INTEREST RATE RISK MANAGEMENT: A CASE STUDY OF GBS MUTUAL BANK

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ABSTRACT

Banks play a pivotal role in the economic growth and development of countries, primarily through the diversification of risk for both themselves and other economic agents. Interest rate risk is regarded as one of the most prominent financial risks faced by a bank. A large portion of private banks' revenue stems from net interest income that is generated from the difference between various assets and liabilities that are held on the balance sheet. Fluctuations in the interest rate can alter a bank's interest income and value, making interest rate risk management vital to its success.

The asset and liability committee of a bank is the internal committee charged with the duty of managing the bank's interest rate risk exposure through the use of various hedging strategies and instruments.

This thesis uses a case study methodology to analyse GBS Mutual Bank interest rate risk management. Its specific business circumstances, balance sheet structure and the market conditions over a specified period are used to comment on the practicality of a variety of balance sheet positioning strategies and derivative hedging instruments. The thesis also provides recommendations for the bank's asset and liability committee in terms of its functions and organisation.

It is elucidated that the most practical balance sheet hedging strategies are a volume strategy and immunisation, while the most practical derivative hedging instruments are interest rate futures and interest rate collars. It is found that the bank has a well functioning asset and liability committee whose only encumbrance to its functionality is the inadequacy of the informational technology used to measure, control and manage its interest rate risk position.

This thesis concludes by summarising the practicality of the various interest rate risk hedging alternatives available to the GBS Mutual Bank. Implementing a

particular strategy or instrument depends, of course, on its asset and liability committee's decision.

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“One of the greatest pieces of economic wisdom is to know what you do not know” – John Kenneth Galbraith.

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DECLARATION

This masters thesis represents my own work and due acknowledgement is given in the references whenever information is derived from another source. No part of this master's thesis has been or is being concurrently submitted for another qualification at any other university.

Gareth Williamson
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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND, CONTEXT AND RATIONALE FOR THE RESEARCH

Risk management is defined by Dickson (1989: 18) in Valsamakis *et al* (1992: 13) as "the identification, analysis and economic control of those risks which threaten the assets or earning capacity of an organisation." As such the management of risk has, explicitly or implicitly, become part of a strategic component of the modern organisation's survival and development (Waring and Glendon, 1998: 3).

Bernstein (1998) in De la Rosa (2003: 55) identifies that the principals of modern risk management were first established in the 1600s when mathematical concepts were first used in games of chance. Twentieth century authors such as Knight (1921) and Keynes (1921) provided noteworthy insights into the development of uncertainty, probability and the law of large numbers - concepts which today underpin risk management. Others such as von Neumann (1926), Markowitz (1952) and Modigliani and Miller (1958) use risk management principals in the development of game theory, portfolio theory, corporate finance and investment theory. A more recent addition to risk management was developed by Merton (1973) and most famously by Black and Scholes (1973) who introduced derivative pricing tools to manage risk efficiently (Kloman, 1999).

This early foundation provided the basis for the rapid development of risk management in the insurance industry. According to Valsamakis *et al* (1992: 3) the first notable risk management provision in an organisation occurred in 1931 when the *American Management Association* incorporated an insurance division

into its business structure. The development of professional risk management was first initiated in South Africa during the 1970s by a number of prominent broking houses and industrial firms[1] (Valsamakis *et al*, 1999).

The insurance industry's success, driven largely by competent risk management, served as a vehicle for the implementation of professional risk management in the wider business community. The adoption of risk management practices in the banking industry was no exception: Heffernan (1996: 164) states that like any business, a profit maximising bank's objective is to add value to its equity by maximising the risk-adjusted return to shareholders. What differentiates a bank from other businesses is that it is exposed to a number of risks that are atypical of other institutions.

Banks, and commercial banks in particular, can be described as unique institutions due to the vital role they play in the financial sector. In particular, their core products of intermediation and the provision of an efficient payment system lend to risk alleviation for other economic agents. Heffernan (1996: 163) describes a bank's core business as the management of risk permeating from both on- and off-balance sheet activities. Faure (2002: 134) goes so far as to comment that the banks' *raison d'etre* is to effectively manage and alleviate risks and liquidity constrictions faced by ultimate lenders while lending to ultimate borrowers.

Interest rate risk is regarded by a number of authors such as Heffernan (1996), Bessis (2002) and Sinkey (2002) as one of the most prominent financial risks faced by a bank. Interest rate risk management is by no means a new trend in banking activities.

[1] Included among these firms were: *Alexander Forbes, First Bowring, Glen Rand MIB* and the *Barlow Rand Group* (Valsamakis *et al*, 1999: 8)

Prior to the early 1970s South African banks focussed primarily on the asset side of their balance sheet, as the liability side was regarded as a 'given'. This, of course, was not detrimental because interest rates were relatively stable (often under deposit rate control) and monetary policy was based on interest rate targeting resulting in a stable funding cost environment. The hedging of interest rate risk under these market conditions was achieved by manipulating the banks' balance sheets to be either short- or long-funded during the interest rate cycle (UBS, 1987: 38).

The early 1970s, however, brought a change to stable market conditions: the UBS (1987: 38) recognises "the oil crisis, large international capital flows, significant inflation differentials between countries, an unstable exchange rate system and a large increase in the debt of the public sector" as contributory factors. Moreover, the 1980s provided no more stability than the previous decade: the traditional banking cartel arrangement was disbanded resulting in increased competition, interest was payable on certain current accounts for the first time, the transition of the central bank policy to a cash reserve system induced an increased interest rate volatility and the creation of new complex financial instruments and services which were primarily driven by market rates all added to the increased market instability (UBS, 1987: 38).

This resulted in investors' and borrowers' preferences shifting to variable rate deposits and loans in an attempt to avoid sharp interest rate fluctuations. In essence, the banks' cost of funds had now switched from no or low interest to high yielding rate-sensitive accounts. The banks' liabilities became far more susceptible to interest rates and prompted the inclusion of effective interest rate risk management for bank liabilities (UBS, 1987: 39).

Blue and Hedberg (2001) in Mahshid and Naji (2001: 1) comment that the evolution in the financial sector over the last twenty years has resulted in intricate balance sheet structures containing complicated derivative instruments. Pyle

(1997: 2) recognises that leveraging inherent in various interest rate derivatives provides an accelerated risk exposure for hedgers, while acknowledging that it is not necessarily the derivative instruments that cause this increased risk *per se*, but rather ineffective risk management.

At this point, it is important to note that bank risk is managed by a number of internal committees. One such committee is the asset and liability committee (ALCO), whose role is manage a bank's interest rate risk by primarily focussing on the type, volume and maturity structure of financial instruments in changing economic environments (Meek, 1987: 5). The ALCO is responsible for the formulation of the basic borrowing and lending strategy, and therefore affects all bank divisions.

1.2 WHY IS THE PROBLEM WORTH ADDRESSING?

The case study analysis for the GBS Mutual Bank (GBS) will provide a range of alternatives which the bank can incorporate into its interest rate risk management strategy. The practicality of each hedging instrument will be discussed, considering the GBS specific business circumstance, its interest rate risk position and market conditions over the specified period.

Furthermore, the thesis will analyse the GBS asset and liability committee in terms of its functions and organisation. Recommendations will be provided on the basis of a theoretical asset and liability structure which may further aid the GBS in its hedging activities.

1.3 OBJECTIVES/GOALS OF THE RESEARCH

The main objectives of this thesis are to:

- analyse the theoretical asset and liability structure

- analyse the various strategies, tools and financial instruments available for interest rate risk hedging
- analyse the GBS Mutual bank's specific business practices and its interest rate risk exposure
- comment on the practicality of the interest rate risk hedging instruments available to the GBS, and provide recommendations for its asset and liability committee.

1.4 METHODOLOGY

The research methodology of the thesis is a case study. The case study method allows for both the generating and the testing of hypotheses and allows the researcher to identify and include certain elements, conditions and information that may be unique to individuals and organisations, thus permitting a more holistic study (Tellis, 1997; Kennedy and Luzar, 1999).

Yin (1984) in Remenyi (1995: 15) recognises the case study methodology as "an empirical inquiry that investigates a contemporary phenomenon within its real life context, when the boundaries between phenomenon and the context are not clearly evident, and in which multiple sources of evidence are used. It is particularly valuable in answering who, why and how questions in management research".

The thesis requires intimate knowledge of the GBS business practices, legal requirements and unique balance sheet structure, all of which provide the rationale for the use of a case study methodology. In order to conduct a thorough analysis, a number of practices specific to the case study methodology must be used; these include access to documentation, archival records and interviews, as well as direct and participant observations with the GBS (Tellis, 1997).

More specifically, the researcher will have access to public GBS archival records, historical GBS balance sheet structures and interviews with GBS senior management. The researcher will also be privy to direct and indirect participation with GBS senior management through on-site involvement at the GBS head office in Grahamstown. The researcher will also conduct interviews with a number of larger South African and international banks in order to generate hypotheses for the practicality of certain interest rate hedging techniques. These interviews are attached in Appendix A.

1.5 ORGANISATION OF THE STUDY

The thesis is divided into seven chapters: following this introductory chapter, Chapter two introduces bank financial risk with specific attention paid to interest rate risk, which is followed by an analysis of the theoretical structure of a bank's asset and liability committee in chapter three. Chapter four explores interest rate risk management, focussing on balance sheet hedging techniques and interest rate derivative instruments.

Chapter five discusses a number of methods for correctly measuring the amount of interest rate risk to which a bank is exposed. Chapter six provides the case study analysis of the GBS. Given the GBS interest rate risk exposure, this chapter provides a number of alternative interest rate risk hedging alternatives and comments on the practicability of their implementation. This chapter also compares the theoretical asset and liability structure to that of the GBS in order to provide recommendations. Chapter seven concludes the study.

CHAPTER TWO

BANK FINANCIAL RISKS

2.1 INTRODUCTION

This chapter provides a brief overview of the South African banking sector as well as an indication of the financial risks faced by banks. Since interest rate risk is at the heart of the thesis, particular attention is given to its defining characteristics and the relationship it has with other financial risks and the various shapes of the yield curve.

Bessis (2002: 11) defines bank risk as "adverse impacts on profitability of several distinct sources of uncertainty". This definition of bank risk serves its importance in providing a sound base for risk measurement and management. Heffernan (1996: 163) recognises that any profit-maximizing organisation incurs risk in its daily operations, yet banks face a number of risks that are atypical to both financial and non-financial firms. Exposure to these various risks has resulted in the banking sector being the most regulated of all financial institutions.

It would be fitting to first give some background to the South African banking sector. This sector is comprised of 36 financial institutions (including two mutual banks) and is largely dominated by four large financial institutions (namely: ABSA Bank Limited, First Rand Bank Limited, Nedbank Limited and The Standard Bank of South Africa Limited) which as at December 2005 constituted 83.6% of the South African banking sector (SARB[2], 2007a: 5-6).

[2] SARB = South African Reserve Bank

Table 2.1 (derived from SARB, 2007a: 90-91) provides a statement of assets and liabilities of the South African banking sector.

TABLE 2.1: SOUTH AFRICAN BANKS: STATEMENT OF ASSETS AND CAPITAL AND LIABILITIES (DECEMBER 2005) (RAND MILLIONS)

Assets				Capital and liabilities			
Balance sheet item	Amount	% growth	% total	Balance sheet item	Amount	% growth	% total
Money	38 338	18.6	2.3	Interbank funding	85 645	17.7	5.1
Interbank advances	72 255	31.9	4.3	Non-bank funding	1 101495	21.1	65.7
Non-bank advances	1 231379	21.4	73.4	Foreign funding	56 832	24.2	3.4
Loans granted under resale agreements	34 648	19.2	2.1	Loans under repurchase agreements	54 307	4.8	3.2
Investment portfolio	254 284	-23.2	15.2	Other liabilities	244 928	-16.3	14.6
Non-financial assets	13 840	18.9	0.8	Acknowledgement of debt	1 004	108.7	0.1
Acknowledgement of debt outstanding	962	99.8	0.1	Capital and reserves	133 331	6.7	7.9
Other assets	31 836	27.3	1.9				
Total assets	**1677543**	**12.0**	**100.0**	**Total capital and liabilities**	**1677543**	**12.0**	**100.0**

Source: SARB (2007a: 90-91).

Table 2.2 (derived from SARB, 2007a: 92-93) presents the composition of certain assets and liabilities shown in Table 2.1.

TABLE 2.2: SOUTH AFRICAN BANKS: COMPOSITION OF SELECTED ASSETS AND LIABILITIES (DECEMBER 2005) (RAND MILLIONS)

Assets (total loans and advances to non-banks)				**Capital and liabilities (non-bank funding)**			
Balance sheet item	Amount	% growth	% Total	Balance sheet item	Amount	% growth	% total
NCD	21 225	27.0	1.7	Demand deposits	511 693	19.3	46.5
Instalment debtors	182 165	19.5	14.8	Savings deposits	57 870	13.3	5.3
Mortgage Loans	522 413	28.6	42.4	Fixed and notice deposits	380 351	18.8	34.4
Credit cards	31 207	47.4	2.5	NCD	151 581	38.0	13.8
Acknowledgement of debt discounted	27 461	22.1	2.2				
Redeemable preference shares	18 258	16.2	1.5				
Overdraft and loans	298 506	7.0	24.2				
Foreign currency loans and advances	145 501	24.7	11.8				
Less: specific provisions	15 358	-5.0	1.2				
Total loans and advances to non-banks	**1 231 379**	**21.4**	**100.0**	**Non-bank funding**	**1 101 495**	**21.1**	**100.0**

Source: SARB (2007a: 92-93).

It will be evident from the tables above that banks are involved in a number of both financial and non-financial activities. Banks can be described as unique institutions as, (according to Heffernan, 1996: 163), the distinguishing features of any bank are its business practices. A bank's core product is that of intermediation, while its core business is to manage risk permeating from both on- and off-balance sheet activities.

The information provided in Table 2.1 and Table 2.2 illustrates that a bank's risk position is largely financial (i.e. 97.4% of assets and 85.4% of capital and liabilities are financial in nature). Of the financial assets, 73.4% is constituted of

non-bank advances which mainly represent the lending activities of the banks particularly in the form of mortgage loans (42.4%), as well as bank loans and overdrafts (24.2%) (SARB, 2007a: 90-93).

Of the financial liabilities, 65.7% is represented by non-bank funding, which describes the various deposit liabilities of a bank and in particular in the form of demand deposits (46.5%) as well as fixed and notice term deposits (34.4%). The South African banks' balance sheet has grown by an average of 12% over a one year period which follows growth rates of 25.4% and 8.6% during the preceding years (SARB, 2007a: 90-93).

The balance sheet illustrates the various forms of risk faced by banks. "For example, the assets indicate the presence of credit risk and market risk; the liabilities indicate the presence of market risk (in the guise of an opportunity cost); the entire balance sheet indicates the presence of interest rate risk (not to be confused with market risk) and liquidity risk" (Dietrich, 2006: 6).

The Banks Act (94 of 1990:8) in SARB (2007b) includes the following as bank risk:

"… types to which the bank is exposed, namely-

(a) solvency risk
(b) liquidity risk
(c) credit risk
(d) currency risk
(e) market risk (position risk)
(f) interest rate risk
(g) counterpart risk
(h) technology risk
(i) operational risk; or
(j) any other risk regarded as material by that bank."

Heffernan (1996: 163-170), Bessis (2002: 12-22) and Faure (2002: 133) elaborate on the number of bank risks by including: gearing risk (leverage risk), performance risk, model risk, regulatory risk, settlement risk (payment risk) and sovereign risk. As aforementioned, only financial bank risks will be discussed in further detail, and particularly the financial risks as indicated by the Banks Act (94 of 1990: 8).

2.2 BANK FINANCIAL RISK

2.2.1 Introduction

This section elaborates on the financial risks faced by banks as specified by the Banks Act (94 of 1990: 8).

2.2.2 Solvency risk

Solvency risk can be described as a peculiar risk in that it is the result or end product of other financial and non-financial risks.

Solvency risk is defined by Bessis (2002: 20) as “the risk of being unable to absorb losses, generated by all types of risk, with available capital”. Since solvency risk is generated from one or a combination of other bank risks and primarily stems from the poor management of these risks, a greater amount of attention will be given to the contributory financial risks.

2.2.3 Liquidity risk

Liquidity risk is defined by Faure (2002: 137) as “the risk of not being able to meet obligations of funds demanded by clients”.

Liquidity risk stems from a balance sheet structuring dilemma where assets and liabilities mature at different periods. The result is a cash flow problem where cash inflows from maturing assets and cash outflows from maturing liabilities are unequal in terms of maturity and other variables. Thus liquidity risk and cash flow management are inextricably linked (UBS, 1987:39).

Liquidity risk is closely linked to interest rate risk. The relationship between these risks will be discussed in further detail below.

2.2.4 Credit risk

Credit risk is defined by Deutsche Bank (2007: 45) as the group’s most important risk that “arises from all transactions that give rise to actual, contingent or potential claims against any counterparty, obligor or borrower”. Credit risk may occur if the asset or loan becomes irrecoverable or if there is a delay in the servicing of the loan. In both instances the solvency of the bank is placed at risk as the present value of the asset declines (Heffernan, 2003: 165).

This risk is the single largest risk faced by banks and can become extremely costly not only due to the initial loss incurred but also due to time and counselling provided in order to retrieve the amount lost (Faure, 2002).

The relationship between credit risk and interest rate risk will be discussed in further detail below.

2.2.5 Market risk

Market risk is defined by Bessis (2002: 18) as “the risk of adverse deviations of the marked-to-market value of the trading portfolio due to market movements, during the period required to liquidate the transactions”. This marked-to-market value is contingent on the market price of all tradable securities held by banks. The market price (i.e. interest rates, equity prices, bond prices, commodity prices, derivative prices, etc) of various securities may change in unanticipated directions, which may alter the securities’ return (Faure, 2002).

Banks, in recent times, have become more susceptible to market risk as banking activities move away from the traditional banking practices to larger trading volumes. This increase in trading activity in the various financial markets has increased banks’ market risk position (Bessis, 2002 and Faure, 2002).

2.2.6 Currency risk

Currency risk is also commonly referred to as exchange rate risk, and is defined by American Express (2007: 1) as “the risk that the value of your investment that is denominated in the currency of another country will rise or fall with the changes in the exchange rate between the countries.”

Banks, especially multinational banks, are large holders of foreign assets, liabilities and derivative financial instruments in their portfolios. If, for example, the value of the currency in which these instruments are held changes unfavourably, the return and payment streams may be affected negatively. Banks most commonly use financial derivative instruments to hedge away currency risk (Bessis, 2002 and Faure, 2002).

2.2.7 Interest rate risk

Banks can be described as intermediaries between lenders and borrowers. For competitive reasons, banks may be obliged to accept client funds with varying maturities that could potentially alter the structure of the balance sheet to an interest rate sensitive position (UBS, 1987: 37). Interest rate risk stems from assets and liabilities maturing at different times, and (according to SARB, 2000: 113) can be encompassed in three elements, namely "the margin between the rates earned on assets and paid on liabilities, the repricing potential of assets and liabilities at different points in time, resulting in mismatches in various time bands between assets, liabilities and derivatives, and, finally, the period during which these mismatches persist".

Interest rate risk can most aptly be illustrated by describing the maturity structure of a bank's assets and liabilities. Banks are usually described as being asset or liability sensitive with regard to the maturity structure of their portfolio.

An asset sensitive bank has a long funded book, whereby short term assets are funded by long term liabilities. The interest rate risk in this case is that (since assets mature before liabilities) the assets need to be reinvested until they are needed to repay the liabilities. Should the bank witness a falling interest rate scenario, the reinvestment of these assets may be attained at rates that are lower than the existing rate payments on liabilities. Obviously, if rates interest rates rise the bank will prosper under its asset sensitive portfolio (UBS, 1987: 13).

Alternatively, a liability sensitive bank has a short funded book, whereby long term assets are funded by short term liabilities. Interest rate risk occurs because liabilities need to be rolled over until assets become available to repay the liabilities. In a rising interest rate scenario, the rollover of the liabilities may occur at a rate that is greater (more expensive) than the rate earned on assets,

affording a squeeze on bank interest rate margins. Obviously, if the bank is faced with a falling interest rate scenario it will prosper from a liability sensitive portfolio (UBS, 1987: 13).

Faure (2002: 134) recognises that banks can theoretically avoid interest rate risk by perfectly matching assets and liabilities "in terms of currency [term to maturity], and have the rates on both sides fixed or floating, and thus enjoy a fixed margin." If a positive sloping (or normal) yield curve is assumed, an ideal portfolio can be constructed for both a falling and rising interest rate environment. During falling interest rates, the most beneficial portfolio would be to have all liabilities short with floating rates and assets long with fixed rates (and *vice versa* for a rising interest rate environment). This type of analysis will be discussed in further detail in chapters four and six.

Faure (2002) recognises that in reality the ideal portfolio construct can be dependent on variables such as bank competition as well as the requirements of clients, investors and stakeholders, all of which may affect the composition of the balance sheet. Thus, banks are naturally exposed to interest rate risk as they have a large variety of assets and liabilities that differ in term to maturity and repricing frequency.

Interest rate risk is viewed by many as one of the most significant risks of a bank. A large portion of private banks' revenue stems from net interest income that is generated from the difference between various assets and liabilities that are held in the balance sheet.

According to SARB (2007a: 103), interest income and interest expense represented 7% and 4.7% of total assets respectively (and therefore an interest margin of 2.3%) for the 12 month average at December 2005. Interest rate risk has its importance in affecting the amount of interest income and interest expenditure of a bank. Table 2.3 represents the composition of both interest

income and interest expense accounts. Interest income is largely comprised of income from mortgage loans (36.5%) as well as overdraft and loans (25.1%) while interest expense is largely comprised of fixed and notice deposits (31.7%) as well as demand deposits (27.4%).

TABLE 2.3: SOUTH AFRICAN BANKS: PERCENTAGE CONTRIBUTION OF INTEREST INCOME AND INTEREST EXPENSE (AVERAGE DECEMBER 2005) (RAND MILLIONS)

Interest income		**Interest expenses**	
Income statement item	Percentage of total	Income statement item	Percentage of total
Interbank loans	6.6	Intragroup funding	3.6
Instalment debtors	15.2	Interbank funding	4.4
Mortgage loans	36.5	Demand deposits	27.4
Credit cards	3.1	Savings deposits	1.9
Acknowledgement of debt discounted	1.9	Fixed and notice deposits	31.7
Redeemable preference shares	1.2	NCD	12.6
Overdraft and loans	25.1	Loans under repurchase agreements	3.9
Foreign currency loans and advances	4.0	Other funding	7.9
Loans under resale agreements	1.8	Foreign funding	1.8
NCD	1.4	Transfer cost of trading	-0.2
Interest income from investments	3.2	Debt instruments	5.0
Interest income	**100.0**	**Interest expense**	**100.0**

Source: SARB (2007a, 107).

2.3 THE RELATIONSHIP BETWEEN INTEREST RATE RISK AND OTHER FINANCIAL RISKS

2.3.1 Introduction

Interest rate risk characteristics and its management are linked to a number of other risks. Interest rate risk can be described as a contributory risk to other risks, and the effective management of interest rate risk can either aid or deter from the effective management of other financial risks.

2.3.2 Interest rate risk and credit risk

Banks often attempt to hedge away all or part of their interest rate risk exposure through the use of a number of on- and off-balance sheet activities and instruments (these activities and instruments will be discussed in detail at a later stage).

Banks can shift a large portion of their interest rate risk exposure to borrowers (i.e. hedge) by granting a larger portion of their lending activities at a variable rate of interest. If this method is employed, it is imperative that the selection of borrowers is conducted with the correct amount of due diligence, as the potential for borrowers to rescind or fail in terms of the agreed contract is increased. In this scenario the bank has, in fact, not reduced its interest rate exposure at all, but has rather increased its exposure to credit risk (UBS, 1987: 39).

2.3.3 Interest rate risk and liquidity risk

The UBS (1987, 39) describes the relationship between interest rate risk and liquidity risk as “inextricably interwoven” because in order to increase its net interest income, the bank must usually sacrifice a degree of its liquidity (Finansbank, 1988: 81).

The relationship between these two bank financial risks is best described by their interaction with the various shapes of the yield curve and the structure of the bank’s balance sheet, discussed below.

2.3.4 Interest rate risk and solvency risk

As aforementioned, solvency risk is derived from the poor management of other bank risks. The inefficient management of interest rate risk can contribute to the potential insolvency of a bank, and therefore increase its solvency risk (Bessis, 2002: 20).

2.4 THE RELATIONSHIP BETWEEN INTEREST RATE RISK AND THE YIELD CURVE

2.4.1 Introduction

The yield curve can be described as a graphical representation of the term structure of interest rates for a particular asset with the same amount of risk[3] but differing terms to maturity at a point in time (UBS, 1987: 37; Mishkin, 2004: 127; Faure, 2002: 49).

[3] The composition of risk in this context refers to: the real risk free rate; current inflation, expected inflation, the liquidity-sacrifice premium and the risk premium, as noted by Faure (2005: 46).

The shape of the yield curve has an impact on a bank's interest rate risk and liquidity risk exposure. The bank may, in some instances, alter the composition of the balance sheet in order to hedge or take advantage of a particular shape in the yield curve (UBS, 1988: 40).

The relationship between interest rate risk and three different shapes of the yield curve will be considered in the flowing format:

- the normal yield curve
- the inverse yield curve
- the flat yield curve.

2.4.2 The normal yield curve

The normal yield curve is represented by a positively sloping curve where short-term securities have lower yields than long-term securities (i.e. short-term interest rates are below long-term interest rates) (UBS, 1987: 37); (Mishkin, 2004: 127). The UBS (1987: 37) describes the positive slope as 'normal' because "an investor should be able to bargain, under normal economic conditions, for a higher return (yield) for his investment the longer he is willing to hold it".

In order to take advantage of the positively sloping yield curve the bank may alter the structure of its balance sheet by borrowing funds short and lending them long. If the expected interest rate forecast proves to be correct, this type of balance sheet structure will increase the bank's interest margin and profit. It must be noted, however, that this type of balance sheet structure will also decrease bank liquidity (and therefore increase liquidity risk) (UBS, 1988: 40).

2.4.3 The inverse yield curve

The inverse yield curve is represented by a downward sloping curve where the return on short-term securities is higher than the return on long-term securities (UBS, 1988: 40). It is recognised (UBS 1988: 40) that the inverse yield curve commonly indicates a change in the interest rate structure where rates in the near-term are expected to fall below long-term rates, ultimately resulting in a normal yield curve.

In order to maximise profits, the bank should alter the structure of the balance sheet by borrowing funds long-term and lending funds short-term. This balance sheet structure will not only maximise bank profits, but also increase the liquidity of the bank (and thereby reduce its liquidity risk exposure). The UBS (1988: 40) does, however, recognise that - since the inverse yield curve indicates a changing interest rate structure - this type of balance sheet structure may increase the bank's interest rate risk exposure if rates change suddenly.

If, for example, the yield curve reverts to an upward sloping curve, the bank may have a large amount of deposit payments at higher rates than the rates received from investing activities (i.e. short-term rates are below long-term rates). This will, of course, place a squeeze on bank margins as the cost of funding is incorrectly structured (UBS, 1988: 40).

2.4.4 The flat yield curve

The flat yield curve represents the situation where the rates on short-term securities are equal to the rates on long-term securities. The UBS (1987: 38) describes the flat yield curve as an interim interest rate period where the interest rate structure is changing from an upward sloping curve to a downward sloping curve or *vice versa*.

The UBS (1988: 41) likens the flat yield curve to the doldrums of sailing where no profit can be made from the mismatching of assets and liabilities. In this scenario interest rate risk is minimised as no returns can be made from restructuring the balance sheet. The UBS (1988: 41) perceives ALCO decisions to increase profitability during this period as a potential danger. This will be evident if complicated financial instruments are used to encourage earnings at the cost of long-term profitability and bank credibility.

2.5 CONCLUSION

It will be clear that bank risk affects the profitability of the bank from a number of distinct sources. This chapter has briefly described the South African banking sector as well as bank financial risk. Particular attention is given to interest rate risk and its relationship between various financial risks and the alternate shapes of the yield curve. The bank must rely on a number of internal committees in order to correctly manage its various risk positions. The ALCO can be described as one such committee that is charged with the duty of managing the interest rate risk and the liquidity risk of the bank. Chapter three presents a discussion on the functionality and organisation of a typical bank's ALCO.

CHAPTER THREE

ASSET AND LIABILITY COMMITTEE OF BANKS

3.1 INTRODUCTION

The previous chapter made it abundantly clear that private sector banks face a multitude of risks in their daily operations. These risks must be effectively managed in order to optimise the bank's risk and return structure.

The ALCO can be described as an internal committee that is charged with the duty of managing the interest rate risk and the liquidity risk of a bank. The UBS (1988: 41) describes asset and liability management to be of the utmost importance to any financial institution, while asset and liability management - with regard to interest rate risk hedging - is defined by the UBS (1988: 41) as a process that "involves the offsetting of risks that endanger the operating and financing flexibility of a financial institution".

The purpose of this chapter is to discuss the various aspects of a typical bank's ALCO. It is arranged as follows:

- FUNCTIONS OF THE ALCO
    - risk measurement
    - simulation
    - risk management.

- ORGANISATION OF THE ALCO
    - scope of the ALCO
    - ALCO decision making process.

3.2 FUNCTIONS OF THE ALCO

3.2.1 Introduction

As aforementioned, the primary purposes of the ALCO are to manage the bank's liquidity risk and interest rate risk positions. The ALCO is equipped with three risk analysis tools to manage its interest rate risk position:

- interest rate risk measurement
- simulation
- interest rate risk management.

3.2.2 Interest rate risk measurement

Interest rate risk measurement aims to quantify the interest rate risk profile of a bank. The correct measurement of the bank's interest rate risk exposure is necessary to ensure proficient risk management. A number of authors such as the UBS (1989: 42), Heffernan (1996: 181-192), Bessis (2002: 166), Sinkey (2002: 219-233) and Gup and Kolari (2005: 117-139) recognise several models for measuring the interest rate risk sensitivity of a bank. The models that will be discussed in this thesis include:

- maturity structure analysis
- balance sheet projection
- gap analysis
- net interest income projection
- risk-return exposure
- duration gap analysis
- ratio analysis.

These risk measurement tools will be discussed in detail in Chapter 5.

3.2.3 Simulation

Bessis (2002: 193) defines simulation as a process "that model(s) the behaviour of the balance sheet under various interest rate scenarios to obtain the risk and the expected target variables, interest income or the marked–to–market value of the balance sheet at market rates". Simulation tries to forecast future profitability and risk by extrapolating from previous and current information in order to forecast and set business policy and hedging programmes (Bessis, 2002: 193).

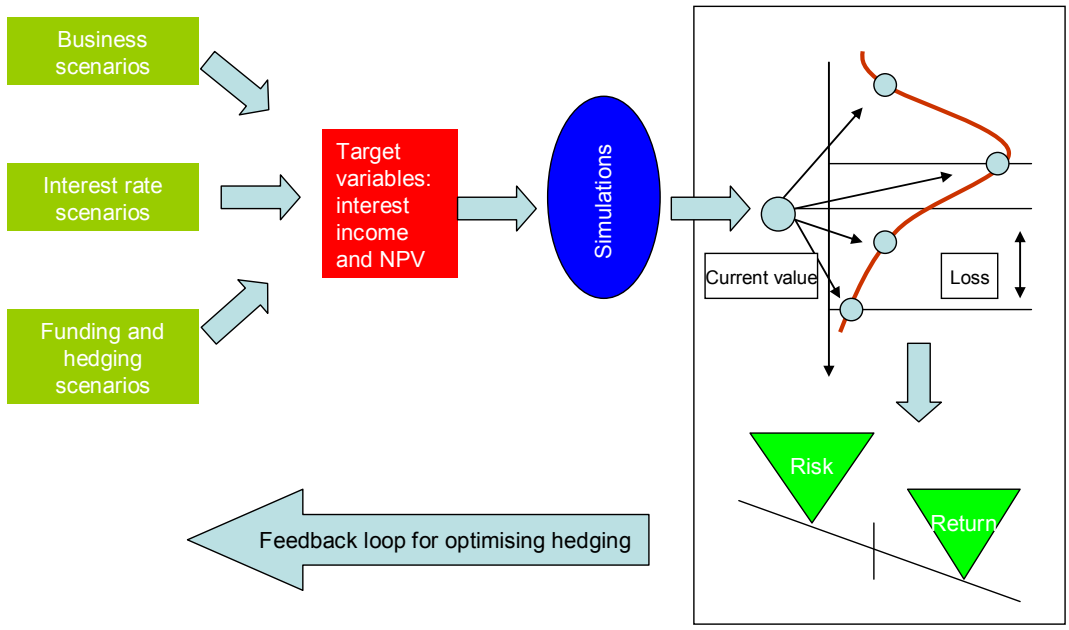
Bessis (2002: 194) identifies seven steps to construct an effective ALCO simulation:

- "select the target variables, interest income and the balance sheet NPV (net present value)
- define interest rate scenarios
- build business projections of the future balance sheets. The process either uses one single base business scenario or extends to several business scenarios. For each business scenario the goal is to project the balance sheet structure at different time points
- project margins and net income, or the balance sheet NPV, given interest rates and balance sheet scenarios. The process necessitates calculations of interest revenues and costs, with all detailed information available on transactions
- when considering optimal risk, include valuing options using more comprehensive interest rate scenarios than for 'direct' interest rate risk. Simulations consider optimal risk by making interest income, or balance sheet NPV, calculations dependent on the time path of interest rates
- combine all steps with hedging scenarios to explore the entire set of feasible risk and return combinations

- jointly select the best business and hedging scenarios according to the risk and return goals of the ALCO" (Bessis, 2002: 194).

These steps are illustrated in Figure 3.1.

FIGURE 3.1: OVERVIEW OF THE ASSET AND LIABILITY MANAGEMENT PROCESS



Source: Bessis (2002: 195).

Bessis (2002: 196) emphasises the importance of using a number of yield curve scenarios when constructing a simulation. This includes both parallel and curvature changes in the yield curve. Along with yield curve assumptions, Gup and Kolari (2005: 138) include assumptions about asset and liability pricing strategies as well as asset and liability mix and growth rates.

Due to its rate sensitive assets and liabilities, a bank's business activities can be described as inextricably linked to the perceived interest rate environment. Therefore Bessis, (2002: 200) concludes that a simulation of an alteration of the balance sheet must include effects on the bank's business risk (e.g. customers, market segments, etc).

Bessis (2002: 193) identifies three simulation outputs:

- the provision of projected target variables under various scenarios
- the measurement of the exposure of a bank to interest rate risk and business risk
- the optimisation of a bank's risk and return profile, measured by expected values of certain target variables under alternate scenarios.

Gup and Kolari (2005, 139) advocate the use of simulation for stress testing which tries to quantify the effect different interest rate scenarios have on income and capital. The authors do, however, state that simulations are often only used by larger banks, as the cost of model development and implementation can be reduced with economies of scale. Brown (2007) maintains that a larger bank's economies of scale often extend to skills sets, computational costs and the number of markets the bank participates in.

3.2.3 Interest rate risk management

3.2.3.1 Introduction

Bessis (2002: i) describes bank risk management as a set of policies and practices that allow a bank to measure, monitor and control its risk position. Risk measurement and simulation can be viewed as prerequisite tasks that must be undertaken for effective risk management. Authors such as Bessis (2002) and Gup and Kolari (2005) incorporate risk measurement and simulation as part of risk management, as indeed they are; this thesis, however, separates these activities and emphasises risk management as the active strategic choices of a bank's ALCO to employ certain financial instruments to achieve its business objectives.

Faure (2006: 88) identifies four financial market participants (that deal as principals), namely: investors, speculators, arbitragers and hedgers. These market participants are distinguished by their market strategies. The bank's ALCO can employ a business strategy that mirrors these strategies in terms of how much risk the bank is willing to take (Gup and Kolari, 2005: 117).

The ALCO strategies discussed are:

- speculative vs prudent risk management
- macro vs micro risk management
- on-balance sheet vs off-balance sheet risk management
- retaining the *status quo.*

3.2.3.2 Speculative vs prudent risk management

Bessis (2002: 181) identifies two alternative ALCO objectives with regard to the hedging policy adopted:

- the ALCO can design a speculative policy with the intent to take advantage of opportunities (and therefore take risks)
- the ALCO can design a prudent policy with the purpose of hedging risks totally or partially. The ALCO can achieve this objective by i) locking in interest rates over time, or ii) "hedging adverse movements only, while still retaining the option to benefit from other favourable market movements" (Bessis, 2002: 181).

Poitras (2002) notes that the distinction may be ambiguous as speculation is often required to fully hedge a bank's risk position.

3.2.3.3 Micro vs macro risk management

The ALCO must decide upon the portion of the balance sheet that it would like to hedge. Faure (2006: 90) defines the difference between the two types of hedging techniques as: “Micro hedging is where each item in a balance sheet (liabilities and/or assets) is valued separately and an autonomous hedge set up for each item. Macro hedging is where the aggregate asset and/or liability portfolios are considered, and the overall risk is hedged in one operation”. Bessis (2002: 125) identifies that a macro hedge can also be performed at a sub-portfolio level, while Mahshid and Naji (2003: 33) identify the macro hedge as the most frequently practised.

3.2.3.4 On-balance sheet vs off-balance sheet risk management

When deciding to hedge a bank’s interest rate risk position, the ALCO must decide whether to use on-balance sheet or off-balance sheet instruments.

On-balance sheet adjustments refer to the alteration of the portfolio of assets and liabilities of the bank. The Rand amount of these balance sheet items will fluctuate in accordance with the changes in the interest rate and the hedging instruments used (Gup and Kolari, 2005: 120).

Off-balance sheet adjustments refer to the bank’s ability to use certain products of financial engineering – such as derivative instruments – in order to manage its interest rate risk. In this case the interest rate risk position can be altered without any adjustment to the portfolio of assets and liabilities on the bank’s balance sheet (Gup and Kolari, 2005: 120).

Both on-balance sheet and off-balance sheet hedging instruments are discussed in detail in Chapter 4.

3.2.3.5 Retaining the *status quo*

Mahshid and Naji (2003: 34) recognise that in certain circumstances the ALCO may decide that hedging the bank against interest rate risk may induce other risks, become too expensive or be content to let the risk fluctuate over the business cycle. In this case the bank may decide to retain the existing business operations with an un-hedged interest rate risk position.

3.3 ORGANISATION OF THE ALCO

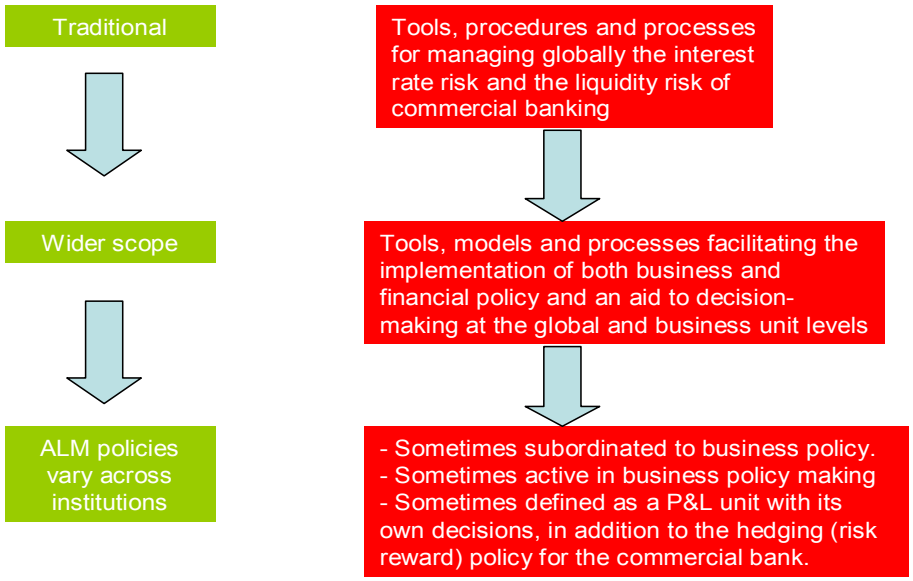
3.3.1 Introduction

The ALCO is influenced by a variety of internal bank departments as well as external factors that influence its business processes. The scope of its functions as well as the decision-making process to which it subscribes is to a large extent determined by the organisation of the ALCO.

3.3.2 Scope of the ALCO

According to Bessis (2002: 70) the scope of asset and liability management (ALM) can vary substantially from a limited balance sheet structuring function to a wider profit centre and hedging function. The ALM can also move away from the traditional balance sheet management function towards a more integrated functionality among various business lines and policies. The scope of ALM is depicted in Figure 3.2:

FIGURE 3.2: ALM SCOPE



Source: Bessis (2002: 70).

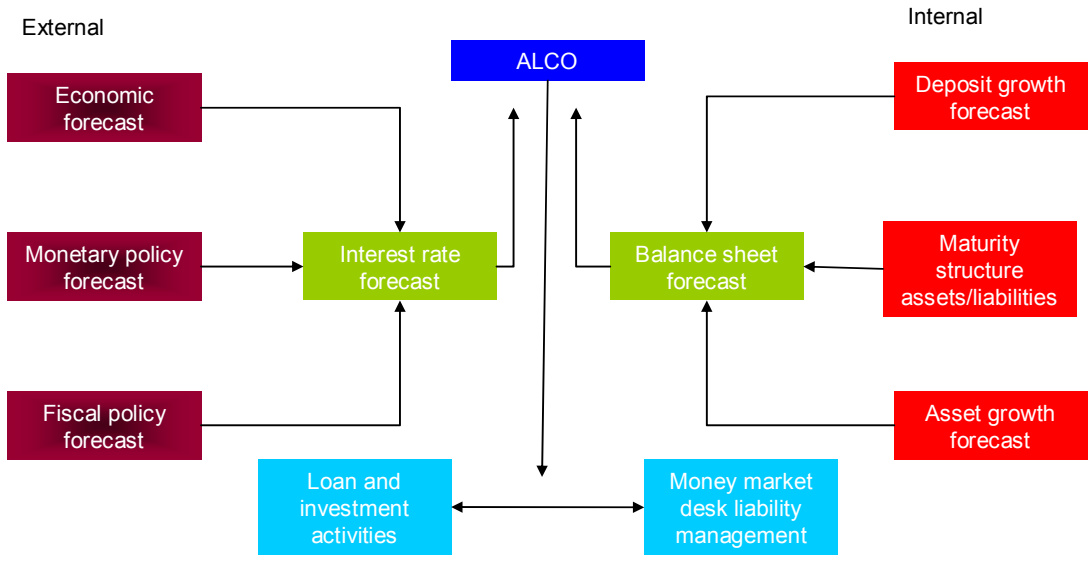
Bessis (2002: 70) recognises that bank financial activities such as funding, investing and hedging influence the amount of interest income, while business policy and development often influence risk. The ALCO must ensure a balance between the risk and interest income through the use of an integrated approach whereby the ALCO has a level of involvement within business lines and policies beyond the simple balance sheet structuring activity.

Meek (1988: 4-5) extends the scope of the ALCO functions to include:

- shaping the basic borrowing and lending strategy
- the management, coordination and direction of changes in maturities and types of bank assets and liabilities
- lending, investing and staffing functions of certain departments
- management of the opportunities and risk presented by the cyclical patterns of the economy and credit demands as well as monetary policy and fiscal policy
- liquidity demand management.

This extended scope advocated by Meek (1988: 5) can be depicted diagrammatically in Figure 3.3.

FIGURE 3.3: ASSET AND LIABILITY COMMITTEE OF A BANK



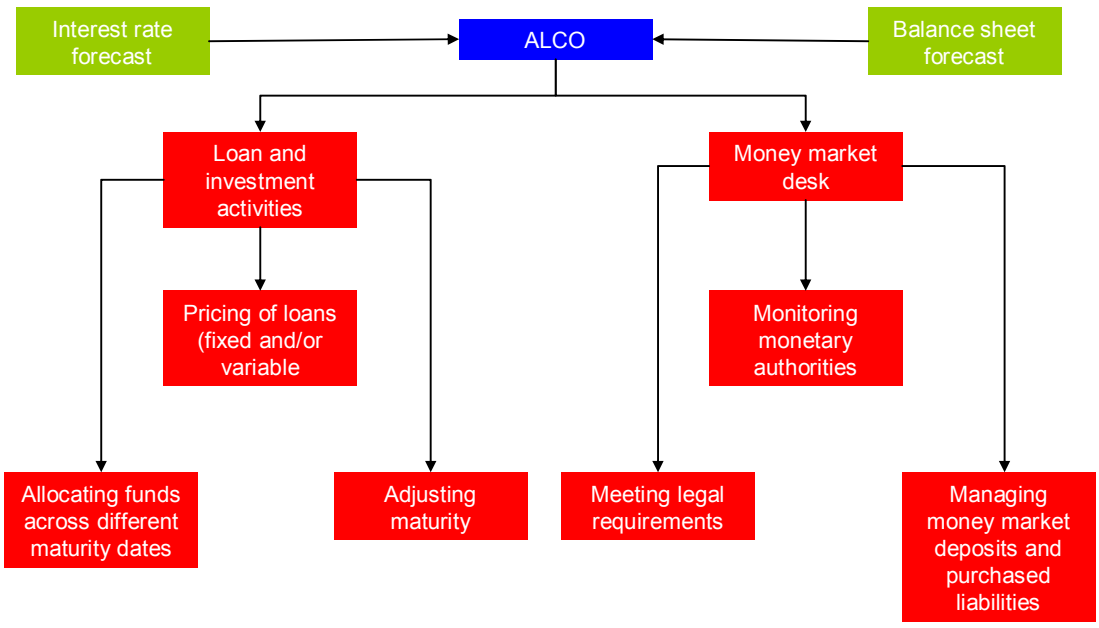
Source: Meek (1988: 5).

3.3.3 ALCO decision making process

The ALCO decision making process is often complex, as it incorporates a number of departments and can be described as part of a forward-looking profit plan for the bank. This requires a number of simulations about the bank's business environment (e.g. interest rate scenario, legal and regulatory implications), and how this environment will affect the bank's balance sheet and profit motive.

The ALCO decision making process can be expressed diagrammatically as in Figure 3.4.

FIGURE 3.4: ASSET AND LIABILITY COMMITTEE DECISION MAKING PROCESS



Source: Meek (1988: 7).

Meek (1988: 7) identifies the following bank employees as typical ALCO members:

- chief financial manager or managing director (acting as chairperson)
- senior employee of foreign investing and lending activities
- senior loan manager (or chair of credit committee)
- chief economist
- senior money market desk manager.

Meek (1988: 7) recognises that chair of the ALCO should oversee the money and capital markets as this will provide the bank with the flexibility to change the mix of assets and liabilities more readily. Meek (1988: 7) identifies that the size of the bank will have an effect on the number of members in the ALCO: smaller banks should have in the region of 4 members, while larger banks should keep their ALCO relatively small with roughly 7 members. The size of the bank will also determine the number of categories of assets and liabilities held on the bank's balance sheet. In order to simplify the bank's balance sheet, the ALCO usually focuses on a reduced set of financial assets and liability classes which can range from between 15 to 20 categories, while larger institutions may address up to 100 categories (Meek, 1988: 7).

Meek (1988: 7) identifies that – due to the extended scope of the ALCO – the agenda of each ALCO meeting can vary widely. Examples of such agendas include:

- monitoring and coordinating role
- revision of the bank's balance sheet, the economic and interest rate outlook, the state of loan demand, and avenues for adjustment
- revision of the bank's foreign currency exposure
- maintaining or improving the positive interest rate spread
- attempting to take advantage of volatile interest rates through the use of balance sheet alteration (Meek, 1988: 7).

In order to accomplish these objectives, Meek (1988: 7), advocates that the frequency of ALCO meetings should occur once or twice monthly, if not weekly.

3.4 CONCLUSION

As seen, the ALCO is a valuable body in a banking institution, particularly due to its effect on the bank's business practices. This requires the ALCO to formulate an interest rate risk strategy that is congruent with its business strategy and market interest rate scenario as well as many other external factors that may affect the bank.

The ALCO has a number of both on-balance sheet and off-balance sheet financial instruments at its disposal for the purpose of hedging its interest rate risk position. A discussion of these instruments as well as examples on their application follows in Chapter 4.

CHAPTER FOUR

INTEREST RATE RISK MANAGEMENT

4.1 INTRODUCTION

Bessis (2002: i) describes bank risk management as a set of policies and practices that allow a bank to measure, monitor and control its risk position. The ALCO is responsible for the effective management of a bank's interest rate risk and liquidity risk. The ALCO has a number of instruments at its disposal to accomplish this, many of which are a product of modern financial engineering.

The purpose of this chapter is to elucidate the instruments that can be used for managing interest rate risk as well as provide examples of how each instrument can be used.

4.2 INTEREST RATE RISK HEDGING INSTRUMENTS: INTRODUCTION

The process of hedging is defined by Eitemann *et al* (2001) in Mahshid and Naji (2003: 32) as "the taking of a position, acquiring either a cash flow, an asset, or a contract that will rise or fall in value to offset a fall or rise in the value of the existing position". Faure (2006) recognises four principal parties involved in the financial markets, namely: speculators, hedgers, investors and arbitragers. Speculators and hedgers are often viewed as opposing economic agents where the risk reduced by hedging activities is taken up by the agent with a speculative position. Cummins *et al* (1998: 31) in Poitras (2002: 132) describes the distinction between the two types of agent's risk appetite quite aptly as: "if managers are attempting to reduce risk through their actions, they are said to be hedging; if managers are tying to increase the firm's risk exposure because they

believe such a strategy will yield abnormal profits, they are said to be speculating". Poitras (2002) does, however, note that the distinction is often ambiguous as speculation is often required to fully hedge a firm's risk position.

A number of authors such as Sinkey (2002), Faure (2006), and Gornton and Rosen (1995) view hedging as a zero sum game where the amount of risk hedged by one party is bought by another party within the financial system. The hedged position of one bank may be bought by another bank with a speculative position or a bank (with the opposite economic view point) that is hedging its own risk position.

Bessis (2002: 181) identifies two alternative ALCO objectives with regard to the hedging policy adopted:

- the ALCO can design a policy with the intent to take advantage of opportunities and take risks
- the ALCO can design a prudent policy with the purpose of hedging risks totally or partially. The ALCO can achieve this objective by i) locking in interest rates over time, ii) or "hedge adverse movements only, while still retaining the option to benefit from other favourable market movements" (Bessis, 2002: 181).

The use of any one of the hedging instruments described below is dependent on a number of factors that may range from a bank's specific business activities to economic availability and access to some of the instruments described. The following are identified as interest rate risk hedging instruments:

- balance sheet positioning instruments
    - net interest income smoothing
    - volume strategy
    - pricing strategies
    - the ideal portfolio
    - immunisation
- financial derivative instruments.

4.2.1 Balance sheet positioning strategies

4.2.1.1 Introduction

Balance sheet positioning strategies rely on the bank's ability to alter the mix and volume of financial assets and liabilities in order to take advantage of different interest rate environments and repricing frequencies of financial instruments. The balance sheet positioning strategies discussed are:

- net interest income smoothing
- a volume strategy
- an interest rate pricing strategy
- the ideal portfolio
- immunisation.

4.2.1.2 Net interest income smoothing

It is important first to consider the importance of net interest income (NII). NII is described by Sinkey (2002: 221) as the bread and butter of banking in that the quintessence of banking is to receive interest income on its assets that is greater than the interest payments on its liabilities. Sinkey (2002: 221) also identifies NII and the net interest margin (NIM) as the primary ALM target variables whose variability must be minimized.

Both NIM and NII can be expressed algebraically as the following:

(1) net interest margin = net interest income / average total assets

where

(2) net interest income = interest income – interest expense.

The process of NII smoothing can be described best as a rudimentary hedging technique of a bank's interest rate risk position. The smoothing technique simply relies on the bank's ability to reduce the variability of NII by saving on NII during the prosperous periods for the occasions when NII is reduced (Hornby, 2007a; Smith, 2007; Tagg, 2007).

If, for example, the bank is asset sensitive (i.e. its assets mature faster and therefore reprice faster than its liabilities) it should by definition have a prosperous NII position during a period of rising interest rates, and a reduced NII position during a falling interest rate scenario. In order to smooth its NII and hedge its interest rate risk, the bank could retain a percentage of this NII for periods when its NII is reduced (Hornby, 2007a; Tagg, 2007).

Similarly, if a bank is described as liability sensitive (i.e. its liabilities mature faster and therefore reprice faster than its assets) it could retain a portion of NII during falling interest rate scenarios for periods when NII is reduced, which will be perceived during rising interest rate environments (Hornby, 2007a; Tagg, 2007).

Obviously, this method is dependent on the interest rate cycle and the positioning of the bank's balance sheet as either asset or liability sensitive.

4.2.1.3 Volume strategy

A volume strategy (as with a NII smoothing strategy) can be described as a fairly basic form of interest rate risk hedging. This method of hedging relies on altering the volume or mix of assets and liabilities on the balance sheet by purchasing or selling the required amount of funds in the market (UBS, 1987: 60).

A volume strategy can be described as similar to a NII smoothing strategy, as both methods rely on the bank's ability to position its balance sheet toward targeting NII. This strategy does not, however, rely on the saving of NII, but rather aims to reposition the balance sheet as either asset or liability sensitive in accordance with the interest rate environment faced by the bank. A volume strategy often relies heavily on bank interest rate forecasts to alter the volume and mix of assets and liabilities both correctly and timeously in order to maximize potential NII (UBS; 1987: 60).

It should be noted, however, that it is often difficult to reposition the bank's balance sheet in the short term as the structure of the balance sheet may be dependent (among other factors) on the bank's business activities. Banks often naturally have a short or long funded book due to their business activities, customer base and business strategy. The repositioning of the balance sheet may be impractical and time consuming in the short term to justify or maximize potential gains (UBS, 1987: 60).

If, for example, a bank is initially described as having a long-funded book or asset sensitive balance sheet where it would naturally receive a higher amount of NII during a rising interest rate scenario and a lower amount of NII during falling interest rates, in order to maximize on NII returns the bank could reposition its balance sheet in accordance with its current or forecasted interest rate environment. In this scenario, the bank would try to lengthen the maturity structure of its assets and shorten the maturity structure of its liabilities during falling interest rates in order to maximize potential returns (UBS, 1987: 60).

4.2.1.4 Interest rate pricing strategy

Just as the South African Reserve Bank uses an interest rate targeting framework to affect the liquidity preference and demand for credit of economic agents, so a bank can affect the volume on its balance sheet via the adjustment of its quoted interest rates.

In this way a pricing strategy becomes similar to a volume strategy in that both methods have a desired result of repositioning the balance sheet to hedge against interest rate risk, yet the pricing strategy uses the quoted rates of interest as an intermediate target variable. The bank has the ability to adjust the interest rates quoted to borrowers and lenders and thereby influence the amount of assets and liabilities on its balance sheet. The bank can use this method to position itself advantageously during experienced and forecasted interest rate cycles (UBS, 1987: 59).

It is important to note that this method is dependent on a number of factors, which include:

- the bank's interest rate spread (margin)
- the customer's interest rate elasticity of demand
- the time needed to reposition the balance sheet (UBS, 1987: 59).

If for example the bank forecasts a declining interest rate trend and would like to take advantage of an increased amount of NII during this period, it can move to a short-funded book. The bank can use a pricing strategy whereby interest rates on short term deposits are increased and/or interest rates quoted on long term loans are increased. This will have the effect of i) increasing the volume of short term deposits as customers receive a higher rate of interest and ii) reducing the amount of long term loans as customer interest payments become greater. In this way the bank has altered the volume of assets and liabilities on its balance sheet to become liability sensitive which would be favourable in the projected interest rate environment (UBS, 1987: 60).

4.2.1.5 The ideal portfolio

The ideal portfolio can be attained with a combination of the above mentioned balance sheet positioning strategies and the bank's ability to buy or sell fixed or floating interest rate financial instruments.

Faure (2002: 134) recognises that banks can theoretically avoid interest rate risk by perfectly matching assets and liabilities "in terms of currency [term to maturity], and have the rates on both sides fixed or floating, and thus enjoy a fixed margin". If a positive sloping (or normal) yield curve is assumed, an ideal

portfolio can be constructed for both a falling and rising interest rate environment (Faure, 2002: 134).[4]

Faure (2002) does, however, recognise that in reality the ideal portfolio construct is virtually impossible as the positioning of the balance sheet and the type of financial instruments held can be dependent on variables such as bank competition as well as the requirements of clients, investors and stakeholders, all of which may affect the composition of the balance sheet. Thus banks are naturally exposed to interest rate risk as they have a large variety of assets and liabilities that differ in term to maturity and repricing frequency.

If a positive sloping yield curve is assumed, the bank can construct a portfolio that is fully hedged against interest rate risk in the following manner: during a falling interest rate environment the most beneficial portfolio would be to have all liabilities short with floating rates and assets long with fixed rates. Conversely, in a rising interest rate environment the ideal portfolio would consist of all the liabilities long with fixed rates and assets short with floating rates (Faure, 2002: 134).

4.2.1.6 Immunisation

Duration is described by the UBS (1988: 43) as a theoretical measure of time in terms of the average life of a stream of payments. It is more concisely defined as "the weighted average of time to receipt of payments due to the holder of a stock" (UBS, 1988: 43). Duration has the effect of converting "a coupon security – which may differ from other securities as to the maturity date, coupon payment,

[4] According to the UBS, (1987:37) even this method of fully matching liabilities and assets may still be susceptible to interest rate risk that arises from fluctuations in interest rate patterns. Changes in interest rates may affect the volumes on either side of the balance sheet differently due to interest rate elasticities of demand, which may, in turn, affect the composition of the balance sheet and the rate sensitivity of the portfolio and thereby induce an interest rate risk position.

and market yield - into its zero-coupon (single payment or bullet) equivalent" (UBS, 1988: 43).

The importance of duration becomes evident when describing the potential immunisation of a bank's balance sheet against interest rate risk. Immunisation refers to the bank's ability to match the average duration of the bank's balance sheet to the investment horizon (UBS, 1988: 43).

The best way in which to describe immunisation is with an example[5]. If it is assumed that:

- the bank holds a R100 000 bond that yields interest payments of 12% pa, paid annually
- the maturity of the bond is 5 years
- the duration of the bond is 4. 04 years
- he bank would like to immunise the return of a single bond against changes in the rate of interest, and obtain a certain targeted income (e.g. 12% pa),

the bank can immunise the bond's return by setting the duration of the bond equal to the investment horizon. Table 4.1 illustrates the effects of immunisation under three different interest rate scenarios, namely: an increased rate of 14%pa, a steady rate of 12%pa and a lower rate of 10%pa. The table also provides a fluctuating holding period of 5 years, 4 years and 3 years.

[5] Example derived from UBS (1988: 43 – 49).

TABLE 4.1: IMPACT OF HOLDING PERIOD ON REALISED ANNUAL RETURN

Stock : R100 000, 12%pa (annual return)
Maturity : 5 years
Duration : 4.04 years

Holding period	Interest rate (%p.a.)	Bond price after holding period (R'000)	Coupon paid (R'000)	Reinvestment income (R'000)	Total value (R'000)	Realised annual return (%p.a.)
5 years	12	100.0	60	16.2	176.2	12.00
	10*	100.0	60	13.3	173.3	11.60
	14* *	100.0	60	19.2	179.3	12.38
4 years	12	100.0	48	9.4	157.4	**12.00**
	10*	101.8	48	7.7	157.5	**12.00*****
	14* *	98.2	48	11.1	157.3	**12.00*****
3 years	12	100.0	36	4.5	140.5	12.00
	10*	103.5	36	3.7	143.2	12.70
	14* *	96.7	36	5.3	138.0	11.30

* Market rate falls to 10% pa after first year and remains there
** Market rate rises to 14% pa after first year and remains there
*** Approximate

Source: UBS (1988: 46).

What is clear from the example provided is that as long as the duration of 4.04 is made equal to the holding period of 4 years, the return of 12%pa is received regardless of the fluctuating interest rate. It is important to note that when the duration is made equal to the holding period the realised annual return remains constant because the rise (fall) in the interest rate induces a decline (rise) in the market price of the bond, while the income earned (lost) on the reinvestment of the bond rises (declines) to offset this amount. The net effect is that the realised return remains constant (UBS, 1988: 43).

The same principal can be applied to an entire portfolio by making the average duration of the portfolio equal to the investment horizon. If for example the ALCO would like an investment horizon of 3.4 years, it could add the following 10% R194 bond (see Table 4.2).

TABLE 4.2: DURATION OF AN ASSET PORTFOLIO

Principal (R)	Bond code	Coupon (%)	Yield (%)	Settlement date	Maturity date	All-in-price (R)	Duration (years)
1 000 000	R153	13.00	14.65	25-06-07	31-08-11	100.00	2.587612572
1 000 000	R157	13.50	10.56	25-06-07	15-09-16	119.55	5.266882925
1 000 000	R206	7.50	11.73	25-06-07	15-01-14	85.04	4.929549648
Average duration of existing portfolio							4.261348381
1 000 000	R194	10.00	12.00	25-06-07	28-02-09	101.87	0.658039832
Average duration of new portfolio							3.360521244

Source: adapted from UBS (1988: 47); bond information supplied by BESA (2007).

Since the investment horizon desired (3.4 years) is now approximately equal to the duration of the portfolio (3.36 years), the ALCO has effectively immunised its realised annual returns against interest rate fluctuations.

Therefore if the ALCO anticipates a rise in interest rates it can immunise itself from the adverse effects of a declining rate by shortening the portfolio by switching to bonds that have a shorter duration (or channelling more new cash) (UBS, 1987: 47).

Immunisation may be a somewhat cumbersome hedging strategy to implement because it relies on the ALCO to constantly rebalance the portfolio so that the duration of the assets constantly matches the investment time horizon, which can become laborious and expensive (Mahshid and Naji, 2003: 26).

4.2.2 Derivative instruments

4.2.2.1 Introduction

A financial derivatives transaction is defined by The Group of Thirty in Reynolds (1995: 48) as “a bilateral contract whose value derives, as the name implies, from the value of an underlying asset, reference rate or index.” The use of derivatives instruments in financial markets is considered a recent development in financial engineering and they have evolved considerably since their inception to include a broad range of underlying instruments. The use of derivative transactions has a number of uses such as speculation, investing and hedging.

Gornton and Rosen do, however, recognise that the use of derivative hedging may present instability in the financial system as, since derivative instruments are seen as opaque, it becomes difficult for stakeholders to identify the risk position of the bank, especially when the underlying assets and liabilities are densely structured. The authors continue to suggest that banks generally take the same position when active in the derivative markets, which may add to systematic risk, especially if these positions are leveraged. Buffet, in Richardson (2006: 17) comments further to describe derivative financial instruments as potentially dangerous due to borrowings, leveraged positions, inadequate margin deposits and inadequate financial accounting systems that fail to correctly capture the risk and return profile of some derivative instruments. A case in point is that of the of the British investment bank, Barings, which in February 1995 sustained losses so severe while trading derivative instruments on the Japanese equities market that it failed (Reynolds: 1995).

Nevertheless, derivative hedging remains a viable method for a financial institution to reduce its risk exposure. There are a number of derivatives that can be used to hedge against interest rate risk, including:

- securitisation
- interest rate forwards
- interest rate futures
- interest rate swaps
- interest rate options
- interest rate caps
- interest rate floors
- interest rate collars
- hybrid derivatives such as
    - options on swaps (swaptions) and
    - options on futures.

4.2.2.2 Securitisation

Securitisation is regarded as a modern addition to structural finance with the first asset backed securities being issued in the United States of America in 1970 by Ginnie Mae, followed by the United Kingdom in 1985. Securitisation was first used in South Africa in 1989 by the Allied Building Society (Barth *et al*., 2005: 19). Barth *et al* (2005: 16) recognise that "financial innovations such as securitization typically are increasing as they represent general welfare. This is because they are a further step towards more complete and perfect markets, and therefore allow firms and institutions to hedge or to protect better against future shocks".

The categorisation of securitisation as a derivative financial instrument may be regarded as a contentious issue. Faure (2006: 186) regards the product of securitisation as a derivative (i.e. the security created) "because they and their prices are derived from debt or other securities that are placed in a legal vehicle such as a company or a trust". In this thesis securitisation is regarded as a derivative instrument.

Securitisation is described by Swanepoel (2003: 1) as “a process by which illiquid assets such as cash flows and connected contract rights are pooled and repackaged into marketable instruments representing claims against the asset pool”. The illiquid assets referred to can include mortgage loans, credit card loans, car loans and business loans among many others. A bank can bundle or pool these illiquid assets together into a special purpose vehicle (SPV, e.g. a trust), divide them into standardised amounts and sell the claims of interest and principal payments as securities (Mishkin, 2004: 237; Gup and Kolari, 2005: 18).

Securitisation is recognised by Sinkey (2002: 249) as being the forerunning financial instrument in pass through finance. Banks are typically described as financial intermediaries in their role of providing indirect financing. Securitisation allows a bank to become active in pass through finance “in which a bank either (1) originates and sells the loan, or (2) originates, sells and services the loan” (Sinkey, 2002: 249) and thereby enables the bank to attract fee income and permit a large number of loan sales.

A bank can use securitisation to reduce its interest rate risk via two methods. As aforementioned, a component of interest rate risk is derived from the mismatch between assets and liabilities. Securitisation has the ability to reduce asset and liability mismatches by “eliminating funding exposure in terms of duration and pricing basis” (Lederman in Wikipedia, 2007: 1). Jones (2004: 2) states that “by moving longer duration assets off their balance sheet and securitizing them, financial institutions are able to decrease their interest rate exposure by reducing the duration gap between assets and liabilities”[6] By removing assets with greater risk sensitivity and longer durations (e.g. a thirty year mortgage bond) off the balance sheet, the bank has the ability to reduce its interest rate risk exposure.

[6] The ability to reduce interest rate risk in this manner is under the assumption that the financial institution uses the proceeds from the secured asset to purchase an asset with a shorter duration or hold it as cash on the balance sheet (Jones, 2004: 2).

Securitisation also allows for interest rate risk to be unbundled from credit risk and the originating bank. Heffernan (1996: 171) states that by unbundling the portion of interest rate risk from the original security and selling the risk to a third party or a third party that has a competitive advantage in interest rate risk management, a bank can reduce its interest rate risk exposure. In this way the bank has the ability to sell the maturity mismatch between assets and liabilities to an investor, and thereby reduce its interest rate risk.

Apart from its advantage of reducing a bank's interest rate risk exposure, other advantages of securitisation for a bank include:

- reduced funding costs: securitisation allows for a bank to benefit from better borrowing rates if the underlying collateral (for example a cash flow) is securitised. Securitisation may provide for rates that are cheaper and more flexible than commercial bank lending rates (Swanepoel, 2003: 1).
- diversification: the ability to restructure the firm's balance sheet and thereby optimise a bank's risk-return profile (Bessis, 2002: 750; Barth *et al*, 2005: 14).
- unbundling of certain risks: since the illiquid assets are placed into an SPV and thereby securitised, certain risks (i.e. credit risk, interest rate risk, prepayment risk) can be separated from the originating bank (Heffernan, 1996: 17; Bessis, 2002: 750; Barth *et al*, 2005: 28).
- fee income: this is in the form of origination fees as well as servicing fees. Fee income increases non-interest income and will therefore raise return on equity. Securitisation also allows for the present value of excess servicing to be regarded as earnings. This immediately increases bank earnings, whereas servicing on loans can only be credited over the life of the loans (Jones, 2002: 2-3).
- wider market participation: through securitisation, banks can access a wider range of investors in comparison with pure loan sales. This reduces

the concentration of investors and its exposure to any one market (Heffernan, 1996: 171; Jones, 2002: 3).

- enhanced liquidity: securitisation has the ability to transform illiquid assets into marketable securities (Heffernan, 1996: 171; Swanepoel, 2003: 1).
- regulatory capital arbitrage: banks have certain capital adequacy ratios that correspond to the weighting of a bank's credit risk position. By securitising assets and therefore reducing its credit risk position, a bank can reduce its risk-based capital (Jones, 2002: 3).

Barth *et al* (2005: 16) recognises credit scoring and credit rating as evaluation methods that can reduce information asymmetries and adverse selection and could possibly act as a substitute for bank monitoring, while Boot and Thakor (1993) in Barth *et al* (2005: 16) state that the pooling and diversification of securitised assets may also reduce asymmetric information.

There are many other advantages that aid the investor; these however will not be discussed as they do not affect the bank's interest rate risk position.

Jones (2002: 4) recognises the following five parties typically involved in pass through asset securitization:

- the loan originator: usually in the form of commercial banks and thrift institutions
- the loan purchaser: usually special purpose vehicles (SPVs) in the form of trusts
- the loan packager: usually the underwriter of the security
- the guarantor: provides financial guarantee insurance or credit enhancement, and is usually in the form government agencies, quasi-government agencies and commercial banks
- the investor: represents the purchaser of the securitised asset.

A typical example of a securitised asset is described by Bessis (2002: 745) and Jones (2002: 2-3) as a process where the originator or seller may decide to securitize a loan or a pool of loans in order to reduce credit risk and interest rate risk or fund its accounts receivables. By transferring the loans into a trust (SPV), the originator moves the loans off the balance sheet. The cash flows from the underlying assets in the SPV generate income to service the investor. The SPV may also be underwritten or guaranteed (by a packager, guarantor or arranger) which enhances the risk profile of the trust so that the SPV becomes an investment grade financial product. The SPV acts as a shield between the originator and the investor, and since the assets are now isolated from the originator, the originator is not responsible for losses incurred by the investor (i.e. credit risk reduction). The SPV can be further segmented into structured notes, where investors can choose different risk-return profiles in which to invest. Rating agencies provide a rating for each structured note and provide information to investors and thereby enhance the note's marketability. It is important to note that the servicing of the SPV attracts fee income which can be attained either by the originating bank or a servicer who is responsible for the maintenance of the SPV (Heffernan, 1996: 171). Bessis (2002: 750) does, however, recognise that there are five parameters that affect the economic validity of the securitisation process for the seller:

- the cost of originating, packaging, underwriting and servicing the SPV
- the structuring of the transaction determining the pool of assets in the SPV and the tranches of notes available, which affects the amount of capital savings and cost of funding respectively
- the risk-return profile of the underlying securities may affect marketability
- the credit risk spreads across rating classes vary since they are market driven
- savings on economic and/or regulatory capital is dependent on the effect securitisation has on the portfolio risk profile of the securitized assets and its risk contribution.

Bessis (2002: 749) defines the securitisation process as economically viable if the weighted average cost of capital of securitisation ($wacc_{sec}$), including operating costs, is below that of the weighted average cost of capital of on-balance sheet items ($wacc_{on\text{-}BS}$), while other financial variables that are affected by the securitisation process include the capital/debt structure, capital gain/loss from sale, as well as new economic capital and new income (Bessis, 2002: 749).

Securitisation is not, however, a riskless process. Some potential risks arising from securitisation include:

- moral hazard: the problem of credit worthiness free riding may occur, where banks rely on monitoring provided by other institutions rather than their own due diligence, especially the monitoring of the underlying assets in the SPV (Barth *et a*l, 2005: 16)
- adverse selection: information asymmetries exist between the buyers and sellers of securitized assets; the sellers have more information about the quality of the underlying assets that are securitised. This may provoke the underwriters to keep the higher quality assets on their portfolio while only selling the lower quality assets. Thus the market may become a market for lemons (Barth *et a*l, 2005: 16)
- inefficient liquidations: Ayotte and Gaon (2005) in Barth *et a*l (2005, 16) state that when necessary assets (e.g. fixed assets, inventories) are securitised, insolvent firms may face inefficient liquidations due to the inefficiency of replacing necessary assets.

4.2.2.3 Interest rate forwards

Faure (2006: 21) defines a forward contract as a contract "between a buyer and a seller that obliges the seller to deliver, and the buyer to accept delivery of, an agreed quantity and quality of an asset at a specified price (now) on a stipulated date in the future".

A forward interest rate contract (FIRC) is one such contract that is sold on a pre-specified date at a pre-specified rate of interest which is determined by the implied forward rate (IFR) for the duration of the contract. Due to the uncertainty of future interest rates, the purpose of FIRC is to lock in or guarantee a certain rate of interest for the period of the contract at an IFR (Faure, 2006: 20).

According to Faure (2006: 24) the FIRC in the South African financial market has the following characteristics:

- trading on exchange as well as over-the-counter (OTC)
- tlexibility with regard to delivery dates and contract size
- the transaction rests on the integrity of the two parties
- both parties are confined to the terms of the contract for the duration of the transaction
- delivery of the underlying asset takes place
- transaction costs may be high.

If, for example[7], the ALCO believes that future interest rates will decline, it could enter into a FIRC that would enable it to secure a certain rate of interest income for a specified period.

[7] Example adapted (slightly) from Faure (2006: 25 - 27).

If it is assumed that:

- the bank requires a R200 million (plus) 206-day negotiable certificate of deposit (NCD) investment (i.e. of another bank) in 100 days' time and would like to secure the rate of interest now as interest rates are expected to fall
- the current rate for a 100-day NCD is 6.5% pa
- the current market rate for a 306-day NCD is 8.5% pa,

in order for the ALCO to protect the amount of interest income earned against possible declining interest rates it can enter into a FIRC. The bank dealer could approach the other bank for a forward rate on R200 million (plus) 206-day NCD for settlement 100 days from now. In order for the dealing bank to be able to supply the forward rate contract it must calculate the IFR over the period.

The implied forward rate can be calculated as follows:

(3) IFR $= \{[1 + (ir_L \times t_L)] / [1 + (ir_S \times t_S)] - 1\} \times [365 / (t_L - t_S)]$

where

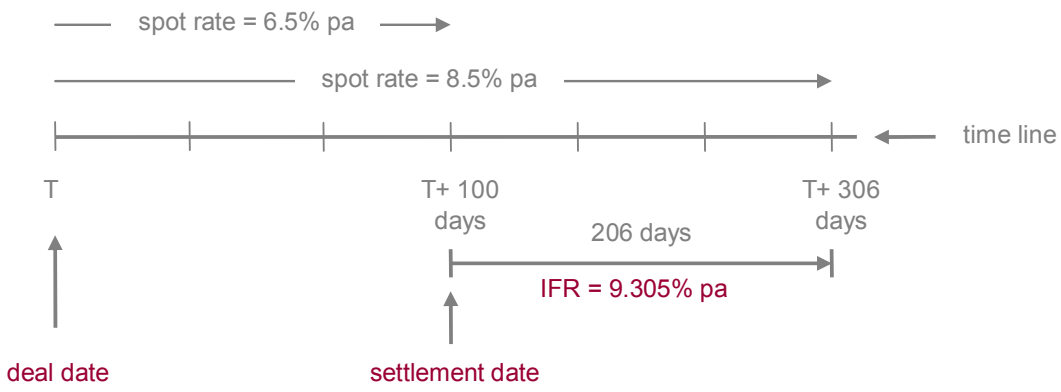
ir_L = spot interest rate for the longer period (306 days)
ir_S = spot interest rate for shorter period (100 days)
t_L = longer period, expressed in days / 365) (306 / 365)
t_S = shorter period, expressed in days / 365) (100 / 365)

therefore

(4) IFR $= \{[1 + (0.085 \times 306 / 365)] / [1 + (0.065 \times 100 / 365)] - 1\} \times 365 / 206$
(5) $= [(1.07126 / 1.017808) - 1] \times 365 / 206$
(6) $= (1.05252 - 1) \times 365 / 206$
(7) $= 0.09305$
(8) $= 9.305\%$ pa.

In order for the dealing bank to make a profit on the transaction, it will quote a rate lower than the IFR (i.e. the dealing bank could quote a rate of say 9.0%pa). If the quoted rate is found to be acceptable and is ratified by the ALCO, it will be evident that the bank has efficiently hedged its interest rate risk by locking in an amount of interest income over the required period. This example can be represented diagrammatically in Figure 4. 1.

FIGURE 4.1: EXAMPLE OF A FORWARD INTEREST RATE CONTRACT



Source: Faure (2006: 159).

4.2.2.4 Interest rate futures

The forward market is viewed as a predecessor to the futures market and was developed primarily to overcome the inadequacies of the former. Thus the forward market and futures market can be viewed as similar save for the exceptions that the futures market transactions are traded on-exchange and have standard contract sizes and quality as well as defined dates in terms of delivery (settlement) (Faure, 2006: 60).

These differentiating features between the two markets imply that the futures market is far more liquid in terms of marketability, and thus makes it more accessible for investors, speculators and hedgers (Faure, 2006: 87 - 90).

An interest rate futures contract is more formally defined by Faure (2006: 60) as "a standardised contract which obligates the buyer to accept delivery of, and the seller to deliver, a standardized quantity and quality of an asset at a specified price on a stipulated date in the future".

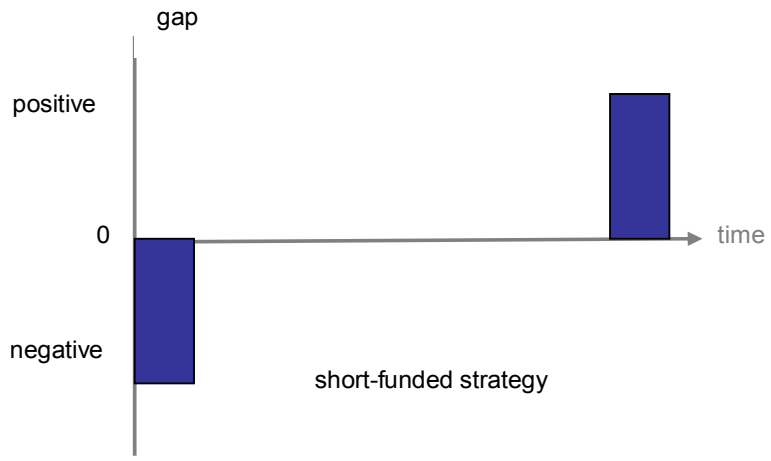
A bank has the ability to hedge interest rate risk in two ways. The first method is to enter into a futures agreement that will hedge against the gap exposure of the bank's balance sheet. The second is to enter into an interest rate futures contract whereby a rate of interest (and therefore interest income) can be locked in over the period of the contract (UBS, 1987: 65-66, and Faure, 2006: 90).

A bank can enter into a futures contract whereby the opposite value of the gap exposure can be bought or sold. If, for example[8] the bank is described as having a liability sensitive portfolio (i.e. a negative maturity gap; see Figure 4.2), it could enter into short futures position in order to hedge its interest rate risk exposure. In a rising interest rate scenario a liability sensitive bank will naturally have a declining NII position, which can be offset by the profits made on a short futures contract. Since the futures price is inversely related to the rate of interest, it becomes a viable method to hedge against changing interest rates. By selling a futures contract, the bank has effectively decreased the liability-sensitivity of the balance sheet (UBS, 1987: 65-67).

This can be represented diagrammatically in Figures 4.2 and 4.3.

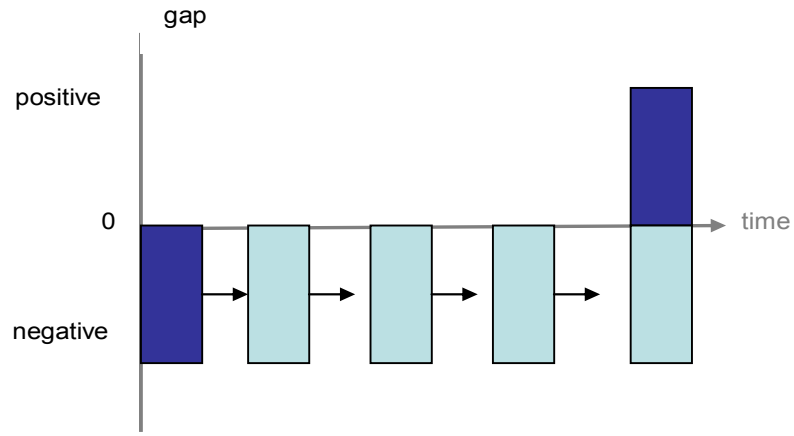
[8] Example derived from UBS (1987: 65-67).

FIGURE 4.2: LIABILITY-SENSITIVE PORTFOLIO



Source: UBS (1987: 66).

FIGURE 4.3: FINANCIAL-FUTURES HEDGING STRATEGY (LIABILITY SENSITIVE PORTFOLIO)



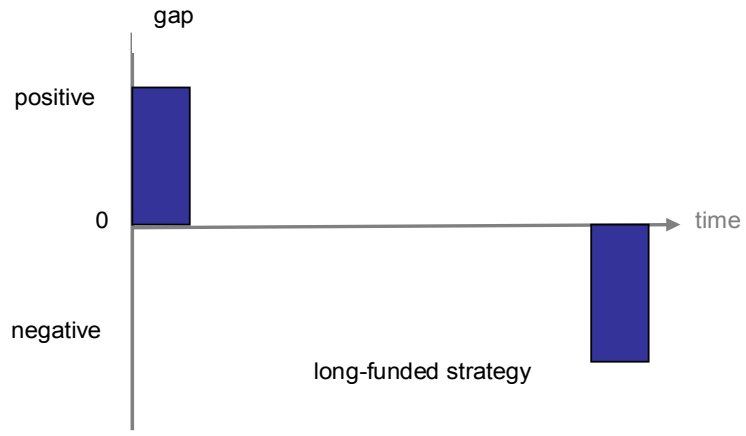
Source: UBS (1987: 66).

Conversely, if the bank is described as being asset sensitive (i.e. a positive maturity gap), it will be susceptible to interest rate risk derived from falling interest rates. The ALCO could purchase a futures contract (i.e. a long futures position) in order to reduce the asset-sensitivity of the balance sheet, as profits

on the futures contract will offset the loss on NII in a falling interest rate scenario (UBS, 1987: 65-67).

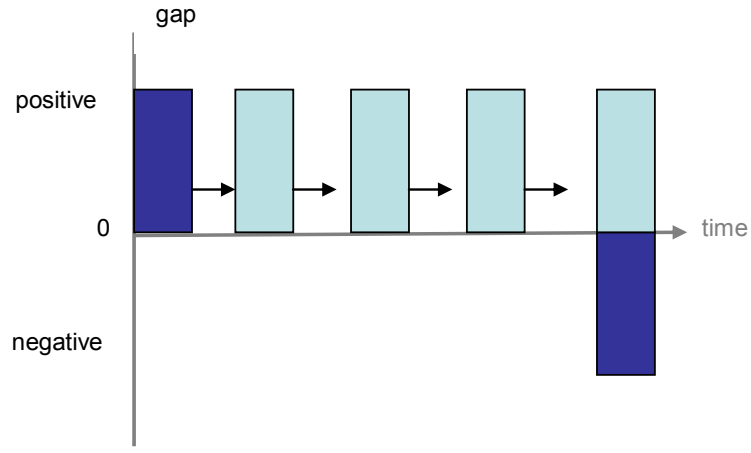
This can be represented diagrammatically in Figures 4.4 and 4.5.

FIGURE 4. 4: ASSET-SENSITIVE PORTFOLIO



Source: UBS (1987: 66).

FIGURE 4.5: FINANCIAL-FUTURES HEDGING STRATEGY (ASSET SENSITIVE PORTFOLIO)



Source: UBS (1987: 66).

4.2.2.4 Interest rate swaps

An interest rate swap (IRS) is defined by Faure (2006: 110) as "an agreement between two parties to exchange a series of fixed rate cash flows for a series of floating rate cash flows in the same currency". The interest payments and receipts are based on a notional principal amount which is typically made through a facilitator. In most cases, the facilitator is a bank that is dedicated to the swap market and takes a certain margin on the swap (Faure, 2006: 110).

Faure (2006: 111) recognises three motivations for IRS agreements:

- transforming a liability
- transforming an asset
- comparative advantage.

A swap designed to transform an asset or liability simply refers to the transformation of the interest rate receivable or payable from a floating rate to a fixed rate (or *vice versa*).

The comparative advantage swap exists due to different borrowing rates quoted to financial institutions in various markets. A financial institution has the ability to swap the interest rate payments at the rate in which it has a comparative advantage and thereby reduce its cost of funds and interest rate risk (Faure, 2006: 115).

As aforementioned, banks enter into swap agreements with other parties (presumably another bank) (via a dealer bank) who have the opposite interest rate viewpoint or a dissimilar balance sheet structure. The example[9] provided is one where two banks hedge their interest rate risk through the restructuring of their respective balance sheets via an interest rate swap.

[9] Example derived from Gup and Kolari (2005: 162 – 165).

- Bank A is described as asset sensitive, that is, the balance sheet is comprised mainly of floating rate-assets (for example long-term loans at 1% below prime) that are financed by fixed interest rate liabilities.
- Bank A expects interest rates to decline during the projected period.
- Bank B is described as liability sensitive, where its balance sheet consists primarily of fixed interest rate assets that are financed by floating interest rate liabilities.
- Bank B expects interest rates to rise during the projected period.

It will be evident that both banks face interest rate risk, yet their exposure to this risk is quite different. If interest rates fall, Bank A will have a declining NII, while Bank B will enjoy a rising NII position. Of course, if interest rates rise, the opposite will be true for both banks. In order to hedge their respective interest rate risk positions, the banks will enter into a swap agreement, whereby Bank A will swap its payments on fixed-rate liabilities in order to receive floating-rate receipts, while Bank B exchanges its payments on variable-rate liabilities in order to receive fixed-rate receipts (Gup and Kolari, 2005: 162 – 165). The details of the situation of each bank follows.

In order to transform its balance sheet and thereby hedge against its interest rate risk position, Bank A can enter into an interest rate swap with the following characteristics: Bank A will pay both a fixed-interest rate on its liabilities as well as a floating-interest rate via the swap transaction, while its receipts include both a floating-interest rate on its assets as well as a fixed-rate of interest via the swap agreement. Bank A therefore has a net position a fixed-rate earning recipient on its assets which are financed by fixed-rate payments on its liabilities via the swap (Gup and Kolari, 2005: 162 – 165).

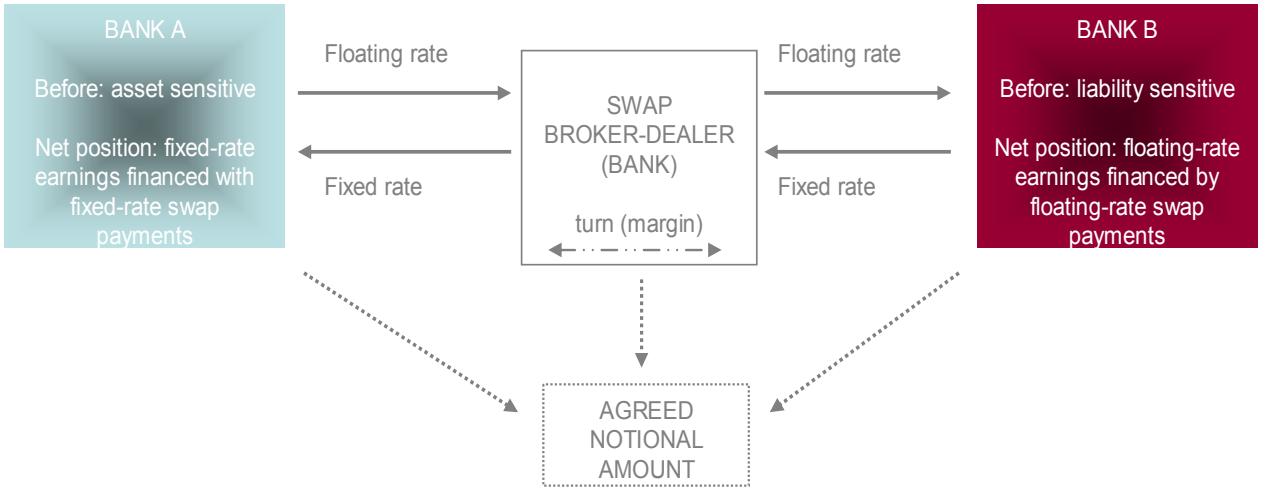
Conversely, Bank B will enter into an interest rate swap with the following characteristics: Bank B will, via the swap agreement, pay a fixed rate and receive

a fixed rate of interest. The net result will be that the fixed-rate receipts from Bank A will be used to pay the fixed-rate liabilities on Bank B's balance sheet, leaving the floating-interest rate earnings matched with floating-interest-rate payments via the swap agreement (Gup and Kolari, 2005: 162 – 165).

It will be clear that the example provided above is an illustration of an IRS that aims to transform both an asset and a liability, and in so doing alters each bank's balance sheet to better cope with their perceived interest rate environment. It must be noted that potential returns may be reduced because the financial institution acting as facilitator to the transaction will take a certain margin (turn) from the agreement as a fee (Gup and Kolari, 2005: 162 – 165; Faure, 2006: 110).

This example can be represented diagrammatically in Figure 4.6.

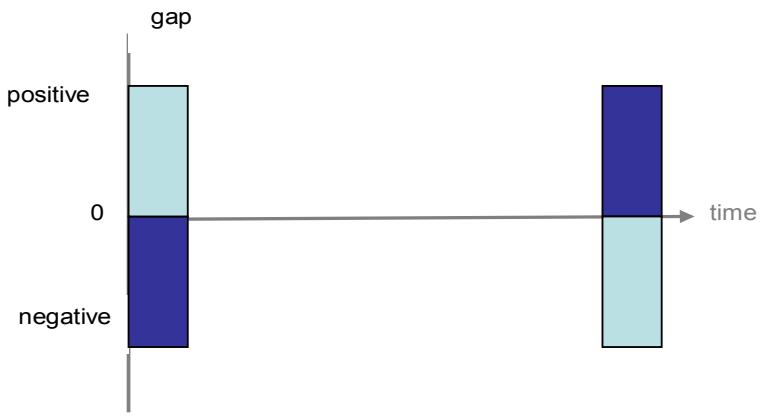
FIGURE 4.6: INTEREST RATE SWAP EXAMPLE: BALANCE SHEET TRANSFORMATION



Source: Gup and Kolari (2002: 162 – 165) and Faure (2006: 111).

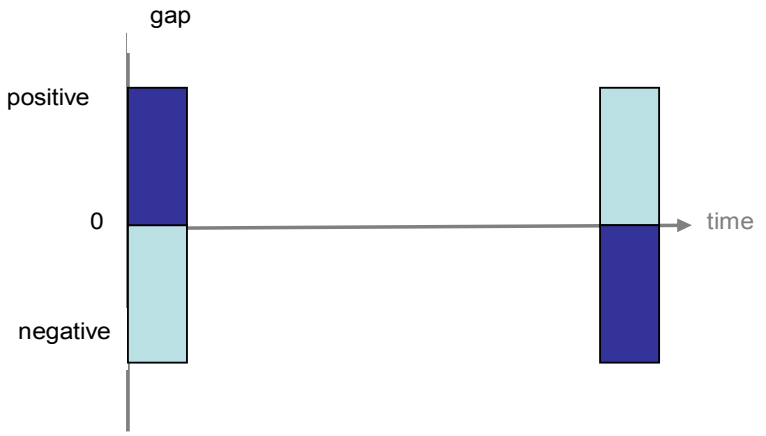
The net position after the interest rate swap for both banks' balance sheet can also be depicted in Figures 4.7 and Figure 4.8.

FIGURE 4.7: INTEREST RATE SWAP HEDGING STRATEGY (LIABILITY-SENSITIVE PORTFOLIO)



Source: UBS (1987: 62).

FIGURE 4.8: INTEREST RATE SWAP HEDGING STRATEGY (ASSET-SENSITIVE PORTFOLIO)



Source: UBS (1987: 62).

4.2.2.5 Option contracts

An options contact is defined by Poitras (2002: 7) as “an agreement between two parties in which one party, the writer, grants the other party, the purchaser, the right, but not the obligation, to either buy or sell a given security, asset, or commodity at a future date under stated conditions”

It is important to note that unlike the previously mentioned derivative contracts which oblige both parties to perform in terms of the contract, an options contract confers on the owner a right to enforce the contract. This option to enforce the contract is most often subjected to a premium to do so, which is usually an upfront payment. In this way an options contract becomes similar to that of an insurance contract where the maximum loss is that of the premium while the potential for gain is limitless (Poitras, 2002: 7; Faure, 2006: 134).

There are three types of options contract, i.e. American, European and Bermudan[10]:

- an American option bestows the right upon the purchaser to exercise the option at any time before and on the expiry date of the contract (Faure, 2006: 133)
- a European option allows for the option to be exercised only on the expiry date of the contract (Faure, 2006: 133)
- a Bermudan option allows for the option to be exercised only on prespecified dates for the duration of the contract (Faure, 2006: 133).

[10] Faure (2006: 133) regards the American option as the most commonly traded contract type, both internationally and domestically.

Options are categorised as either call or put options:

- a call option is defined by Poitras (2002: 7) as an contract that “gives the option buyer the right to purchase the underlying asset or commodity from the option seller at a given price”
- a put option is defined as an option that “gives the option buyer the right to sell the underlying asset or commodity to the option seller at a given price” Poitras (2002: 7).

These abovementioned option purchasers and sellers can be further classified as having either a long or short position in accordance to their market position:

- the long position refers to the buyer of the contract, who has purchased the option - usually at a premium – and will benefit from the option if the contract is enforced. The contract will be enforced at a strike price as long as it is beneficial to do so (Faure, 2006: 134).
- the short position refers to the seller (writer) of the contract, who has sold the option in order to receive the premium. The seller has no option to enforce the contract; rather the seller is obliged to perform, in terms of the contract, if the option is enforced by the buyer (Faure, 2006: 134).

An options contract is in the money (ITM) – if the price of the underlying asset is greater than the strike price; at the money (ATM) – if the price of the underlying asset is equal to the strike price; or out of the money (OTM) – where the price of the underlying asset is less than the strike price (Faure, 2006: 134).

The option to exercise the contract will depend on the price movement of the underlying asset. Table 4.1 provides a payoff profile, which describes the costs and benefits that accrue either to the buyer or the writer under different scenarios of price movement of the underlying instrument:

TABLE 4.3: PAYOFF PROFILES OF WRITER AND BUYER

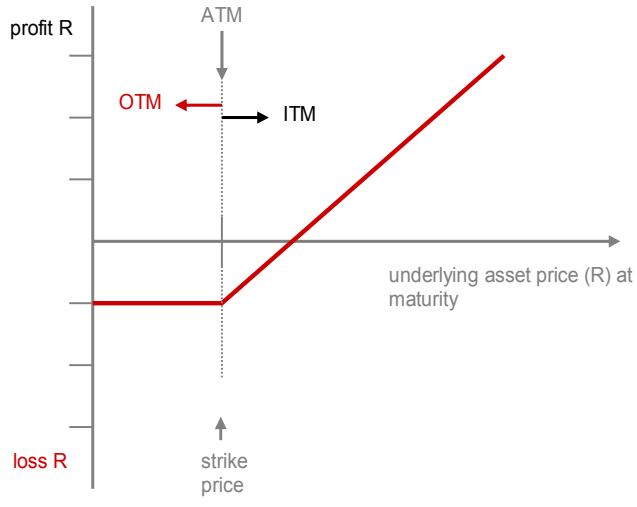
Position	Change in price of underlying asset	Profit or loss
Call option – buy (long call)	Fall Rise	Loss: premium only Profit: unlimited
Call option –sell (write) (short call)	Fall Rise	Gain: premium only Loss: unlimited
Put option – buy (long put)	Fall Rise	Profit: unlimited Loss: premium only
Put option – sell (write) (short put)	Fall Rise	Loss: unlimited* Gain: premium only

Note: these profiles only apply if strike price = price of underlying on deal day.
* = unlimited up to the point where the underlying has no value.

Source: Faure (2006: 135).

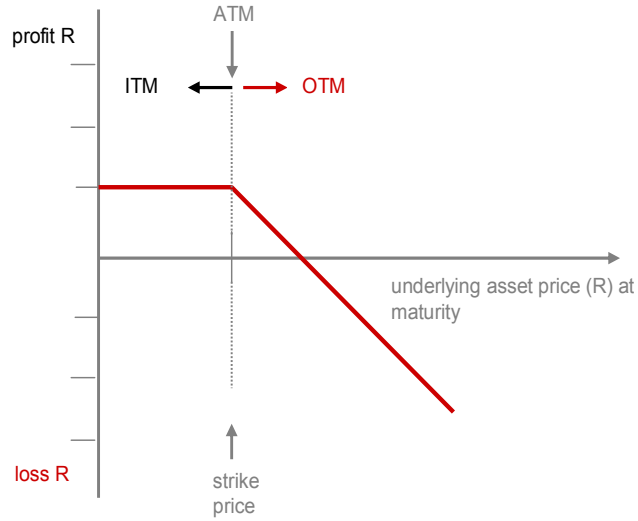
Table 4.3 can also be depicted diagrammatically in figures 4.9 to 4.12.

FIGURE 4.9: LONG CALL OPTION



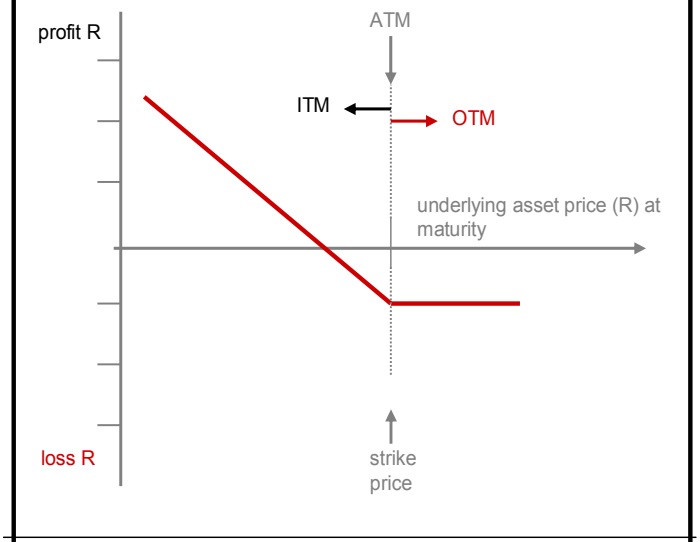
Source: Faure (2006: 136).

FIGURE 4.10: SHORT CALL OPTION



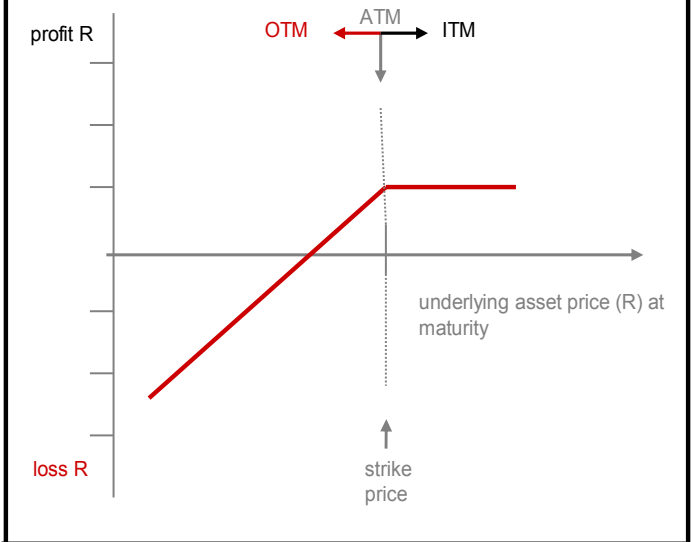
Source: Faure (2006: 137).

FIGURE 4.11: LONG PUT OPTION



Source: Faure (2006: 138).

FIGURE 4.12: SHORT PUT OPTION



Source: Faure (2006: 139).

4.2.2.6 Interest rate caps

An interest rate cap is defined by Reynolds (1995: 107-108) as an "agreement by the seller to pay the buyer the excess of the prevailing market index over a 'cap' rate based on the agreed notional principal amount". The market index rate agreed upon is usually a short term rate such as the JIBAR rate or LIBOR rate (Reynolds, 1995: 108; Faure, 2006: 159).

Caps and floors (and indeed collars) can be described as akin to options contracts as they have option-like attributes. Faure (2006: 158) goes so far as to describe caps and floors as "cap and floor options", while Bessis (2002: 184) describes caps and floors as "common interest rate options". Caps and floors do, however, have an advantage in that they are exclusively over the counter (OTC) financial instruments and are thus individually tailored (Reynolds, 1995: 106).

An example of an interest rate cap and its benefits to interest rate risk management follows[11]:

a cap makes it possible for a bank with a borrowing requirement to hedge against rising interest rates. For the price of the premium, the bank attains a ceiling interest rate (maximum) at which it can borrow, but does not forgo right to benefit from falling interest rates.

A cap would provide as a viable hedging instrument in the following instance:

- the bank needs to borrow R10 million in 6 months' time for a period of 3 months
- the bank is concerned about rising interest rates in the near future
- the present 6-month market rate (JIBAR rate) is 11.0% pa
- the bank is quoted a T6-month – T9-month (T6m-T9m or 91 days) cap by a dealing bank at 11.3% pa
- the premium payable for the cap is R12 000.

If the JIBAR rate in 6-months' time is below 11.3% pa, the bank will allow the cap to lapse (i.e. it will not exercise the cap). In this case it would be more beneficial for the bank to borrow at the reduced JIBAR rate, of say 10.2% pa, while the total cost to the bank would still include the premium paid for the cap:

(9) $$\text{Cost to bank} = (C \times ir \times t) + P$$

where

C = consideration
ir = interest rate (expressed as a unit of 1)
t = term (expressed as number of days / 365)
P = premium.

[11] Example adapted (slightly) from Faure (2006: 158-161).

therefore

(10) Cost to bank = (R10 000 000 × 0.102 × 91/365) + R12 000
(11) = R254 301.37 + R12 000
(12) = R266 301.37

and therefore the interest paid by the bank (ignoring that the premium is paid upfront) is:

(13) total interest rate paid = R266 301.37 / R10 000 000 × 365 / 91
(14) = 0.026630137 × 4.010989011
(15) = 0.106813
(16) = 10.68% pa.

If, however the JIBAR rate on settlement date does rise to say 12.3%, the cap will be enforced, and settlement amount will occur according to the following formula:

(17) SA = NA × [(rr – csr) × t]

where

SA = settlement amount
NA = amount
rr = reference rate (expressed as a unit of 1)
csr = cap strike rate (expressed as a unit of 1)
t = term (expressed as number of days / 365)

therefore

(18) SA = R10 000 000 × [(0.123 – 0.113) × 91 / 365
(19) SA = R10 000 000 × 0.010 × 0.249315068
(20) SA = R24 931.51.

The financial benefit that will accrue to the bank will be equal to the settlement amount less the premium paid for the cap:

(21) Financial benefit = SA – P
(22) = R24 931.51 – R12 000
(23) = R12 931.51.

Hence the bank will pay the market rate for its borrowing requirements, but this amount will be reduced by the amount received from the dealing bank less the premium paid.

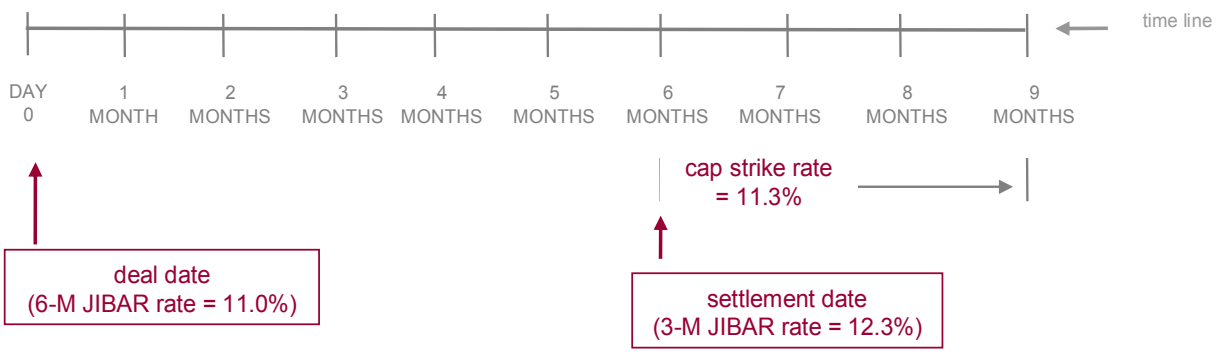
(24) Cost to the bank = (C × ir × t) – (SA – P)
(25) = (R10 000 000 × 0.123 × 91 / 365) – (R12 931.51)
(26) = R293 726.02

(27) Total interest paid = (R293 726.02 / R10 000 000 × (365/91)
(28) = 0.029372602 × 4.010989011
(29) = 0.11781
(30) = 11.78%

It is clear from the above example that if the interest rate on the settlement date is above that of the strike rate, it is possible (and beneficial) for the bank to hedge its interest rate risk exposure by enforcing the cap. In this case the bank has benefited by an amount of R12 931.51 or 0.52% below the current market lending rate.

The above mentioned example can be represented diagrammatically in Figure 4.13.

FIGURE 4.13: EXAMPLE OF T6-MONTH – T9-MONTH CAP



Source: Faure (2006: 159).

4.2.2.7 Interest rate floors

A floor can be described as the exact opposite of a cap. Reynolds (1995: 107) defines a floor as "an agreement by the floor seller to pay the buyer an excess of an agreed minimum rate". Poitras (2002: 411) elaborates on this definition to state that "the floor provider, often a borrower in the floating rate debt market, agrees to make payments to the purchaser when the reference rate falls below the stated floor".

A floor is used when the bank expects future interest rates to fall, and would like to lock in a certain return on its investments. It is perhaps best to elucidate on interest rate floors with an example[12].

[12] Example adapted (slightly) from Faure (2006: 161 - 162).

If a bank expects to receive R10 000 000 in 6 months' time but only requires these funds for payment of outstanding debt in the subsequent 3 months, (i.e. in 9 months' time) it can enter into an interest rate floor contract to protect against falling rates.

If it is assumed that:

- the bank needs to invest R10 million in 6 months' time for a period of 3 months
- the bank is concerned about falling interest rates in the near future
- the present 6-month market rate (JIBAR rate) is 11.0% pa
- the bank is quoted a T6-month – T9-month (T6m-T9m or 91 days) floor by a dealing bank at 10.6% pa
- the premium payable for the floor is R 12 000,

then if the JIBAR rate in 6-months' time is above 10.6% pa, the bank will allow the floor to lapse (i.e. it will not exercise the floor). In this case, it would be more beneficial for the bank to invest at the higher JIBAR rate of say 12% pa, while the total cost to the bank would still include the premium paid for the floor.

If, however, in 6 months' time (on the settlement date), the bank is correct about its views on future interest rates and the 3-month JIBAR rate declines to 9.6%pa, the bank will enforce the floor, and the dealing bank will pay the following amount:

(31) SA = NA × [(fsr[13] – rr) × t]

(32) = R10 000 000 × [(0.106 – 0.096) × 91 / 365]

(33) = R10 000 000 × (0.010 × 0.249315068)

(34) = R10 000 000 × 0.00249315

(35) = R24 931.51.

[13] fsr = floor strike rate.

The financial benefit to the bank is:

(36) financial benefit = SA – P
(37) = R24 931.51 – R12 000
(38) = R12 931.51

By enforcing the floor, the company has increased its income due to the settlement received from the dealing bank less the premium paid. Thus the total earnings on the R10 000 000 investment is calculated as

(39) earnings on investment = (C × ir × t) + (SA – P)
(40) = [R10 000 000 × (0.096 × 91 / 365)] + R12 931.51
(41) = (R10 000 000 × 0.023934246) + R12 931.51
(42) = R239 342.47 + R12 931.51
(43) = R252 273.98.

Thus the total interest earned on the investment is[14]:

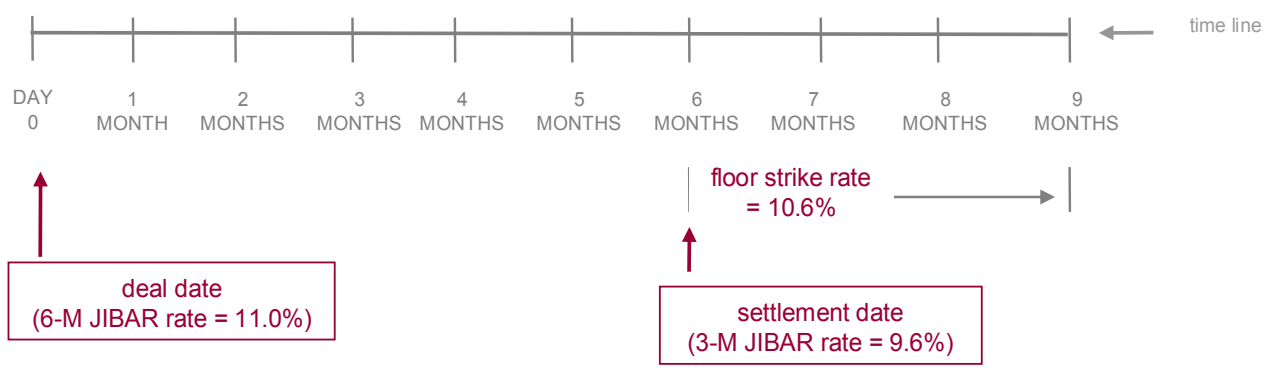
(44) total interest earned = (Earnings on investment / C) × (365 / 91)
(45) = R252 273.98 / R10 000 000) × 4.010989011
(46) = 0.025227398 × 4.010989011
(47) = 0.10118
(48) =10.12%

It is clear from the above example that if the interest rate on the settlement date is below that of the floor strike rate, it is possible (and beneficial) for the bank to hedge its interest rate risk exposure by enforcing the floor. In this case the bank has benefited by an amount of R12 931.51 or 0.52% above the current market investment rate.

[14] Ignoring the fact that the premium is paid upfront

The abovementioned example can be represented diagrammatically if Figure 4.14.

FIGURE 4.14: EXAMPLE OF T6-MONTH – T9-MONTH FLOOR



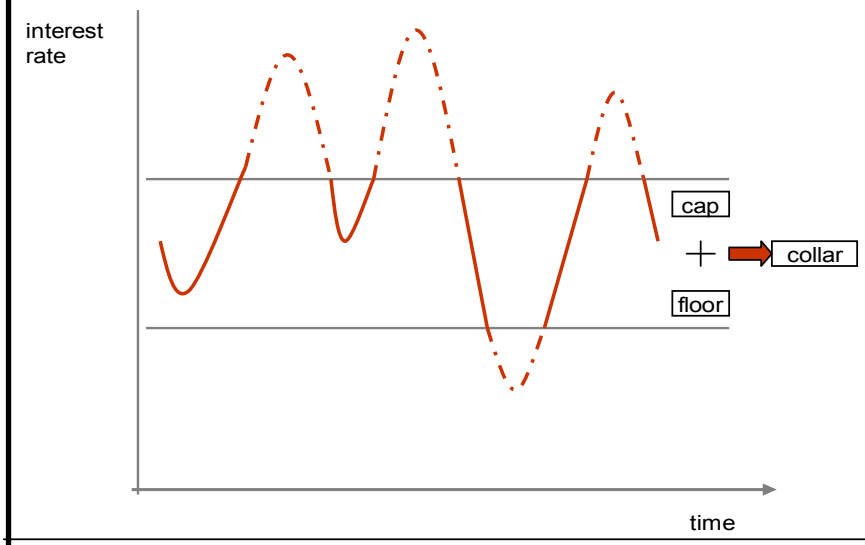
Source: Faure (2006: 161).

4.2.2.8 Interest rate collars

An interest rate collar is the combination of both a cap contract and a floor contract (Faure, 2006: 158). Bessis (2002: 184) recognises that purchase/sale of a cap or floor can become expensive due to the premium paid and the movement of market rates on the settlement date. In order to reduce the cost of using these option based hedging instruments, it is possible to purchase/sell a cap and a floor simultaneously (Bessis, 2002: 184).

Figure 4.15 gives a diagrammatic representation of a collar:

FIGURE 4.15: CAP, FLOOR AND COLLAR



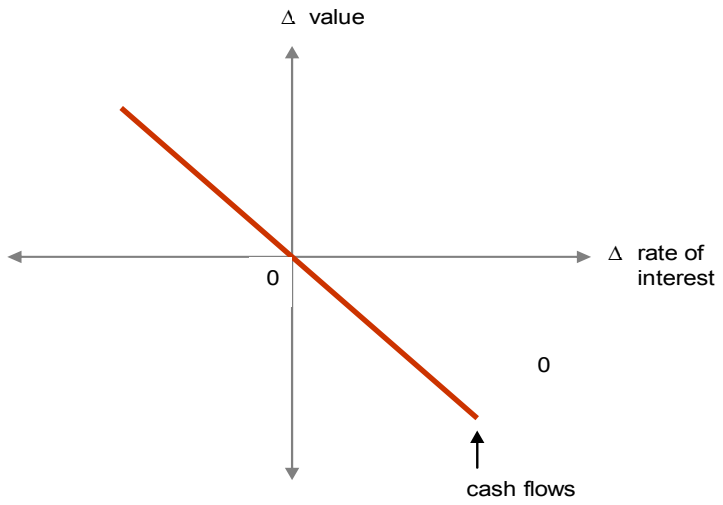
Source: Bessis (2002: 185).

The best way in which to describe the benefits of hedging interest rate risk through the use of a collar is with an example. The following provide examples of both a liability sensitive bank and an asset sensitive bank[15]:

As aforementioned, a liability sensitive bank's balance sheet is defined as one whose liabilities reprice before assets. This type of maturity structure will induce a prosperous NII position during falling interest rates and a reduced NII position during rising rates. Figure 4.16 represents the negatively sloped profit profile of a liability sensitive bank, where a negative relationship exists between the bank's value (through its received cash flows: i.e. NII) and the market rate of interest (Sinkey, 2002: 247).

[15] Example adapted (slightly) from Sinkey (2002: 246 - 247).

FIGURE 4.16: PROFIT PROFILE OF A LIABILITY SENSITIVE BANK



Source: Sinkey (2002: 247).

The bank can reduce its interest rate risk position through the purchase of a collar. In this case the liability sensitive bank should – simultaneously - purchase an interest rate cap and sell an interest rate floor.

The collar provides a minimum and a maximum for the bank's value. There are three interest rate scenarios that affect the value of the bank:

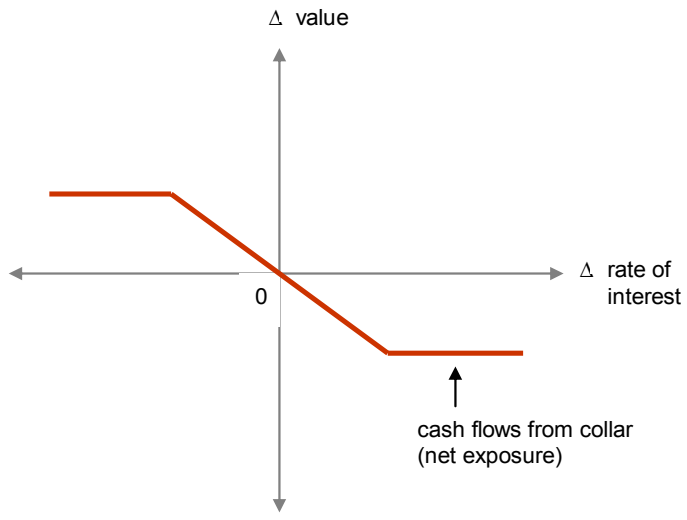
- if interest rates rise beyond the cap strike rate the bank will enforce the cap option and reduce its interest rate exposure by the amount of interest payments from the cap writer. The sale of the floor will also attract income (in the form of a premium) that will offset the premium paid for the cap (Sinkey, 2002: 247)
- if interest rates fall, the sale of the floor may be a more contentious issue. By selling the floor contract, the bank will limit its upper value. It will do this only if it perceives that there is a probability of only a slight decrease in interest rates. If interest rates do fall only slightly (i.e. rates fall to a level

above the floor strike rate) and the floor is not enforced by the buyer, the bank will have earned income via the sale of the floor (i.e. the premium) that will offset the premium paid for the cap. Thus the net gain or loss in this scenario will depend on the amount by which the premium received on the floor offsets the premium paid on the cap (Sinkey, 2002: 247)

- if interest rates do fall considerably, (i.e. below the floor strike rate) the bank will be enforced to make interest payments to the purchaser of the floor. The net gain or loss in this scenario will depend on two variables: i) the amount by which the premium received offsets the premium paid, and ii) the interest payments made to the purchaser of the floor (Sinkey, 2002: 247).

Figure 4.17 illustrates the cash flows associated for a liability sensitive bank with an interest rate collar. An important economic effect is the reduced variability of the bank's value due to the hedge provided by the collar:

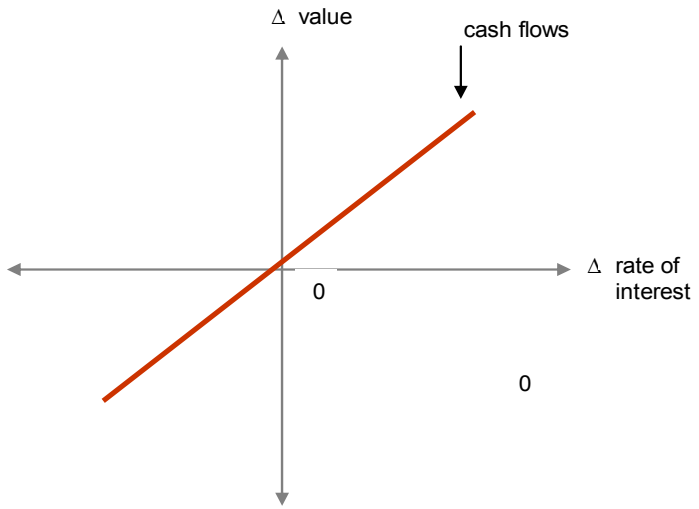
FIGURE 4.17: PROFIT PROFILE OF A LIABILITY SENSITIVE BANK WITH AN INTEREST RATE COLLAR



Source: Sinkey (2002: 247).

Alternatively, if the bank concerned is described as asset sensitive, where its assets reprice before liabilities, the bank will have the opposite payoff profile compared to the previously discussed example. In this case the bank will have a prosperous NII position during rising rates and a reduced NII position during falling rates. Figure 4.18 represents the positively sloped profit profile of an asset sensitive bank, where the bank's value increases as interest rates rise.

FIGURE 4.18: PROFIT PROFILE OF AN ASSET SENSITIVE BANK



Source: Sinkey (2002: 248).

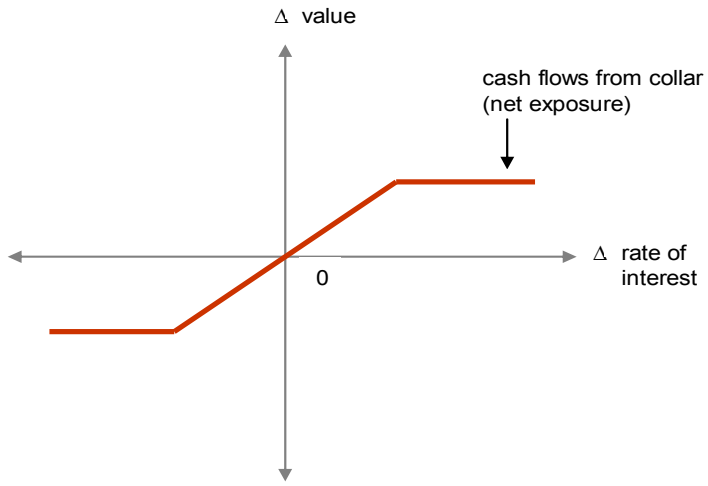
The bank can reduce its interest rate risk position through the use of a collar. In this case the asset sensitive bank should – simultaneously – sell an interest rate cap and purchase an interest rate floor.

The collar once again provides a minimum and a maximum for the bank's value. There are three interest rate scenarios that affect the value of the bank:

- if interest rates fall below the floor strike rate, the bank will enforce the floor option and reduce its interest rate exposure by the amount of interest payments from the floor writer. The sale of the cap will also attract income (in the form of a premium) that will offset the premium paid for the floor. (Sinkey, 2002: 248)
- by selling the floor contract, the bank will limit its upper value. It will do this only if it perceives that there is a probability of only a slight increase in interest rates. If interest rates do rise slightly (i.e. rates rise to a level below the cap strike rate), and the cap is not enforced by the buyer, the bank will have earned income via the sale of the cap (i.e. the premium) that will offset the premium paid for the floor. Thus the net gain or loss in this scenario will depend on the amount by which the premium received on the cap offsets the premium paid on the floor (Sinkey, 2002: 248)
- if interest rates do rise considerably, (i.e. above the cap strike rate) the cap will be enforced by the buyer and the bank will be required to compensate interest payments The net gain or loss in this scenario will depend on two variables: i) the amount by which the premium received offsets the premium paid, and ii) the interest payments made to the purchaser of the cap (Sinkey, 2002: 248).

The collar provides an interest rate hedge which reduces variability of the bank's value. Figure 4.19 illustrates the cash flows associated for an asset sensitive bank with an interest rate collar:

FIGURE 4.19: PROFIT PROFILE OF AN ASSET SENSITIVE BANK WITH AN INTEREST RATE COLLAR



Source: Sinkey (2002: 248).

4.2.2.9 Hybrid derivatives

4.2.2.9.1 Introduction

Hybrid derivatives are so named as they can be described as derivatives on existing derivative contracts. The use of hybrid derivatives is advocated by Heffernan (1996: 179) as a method that enhances the efficiency of a bank's risk management because it unbundles certain risks from financial instruments and makes them more transparent. This unbundling of risk allows for the bank to engage in activities such as hedging, speculation and proprietary trading while the servicing of some hybrid derivative contracts may render fee based service income (Heffernan, 1996: 179).

The hybrid derivatives discussed in this thesis are:

- options on swaps (swaptions), and
- options on futures.

4.2.2.9.2 Options on swaps (swaptions)

A swaption can be described as a recent addition to financial engineering which allows for an option on a swap transaction. This type of contract affords "the buyer the right, but not the obligation, to enter into a specific swap contract on a future date" (Sinkey, 2002: 249). Faure (2006: 155) recognises that options are only found on interest rate swap agreements, and defines a call swaption contract as one that "imparts the right to the holder to receive the fixed rate in exchange for the floating rate, while in put swaptions, the holder has the right to pay fixed and receive floating" (Faure, 2006: 155). The option to enforce the swap agreement is, of course, subject to a fee (i.e. the premium).

If for example, the following is assumed:

- the bank requires a five-year floating rate in 6 months' time
- the rate payable on the five-year loan is referenced to the 3-month JIBAR rate
- the bank believes interest rates are about to rise, and would thus like to lock in future rates now (i.e. convert the floating rate loan into a fixed rate loan) (Faure, 2006: 155)

then in order to reduce its interest rate exposure, the bank has the ability to buy a put swaption from a dealing bank. If it is assumed that the dealing bank quotes a swap rate of 12% pa payable every three months for the duration of the five-year loan, the bank will have the following options available to it:

- the bank will allow the contract to lapse (i.e. not enforce the option to enter into the swap agreement) if in 6 months' time; the fixed rate on a normal five-year swap is lower than 12% pa. In this case the bank will enter into a normal swap agreement at the lower quoted rate (Faure, 2006: 155)
- the bank will enforce the swaption agreement if the fixed rate on a normal swap agreement is greater than 12% pa. It is clear that if the swaption is enforced, the bank is guaranteed that the rate payable on the future transaction will not exceed the agreed fixed rate quoted by the dealing bank (Faure, 2006: 155).

Insofar as the interest rate risk position is concerned, the bank has attained a ceiling for its interest payments via the swap, while still retaining the option to benefit from falling rates (Faure, 2006: 155).

4.2.2.9.3 Options on futures

According to Sinkey (2002: 248 – 249) if the bank purchases "call options on an interest rate contract, it will have the right (but not the obligation) to purchase the designated contract at the exercise price (i.e. acquire a long position) at any time during the exercise period. The seller (writer) of the call receives the call premium and must deliver the designated futures contract if the option is exercised". The writer of the option must deliver a long position in the underlying futures contract as well as "an amount that is equal to the difference between the last MTM[16] futures price and the exercise price (futures price – exercise price)" (Faure, 2006: 149).

Conversely, if the bank decides to purchase a put option on an interest rate futures contract, "it will retain the right (but no the obligation) to sell the contract to the dealing bank at the exercise price (i.e. to acquire a 'short position'), at a time, for the duration of the exercise period" (Sinkey, 2002: 249). In this case "the

[16] Marked to market

writer is obliged to receive a short position in the underlying futures contract as well as an amount that is equal to the difference between the last MTM futures price (exercise price – futures price)" (Faure, 2006: 149).

Faure (2006: 150) recognises the following options available on interest rate futures in South Africa:

- R153 long bond (13%pa 2010)
- R157 long bond (13.5%pa 2015)
- R186 long bond (10.5%pa 2026)
- R194 long bond (10.0%pa 2008)
- R201 long bond (8.75%pa 2014)
- j-FRAs
- j-Notes (futures on notional swaps) (Faure, 2006: 150).

If for example a bank is described as being asset sensitive (that is, the bank's rate sensitive assets reprice faster than its rate sensitive liabilities and would thus have a positive maturity gap) and is concerned about falling interest rates, it could enter into an option on a futures contract in order to hedge its interest rate risk exposure. The bank could buy a call option on a R153 futures contract. If interest rates do fall, the call option would be enforced by the holder as benefits will occur to the difference between the futures price and the exercise price. Of course, if rates rise the option will not be exercised (Gup and Kolari, 2005: 160; Faure, 2006: 149).

Alternatively, a bank that is described as liability sensitive could purchase a put option in order to hedge itself from the interest rate risk attributed to rising rates. The bank could buy a put option on a R153 futures contract. If rates rise, the option will be exercised, as profits will be equal to the difference between the exercise price and the futures price. If rates fall the option will not be exercised (Gup and Kolari, 2005: 160; Faure, 2006: 149).

4.2.3 Retaining the *status quo*

Mahshid and Naji (2003: 34) recognise that in certain circumstances the ALCO may decide that hedging the firm against interest rate risk may induce other risks or become too expensive, or be content to let the risk fluctuate over the business cycle. In this case the bank may decide to retain the business operations with an un-hedged interest rate risk position.

4.3 CONCLUSION

As seen, hedging against interest rate risk can become a somewhat enigmatic task due to the wide variety of complex financial instruments that assist in managing / alleviating risk. This chapter has identified a number of financial instruments that can be used to hedge against interest rate risk: the uses of some of these instruments are regarded as on-balance sheet techniques, while others consist of derivative instruments and off-balance sheet instruments. The use of any particular instrument will depend upon the interest rate hedging strategy of the ALCO as well as the potential benefits of the instrument selected.

Chapter five introduces a number of interest rate risk measurement models that aim to gauge a bank's risk exposure. Risk measurement forms part of the ALCO function and is necessary in order to correctly hedge a bank's risk position.

CHAPTER FIVE

INTEREST RATE RISK MEASUREMENT

5.1 INTRODUCTION

As noted in the previous chapter, interest rate risk measurement forms an integral part of the ALCO functionality. In order to correctly manage its interest rate risk position, a bank must ensure that it has the ability to appropriately capture its interest rate risk exposure. This chapter aims to describe a number of interest rate risk measurement models as well as provide examples of how some of these methods are used.

5.2 INTEREST RATE RISK MEASUREMENT MODELS

5.2.1 Introduction

A number of authors such as the UBS (1989: 42), Heffernan (1996: 181-192), Bessis (2002: 166), Sinkey (2002: 219-233) and Gup and Kolari (2005: 117-139) recognise several models for measuring the interest rate risk sensitivity of a bank. The models that will be discussed in this thesis include[17]:

- maturity structure analysis
- balance sheet projection
- gap analysis
- net interest income projection
- risk-return exposure

[17] The selection of models is by no means complete, but is rather based on the capacity of the bank with regard to the empirical analysis. The capacity in this regard refers to the bank's size, information technology capacity and market participation. A discussion of the Bank and its specific circumstance will follow this chapter

- duration gap analysis
- ratio analysis

5.2.2 Maturity structure analysis

As aforementioned by Faure (2002: 134), a portion of interest rate risk is derived from the mismatch in a bank's term to maturity of assets and liabilities. Maturity structure analysis provides an insight into the interest rate sensitivity of a bank by assessing the variable-rate and fixed-rate items on the bank's balance sheet with regard to their term to maturity (UBS, 1987: 42).

The assets and liabilities in a maturity analysis are assembled into three distinct groups:

- variable-rate items (items that have an immediate repricing frequency)
- fixed-rate items (items that can only be repriced on maturity)
- non-rate items (items that neither receive nor pay interest i.e. current account and equity) (UBS, 1987: 42-43).

Maturity structure analysis serves its purpose in a bank's interest rate risk sensitivity analysis by assessing the bank's variable-rate and fixed-rate exposure with regard to each balance sheet item's maturity and can be described as a precursor to balance sheet projection and gap analysis; discussed later (UBS, 1987: 42).

An example of a total maturity ladder for a fictional bank for October 2007 is presented in Table 5.1.

TABLE 5.1: MATURITY ANALYSIS (OCTOBER 2007)								
	< 1 month (R)	< 2 month (R)	< 3 month (R)	< 4 – 6 month (R)	< 7 - 9 month (R)	< 10 - 12 month (R)	12 + month (R)	Total (R)
Variable rate assets	15 073 780	-	-	-	-	-	-	15 073 780
Variable rate liabilities	14 050 000	3 000 000	-	-	-	-	-	17 050 000
Difference	1 023780	- 3 000 000	-	-	-	-	-	- 1 976 220
Fixed rate assets	9 675 000	3 150 000	2 390 000	10 235 000	500 000	250 000	16 075 000	42 275 000
Fixed-rate liabilities	6 687 500	3 000 000	1 500 000	10 812 500	-	5 000 000	-	27 000 000
Difference	2 987 500	150 000	890 000	- 577 500	500 000	- 475 000	16 075 000	13 298 780
Non-rate assets	-	-	-	-	-	-	1 381 250	1 381 250
Non-rate liabilities	-	-	-	-	-	-	14 680 027	14 680 027
Difference	-	-	-	-	-	-	-	- 13 298 777
Source: adapted from UBS (1987: 46-47).								

This maturity structure analysis represents the maturing balances of the bank's variable-rate items, fixed-rate items and non-rate items in a monthly maturity basket. The range of maturity periods extends from short-dated maturities of one month to longer dated items of over one year maturities[18] (UBS, 1987: 42-48).

In order to correctly represent the maturity structure of the bank's assets and liabilities, UBS (1987: 44 - 48) emphasises that the bank must incorporate the use of a runoff schedule[19], which represents the bank's actual maturing balances

[18] It must be noted that the maturity analysis incorporates a projection of new bank business and rollovers (UBS, 1987: 42-48)

[19] A runoff schedule represents an aggregation of the bank's maturing balances. The aggregation of this type of data may require complex mathematical techniques while implementation may be prone to be problematic in practice (UBS, 1987: 42).

as well as the use of a dynamic averaging technique[20]. The dynamic averaging technique derives its importance from the risk structure implied in standard reporting techniques that use a pre-specified date on which to determine the maturity structure. By using a pre-specified date the bank may be susceptible to an increased/decreased rate of risk due to large balances maturing after the specified date of reporting. The dynamic averaging technique alleviates this static maturity reporting by averaging the balances at the first of each month for two successive periods (UBS, 1987: 44 - 48).

5.2.3 Balance sheet projection

The abovementioned maturity structure analysis can be defined as a forward looking interest rate risk measurement tool. Balance sheet projection is a process whereby these maturity ladders can be used to project monthly balance sheets for the prevailing time period. Balance sheet projection makes it possible for the bank to forecast a number of variables for a specified time period (UBS, 1987: 48).

5.2.4 Gap exposure analysis

Heffernan (1996: 189) and Gup and Kolari (2005: 121) describe gap analysis[21] as the easiest and most commonly used interest rate risk measurement tool. Gap analysis is defined by Gup and Kolari (2005: 121) as an approach where "all assets and liabilities are classified into groups – interest-rate sensitive or non-interest-rate sensitive – according to whether their interest return (in the case of assets) or interest cost (in the case of liabilities) varies with the general level of interest rates". The rate sensitive assets (RSAs) and rate sensitive liabilities

[20] The runoff schedule may alter over time as maturing balances may be reinvested at different maturities and at different interest rates (the rollover activity of the bank) and the bank may attract new business over the period. If any of these disturbances occur, both the runoff schedule and the dynamic averaging monthly balances must be recalculated in order to correctly capture the maturity structure of the bank's balance sheet (UBS, 1988: 48).

[21] Also referred to as the 'dollar gap' or the 'funding gap' (Gup and Kolari, 2005: 121).

(RSLs) described above are those that reprice within a defined time period (e.g. 0-30 days, 31-60 days, 61-90 days, etc)[22] and exist for short-term as well as long-term assets and liabilities. Gap analysis represents the imbalance – in rand terms – between the RSAs and RSLs, and in this way focuses on net interest income and the bank's interest rate sensitivity (UBS, 1987: 48).

UBS (1987: 48) defines a positive gap as an imbalance that indicates that a larger amount of assets are maturing and/or being repriced than liabilities, and a negative gap as the converse, where a larger amount of liabilities are maturing and/or being repriced than assets.

Sinkey (2002: 227) and Gup and Kolari (2005: 122-123) describe the gap as well as its relationship with NII algebraically as:

(49) $$\text{Gap (\$)} = \text{RSA (\$)} - \text{RSL (\$)}$$

(50) $$\Delta NII = \Delta r\,(\text{Gap}) = \Delta r\,(\text{RSA} - \text{RSL})$$

where

Gap ($)	= maturity gap (dollar gap or funding gap)
RSA ($)	= rate sensitive assets
RSL ($)	= rate sensitive liabilities
ΔNII	= expected change in net interest income
Δr	= expected change in interest rate

Gup and Kolari (2005: 122 -123) recognise that in order to correctly benchmark the interest rate sensitivity of one institution to another, one should incorporate the use of ratio analysis such as the relative gap ratio and the interest-sensitivity ratio, expressed algebraically below:

[22] The defined time period selected (hereafter referred to as a 'maturity bucket') is crucial to the analysis because the repricing frequency of different assets and liabilities vary, and will thus affect the maturity bucket structure (Gup and Kolari, 2005: 121).

(51) Relative gap ratio = $Gap / Total assets

(52) Interest-sensitivity ratio = $RSA / $RSL

The relative gap ratio expresses the dollar amount of the gap as a percentage of total assets, which allows for a common size benchmarking between institutions that are of a different size. The interest sensitivity ratio expresses the dollar amount of RSAs as a fraction of the dollar amount of RSLs. Institutions with an amount greater than one are said to be asset sensitive, while those that are liability sensitive will have a value less than one (Gup and Kolari, 2005: 122 - 123).

An example[23] may aid the discussion: If it assumed that a bank has RSAs to the value of R125 million and RSAs to the value of R77 million, following the equation set above, it will be clear that the bank has the following maturity gap:

(53) Gap (R) = R125 Million – R77 Million

(54) Gap (R) = R48 Million

If it is further assumed that the rate of interest rises from 10% to 13%, the bank's NII would rise by the following amount:

(55) ΔNII = Δr (Gap)

(56) ΔNII = 0.03 (R48 Million)

(57) ΔNII = R1 440 000

Of course, if the bank had a negative maturity gap or interest rates declined, the bank would have a lower amount of NII. The effect of a changing interest rate on NII for banks with various maturity gaps is summarized in Table 5.2:

[23] Example adapted (slightly) from Gup and Kolari (2005: 123).

TABLE 5.2: ALTERNATIVE MATURITY GAPS, INTEREST RATE CHANGES AND NET INTEREST RATE INCOME			
Gap	Gap structure	Change in interest rate	Change in net interest income
Positive	RSA > RSL	Increase	Increase
Positive	RSA > RSL	Decrease	Decrease
Negative	RSA < RSL	Increase	Decrease
Negative	RSA < RSL	Decrease	Increase
Zero	RSA = RSL	Increase	No change
Zero	RSA = RSL	Decrease	No change
Source: Gup and Kolari (2005: 124).			

If it is assumed that the bank has total assets amounting to R 300 million, it will be evident that the bank has the following relative gap ratio and interest-sensitivity ratio:

(58) Relative gap ratio = R48 million / R300 million
= 0.160

(59) Interest-sensitivity ratio = R125 million / R 77 million
= 1.623

A distinction must be made between the incremental[24] gap and the cumulative gap: Gup and Kolari (2005: 124) describe the incremental gap as "the difference between rate-sensitive assets and rate-sensitive liabilities over increments of the

[24] Also referred to as the 'marginal gap' by Bessis (2002: 170)

planning horizon", while the cumulative gap measures the same difference between rate-sensitive assets and rate-sensitive assets over a longer time horizon. The distinction between the incremental gap and the cumulative gap is illustrated in Table 5.3.

TABLE 5.3: INCREMENTAL AND CUMULATIVE GAPS (RAND MILLIONS)

Days	Assets maturing or repriced within	Liabilities maturing or repriced within	Incremental gap	Cumulative gap
0 – 30	5000	3000	2000	2000
31 – 90	2500	2000	500	2500
91 – 180	0	2000	-2000	500
181 – 365	0	500	-500	0
	7500	7500		

Source: Gup and Kolari (2005: 124).

The UBS (1987: 49) states that "the size and timing of interest-sensitive gaps are crucial in the analysis of interest rate risk exposure". For example, the bank in Table 5.3 is vulnerable to interest rate risk during a falling interest rate scenario. If interest rates fall, the positive cumulative call to 3-month gap for the one year period will mean that a greater amount of assets than liabilities will be repriced at lower rates, resulting in lower NII amounts. If, however, interest rates rise, the opposite will be true (UBS, 1987: 50).

5.2.5 Net interest income projection

A NII projection allows the ALCO to view the future cash flows derived from interest earning assets and interest payable liabilities of the bank's balance sheet. It must be noted, however, that in order to correctly account for variable-rate items, bank rollovers and new business, the bank must first complete an interest rate projection or forecast (UBS, 1987:55).

An interest rate forecast represents the bank's view of the course of various interest rates that affect its NII position. The interest rate forecast is defined by the UBS (1987:55) as "a combination of market determined rates (e.g. money market rates) and interest rates determined by the bank itself (e.g. its retail deposit rates)". Since the interest rate forecast is constructed from both market-driven prices as well as the bank's internal interest rate quotes, the UBS (1987: 55) recognises that the interest rate forecast should be consistent with both the bank's broad economic forecast as well as the bank's internal pricing policy.

The amount of NII represents the difference between interest income and interest expenditure where interest amounts are attributed from three sources: (i) the runoff of the existing book, (ii) rollovers (iii) and expected new business. The UBS (1987: 55) identifies three sources of variables that have the potential to alter the amount of projected NII: "(i) market interest rates (i.e. the rate effect on net interest income), (ii) asset and liability growth (i.e. the volume effect) and (iii) maturity and repricing characteristics of new and non-maturity accounts (i.e. the mix effect)".

5.2.6 Risk-return analysis

Risk–return analysis[25] can be described as an interest rate risk simulation method and is defined by the UBS (1987: 56) as a process that is "based on simulation exercises introducing different gap exposures into different interest rate scenarios to establish their impact on the bank's net interest income".

[25] Also referred to as 'interest rate sensitivity analysis' by the UBS (1987: 55).

Risk–return analysis is best described with an example[26]:

If for example it is assumed that a bank produces three sets of interest rate forecast represented by the most likely interest rate scenario (i.e. the 'base case' forecast) and the two most realistically extreme interest rate scenarios (i.e. the 'high rate' and the 'low rate' forecasts) which correspond to a certain NII position for the bank (UBS, 1987: 55 - 59), the bank then has the option of incorporating alternate balance sheet structures (i.e. 'short funded', 'long funded' and 'current funded' book) which will alter the cumulative call to 3-month gap. Combining these new gap exposures with the alternate interest rate scenarios will yield the maximum and minimum return as well as the risk and return premium for each scenario (UBS, 1987: 55 - 59).

This type of analysis can also yield a 'zone of indifference' where the structure of the balance sheet can immunise the bank's NII against changes in the interest rate. In this case the zone of indifference corresponds with a negative call to 3 – month gap of R900 000. The above-mentioned example is represented in tabular from in Table 5.4, as well as in a graphical format in Figure 5.1 (UBS, 1987: 55 - 59).

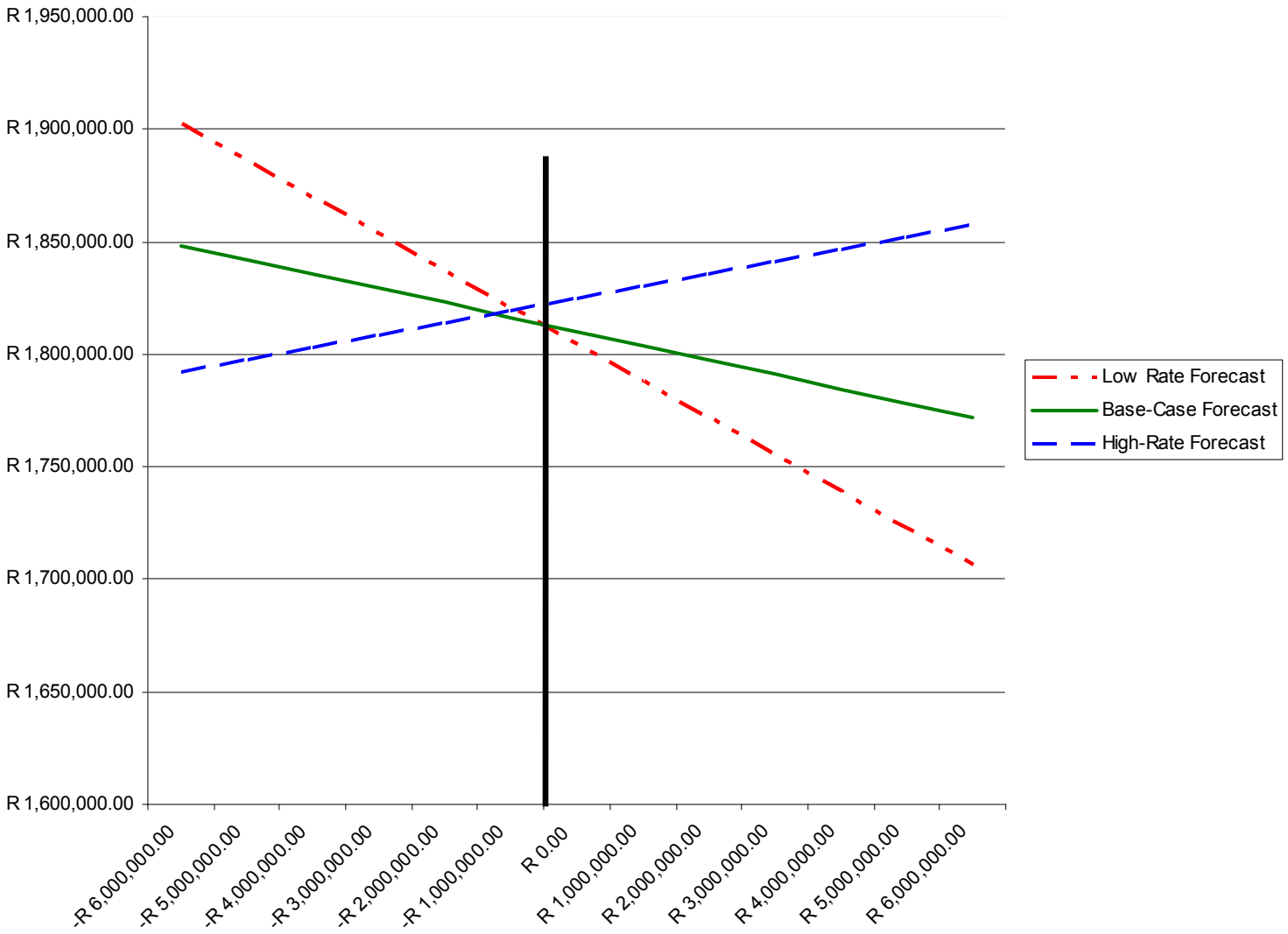
TABLE 5.4: RISK-RETURN ANALYSIS (Rand)

Position of book	3 – Month gap	Net interest income rate scenario		Minimum return	Maximum return	Risk premium	Return premium
		Low	High				
Short	- 3 443 278	1 860 819	1 806 146	1 806 146	1 860 819	13 854	40 819
Current	418 242	1 797 336	1 831 375	1 797 336	1 831 375	22 664	11 375
Long	5 274 015	1 718 095	1 853 624	1 718 095	1 853 624	101 905	33 624
Indifferent	- 900 000	1 820 000	1 820 000	1 820 000	1 820 000	-	-

Source: UBS (1987: 58).

[26] Example extracted from UBS (1987: 55 – 59).

FIGURE 5.1: INTEREST RATE SENSITIVITY ANALYSIS AND THE ZONE OF INDIFFERENCE



Source: UBS (1987: 57).

It is important to note from Table 5.6 that the ALCO should change the structure of the balance sheet (which is currently slightly long funded) to either an interest rate risk immune position (which is slightly short funded) or a larger short funded position in order to make correct use of the risk – return trade-off (UBS, 1987: 55 - 59).

The zone of indifference can be viewed as the as the triangular area in Figure 5.1 that is created where the base-case forecast, low-rate forecast and the high-rate forecast intersect. This area will give a stable amount of net interest income no matter the interest rate fluctuations. Positions outside the zone of indifference relate to the banks' ability to increase returns, although at the cost of increased risk. The UBS (1987: 58) states that during period of high interest rate instability the ALCO should aim for a gap that is close to the zone of indifference.

The UBS (1987: 57) identifies three variables that have the ability to change the structure of the amounts reflected in Table 5.4: "(i) the relationship between the cumulative gap measure chosen (e.g. call to 3 – month) and the degree of stability of the discretionary balances during this particular time interval (e.g. some balances may show seasonal fluctuations); (ii) the degree of the difference between the bank's view and the market's view of the expected yield curve (the larger the difference, the greater the net interest rate sensitivity to net interest rate movements; and (iii) factors that determine the bank's yield curve such as its product pricing policy".

5.2.7 Duration gap analysis

The duration gap is often cited along with the maturity gap as one of the most common interest rate sensitivity measurement tools

The duration of a stock is expressed algebraically by the UBS (1988: 43) as:

(60)
$$D = \sum_{t=1}^{n} (t) \left[\frac{CFt \,/ (1 + r)^{t}}{\sum_{t=1}^{n} CFt \,/ (1 + r)^{t}} \right]$$

where

D = duration
t = time period (length of time of the cash flow)
n = number of periods of time to final maturity
CF_t = total cash flow (interest and/or principal repayment) at time period t
r = yield to maturity
∑ = summation sign

The UBS (1987: 43) identifies the denominator as “the present value of the entire cash flow from the stock, while the numerator is the present value of that part of the cash flow due in period t. By definition, therefore, the term in parenthesis gives the proportion of the entire cash flow from the stock that is due in period t”.

The UBS (1987: 47) as well as Gup and Kolari (2005: 135 – 138) identify that due to the linear relationship duration provides between a change in the market yield and the price of a sock over the maturity scale, the principals of duration can be used as an interest rate sensitivity measure.

Houpt and Embersit (1991: 637) in Gup and Kolari (2005: 137) identify that modified duration has the ability to “reflect an instrument’s discrete compounding of interest; duration measures the instrument’s price volatility to changes in market yields”. The authors familiarise modified duration as the measure of the price elasticity of a financial instrument with regard to interest rate changes.

Modified duration is expressed algebraically by Houpt and Embersit (1991: 637) in Gup and Kolari (2005: 137) as:

$$(61)\quad \text{Modified duration} = \frac{\text{Macaulay duration}}{1 + R/c}$$

where

R = per period rate of return of the instrument

c = number of times per period that interest is compounded

Alternatively, this relationship between the instrument's price sensitivity, modified duration and changes in the rate of interest is expressed by Houpt and Embersit (1991: 637) in Gup and Kolari (2005: 137) as:

$$(62)\ \text{Percentage change in price} = -\ \text{Modified duration} * \frac{\text{basis point change in yield}}{100}$$

Houpt and Embersit (1991: 637) *in* Gup and Kolari (2005: 137) maintain that since duration provides a standard measure of price sensitivity for a variety of financial instruments, the duration of an entire portfolio (e.g. a bank's portfolio) can be calculated as the weighted average of the portfolio's components. From this analysis, the duration of the firm's net worth can be defined as the weighted average of its assets and liabilities. The weighted averages of assets, liabilities and off-balance sheet items' estimated duration will yield a measure of interest rate risk exposure.

This type of analysis is best described with an example[27]:

Table 5.5 represents a hypothetical bank balance sheet. The bank has three categories of assets, namely: cash, business loans and mortgage loans. Cash obviously has zero duration and does not earn interest, while business loans have a 2.5 year maturity (amortized monthly) and mortgage loans have a thirty-

[27] Example by Gup and Kolari (2005: 135 – 136).

year maturity (amortized monthly). The liabilities side of the balance sheet is comprised of equity capital as well as CDs with maturities of one year and five years, both of which pay interest only once at maturity. It is also assumed that rate of interest received on loans is 13% pa while deposits pay 11% interest pa (Gup and Kolari, 2005: 135 – 136).

TABLE 5.5: BALANCE SHEET DURATION

Assets	$	Duration (years)	Liabilities	$	Duration (years)
Cash	100	0.00	CD, 1 year	600	1.00
Business loans	400	1.25	CD, 5 year	300	5.00
Mortgage loans	500	7.00	Total liabilities	900	
			Equity	100	
Total	1000	4.00	Total	1000	2.33

Source: Gup and Kolari (2005: 135).

It can be noted from Table 5.5 that the weighted duration of the bank's assets amounts to 4.0 years while the weighted duration of the bank's liabilities is 2.33 years. The bank's duration gap is measured by Gup and Kolari (2005: 135) as the following equation:

(63) $$DGA = D_a - WD_L$$

where

DGAP = duration gap
D_a = average duration of assets
D_L = average duration of liabilities
W = ratio of total liabilities to total assets.

therefore

(64) DGAP = 4.00 – (0.90) (2.33)

(65) = 4.00 – 2.10 = 1.90 years

Since the duration gap is positive (1.90 years), if the rate of interest were to rise the net worth of the bank would decline as the value of assets would drop by more than the value of liabilities. Conversely, if the rate of interest falls the net worth of the bank would rise as the value of assets would increase by more than the value of liabilities (Gup and Kolari, 2005: 135 – 136).

Gup and Kolari (2005: 135 -136) describe the approximate relationship between the change in the market value of equity (net worth of the bank), the bank's duration gap structure and the change of the rate of interest as:

(66) Δ Net worth / TA $\approx$ -DGAP Δi / (1 +i)

where

Net worth	= net worth
TA	= total assets
DGAP	= duration gap
i	= rate of interest
Δ	= change operator.

In order to attain the dollar amount of change in net worth, the following equation can be used (Gup and Kolari, 2005: 136):

(67) $ ∆ Net worth ≈ -DGAP [∆i / (1 + i)] * TA

If it is assumed that the current rate of interest is 11% and increases by 1%, the percentage change in net worth will be:

(68) % ∆ Net worth ≈ -1.90 * (1 / 1.11)
(69) ≈ 1.7%

and therefore the Dollar amount of change in net worth will be:

(70) $ ∆ Net worth ≈ -1.90 * (1 / 1.11) * $1000
(71) ≈ -$17

Table 5.6 describes how different duration gap structures and changes in rate of interest affect the net worth of a bank:

TABLE 5.6: DURATION GAP, INTEREST RATES AND CHANGES IN NET WORTH

Duration Gap	Change in interest rate	Change in net worth
Positive	increase	decrease
Positive	decrease	increase
Negative	increase	increase
Negative	decrease	decrease
Zero	increase	no change
Zero	decrease	no change

Source: Gup and Kolari (2005: 136).

5.2.8 Ratio analysis

Ratio analysis is described by Correia *et al* (2003: 5–10) as a tool of financial statement analysis that illustrates the relationship of one amount to another in

order to evaluate bank performance. Bank performance in this context is gauged through comparative analysis as well as industry and inter-firm benchmarking.

Banks often focus on certain target accounts or ratios in order to manage their interest rate risk position. The UBS (1988: 47), however, asserts that it is not possible to target all accounts at the same time as these variables are affected differently by changes in the rate of interest and the restructuring of the balance sheet. It is also recognised that a single balance sheet structure cannot protect all bank accounts at the same time, while the decision on any one structure or ratio will depend (among other variables) on bank strategy, management decisions, the competitive environment and stakeholders' interests.

5.3 CONCLUSION

In order to correctly hedge against a particular interest rate risk position, a bank must ensure that it has the appropriate tools at its disposal in order to correctly capture the amount of interest rate risk to which it is exposed. This chapter has identified and provided examples on a number of interest rate risk measurement tools that aim to quantify the bank's risk position. These methods are primarily based on the bank's balance sheet structure as well as certain financial statements. The use of any particular measurement method will depend on a number of factors such as the bank's ALCO and its target variables, shareholders, stakeholders and competitive factors.

Chapter six will provide the case study analysis of the GBS Mutual Bank. The discussion of various interest rate risk hedging instruments as well as the function and organisation of the ALCO will be discussed in order to comment on their practicality and to provide recommendations.

CHAPTER SIX

EMPIRICAL ANALYSIS: GBS MUTUAL BANK INTEREST RATE RISK MANAGEMENT

6.1 INTRODUCTION

The purpose of this chapter is to present an empirical analysis in the form of a case study of the GBS interest rate risk management. The previous chapters have elucidated on interest rate risk, the theoretical ALCO structure, interest rate risk measurement and interest rate hedging tools in order to provide a theoretical foundation for the correct implementation of interest rate risk hedging by the GBS.

The case study analysis of the GBS extends for an eleven-year period: 1996 – 2007. The selection of this period is at the request of the GBS due to the shape of the term structure of interest rates over that period.

This analysis begins with the description of the GBS business practices as a mutual bank, its balance sheet and its ALCO structure as well as its interest rate risk exposure. Once the GBS has aptly been described, the term structure of interest rates for the respective period will be illustrated.

Using both the term structure of interest rates and the GBS interest rate risk exposure, the selection of a number of interest rate risk hedging tools will be discussed. Each instrument will be illustrated with the aid of an example, and the practicality of each interest rate hedging tool will also be commented on. Thereafter the discussion of the GBS ALCO in terms of its functions and organisation will follow.

The chapter is arranged as follows:

- the GBS Mutual Bank specific business circumstance
- the South African term structure of interest rates: 1996 – 2007
- interest rate risk hedging instruments
- GBS Mutual Bank asset and liability structure recommendations
- conclusion.

6.2 GBS MUTUAL BANK SPECIFIC BUSINESS CIRCUMSTANCE

6.2.1 Introduction

The purpose of this section is to provide a background to the GBS business practices. The mutuality of the bank is a distinguishing feature that differentiates its business activities substantially from other private sector banks and affects its interest rate risk exposure. The balance sheet structure will also be discussed because the mixture, volume and repricing frequency of the assets and liabilities is the primary source of the GBS interest rate risk exposure.

The present GBS ALCO structure will also be discussed: the ALCO structure and its decision making processes determine the management of the bank's interest rate risk position. This is followed by a brief synopsis of the GBS interest rate risk position.

6.2.2 Business practices

The GBS head office is located in Grahamstown in the Eastern Cape Province. The bank has branches located in Cape Town, Port Alfred and Port Elizabeth as well as a number of agencies countrywide.

The bank was originally formed as the Grahamstown Building Society in 1877 and is regarded one of South Africa's oldest financial institutions. It must also be noted that a large portion of the bank's current business activity is derived from its previous business structure as a building society. For example, a significant portion of the bank's assets is in the form of home mortgages (GBS, 2007).

It being a mutual bank, GBS has a particular business strategy. The mutuality of the bank infers that there are no shareholders, but rather the bank is owned by its share-depositors. Since there are no shareholders, the GBS is not purely profit driven as other commercial banks would be. Rather, bank profits are generated primarily to sustain bank reserves and capital adequacy requirements. The GBS's primary source of funds or primary liabilities is bank deposits, while its primary assets or uses of funds are mortgages and asset backed finance (Hornby, 2007b).

The community banking business model and its small geographic footprint in the Grahamstown and larger Eastern Cape area of South Africa affect the number and demographic composition of its clients. As such, the GBS has incorporated a personalised banking service for its customers in order to generate a competitive advantage over its larger competitors. For example, a large portion of its clients is composed of elderly citizens who prefer high yield deposits. The GBS often quotes rates above those of its competitors in an effort to retain and attract this type of client (Bowker, 2007).

The GBS is one of the smallest of the South African banks. It accounts for less than one percent of the total of the South African banking sector's size measured by total banks' balance sheet (as at July 2007) (SARB, 2007c).

The GBS advocates a low risk profile in the granting of short-term credit due to the following business practices:

- a significant portion of the bank's advances is collateralised. These advances are primarily in the form of mortgages in residential properties, smaller commercial and industrial properties as well as asset backed finance (ABF). The bank's focus on these types of advances stems primarily from its previous business structure as a building society. In 2007 mortgages account for R260 million, while ABF accounts for R190 million (GBS, 2007; Hornby, 2007b)
- being regulated by the Mutual Banks Act, No 124 of 1993, the bank is statutorily required to hold an amount of capital of not less than 10 percent of its risk-based assets as a buffer against losses by depositors (GBS, 2007)
- the GBS continues to trade profitably with experienced management (GBS, 2007).

Bowker (2007) describes the bank as a specialist in term investing. Excess funds are placed in the interbank market, usually with a 3-month to one-year maturity.

6.2.3 Balance sheet structure

Table 6.1 represents the GBS balance sheet structure for the period of March 1996 – March 2007. Table 6.2 illustrates the GBS income statement for the same period.

TABLE 6.1: GBS MUTUAL BANK BALANCE SHEET: R'000 (1996 – 2007)												
	2007	**2006**	**2005**	**2004**	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**
Reserves	47 653	43 172	38 479	34 301	29 578	25 738	24 174	23 870	21 395	18 843	16 935	15 070
Risk provisions	3 737	2 237	1 654	1 946	3 896	4 228	4 928	3 417	2 223	1 972	1 615	701
Share deposits	195 668	126 396	56 888	47 951	29 409	24 552	23 827	24 042	22 946	20 024	17 264	18 000
Deposits	361 563	338 884	333 360	284 108	235 568	240 134	226 289	212 259	221 129	191 361	153 132	147 957
Other liabilities	9 906	8 580	7 189	4 575	5 510	4 537	3 742	1 831	3 135	1 953	1 544	984
Total liabilities	618 527	519 269	437 570	372 881	303 961	299 189	282 960	265 419	270 828	234 153	190 490	182 712
Cash and short term securities	98 102	75 268	63 844	55 039	47 244	23 695	41 589	13 387	26 394	27 474	14 462	6 360
Investments	51 143	45 261	41 966	37 311	11 921	45 753	23 195	16 218	29 907	22 112	14 386	27 470
Advances	465 253	394 949	327 860	276 195	239 924	224 509	211 406	228 612	210 870	183 655	159 860	147 346
Other	4 029	3 791	3 900	4 336	4 872	5 232	6 770	7 202	3 657	912	1 782	1 536
Total assets	618 527	519 269	437 570	372 881	303 961	299 189	282 960	265 419	270 828	234 153	190 490	182 712
Source: GBS (1996 – 2007).												

TABLE 6.2: GBS MUTUAL BANK INCOME STATEMENT: R'000 (1996 – 2007)												
	2007	**2006**	**2005**	**2004**	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**
Net interest margin	19 075	15 439	12 936	13 109	15 589	11 189	11 740	11 808	14 177	9 996	9 966	7 928
Other income	4 720	4 168	4 016	2 479	2 265	2 510	2 732	2 976	1 762	1 181	1 157	837
Total income	23 795	19 607	16 952	15 588	17 854	13 699	14 472	14 784	15 939	11 177	11 123	8 765
Impairment and provisions	(1 879)	(987)	(509)	(751)	(2 952)	(2 577)	(4 153)	(3 248)	(2 333)	(1 006)	(1 547)	(763)
Operating expenses	(15 260)	(12 818)	(11 706)	(10 626)	(9 732)	(9 303)	(9 084)	(9 650)	(9 198)	(7 259)	(6 983)	(5 699)
Tax	(1 462)	(1 280)	(1 143)	(1 062)	(1 330)	(255)	(125)	77	(1 856)	(1 003)	(728)	(773)
Profit after tax	5 194	4 522	3 594	3 149	3 840	1 564	1 110	1 963	2 552	1 909	1 865	1 530
Source: GBS (1996 – 2007).												

6.2.4 Asset and liability committee

The GBS does not have an ALCO per se. Rather, the bank relies on its interest rate risk management from the risk management sub-committee. This sub-committee is responsible for the management of all GBS bank risk. Meetings are scheduled once a week, and minutes of the meetings are provided to the board of directors on a monthly basis (Hornby, 2007b).

The GBS ALCO does not make use of any computer generated simulations of interest rate structures or balance sheet structures and has historically never actively hedged its interest rate risk position (Hornby, 2007b).

6.2.5 Interest rate risk exposure

The best way in which to describe the GBS interest rate risk position is to describe the maturity structure of its assets and liabilities.

The GBS can be described as asset sensitive, that is its assets mature faster (and therefore reprice faster) than its liabilities, in which case the cash forthcoming from maturing assets must be reinvested until such time as the liabilities mature and require repayment. The bank is therefore susceptible to interest rate risk during a falling interest rate environment as this reinvestment of assets can only be accomplished at rates lower than the rates being paid on liabilities (UBS, 1987: 37; Faure, 2007a; Hornby, 2007a; Nel, 2007; Tagg, 2007).

The GBS also suffers from interest rate risk derived from its community banking business model. The GBS often pays higher rates for established depositors, rendering a squeeze on bank margins. The bank has tried to relieve this pressure on its margins by quoting higher rates on its asset products (mainly mortgages and ABF), which may have the disadvantage of deterring volume on the assets side and exacerbating its interest rate risk position (Faure, 2007a; Hornby, 2007a; Nel, 2007; Tagg, 2007).

Therefore, due to the maturity structure of its assets and liabilities as well as its community banking business model, the GBS has experienced lower NII figures in a declining interest rate environment where bank margins are squeezed (Hornby, 2007a; Tagg, 2007).

The GBS interest rate repricing mismatch at 31 March 2007 is presented in Table 6.3.

TABLE 6.3: GBS MUTUAL BANK REPRICING MISMATCH: R'000 (31 March 2007)				
Maturity	**0-31 Days**	**32-90 Days**	**91-365 Days**	**Other**
Assets	513 395	35 959	32 326	33 110
Liabilities	(138 266)	(192 480)	(166 781)	(69 610)
Other	-	-	-	(47 653)
Repricing mismatch	375 129	(156 521)	(134 455)	(84 153)
Source: GBS (2007: 36).				

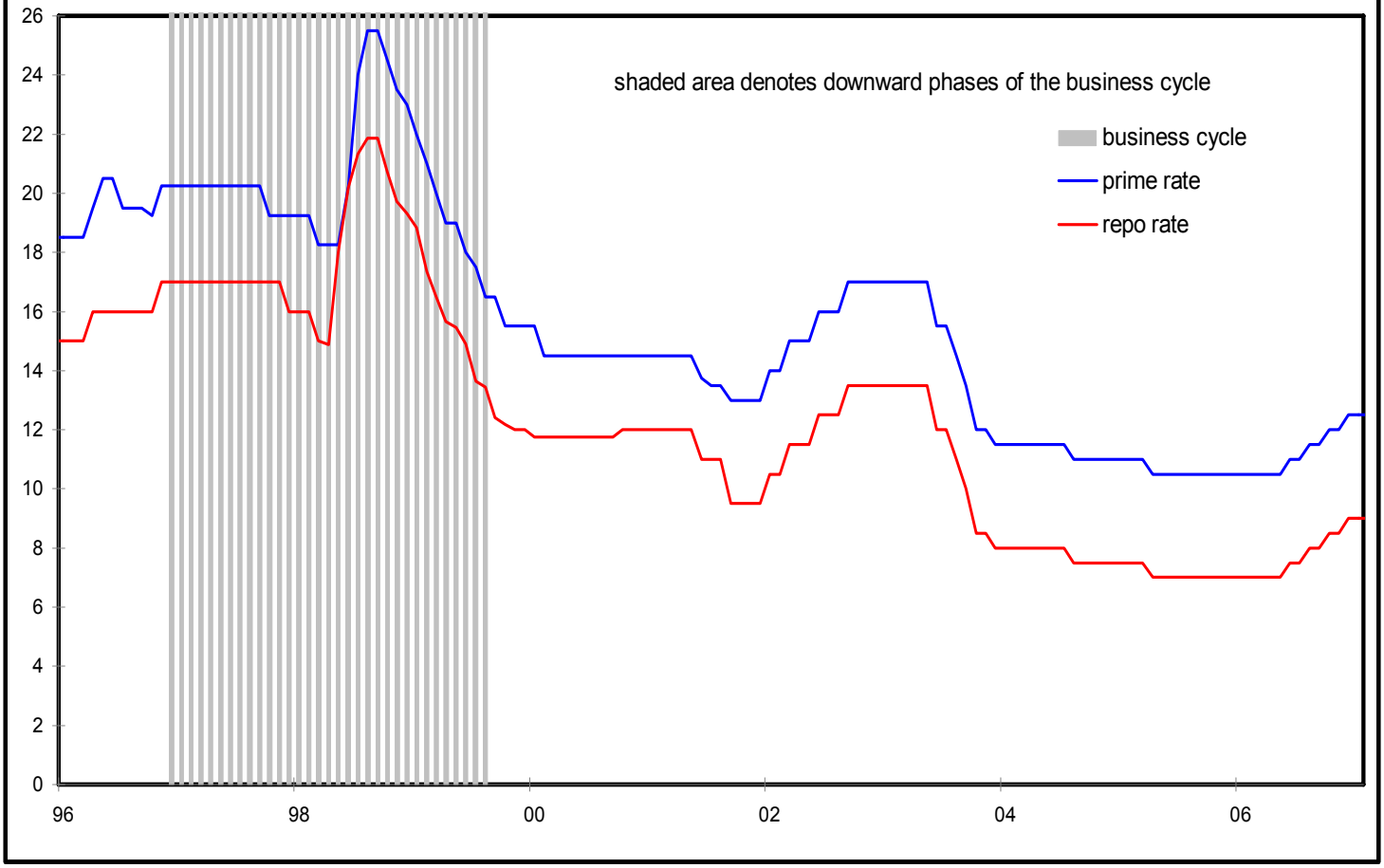
The GBS (2007: 36) states that, given this balance sheet mismatch, a 1% increase in the prime rate will result in an increase to net interest margin by R 1.4 million, while a 1% decrease in the prime rate will reduce the GBS net interest margin by R 1.3 Million.

6.3 SOUTH AFRICAN INTEREST RATE CYCLE AND TERM STRUCTURE OF INTEREST RATES: 1996 – 2007

The South African interest rate cycle and term structure of interest rates over the period January 1996 to March 2007 provides the historical background for the study.

Figure 6.1 illustrates the cyclical interest rate fluctuations in the form of the repurchase rate and the bank prime lending rate over the period (SARB, 2007d).

FIGURE 6.1: INTEREST RATE CYCLE (1996 - 2007)



(SARB, 2007d)

Figure 6.2 illustrates the South African 10-year bond rate and the 91-day treasury bill rate over the same period (SARB, 2007d; Faure, 2007).

.

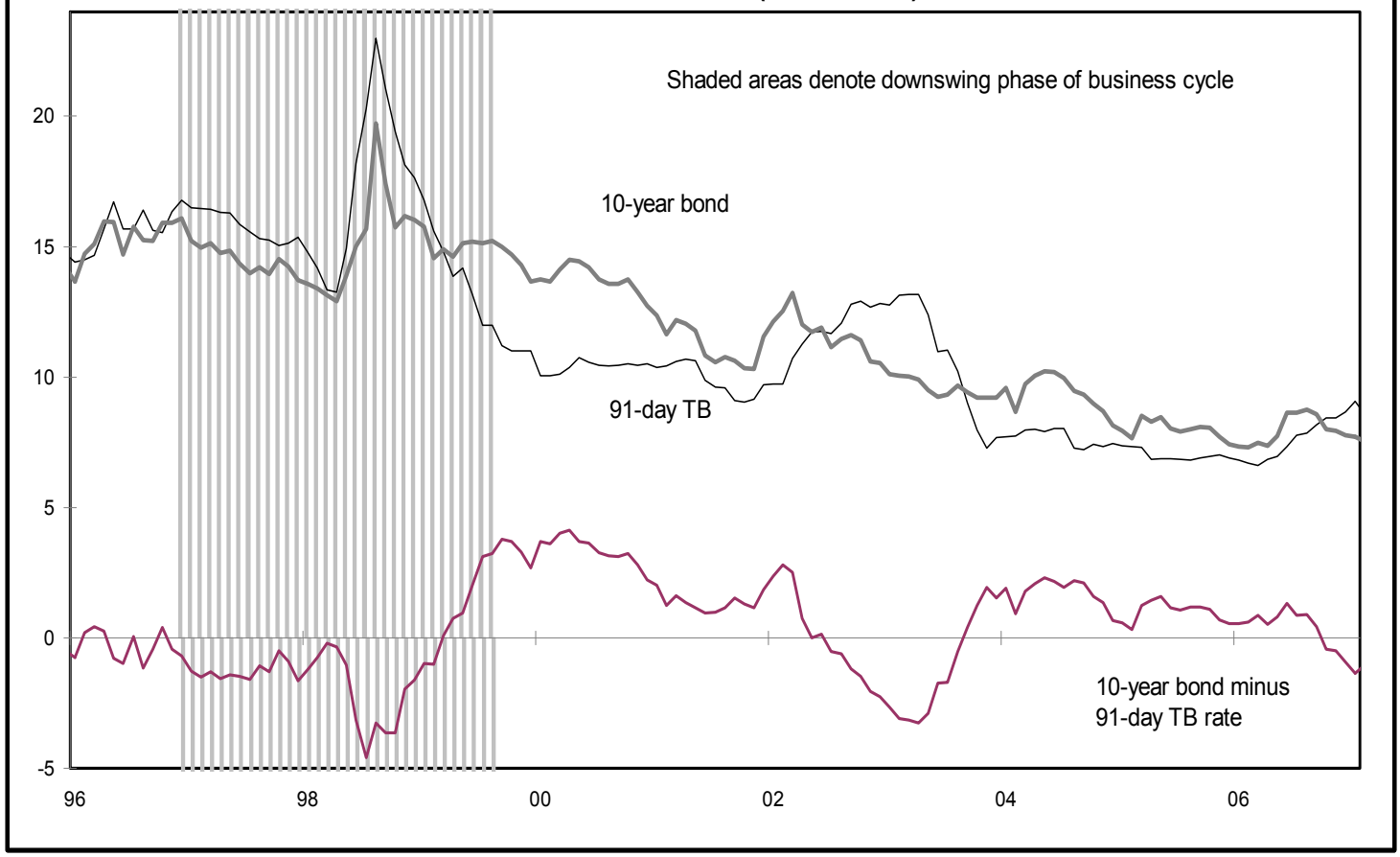
It can be noted that the South African yield curve can be deduced from this data. When the difference between the 10-year bond rate and the 91-day treasury bill rate is:

- positive: the normal yield curve (upward sloping) exists where the yield on longer-dated bonds is higher than the yield on short-dated bonds (UBS, 1987: 40); (Mishkin, 2004: 127). A positive or upward sloping yield curve

occurs during March 1999 - May 2002 and September 2003 - October 2006

- negative: the inverse or abnormal yield curve (downward sloping) exists where the yield on short-dated bonds is higher than the yield on long-dated bonds (UBS, 1987: 40). A negatively shaped yield curve occurs during November 1996 - March 1999 and June 2002 - September 2003
- zero: the flat yield curve exists where the yield on short-dated bonds is equal to the yield on long-dated bonds (UBS, 1987: 41). A flat yield curve appears on a number of occasions during 1996 as well as March 1999; June 2002; September 2003 and October 2006.

FIGURE 6.2: THE 10-YEAR BOND RATE, THE 91-TREASURY BILL RATE AND THE DIFFERENTIAL (1996 - 2007)



(SARB, 2007d; Faure, 2007b).

6.4 GBS MUTUAL BANK INTEREST RATE RISK HEDGING: INTRODUCTION

The GBS interest rate risk exposure, its specific business circumstance and the market background over the specified period have been elucidated. This section provides recommendations on the implementation of the interest rate risk hedging instruments available to the GBS. Particular attention is given to each instrument's practicality in the South African financial sector.

The interest rate risk hedging tools discussed are:

- balance sheet positioning instruments
- financial derivative instruments
- retaining the *status quo.*

6.4.1 Balance sheet positioning instruments

6.4.1.1 Introduction

Balance sheet positioning strategies rely on the bank's ability to alter the mix and volume of financial assets and liabilities in order to take advantage of different interest rate scenarios and repricing frequencies of financial instruments. The balance sheet positioning strategies discussed are:

- net interest income smoothing
- a volume strategy
- a pricing strategy
- the ideal portfolio
- immunisation.

6.4.1.2 Net interest income smoothing

Due to its asset sensitive balance sheet, the GBS will have a prosperous NII position during upward sloping phases of the interest rate cycle. In order to hedge its interest rate risk using a NII smoothing strategy, the GBS should retain a certain percentage of its NII for the periods when interest rates decline (Smith, 2007).

This is the current technique employed by the GBS. Larger portions of funds are saved during rising interest rate periods in order to offset losses during periods of declining interest rates (Hornby, 2007a; Tagg, 2007).

6.4.1.3 Volume strategy

During a falling interest rate environment, the GBS can alter the volume of financial instruments on its balance sheet in order to maximise its NII. In order to accomplish this, the GBS should lengthen the maturity structure of its assets and shorten the maturity structure of its liabilities (UBS, 1987: 60).

If the interest rate cycle is upward sloping, the GBS will naturally be in a position to benefit from its asset sensitive balance sheet. This balance sheet structure can be accentuated by further shortening the maturity structure of its assets and lengthening the maturity structure of its liabilities.

6.4.1.4 Pricing strategy

As aforementioned, a pricing strategy is similar to a volume strategy in so far as the outcome is to alter the structure of the bank's balance sheet by changing the volume and mix of its assets and liabilities. The difference lies in the intermediate target variable of the bank's quoted rates.

The GBS could use a pricing strategy in the following manner: when the prevailing interest rate trend is downward sloping, it can effectively hedge its interest rate position by increasing rates on short-term deposits and/or increasing rates on long-term loans. This will increase the volume of short-term deposits due to the higher rate of interest received by customers and reduce the amount of long-term loans as customer interest payments become greater. In this way the GBS can effectively alter the volume of the assets and liabilities on its balance sheet in order to take advantage of a falling interest rate environment (UBS, 1987: 59).

It must be noted, however, that this strategy may have some practical drawbacks for the GBS. The GBS regards itself as a price-taker in so far as its quoted rates are linked to rates quoted by its larger competitors. Any significant restructuring of interest rates may hamper interest margins and business practices. The GBS often quotes rates that are favourable to certain customers in order to attract business away from its larger competitors, which may also deter from the effectiveness of the pricing strategy. For example, better rates are quoted to customers over the age of forty (UBS, 1987: 59; Hornby, 2007b; Tagg, 2007).

It is also recognised by the UBS (1987: 59) that a pricing strategy may also take longer to implement due to the intermediary target variables. Moreover, Auret (2007) identifies that a pricing strategy's effectiveness requires substantial customer volume in order to change the structure of the balance sheet.

This strategy is highly dependent on the individual customer's interest rate elasticity of demand. A positive aspect of this strategy is that it appeals to the GBS client base, being older individuals who favour high yield deposits. This factor may increase the effectiveness and time to implementation of the strategy. Of course, if lending rates are increased the bank may become more susceptible to adverse selection and moral hazard implications as only customers with risky investments will be willing to pay a higher interest rate. This has the dangerous

effect of altering the credit risk profile and liquidity risk profile of the bank, which may also contribute to an increased solvency risk (UBS, 1987: 59; Milgrom and Roberts, 1992: 153; Bowker, 2007).

6.4.1.5 The ideal portfolio

The ideal portfolio can be regarded as a utopian ideal for a bank to manage its interest rate risk. This type of portfolio is a balance sheet positioning strategy that perfectly matches assets and liabilities in term to maturity as well as fixed-rate and floating-rate financial instruments (Faure, 2002: 134).

During an upward sloping yield curve environment, the GBS can construct a portfolio in the following manner: the GBS can construct a portfolio with long-dated fixed-rate liabilities and short-dated floating-rate assets (Faure, 2002: 134).

If a downward sloping interest rate environment persists, the GBS should hold a portfolio containing short-dated floating-rate liabilities and long-dated fixed rate-assets (Faure, 2002: 134).

It is recognised, however, that the ideal portfolio is often not attainable due to competitive factors as well as constraints placed by clients, investors and stakeholders (Faure, 2002).

6.4.1.6 Immunisation

Immunisation has the capacity to negate the effects of changing interest rates on the bank's return. The GBS has the ability to immunise itself against interest rate risk at either the individual asset class level or the entire portfolio level.

By making the duration of the bond or indeed the average duration of the entire portfolio equal to the investment horizon, the GBS can offset its interest rate risk

exposure. A fall in the rate of interest will induce a rise in the market price of the bond/portfolio which will be offset by the reduction of income earned on the reinvestment of the bond/portfolio. The net effect is that the realised return remains constant (UBS, 1987: 43 - 47).

It is recognised, however, that immunisation does not take convexity into account and may be expensive and time consuming to implement because the GBS will need to continuously rebalance the portfolio in order to match the duration of its instruments to the investment time horizon (Mahshid and Naji, 2003: 26).

Auret (2007) recognises that immunisation may be a useful tool, especially through the use of treasury bills and government bonds. But it is also acknowledged that these types of securities have pockets of liquidity and may be problematic to perfectly match the holding period with the instrument's duration.

6.4.2 Derivative instruments

6.4.2.1 Introduction

Interest rate derivatives provide a viable method for the GBS to hedge its interest rate risk position. The practicality of the derivative instrument depends on the instrument's availability in the South African financial system, transaction costs, particular requirements (e.g. margining, pricing, monitoring, etc) as well as the GBS specific business circumstance. The use of any derivative instrument for interest rate risk hedging purposes will be a new addition to the GBS ALCO.

The financial derivatives discussed are:

- securitisation
- interest rate forwards
- interest rate futures

- interest rate swaps
- interest rate options
- interest rate caps
- interest rate floors
- interest rate collars
- hybrid derivatives such as
    - options on swaps (swaptions) and
    - options on futures.

6.4.2.2 Securitisation

The GBS can use securitisation to reduce its interest rate risk exposure by moving the longer duration assets and/or the more interest rate sensitive items off-balance sheet by securitising them. In so doing, the interest sensitivity of the portfolio and the duration gap between assets and liabilities can be reduced (Jones, 2004; Lederman in Wikipedia, 2007).

Securitisation also allows for the unbundling of risk. Interest rate risk can be unbundled from other risks and the originating financial instrument. This portion of interest rate risk can then be sold to a third party or managed by a more competent third party (Heffernan, 1996: 171).

Some negative aspects that relate to the use of securitisation for the GBS include the use of securitisation as a method to reduce interest rate risk as it is extremely complicated to implement. Furthermore, securitisation requires a critical mass in order to disseminate interest rate risk effectively. Auret (2007) states that some benefits of securitisation can be realised with a value of R250 million, while the true benefits of risk diversification are realised closer to a value of R500 million. The benefits from any values smaller than this are eroded by the cost and complexity of the securitisation process.

Auret (2007) continues by taking the perspective of the investor of the securitised asset into account. It is unlikely that an investor will invest in a once-off securitised asset from an issuer. The grading of the paper is also a concern because the GBS may have a lower graded paper in comparison to other larger financial institutions.

6.4.2.3 Interest rate forwards

The interest rate forward contract is a viable interest rate derivative instrument that has the ability to hedge the GBS interest rate risk position. Since the GBS suffers from a reduced NIM during downward periods of the interest rate cycle, it can enter into an interest rate forward contract that locks in a certain amount of interest income during these periods.

One shortcoming of the interest rate forward contract is that it is generally more expensive than those of interest rate futures. This is due to lower liquidity (and therefore higher bid/offer spreads) and higher transaction costs (Brown, 2007).

An advantage of the forward contact is its ability to be tailored to the GBS specific requirements, which can allow the GBS to hedge a position more precisely (Brown, 2007). Gup and Kolari (2005: 155) reiterate this quality adding that the contracts are not marked to market and therefore have no liquidity risk seeing that they require no margin call. A disadvantage of this, however, is that in order to close out a contract early, the counterparty must be negotiated with. Also, credit risk is increased as the contract is an OTC instrument and not guaranteed by an exchange.

6.4.2.4 Interest rate futures

As alluded to, the use of interest rate futures is one of the more practical financial instruments that can be used in order to hedge the GBS interest rate risk

position. In a falling interest rate scenario the asset sensitive GBS will have a declining NII position. This decline in NII can be offset by the profits made by taking a long futures position. As rates decline, the profits made on the futures contract are able to offset the reduction of NII (UBS, 1987: 65).

Brown (2007) recognises that the futures market is ideally suited to smaller financial institutions due to the smaller bid/offer spread and greater liquidity. However, the use of futures may be somewhat cumbersome as the instrument cannot net-off cash flows (as a swap transaction would do) and the GBS may have to reverse its position in order to close out its overall position. Gup and Kolari (2005: 152) recommend that the futures contract selected for hedging purposes should be in the same asset or one that is highly correlated (cross hedge) to the cash market instrument.

Futures contracts require a commitment of funds in the form of a margin and are guaranteed by an exchange (Gup and Kolari, 2005: 147).

6.4.2.5 Interest rate swaps

The GBS has the ability to hedge its interest rate risk position with the use of a swap in the following manner: the GBS has an asset sensitive position where its balance sheet is comprised mainly of floating-rate assets which are financed by fixed-rate liabilities. In order to enter into a swap transaction the GBS will require a counterparty (or an intermediating bank) with the opposite interest rate forecast (i.e. rising interest rate scenario) and risk profile. The counterparty would have a liability sensitive balance sheet composed primarily of fixed interest rate assets that are financed by floating interest rate liabilities (Gup and Kolari, 2005: 162-165).

A swap would allow the GBS to exchange the floating-rate received on its assets for a fixed-rate via the swap. It will have a net position of its fixed-rate payments

matched by fixed-rate receipts via the swap and thereby reduce its interest rate risk exposure in a declining rate environment (Gup and Kolari, 2005: 162-165; Faure, 2006: 110).

Brown (2007) identifies that the swap transaction is an ideal method of hedging the GBS interest rate risk position because the cash flows can be netted out, unlike the futures contact which must be physically reversed. Brown (2007) recognises that swaps are typically used by sophisticated counterparties as they need to marginalise with the provision of credit lines with the market maker, and require sophisticated systems in order to book and monitor correctly.

6.4.2.6 Interest rate options

The options contract provides the right but not the obligation for the GBS to enforce a particular contract. This allows the GBS a greater degree of freedom upon exercising its hedging strategy (Poitras, 2002).

Brown (2007) identifies that the options contract, although a viable instrument, incurs the same implementation deficiencies as the futures, forwards and swap contracts because the booking and monitoring of the contract require sophisticated systems. Moreover, the correct pricing of options is a complex process and the premiums quoted may be expensive, especially for a smaller bank with smaller contracts.

Specific option based contracts will be examined when interest rate caps, floors and collars are discussed.

6.4.2.7 Interest rate caps

The interest rate cap provides the GBS with the ability to receive an amount over a certain agreed rate (i.e. the cap rate) (Reynolds, 1995). The interest rate cap

contract would not be a viable hedging instrument for the GBS as it provides an upper limit for its interest earnings during a rising interest rate scenario. Since the GBS is asset sensitive and prospers under the rising interest rate scenario, the interest rate cap would place an upper limit on earnings and reduce potential earnings.

The GBS can, however, sell an interest rate cap in order to attain extra income derived from the premium paid by the buyer. This will be examined in further detail when interest rate collars are discussed.

6.4.2.8 Interest rate floors

The use of an interest rate floor is an ideal instrument which the GBS can utilise in order to protect its interest income during a declining interest rate scenario. The purchase on an interest rate floor is essentially a series of interest rate put options by which the writer guarantees the GBS an amount that increases as the rate of interest declines (Gup and Kolari, 2005: 160).

If the GBS expects future interest rates to fall below a certain rate, it can hedge its interest rate risk position through the purchase of the floor contact, which will be enforced at a level below the floor strike price/rate. The seller of the floor will then compensate the GBS by an amount equal to the difference between the floor strike rate and the actual rate of interest. This is, of course, based on a notional principal amount (Reynolds, 1995).

6.4.2.9 Interest rate collars

The interest rate collar is a combination of the interest rate cap and the interest rate floor. The GBS, in order to hedge its interest rate risk position during a falling rate environment, can use an interest rate collar in the following manner: it can buy an interest rate floor at a pre-specified rate and simultaneously sell an

interest rate cap. This would allow the GBS to enforce the contract below the floor strike rate and reduce its interest rate risk exposure. The sale of the interest rate cap would allow the GBS to receive a premium from the buyer and thereby offset the premium paid for the purchase of the floor (Bessis, 2002).

The use of the interest rate cap, interest rate floor and indeed the interest rate collar is advocated by Lippiatt (2007), who regards the ability of the collar's cost reducing characteristics as an important aspect for the GBS. Lippiatt (2007) advises that the use of such interest rate contracts should not exceed a period of three years due to the volatility and uncertainty in interest rates beyond such a time frame. It is also acknowledged that the use of these interest rate derivatives is highly administratively intensive (Lippiatt, 2007).

6.4.2.10 Hybrid derivatives

6.4.2.10.1 Introduction

Hybrid derivatives are complex financial instruments that have derivative characteristics imbedded in already existing derivative instruments. The hybrid derivatives discussed are:

- options on swaps (swaptions)
- options on futures.

6.4.2.10.2 Options on swaps (swaptions)

The call swaption would allow the GBS the right to receive a fixed rate in exchange for a floating rate and thereby reduce its interest rate risk exposure during a declining rate scenario (Faure, 2006: 155).

Lippiatt (2007) advocates the use of the swaption for the GBS to lock in a certain rate of interest. The swaption is also seen as being less administratively cumbersome in comparison with interest rate caps, floors and collars. Lippiatt (2007) recommends that the contract should not be entered into for a period longer than 12 months, while Brown (2007) states that the swaption may be somewhat more expensive than other derivative instruments due to the contact's complex nature.

6.4.2.10.3 Options on futures

The GBS could enter into an option on a futures contract in order to hedge its interest rate risk exposure. In order to do so, it could buy a call option on a futures contract. If interest rates fall, the call option would be enforced by the GBS as benefits will occur by an amount equal to the difference between the futures price and the exercise price. Of course, if rates rise the option will not be exercised as the GBS naturally receives a higher NIM under this scenario (Gup and Kolari, 2005: 160; Faure, 2006: 149).

Options on futures contracts, although being a viable interest rate risk hedging instrument, may be more expensive than other instruments due to their complexity (Brown, 2007).

6.4.3 Retaining the *status quo*

Another option for the GBS is to retain the *status quo*, where the GBS would not alter its interest rate smoothing strategy. There are a number of reasons the current strategy may be retained, including: other hedging options may be too expensive, requiring a large amount of monitoring and sophisticated systems, or may alter the business structure of the bank unfavorably (Mahshid and Naji, 2003: 34).

6.5 GBS MUTUAL BANK ASSET AND LIABILITY COMMITTEE RECOMMENDATIONS

6.5.1 Introduction

Chapter 3 has outlined the theoretical structure for the correct function and organisation of a bank's ALCO. Since the GBS interest rate risk hedging strategy is guided by the ALCO, a number of recommendations can enhance its hedging strategy through the ALCO function and organisation. These recommendations are formulated with the GBS business structure, size, skill set and information technology capacity at the fore.

6.5.2 Functions of the GBS ALCO

The functions of the GBS ALCO are to correctly measure the bank's interest rate risk exposure, simulate interest rate scenarios and manage its interest rate risk position.

The GBS performs all of these tasks sufficiently well with the bank's current level of technical aptitude. Larger banks rely on complex measurement and scenario building as well as monitoring and pricing systems in order to correctly hedge their interest rate risk position. Since financial risks are correlated, the GBS must ensure that any interest rate hedging activities are taken with other financial risks in mind. Complex computational systems have the ability to correctly gauge these variables, but are incurred by a cost to the user (Brown, 2007).

The GBS has the ability to implement a number of ALCO strategies that affect the bank's interest rate risk hedging strategy: Hornby (2007b) describes the GBS

as a low risk bank where the current interest rate risk hedging strategy would comply with a prudent strategy rather than a speculative strategy. Under a prudent hedging strategy the GBS would hedge its interest rate risk totally or partially by either locking in a certain NIM over time or hedging adverse interest rate movements only, while still allowing for the bank to prosper under favorable interest rate trends (Bessis, 2002: 181).

6.5.3 Organisation of the GBS ALCO

Joacim (2007) advocates an ALCO scope that transcends into all the areas of the GBS business practices. Bessis (2002: 70) and Joacim (2007) state that an ALM policy should be incorporated into the entire business policy because interest rate risk hedging strategies require the participation of other departments in order to be effective.

The GBS should also incorporate the use of external and internal sources of information when panning its ALCO structure. External sources such as macroeconomic indicators (i.e. fiscal policy, monetary policy, etc) provide the basis for the bank's internal interest rate forecast, while internal structures (i.e. maturity structure, growth forecast, etc) provide for the balance sheet forecast (Meek, 1988). The GBS currently performs these activities extremely well.

Joacim (2007) recommends that ALCO meetings should be conducted frequently in order to correctly monitor the GBS interest rate risk exposure. During times of market instability the meetings can be conducted daily, while under normal business circumstances they should be held once or twice weekly. The GBS currently follows these practices.

The GBS is in alignment with Meek's (1988: 7) view of the number of participants in the ALCO: the GBS currently employs 5 members in its risk sub-committee. These members span across all the GBS departments.

6.6 CONCLUSION

This chapter has analysed the GBS business structure, its ALCO and its interest rate risk exposure in order to postulate a number of viable interest rate risk hedging alternatives. Some are deemed impracticable due to limiting variables such as cost, access to markets and the GBS business practices. However, it is also indicated that a number of hedging instruments suit the GBS sufficiently well to be incorporated into the ALCO hedging strategy.

This chapter also discussed the GBS ALCO in terms of its functions and organisation: the GBS currently ascribes to a well functioning ALCO in the form of its risk sub-committee. The primary encumbrance to its functionality is the inadequacy of the informational technology used to measure its interest rate risk position and hedging activities.

CHAPTER SEVEN

CONCLUSION

7.1 INTRODUCTION

This thesis began by briefly describing bank financial risk, with particular attention being given to interest rate risk in an attempt to provide a solid foundation for investigating interest rate risk management. It then explored all facets of interest rate risk management in detail: since interest rate risk management is effected by the committee by which it is managed, the thesis also investigated the theoretical structure of the ALCO in terms of its functions and organisation. It considered a number of balance sheet hedging strategies as well as derivative interest rate risk hedging instruments with the aid of examples. The thesis then discussed a number of interest rate risk measurement models.

All this provided for the basis for the empirical analysis in the form of a case study of the GBS. Comments on the practicality of the interest rate risk hedging strategies and instruments were provided as well as recommendations on the GBS ALCO.

7.2 THE STUDY

It was elucidated that the GBS has an asset sensitive balance sheet and is thus susceptible to a reduction in net interest income during a declining interest rate scenario. Hedging of its interest rate risk exposure is therefore most beneficial during this market environment.

Two primary forms of interest rate risk hedging were established: balance sheet structuring relies on the bank's ability to alter the mix and volume of its assets

and liabilities in an effort to better manage its interest rate exposure, while the use of financial derivative instruments accomplishes the same task in a different manner.

The risk reduction capacity of the derivative instruments stems from their payoff profile being linked to that of a previously issued security and can thereby be used to reverse a particular position (e.g. forwards, futures and securitisation). Banks - due to competitive reasons and stakeholders' interests - must often take positions which they do not necessarily want and which may negatively influence their interest rate risk position. The derivative market provides a means by which they can still accept these unfavourable positions in the cash market and then tailor their balance sheets to better suit their needs by using the derivative market (e.g. forwards, options and swaps).

The practicality of these two hedging methodologies was commented on in terms of the GBS specific business circumstance, its balance sheet structure and the market background over the specified period, as well as other limiting variables (e.g. accessibility, cost, liquidity, marketability etc). A model of the interest rate risk hedging strategies and instruments available to the GBS and the practicality of each can be made: table 7.1 provides the advantages and disadvantages of the various balance sheet positioning strategies available to the GBS, while figure 7.2 provides the same information for the derivative hedging instruments.

TABLE 7.1: GBS BALANCE SHEET HEDGING ALTERNATIVES: ADVANTAGES AND DISADVANTAGES		
Balance sheet position strategy	**Advantages**	**Disadvantages**
NII smoothing strategy	• Current strategy employed by ALCO • Simple implementation	• Dependent on cyclical market movements
Volume strategy	• Time to implementation is immediate • Instruments readily available (e.g. government bonds and treasury bills)	• May be difficult to restructure the balance sheet in a short period • Instruments have pockets of liquidity
Pricing strategy	• Appeals to GBS client base • May increase time to implementation	• Restructuring of rates may hamper business activity • Longer time to implementation due to intermediate target variable • Requires critical mass • Dependent on customer's interest rate elasticity of demand • Adverse selection and moral hazard implications
Ideal portfolio construct	• Perfectly negates interest rate risk	• Regarded as unattainable due to competitive factors as well as client, investors and stakeholder interests
Immunisation	• Is possible at individual asset class level or entire portfolio level • Instruments readily available (e.g. government bonds and treasury bills)	• Does not take convexity into account • Requires continuous portfolio rebalancing which may be expensive and time consuming • Instruments have pockets of liquidity

TABLE 7.2: GBS DERIVATIVE HEDGING ALTERNATIVES: ADVANTAGES AND DISADVANTAGES		
Derivative hedging instrument	**Advantages**	**Disadvantages**
Securitisation	• Unbundles risk, allowing it to be sold or managed by a third party	• Complicated to implement • Requires critical mass • Investor may not invest in a once-off securitised asset • May be a lower graded paper than that of other financial institutions
Interest rate forwards	• Contract can be individually tailored • No margin required	• More expensive than futures contract (i.e. lower liquidity and higher transactions costs) • Not exchange guaranteed • Early close-out requires re-negotiation • Position requires physical close-out
Interest rate futures	• Less expensive than forward contract (i.e. higher liquidity and lower transactions costs) • Exchange guaranteed	• Cannot be individually tailored • Margin required • Position requires physical close-out
Swaps	• Contract can be individually tailored • Position close-out automatic (i.e. cash-flows netted-out)	• Requires sophisticated booking and monitoring systems and credit lines from market maker
Options Caps	• Sale of a cap attracts income from premium	• Purchase of a cap is not suitable: places upper limit on potential earnings • Administratively cumbersome
Floors	• Purchase of a floor yields an increased value as interest rates decline	• Cost amounts to premium paid for purchase of floor • Administratively cumbersome
Collars	• Purchase of a floor increases in value as interest rates decline • The premium paid for the floor is offset by the premium received from the sale of the cap.	• Administratively cumbersome
Hybrid derivatives Swaptions	• Option on the swap contract provides increased flexibility	• Premium paid to the option writer • May be more expensive due to contract's complexity
Options on futures	• Option on the futures contract provides increased flexibility	• Premium paid to the option writer • May be more expensive due to contract's complexity

Tables 7.1 and 7.2 indicate that each hedging tool has its own nuance in terms of its practicality. Of the balance sheet positioning strategies, the most practical for the GBS are the volume strategy and immunisation: volume strategy allows the GBS to more easily structure its balance sheet through the use of readily available financial instruments and allows it to take advantage of different interest rate environments, and immunisation is similar in this regard as the financial instruments used are readily available. Immunisation differentiates itself, however, by not allowing the GBS to take advantage of various changes in the interest rates as its purpose is to fully immunise the balance sheet against interest rate fluctuations.

The selection of a particular positioning strategy will depend on the ALCO's choice of either a speculative or prudent risk management strategy. For example, a volume strategy would be better suited to a speculative strategy whereas immunising the balance sheet against interest rate risk would be in alignment with a prudent strategy.

Of the derivative interest rate risk hedging instruments, interest rate futures and interest rate collars are the most practical. Being exchange traded on the SAFEX, interest rate futures are guaranteed and marked-to-market. Furthermore, the futures market is highly liquid, making the closing-out of positions simple. Thus futures are easily accessible and ideally suited to a smaller financial institution.

The interest rate collar derives its practicality from its cash flows being inversely related to the interest rate, as well as providing certain cost reducing capabilities. As the interest rate declines, so the cash flows from the purchase of the floor increase, while the premium paid for the purchase of the floor is offset by the premium received from the sale of the cap. Thus the collar has a cash flow

structure that is ideally suited to the GBS interest rate risk exposure as well as being more economical than other hedging alternatives.

The selection of a particular hedging instrument is a somewhat precarious task designated to the ALCO and will depend on a number of factors. The hedging technique implemented should not adversely affect the GBS business practices, while other considerations such as cost and complexity in terms of monitoring, booking and pricing should also be taken into account. Of course, if all of the abovementioned hedging alternatives are found to be incompatible for any reason, the ALCO has the option to retain the *status quo.*

The thesis also investigated the theoretical structure of a bank's ALCO in terms of its functions and organisation and provided recommendations to the GBS ALCO. It was found that the GBS has a well functioning ALCO where the bank's profitability reflects its competent managerial team. The primary encumbrance to its functionality is the inadequacy of the informational technology used to measure its interest rate risk position and hedging activities.

7.3 SUGGESTIONS FOR FURTHER RESEARCH

Since the ALCO is also responsible for a bank's liquidity risk management, the study could be extended to include this risk-type. Due to their relationship, the management of these two risks is viewed as a somewhat enigmatic task. For example, if a normal yield curve is assumed the bank will borrow funds short and lend them long. In so doing it increases its interest rate exposure and profitability but at the cost of bank liquidity. Thus the lack of liquidity can become a restraint on its profitability which is often referred to as the 'tension' between profitability and liquidity (UBS, 1987: 40).

Another interesting addition would be the inclusion of other financial risks that fall outside the scope of the ALCO. Of course, the most significant would be credit

risk because any hedging obligation that cannot be fulfilled by the counterparty will increase the bank's credit risk (UBS, 1987: 39).

7.4 CONCLUSION

This chapter commented on the practicality of a number of balance sheet positioning strategies that could be adopted by the GBS ALCO, specifically advocating two: a volume strategy and immunisation. Two interest rate derivative instruments were also suggested for this purpose: interest rate futures and interest rate collars proved to be the most practical. The decision to include any one hedging technique depends, of course, on the preference of the GBS ALCO.

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APPENDIX A

Nedbank interview

Interview with: Mr Graeme Auret: Division Director: Corporate Banking
Ms Chantal Lippiatt: Head: Derivatives Sales

Venue: Nedbank Head Office, 135 Rivonia Road, Johannesburg.

Gareth Williamson (hereafter GW): I have identified four possible hedging techniques that can be used to hedge interest rate risk; these include: immunization, pricing strategies, securitization and derivative hedging. Considering the bank in question is a small mutual bank in Grahamstown, which out of these would be the most practical?

Graeme Auret (hereafter GA): Suggests that securitization would be an impractical tool for hedging for a number of reasons.

Firstly hedging only really starts to disseminate risk after a critical mass is reached. Nedbank has securitized balance sheet items successfully, but the true benefits only occur at the R500 million mark. Some benefits can be seen at R250 Million, but the process of securitization is expensive below this amount. The bank in question is small so reaching the critical mass could be problematic.

Secondly the buyer of the securitized asset must be taken into account. Will a buyer purchase a securitized asset from a B grade financial institution?

Lastly, securitization is also only really effective if the process is continually rolled over and added to. The securitized asset can be viewed as a product by the buyer. Will a buyer purchase a once off securitization tranche or one that is rolled over infrequently?

GA: Suggests that a pricing strategy may also be impractical for a number of reasons, these include:

A pricing strategy is only effective if the bank has a large amount of customers, so that the balance sheet quickly starts to reflect the volumes changing on either side of the balance sheet. This method may also be quite dangerous as there are many other risk factors (such as credit risk) tied up with the interest rates quoted by the bank. For a small bank this may lead to a run on deposits which has solvency and liquidity aspects to it. I suggest that there should not be too many fixed rates provided as the technology for determining (forecasting) future interest rates may not be advanced enough and may contribute to the interest rate risk position.

GA: I suggest that immunization may be practical, especially the use of government bonds and treasury bills. It must be noted however that this may be problematic for two reasons

Firstly government stock has pockets of liquidity, so trading may be problematic in some stocks.
Secondly, since there are pockets of liquidity, perfectly matching maturities is problematic, but it is possible to get the maturities quite closely matched.

Chantal Lippiatt (hereafter CL): I suggest two derivative instruments could be used quite successfully.

1) The use of caps and floors (collars). Especially the purchasing of a floor and selling of a cap in the current yield curve environment. It is also suggested that the collar should not exceed three years due to the volatility in interest rates beyond this time frame. My outlook is that the yield curve will stay flat until Quarter 2 of 2008, and thereafter the rate of interest should drop by 100 basis points. The use of floors and caps is, however seen as administratively intensive.
2) The use of swaptions. This is viewed as a viable option as to lock in interest rates while still retaining the option to let the contract subside if not beneficial. The period of the contract should be no longer than 12 months. This method is seen as less administratively intensive than the cap and floor method. In the current yield curve environment I suggests the swaption should strike at today's level.

There were a number of other suggestions from the interviewees. These include:

- The real risk in managing interest rate risk is the affect interest rates have on credit risk. Nedbank issues credit to customers if they deem the customer able to withstand interest rate shocks of 3%. This shock is also dependant on the position the customer is in with regard to the interest rate cycle. If the client requires credit at the top of the cycle, the interest rate shock is reduced to between 1% and 2% increase, whereas if the client demands credit at the bottom of the interest rate cycle the interest rate shock could be 3% or more.
- Nedbank suggests that since the bank is small, a run on deposits may close the bank. It therefore suggests it keeps assets over and above their minimum solvency and liquidity ratios.
- The bank may have over extended themselves in long dated assets. Nedbank has a typical deposit book of a maturity of 3 months and an asset book of 5 year maturity.
- Nedbank appreciates the community banking business approach as a method to entice customers away from the other big four banks, but suggests that GBS should try divorce itself from customers gaining special interest rates as it may squeeze margins and enhance other risks. Nedbank did however find an exception to this, whereby customers can be granted special rates upon credit worthiness and if the customer brings in some critical mass to the bank.

- Nedbank views the interest rate risk as a secondary to credit risk. Nedbank does however note that the two are inextricably linked and would go so far as to say that the interest rate environment determines the credit risk environment. Bank failure may be dependant on the interest rate environment at the point of over lending. The actual failure of a bank may only occur after 2 years from the initial over lending due to the lag for monetary policy to become effective within the economy.

Disclaimer: It is important to note that this document must be regarded as confidential between the interviewer, Mr G Williamson, and Professor Faure of Rhodes University. No person may be held accountable for the information contained within this document.

Deutche Bank interview

Interview with: Mr Alistair Brown: Vice President (London, England)

Venue: Electronic mail conversation.

Gareth Williamson (hereafter GW): I have identified four possible hedging techniques that can be used to hedge interest rate risk, these include: immunization, pricing strategies, securitization and derivative hedging. Considering the bank in question is a small mutual bank in Grahamstown, which out of these would be the most practical?

Alistair Brown (hereafter AB): I suggest that securitization would be an impractical tool for hedging as it requires a critical mass and more than one issue to be successful. It is also very expensive and more of a tool to hedge consumer credit risk and provide funding than to hedge rates.

AB: I suggest two derivative instruments could be used quite successfully.

3) The use of interest rate forwards: these can be used because they can reduce the interest rate risk exposure with a great degree of practicality.
4) The use of interest rate futures: I would suggest this as the most viable option for the bank because there is more liquidity in the futures market meaning you can put your hedges at cheaper levels and get out of them at a low bid/offer - i.e. cheaper. The smaller bid/offer spread allows the client to hedge delta perfectly. One draw back is that the product cannot be packaged together into one instrument which nets across cash flows (e.g. a swap).

There were a number of other suggestions from the interviewee. These include:

- Swaps may be impractical as these instruments require credit lines with market makers, which a smaller bank may not have access to. Swaps also require a large amount of monitoring and booking administration.

- Interest rate options may be impractical because smaller banks often pay option premiums, which will affect the price of the option. The options contract also requires booking and monitoring administration. Hedging interest rate risk with the use of options contracts also requires sophisticated valuation techniques.

- Options on swaps: The same practical issued apply regarding monitoring, booking and pricing, but they are nonetheless a good way of hedging

convexity. The hedging needs to be longer than 10 years as anything shorter may be too expensive.

- Options on futures: These contracts can be used to hedge interest rate risk but are quite complex and therefore more expensive.

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