is also explained.

Study chapter 15 of the prescribed book.

ACTIVITY

Compare and contrast four prominent approaches to measuring investment performance on a risk-adjusted basis. In developing your answer, comment on the conditions under which each measure will be most useful.

FEEDBACK

Treynor (1965) divides a fund's excess return (return less risk-free rate) by its beta. For a fund not completely diversified, Treynor's "T" value will understate risk and overstate performance.

Sharpe (1966) divides a fund's excess return by its standard deviation. Sharpe's "S" value will produce evaluations very similar to Treynor's for funds that are well diversified.

Jensen (1968) measures performance as the difference between a fund's actual and required returns. Since the latter return is based on CAPM and a fund's beta, Jensen makes the same implicit assumption as Treynor, namely that funds are completely diversified.

The information ratio (IR) is calculated by dividing the average return on the portfolio less a benchmark return by the standard deviation of this excess return. The IR can be viewed as a cost-benefit ratio in that the standard deviation of return can be viewed as a cost associated in the sense that it measures the unsystematic risk taken on by active management. Thus, the IR is a cost-benefit ratio that assesses the quality of the investor's information deflated by unsystematic risk generated by the investment process.

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 15 in the prescribed book.

(2) Additional assessment questions:

(a) Describe two major factors that a portfolio manager should consider before designing an investment strategy. What types of decisions can a manager make to achieve these goals?

(b) Describe how the Jensen measure of performance is calculated. Under what conditions should it give a similar set of portfolio rankings to the Sharpe and Treynor measures? Is it possible to adjust the Jensen measure so that a portfolio's alpha value is measured relative to an empirical form of the arbitrage pricing theory rather than the capital asset pricing model? Explain.

(c) The following portfolios are being considered for investment. During the period under consideration the risk-free rate is 7%.

Portfolio	Return (%)	Beta	σ (%)
P	15	1,0	5
Q	20	1,5	10
R	10	0,6	3
S	17	1,1	6
Market	13	1,0	4

(i) Calculate the Sharpe measure for each portfolio and the market portfolio.
(ii) Calculate the Treynor measure for each portfolio and the market portfolio.
(iii) Rank the portfolios using each measure, explaining the cause of any differences you find in the rankings.

Use the following information to calculate the answers to questions d and e.

Portfolio	Average return	Standard deviation	Beta
Alpha	7%	3%	0.4
Beta	10%	8%	1.0
Gamma	13%	6%	1.1

Assume a risk-free rate of return (R_f) of 3%.

(d) Calculate the risk-adjusted portfolio performances of the three portfolios using the Sharpe measure.

(1) Alpha 0.10 Beta 0.07 Gamma 0.09
(2) Alpha 1.33 Beta 0.88 Gamma 1.67
(3) Alpha 1.20 Beta 0.00 Gamma 2.30
(4) Alpha 0.20 Beta 1.50 Gamma 2.30

(e) Calculate the risk-adjusted portfolio performances of the three portfolios using the Jensen measure.

(1) Alpha 0.10 Beta 0.07 Gamma 0.09
(2) Alpha 1.33 Beta 0.88 Gamma 1.67
(3) Alpha 1.20 Beta 0.00 Gamma 2.30
(4) Alpha 0.20 Beta 1.50 Gamma 2.30

Use the table below to answer the following questions f, g and h.

Unit trust	Average rate of return	Variance	Beta
SBIF	26	4.84	0.94
RDPF	18	1.00	0.22
RMBF	22	3.24	0.65
Total market index	24	4.00	

Assume a risk free rate of return of 15%.

(f) Evaluate the performance of unit trust SBIF according to the method of Sharpe.

(1) –0.50
(2) 1.20
(3) 2.20
(4) 5.00

(g) Evaluate the performance of unit trust RDPF according to the method of Jensen.

(1) –0.21
(2) 0.102
(3) 1.02
(4) 2.10

(h) Evaluate the performance of unit trust RMBF according to the method of Treynor.

(1) 2.16
(2) 3.88
(3) 10.77
(4) 13.85

Answers to additional assessment questions

(a) The two major factors would be: (1) attempting to derive risk-adjusted returns that exceed a naïve buy-and-hold policy, and (2) completely diversifying – ie, eliminating all unsystematic risk from the portfolio. A portfolio manager can do one or both of two things to derive superior risk-adjusted returns. The first is to have **superior timing** regarding market cycles and adjusting the portfolio accordingly. Alternatively, you can consistently **select undervalued shares**. As long as you do not make major mistakes with the rest of the portfolio, these actions should result in superior risk-adjusted returns.

(b) Jensen's alpha (α) is found from the equation. $R_{jt} - rf_t = \alpha_j + \beta_j\left(R_M - rf_t\right) + e_{jt}$ The α_j indicates whether a manager has superior ($\alpha_j > 0$) or inferior ($\alpha_j < 0$) ability in market timing or share selection, or both. As suggested above, Jensen defines superior (inferior) performance as a positive (negative) difference between a manager's actual return and his or her CAPM-based required return. For poorly diversified funds, Jensen's rankings would follow those of both Treynor and Sharpe. By replacing the CAPM with the APT, differences between funds' actual and required returns (or "alphas") could provide fresh evaluations of funds.

(c) (i) Sharpe

$$S_P = \frac{15 - 7}{5} = 1{,}60$$

$$S_Q = \frac{20 - 7}{10} = 1{,}30$$

$$S_R = \frac{10 - 7}{3} = 1{,}00$$

$$S_S = \frac{17 - 7}{6} = 1{,}67$$

$$Market = \frac{13 - 7}{4} = 1{,}50$$

(ii) Treynor

$$T_P = \frac{0{,}15 - 0{,}07}{1{,}00} = 0{,}0800$$

$$T_Q = \frac{0{,}20 - 0{,}07}{1{,}50} = 0{,}0867$$

$$T_R = \frac{0{,}10 - 0{,}07}{0{,}60} = 0{,}0500$$

$$T_S = \frac{0{,}17 - 0{,}07}{1{,}10} = 0{,}0909$$

$$Market = \frac{0{,}13 - 0{,}07}{1{,}00} = 0{,}0600$$

(iii) Rankings

	Sharpe	**Treynor**
P	2	3
Q	4	2
R	5	5
S	1	1
Market	3	4

It is apparent from the rankings above that Portfolio Q was poorly diversified, since Treynor ranked it #2 and Sharpe ranked it #4. Otherwise, the rankings are similar.

(d) Sharp measure:

SPI = $(r_p - r_f) / (\delta_p)$

(2) Alpha = (7% – 3%) / 3% = 1.33%

Beta = (10% – 3%) / 8% = 0.88%

Gamma = (13% – 3%) / 6% = 1.67%

(e) Jensen measure:

Jensen's alpha (α) = $r_p - [r_f + \beta (r_m - r_f)]$

(3) Alpha = 7% – [3% + 0.4(10% – 3%)]

= 7% – 5.8%

= 1.2%

Beta = 10% – [3 % + 1.0(10% – 3%)]

= 10% – 10%

= 0.00%

Gamma = 13% – [3% + 1.1(10% – 3%)]

= 13% – 10.70%

= 2.30%

(f) Sharpe:

SPI $= (r_p - rf) / \delta_p$

$= (26 - 15) / \sqrt{4.84}$

= 11 / 2.2

(4) SPI = 5.00

(g) Jensen's alpha $(\alpha) = r_p - [r_f + \beta (r_m - r_f)]$

$\alpha = 18 - [15 + 0.22 (24- 15)]$

$\alpha = 18 - 16.98$

(3) $\alpha = 1.02\%$

(h) Treynor:

TPI $= (r_p - r_f) / \beta$

$= (22 - 15) / 0.65$

$= 7 / 0.65$

(3) TPI = 10.77

SUMMARY

This study unit has shown you how to judge and assign the performance of a portfolio. The following study unit presents the foreign exchange market and shows how exchange rates are determined and influenced by domestic/foreign inflation and interest rates.

Topic 5

FOREIGN EXCHANGE

AIM

This topic serves as an introduction to the foreign exchange market and the factors determining exchange rates. The value of currencies is established by the interplay of domestic and foreign interest/inflation rates. Different theories (interest rate parity, purchasing power parity, and the international Fischer effect) are presented in an attempt to explain exchange rate behaviour.

TOPIC LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- discuss foreign investment by South African residents
- explain the foreign exchange market
- explain exchange rate determination and behaviour
- discuss foreign exchange investments as an alternative asset class

TOPIC CONTENT

Study unit 16: Foreign exchange management

Study unit 16

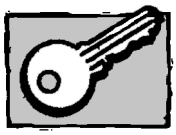
Foreign exchange management

CONTENTS

LEARNING OUTCOMES

Once you have worked through this study unit, you should be able to:

- discuss the restrictions faced by South African residents interested in making foreign investments
- explain what foreign exchange is and how it trades
- explain and use the foreign exchange conventions adopted by the Financial Markets Association (ACI)
- explain and calculate the bid-ask spread and discuss the factors influencing the spread
- define direct and indirect methods of foreign exchange quotations and convert direct (indirect) foreign exchange quotations into indirect (direct) foreign exchange quotations
- define currency appreciation and depreciation and calculate the percentage appreciation/depreciation
- calculate and interpret currency cross rates, given two spot exchange rate quotations involving three currencies
- define currency arbitrage and perform triangular arbitrage
- distinguish between the spot and forward markets for foreign exchange
- calculate and interpret a forward discount or premium and express it as an annualised rate
- explain interest rate parity and illustrate covered interest arbitrage
- discuss exchange rate determination and behaviour
- discuss the economic and political factors affecting exchange (ie supply and demand, balance of payments, current/capital account balances, relative inflation rates, relative interest rates, real interest rates and government policies)
- explain how exchange rates are determined in a flexible or floating exchange rate system
- describe a fixed exchange rate and pegged exchange rate system
- discuss absolute purchasing power parity and relative purchasing power parity
- forecast future exchange rates using relative purchasing power parity (PPP)
- discuss the Big Mac index as an example of how to use purchasing power parity in comparing living standards across countries
- discuss the international Fischer effect (IFE)
- forecast future exchange rates using interest rate differentials (i.e. the relative purchasing power parity and international Fischer effect combination)
- discuss foreign exchange investments as an alternative investment class



KEY CONCEPTS

Alternative asset class	Economic/political factors	Interest rate parity
Balance of payments	Foreign exchange conventions	International Fischer effect
Bid-ask spread	Foreign exchange market	International parity relationships
Big Mac index	Foreign investment	Purchasing power parity (PPP)
Capital account	Forward discount/premium	Real interest rates
Cross rates	Forward exchange market	Relative inflation rates
Currency arbitrage	Government policies	Relative interest rates
Current account	Inflation rate differential	Supply and demand
Direct/indirect quotation	Interest rate differential	Triangular arbitrage

OVERVIEW

The trading of currencies takes place in foreign exchange markets whose primary function is to facilitate international trade and investment. Knowledge of the operation and mechanics of these markets is important for any fundamental understanding of international financial management. The foreign exchange market permits the transfer of purchasing power denominated in one currency for that of another currency. This market is not a physical place, but rather an electronically linked network of banks, foreign exchange brokers and dealers whose function it is to bring together buyers and sellers of foreign exchange. You should know that currencies trade for immediate delivery in the *spot market* and for future delivery in the *forward market*. Prepare for questions in the form of calculations – know how to calculate a bid-ask spread and cross rates and how to determine if an arbitrage opportunity exists. Also, be familiar with the theories presented in chapter 16 of the prescribed book. The interest rate parity theorem equates the difference in the domestic and foreign interest rate to the forward discount or premium and is a useful tool to determine if arbitrage opportunities exist.

Study chapter 16 of the prescribed book.

Covered interest arbitrage

Example (Also see the example on p 279 of the prescribed book with a bid-ask spread.)

1-year futures rate (USD/GBP)	$1,58/£
Spot rate (USD/GBP)	$1,60/£
US 1-year rate (C1)	6%
UK 1-year rate (C2)	10%

Identify whether or not an arbitrage opportunity exists. If one does exist, construct the appropriate strategy and compute the arbitrage profits.

IRP equation: $F = S \times \left(\frac{1 + r_{C1}}{1 + r_{C2}} \right)$ or $1 + r_{C1} = \left(\frac{F}{S} \right) \times \left(1 + r_{C2} \right)$

Step 1: Identify the existence of an arbitrage opportunity.

$$1{,}06 \neq 1{,}10 \times \left(\frac{1{,}58}{1{,}60} \right)$$

$$1{,}06 < 1{,}08625$$

borrow dollars (C1) lend pounds (C2)

Step 2: Identify and arrange the appropriate strategy.

The USD interest rate is less than the USD-adjusted GBP rate (hedged foreign rate). Therefore we should borrow USD (at the *low rate*); convert to GBP and invest the GBP (at the *high rate*); and at the end of the year, convert back to USD at the forward rate, and pay off the loan with the proceeds.

Step 3: Construct the trades necessary to execute the arbitrage strategy:

- Borrow USD1 for one year at 6% and repay USD1,06 in one year
- Exchange your USD1 for 0.6250 GBP at the current exchange rate
- Lend GBP for one year at 10%. You will have GBP0.6250 x 1,10 = GBP0.6875 in one year
- Enter into a forward agreement to exchange GBP0.6875 for USD at the forward rate of USD1.5800 per GBP
- Wait one year. Collect 0.6875 x USD1.5800 = USD1.0863 from your British lending activities and repay your USD-based loan of USD1.06

Step 4: Compute the arbitrage profits.

Arbitrage profits are USD1.0863 – USD1.06 = USD0.0263

Notice that the currency we chose to borrow depended on the relationship between the unhedged and hedged interest rates. Remember to borrow in the low rate currency and invest in the high interest rate currency.

ACTIVITY

Go onto the x-rates.com website and compare the 120-day exchange rate graphs for the following:

- American dollar (USD), South African rand (ZAR)
- British pound (GBP), South African rand (ZAR)
- American dollar (USD), British pound (GBP)

Address: http://www.x-rates.com

Select:	American Dollar (base currency) and South African Rand in the graph box
Click on:	Go
Select:	British Pound (base currency) and South African Rand in the graph box
Click on:	Go
Select:	American Dollar (base currency) and British Pound in the graph box
Click on:	Go

Based on these values, is the cross rate between the American dollar and the British pound what you expected it to be?

FEEDBACK

A visual inspection of the three graphs reveals that the South African rand depreciated against both the American dollar and British pound during the May 1 to June 28 period, before strengthening (appreciating) against the dollar and consolidating (remaining steady) against the pound in the subsequent period. From July 28 onwards the American dollar depreciated against the British pound before recovering some of the previous losses suffered.

You should relate this to the cross rates mentioned on page 277 of the prescribed book. On 21 August 2006 the rates *quoted* were:

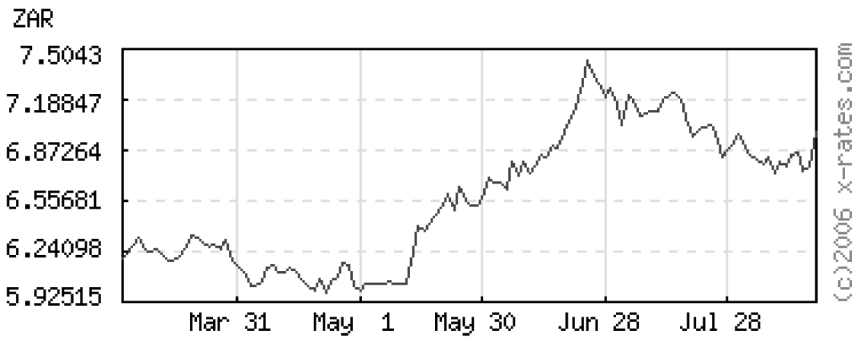
ZAR/USD	R6.986/USD
ZAR/GBP	R13.1393/GBP
GBP/USD	**£0.531689**/USD

Calculated cross rate:

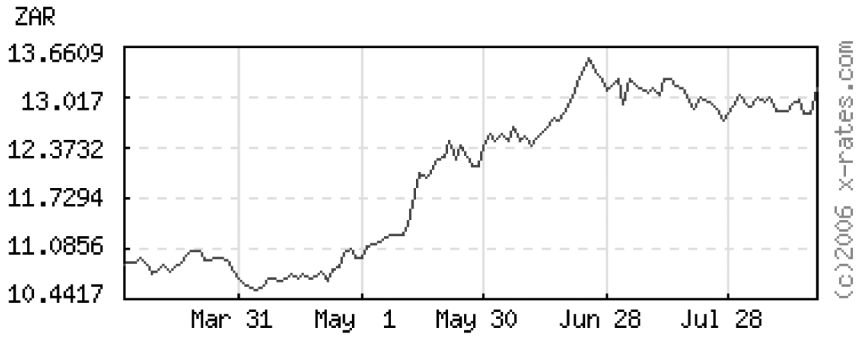
$$\frac{ZAR}{USD} \times \frac{GBP}{ZAR} = GBP/USD$$

$$6{,}986 \times \frac{1}{13{,}1393} = 0{,}531687$$

American Dollar – South African Rand



British Pound – South African Rand



American Dollar – British Pound

ASSESSMENT

(1) Answer the self-assessment questions found at the end of chapter 16 in the prescribed book.

(2) Additional assessment question:

You are given the following bid-ask information on the USD/GBP exchange rate and the interest rates in each currency.

Rate	Bid	Ask
Spot (USD/GBP)	1.6000	1.6400
Forward (USD/GBP)	1.5400	1.5800
r_{USD}	6.0%	6.1%
r_{GBP}	10.0%	10.2%

Determine whether arbitrage profits are available by calculating covered interest arbitrage. Assume you start with USD1 million or GBP625 000.

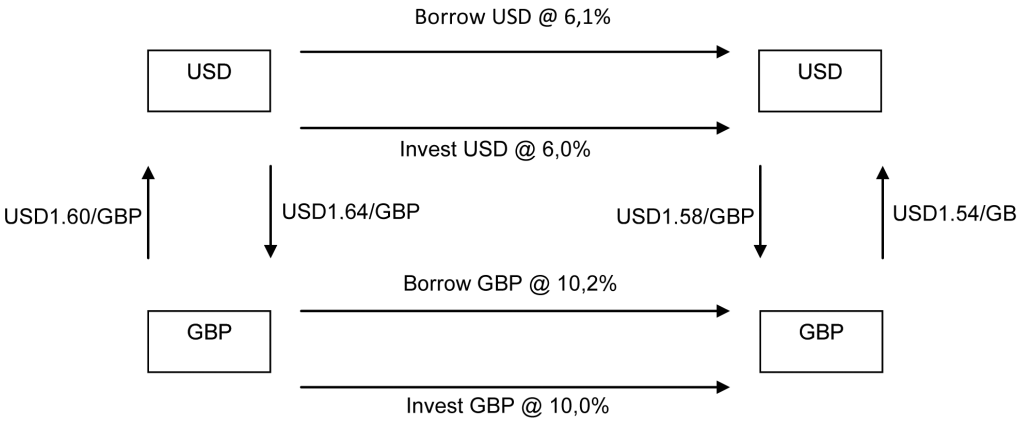
Answer to additional assessment question

Here is how we can interpret each of these rates:

Rate	Bid	Ask
Spot (USD/GBP)	1.6000	1.6400
	GBP to USD	USD to GBP
Forward (USD/GBP)	1.5400	1.5800
	GBP to USD	USD to GBP

Rate	Bid	Ask
r_{USD}	6.0%	6.1%
	Invest USD @ 6,0%	Borrow USD @ 6,1%
r_{GBP}	10.0%	10.2%
	Invest GBP @ 10.0%	Borrow GBP @ 10.2%

The bid interest rate (the lower rate) is the rate at which you can invest in that currency and the ask rate (the higher rate) is the rate at which you can borrow in that currency. Unfortunately, the only way to determine whether arbitrage is profitable is to calculate the profits going both directions – borrowing in currency one and investing in currency two, and then borrowing in currency two and investing in currency one. The best way to keep this straight is to draw the IRP diagram with arrows indicating the direction of the cash flows. For example, the USD/GBP bid rate of 1,60 is the rate to convert GBP to USD, as indicated by the arrow.



Let's start by borrowing USD1 million.

- Borrow USD1 million for one year at 6.1% and repay USD1 061 000 in one year.
- Exchange your USD1 million for GBP609 756 at the spot ask rate of 1,64.
- Invest GBP for one year at 10%. You will have GBP(609 756 x 1.10) = GBP670 732 in one year.
- Enter into a forward exchange agreement to exchange GBP670 732 for USD at the forward bid rate of USD1.54 per GBP.
- Wait one year. Collect GBP670 732 x USD1.54/GBP = USD1 032 927 from you British investing activities and repay your USD-based loan of USD1 061 000.
- Your arbitrage profit is USD(1 032 927 – 1 061 000) = –USD28 073
  There is no arbitrage opportunity available by borrowing USD and investing GBP.

If we start with GBP625 000:

- Borrow GBP625 000 at 10.2% and repay GBP688 750 in one year
- Exchange your GBP625 000 for USD1 million at the spot bid rate of 1,6
- Invest USD for one year at 6%. You will have USD(1 000 000 x 1.06) = USD1 060 000 in one year
- Enter into a forward exchange agreement to exchange USD1 060 000 for GBP at the forward ask rate of USD1.58 per GBP

- Wait one year. Collect USD1 060 000 ÷ USD1.58/GBP = GBP670 886 from your U.S. investing activities and repay your GBP-based loan of GBP688 750
- Your arbitrage profit is GBP(670 886 – 688 750) = –GBP17 864

Arbitrage profits are also not available by borrowing GBP and investing USD.

This example illustrates the fact that in all instances transaction costs (bid-ask spread) reduce possible arbitrage profits, and in many cases this may even prevent any arbitrage opportunity.

Apply this method to the example on page 279 and verify the result.

SUMMARY

The chapter in the prescribed textbook has introduced you to the foreign exchange market and the factors influencing/determining exchange rates. The interest rate parity (IRP), purchasing power parity (PPP) and international Fischer effect (IFE) theories were covered. Arbitrage opportunities due to the violation of the principles contained in these international parity relationships were illustrated. This concludes the module on portfolio management.

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