The regulatory treatment of liquidity risk in South Africa

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Dissertation submitted in the School of Economics of the North-West University (Potchefstroom campus) in partial fulfilment of the requirements of the degree *Magister Commercii (Risk Management)*

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April 2008

"Anyone who stops learning is old, whether at twenty or eighty.
Anyone who keeps learning stays young."

Henry Ford

Acknowledgements

I would like to thank my supervisor, Professor Paul Styger for his insight and suggestions. As with any big project, one is always dependent on other people for help and suggestions, therefore thank you to all the people whom I consulted from time to time for their suggestions and input, especially Jackie Brevis, Sandra de Lange, Carel Oosthuizen, Leon Potgieter and Rob Urry of the South African Reserve Bank for making time to accommodate my questions and queries. I would also like to thank Gunter Joachim for taking the time to discuss practical aspects of liquidity risk in South Africa with me.

I would like to extend a very special thank you to Ziets Botha, Sandra de Lange, Maarten Fouche, Margaux Noble, Leon Potgieter, Zurika Robinson and Rob Urry for each reading at least one chapter of my dissertation and for their valuable inputs and suggestions. Also thank you to Aléta Mostert who ensured that my spelling and grammar were correct.

Then to my mom Petra and dad Gawie and my two brothers, Gabriël and Riaan, thank you for all the support and sacrifices that you have made. I am very grateful that all of you were here to see me achieve this.

Lastly, I would like to thank all the wonderful people that I know. Each of you has made some impact on and contribution to my life.

Dedication

I dedicate this study to my grandfather who turns 94 this year (2008). Thank you for all the advice and knowledge that you have passed on to us all. You are a wonderful role model and I have nothing but respect and admiration for you. I aspire to one day achieve true greatness as you have done.

Abstract

South Africa will be implementing Basel II on 1 January 2008. Basel II provides regulatory capital requirements for credit risk, market risk and operational risk. The purpose of capital requirements is to level the playing field for all internationally active banks and to protect consumers against these risks. Although there is an obvious threat of liquidity risk and it is important to correctly measure and manage liquidity risk, it is almost glaringly omitted from Basel II.

The result of not managing liquidity risk properly may have dire consequences for banks because a liquidity crisis may happen without warning. Therefore, the aim of this study was to explore current practices and to propose guidelines for effective liquidity risk regulation in South Africa. A literature study and quantitative analysis on liquidity risk in South Africa were conducted to assess whether it is valid for regulators to require banks to hold capital for liquidity risk.

This study provides conclusions and recommendations on the regulatory treatment of liquidity risk in South Africa under Basel II. Although Pillar 2 reviews a variety of other risks and not only liquidity risk, it is proposed that the liquidity risk part of such reviews is conducted on the basis of a questionnaire used to determine possible gaps between banks' practices and prescribed criteria regarding the management and measurement of liquidity risk. It is important to note that such an approach has a constraint in terms of the substantial amount of work that would have to be done on the regulation of liquidity risk by both regulators and banks. Therefore resource constraints and the cost versus the benefit of such an approach would have to be considered carefully.

The all-encompassing conclusion to this study is that capital would not be an effective mitigant for liquidity risk for a number of reasons. Liquidity risk differs from bank to bank and a general capital charge for all banks may not be sensible, therefore liquidity risk should be analysed on a bank-by-bank basis. In other words, capital could be charged for liquidity risk under Pillar 2(b) of Basel II. Such a capital charge would not serve the purpose of covering losses resulting from liquidity risk, but would instead impose a penalty on banks that are deemed to manage and measure liquidity risk imprudently. Such a penalty would typically be quite small but would serve as an incentive for banks to improve their management and measurement techniques to the desired level as set out by prescribed criteria. The criteria that should be used for determining whether banks measure and manage liquidity risk prudently should be of such a nature that the Bank Supervision Department (BSD) of the South African Reserve Bank (SARB) complies with Basel Core Principle 14: Liquidity Risk in regulating liquidity risk. In addition, it should align the criteria used to the 14 Principles for the sound management of liquidity as prescribed by the Bank for International Settlements and the Institute of International Finance.

Furthermore, it is proposed that the BSD should not prescribe to banks which methods to use to report their liquidity risk, because all banks are not the same in terms of size and sophistication. For this reason, banks should be allowed to follow an *internal models approach for liquidity risk* whereby banks are, subject to regulatory approval, allowed to use their own internal liquidity risk measures to report liquidity risk to the BSD. This approach is similar to the approach followed by the Bundesbank in Germany.

A liquidity risk questionnaire could be drafted according to which banks' liquidity risk management and measurement is assessed in terms of the sound Principles for managing liquidity risk and the Basel Core Principles. One questionnaire could be used for the purposes of assessing the quality of banks' liquidity risk management and measurement in terms of a Supervisory Review and Evaluation Process (SREP) as well as for banks applying for approval of an *internal models approach for liquidity risk*. The same questionnaire could be used for both purposes, or the questionnaire could be divided into two clear sections whereby all banks are required to answer the SREP (or Pillar 2(b)) section, and only banks applying for the use of an *internal models approach for liquidity risk* are required to complete this section.

A further conclusion to this study is that the BSD should publish a framework in which its approach to regulating liquidity risk is described in detail. Some aspects that should be included in such a document include a widely-accepted definition for liquidity risk and guidelines/minimum standards for measurement and management techniques for liquidity risk and the process that will be followed under Pillar 2 of Basel II.

If the BSD is concerned about the level of potential liquidity risk in the South African banking system, it should consider having the additional instruments that are eligible as collateral included as instruments eligible for liquid asset reserve requirements. An additional mitigant for liquidity risk may be that the BSD requires banks to report their liquidity risk more frequently than the current monthly basis.

Key terms

- Liquidity risk
- South Africa
- Basel II
- Sound principles for managing liquidity risk
- Regulatory treatment of liquidity risk

Opsomming

Basel II word op 1 Januarie 2008 geïmplimenteer Suid-Afrika. Basel II vereis van banke om regulatoriese kapitaal te hou vir krediet-, mark- en operasionele- risiko. Die doel van die kapitaalvereistes is om die speelveld tussen internasionale aktiewe banke gelyk te maak en om die publiek te beskerm teen hierdie risiko's. Alhoewel likiditeitsrisiko 'n groot gevaar inhou en dit van uiterste belang is om dit korrek te meet en te bestuur, is dit 'n wesenlike weglating in Basel II.

As likiditeitsrisiko nie behoorlik bestuur word nie, kan dit ontsettende gevolge hê omdat dit kan toeslaan sonder enige waarskuwing. Daarom was die doel van hierdie studie om huidige praktyk rondom die bestuur van likiditeitsrisiko te bestudeer en om riglyne vir die effektiewe regulering van likiditeitsrisiko in Suid-Afrika daar te stel. 'n Literatuurstudie en kwantitatiewe analise oor likiditeitsrisiko in Suid-Afrika was gedoen om te bepaal of dit houdbaar is vir bank toesighouers om van banke te vereis om kapitaal te hou vir likiditeitsrisiko.

Die studie voorsien gevolgtrekkings en voorstelle aangaande die regulatoriese hantering van likiditeitsrisiko in Suid-Afrika onder Basel II. Alhoewel die hersiening van Pilaar 2 'n verskeidenheid risiko's insluit, word dit voorgestel dat die likiditeitsrisiko gedeelte daarvan op die basis van 'n vraelys gedoen word waarvolgens die Departement Banktoesighouding (DBT) van die Suid-Afrikaanse Reserwebank (SARB) elke bank se proses vir die bestuur en meting van likiditeitsrisiko evalueer. Die vraelys kan gebruik word om tekortkominge, gebasseer op voorgeskrewe kriteria, in banke se huidige likiditeitsrisiko meting en bestuur te identifiseer. Dit is belangrik om in ag te neem dat 'n tekort aan hulpbronne 'n beperking kan wees as so 'n benadering gevolg word. Daarom is dit belangrik om 'n behoorlike analise te doen in terme van die voordele en nadele van so 'n benadering.

Die omvattende gevolgtrekking tot hierdie studie is dat kapitaal nie 'n effektiewe versagtende middel vir likiditeitsrisiko is nie as gevolg van 'n verskeidenheid redes. Likiditeitsrisiko verskil van bank tot bank en 'n algemene kapitaalvereiste vir likiditeitsrisiko vir alle banke sal nie sinvol wees nie, daarom moet likiditeitsrisiko ge-analiseer word op 'n bank-tot-bank grondslag. Met ander woorde, daar kan 'n kapitaalvereiste vir likiditeitsrisiko onder Pilaar 2(b) van Basel II gehef word. So 'n kapitaalvereiste sal nie die doel dien om verliese wat deur likiditeitsrisiko veroorsaak word te dek nie, maar eerder om banke te straf wat beskou word as banke wat nie likiditeitsrisiko behoorlik en konserwatief meet en bestuur nie. So 'n kapitaalvereiste sal tipies baie klein wees, maar sal as aansporing dien vir banke om hulle likiditeitsrisiko meting en bestuurstegnieke te verbeter tot die gewensde vlak soos voorgeskryf deur sekere kriteria. Die kriteria vir sulke evaluasies moet van so 'n aard wees dat die DBT aan die vereistes van Beginsel 14 van die *Basel Core Principles* voldoen in die regulering van likiditeitsrisiko. Die DBT moet ook die kriteria in lyn bring met die veertien

Beginsels vir die effektiewe bestuur van likiditeitsrisiko soos beskryf deur die *Bank for International Settlements* en die *Institute of International Finance*.

Verder word dit voorgestel dat die DBT verkieslik nie aan banke moet voorskryf watter tegnieke van likideitsrisiko meting en bestuur te implimenteer nie. Die rede hiervoor is dat alle banke nie op dieselfde vlak is in terme van grootte en kompleksiteit nie. Daarom moet banke toegelaat word om 'n *interne modelle benadering vir likiditeitsrisiko* te volg waaronder, onderworpe aan regulatoriese goedkeuring, hulle toegelaat kan word om hulle eie maatreëls te gebruik om hulle likiditeitsrisiko aan die DBT te rapporteer.

'n Likiditeitsrisiko vraelys kan opgestel word waarvolgens banke se likiditeitsrisiko bestuur en meting ge-evalueer word in terme van die Beginsels vir die effektiewe bestuur van likiditeitsrisiko en die *Basel Core Principles*. Dieselfde vraelys kan gebruik word vir beide die evaluasie van die kwaliteit van banke se likiditeitsrisiko meting en bestuur in terme van 'n *Supervisory Review and Evaluation Process (SREP)* onder Basel II asook vir banke wat aansoek doen vir goedkeuring van 'n *interne modelle benadering vir likiditeitsrisiko.* Daarvolgens kan so 'n vraelys in twee duidelike seksies verdeel word waarvolgens alle banke vereis word om die *SREP* of Pillaar 2(b) seksie te beantwoord, en slegs banke wat aansoek doen vir die goedkeuring vir die gebruik van 'n *interne modelle benadering vir likiditeitsrisiko* vereis word om hierdie bylae te beantwoord.

'n Verdere gevolgtrekking van hierdie studie is dat die DBT 'n raamwerk moet publiseer waarin hulle hulle regulatoriese benadering ten opsigte van likiditeitsrisiko in detail beskryf en waarin 'n algemene aanvaarde definisie vir befondsings-likiditeitsrisiko geformuleer word.

As die DBT bekommerd is oor die vlak van potensiële likiditeitsrisiko in die Suid-Afrikaanse banksektor, kan hulle oorweeg om die addisionele instrumente wat geskik is om te gebruik as kollateraal in te sluit as geskikte instrumente wat gehou kan word as likiede bates vir die likiede-bate reserwevereistes. 'n Addisionele versagtende middel vir likiditeitsrisiko kan wees dat die DBT van banke vereis om op 'n meer gereelde basis hulle likiditeitsrisiko aan die DBT te rapporteer as die huidige maandelikse basis.

Sleutelterme

- Likiditeitsrisiko
- Suid-Afrika
- Basel II
- Beginsels vir die bestuur van likiditeitsrisiko
- Regulatoriese behandeling van likiditeitsrisiko

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Chapter 1
Introduction

"In particular, the Committee underscored the importance of implementing the Basel II capital framework, ***strengthening supervision and risk management practices in areas like liquidity risk,*** *and improving the robustness of valuation practices and market transparency for complex and less liquid products."* (Bank for International Settlements (BIS), 2007a:1).

1.1 Context

The implementation of the International Convergence of Capital Measurement and Capital Standards – A Revised Framework (known as Basel II) becomes effective in South Africa on 1 January 2008. Basel II provides for regulatory capital requirements for credit risk, market risk and operational risk. The purpose of capital requirements is to level the playing field for all internationally active banks and to protect consumers against these risks (Koch and MacDonald, 2006:312).

Central to liquidity in banks is the fact that most banks are in the business of liquidity transformation, i.e. they take deposits that are often payable to customers on demand or on notice over a short period and use it to fund credit facilities to borrowers over longer periods of time (Financial Supervision Commission (FSC), 2005:2). It is often argued that credit risk is the single largest risk facing banks, but more banks have failed because of liquidity risk than credit risk (Hoggarth *et al.*, 2003:109-111 and Champ 2003:2-3). The reason for this is because banks are particularly vulnerable to a sudden unexpected demand on them for funds. Liquidity problems experienced by a particular bank can quickly and easily spread to other banks and have dire consequences for the financial system as a whole (Reserve Bank of Australia (RBA), 1998:1). Liquidity risk can have contagion effects across an entire banking system, and Wolf (2007) states that perhaps the answer is tighter regulation in the form of higher capital requirements, or perhaps an obligation to obtain long-term subordinated debt, or specific liquid asset reserve requirements.

West (2004:8-13) identified some of the major financial risk management crises that took place during the decade up to 2004 and, in most of them, liquidity risk was central. High-profile financial disasters such as those by Orange County Municipality, Barings Bank, Long Term Capital Management (LTCM), Enron and more recently that of Amaranth Advisors LLC have reiterated the integral part that risk management has to play in the day-to-day management of banks and other institutions. For this reason it is important that liquidity risk forms part of banks' overall risk

management strategies. In addition, the Bank for International Settlements (BIS) has issued guidelines on the sound management of liquidity risk for banking institutions. These sound practices are set out in a list of fourteen principles that ensure sound liquidity management, but a capital charge for liquidity risk is not prescribed (BIS, 2000b:1).

However, the above-mentioned measures and practices do not quantify liquidity risk as a number which can be interpreted as being dangerous or not. Berger and Bouwman (2006:1) support this view and state that there is currently no comprehensive measure of bank liquidity risk. For this reason they attempt to develop a comprehensive measure and explore the relationship between bank liquidity creation and capital. Belousov and Bobyshev (2005:3) explain how liquidity risk should be incorporated into overall market risk measurement, while Kronseder (2003c) explores the possibility of applying a "liquidity-at-risk" measure to complement current measures. Kronseder (2003a:4-5) and the BIS (2006f:6-8) have explicitly identified and discussed the sources of liquidity risk while the Hong Kong Monetary Authority (HKMA) (2004:52), among others, have identified early warning signals for liquidity problems, but the regulatory treatment of liquidity risk under Basel II remains vague.

The fact that many banks have previously failed as a result of liquidity crises and are exposed to liquidity risk daily, along with the uncertain treatment thereof under Basel II, leads to the question: "Is it valid for regulators to require a capital charge under Pillar 2 (the supervisory add-on) of Basel II given current practices in the management and measurement of liquidity risk?"

1.2 Rationale for this study

This section focuses on the rationale for doing this study. It covers the problem statement, objectives and methodology.

1.2.1 Problem statement

Although the danger of liquidity risk and the importance to correctly measure and manage liquidity risk are obvious, the treatment thereof is an almost glaring omission from Basel II. This is emphasised by the fact that the term "liquidity risk" appears only three times in the Basel II document of almost 350 pages. The BIS does not require banks to hold capital against liquidity risk as a Pillar I requirement. Instead, it has set forth a set of guidelines in two papers called *Sound Practices for Managing Liquidity in Banking Organisations* (BIS, 2000b) and *The Management of Liquidity Risk in Financial Groups* (BIS, 2006f). These quantitative and qualitative standards and guidelines, together with the Basel Core Principles serve as the only guidelines on the regulatory treatment of liquidity risk.

1.2.2 Objectives

The result of not managing liquidity risk properly may be dire for banks because a liquidity crisis may happen without warning. Therefore, the aim of this study is to explore current practices of the management and measurement of liquidity risk and to propose guidelines for effective liquidity risk regulation in South Africa. This study provides conclusions and recommendations on the regulatory treatment of liquidity risk in South Africa under Basel II.

1.2.3 Methodology

To reach the goal and objectives of the study, firstly a quantitative analysis on liquidity risk in the South African banking system was conducted. Secondly, a liquidity risk questionnaire was presented to a variety of bankers and ex-bankers in order to assess whether it is, in their view, valid for regulators to require banks to hold capital for liquidity risk.

In order to determine the state of funding liquidity and, therefore, the degree of funding liquidity risk in a country's banking sector, the analysis of an aggregated balance sheet of all the banks in that country could prove useful. For doing this, data was gathered from the South African Reserve Bank (SARB) website where all DI returns that are submitted by the banks to the SARB are available in an aggregated version. Data was collected from the DI 100 (regulatory balance sheet) and DI 300 (liquidity risk return) for the 60 months from May 2002 to April 2007 for the aggregate banking sector. The liabilities and assets sides of the DI 100 were analysed separately in terms of the term structure and composition of each side before a conclusion was reached regarding the funding mismatch of the South African banking sector on an aggregated basis.

The analysis conducted on the aggregated DI 300 used only lines 1-7, or the contractual mismatch (SARB, 2007a). The reason for this is that different banks use different ALCO models and apply different assumptions to arrive at their theoretical mismatch figures, whereas contractual mismatches are not subject to any assumptions. The analysis on the DI 300 was conducted to determine whether results would support those from the analysis done on the DI 100.

An analysis on the aggregated figures of the South African banking sector does, however, not indicate exactly where the liquidity risk lies. The DI 900 is a return completed and submitted to the SARB on a monthly basis which indicates the institutional and maturity breakdown of liabilities and assets. Data was collected from the DI 900 for five quarterly periods from April 2006 to April 2007 and not for the same period of time as was the case for the analyses on the DI 100 and DI 300 returns to avoid the onerous exercise of calculating eleven ratios for eleven

institutions for sixty months. Each return represents data only for the month in which it was submitted.

The analysis conducted on the DI 900 was similar to the analysis done by Saayman (2003), because the ratios used in that study fell perfectly into the paradigm of this paper. The liquidity positions of ten different banks as well as that of the total banking sector in South Africa are calculated. Five months' information was used, namely April 2006, July 2006, October 2006, January 2007 and April 2007.

1.3 Document structure

The dissertation is structured as follows.

Chapter 2 defines and describes characteristics, sources and ways in which liquidity risk can be mitigated.

Liquidity risk management, a typical asset and liability management committee (ALCO) process, and various ways in which to measure liquidity risk are discussed in Chapter 3.

Chapter 4 covers Basel II and liquidity risk. The chapter starts by defining regulatory capital and economic capital and highlights some of the main differences between the two. The chapter then provides an overview of Basel II and its history. As liquidity risk is expected to be treated under Pillar 2 of Basel II, the chapter discusses Pillar 2 in more detail, paying attention to the Principles of Pillar 2, as well as the Supervisory Review and Evaluation Process and banks' Internal Capital Adequacy Assessment Processes. Pillar 3 is discussed briefly at the end of the chapter, after which an assessment is made on where liquidity risk fits into Basel II.

Chapter 5 discusses international best practice guidelines for the management of liquidity. This is followed by a discussion on Basel Core Principles and specifically Core Principle Fourteen, to ascertain what is expected from regulators in terms of regulating liquidity risk from a theoretical point of view.

Chapter 6 focuses on liquidity risk in South Africa. Practical aspects of the South African banking system are described before the aggregate banking sector balance sheet and liquidity risk returns are analysed to determine to what extent the South African banking sector is exposed to liquidity risk. A liquidity ratio analysis is also performed on ten banks in the South African banking sector, after which liquidity risk in South Africa is discussed in terms of responses received to a questionnaire that was compiled.

Chapter 7 applies the theory that is discussed in Chapter 5 in order to make recommendations and proposals on how liquidity risk could be regulated in South Africa from a practical perspective

Chapter 8 provides a summary of findings, conclusions and implications, and future research opportunities.

Chapter 2
Liquidity Risk

2.1 Introduction

According to Brar (2005:1), one of the primary reasons why there has been increased attention on liquidity risk in recent years, is the anticipated impact of Basel II. Basel II will have a significant impact on current practices with regard to liquidity risk management and, more specifically, funding liquidity risk. Basel II is intended to ensure that financial institutions have sufficient capital commensurate with their risk profiles. Even though the importance of and potential damage that liquidity risk may inflict on banks and whole financial systems, its treatment remains vague in Basel II. In order to propose how liquidity risk should be treated in South Africa, it is important to thoroughly understand what liquidity risk is, where it comes from and how it can be mitigated. This chapter discusses all these elements to provide a background understanding of liquidity risk, its meanings, its characteristics and how it can be mitigated. Chapter 3 ties in with this chapter and discusses the management and measurement of liquidity risk.

A discussion of and a definition for the different kinds of liquidity risk are firstly given to formulate an all-encompassing definition of liquidity risk for the purpose of this study. In the second section of this chapter, the characteristics of liquidity risk are discussed as it is extremely important to understand them before liquidity risk can be managed effectively. The sources of liquidity risk as well as the link between liquidity risk and other risks are discussed, after which early warning signals of liquidity risk and methods to mitigate liquidity risk are discussed. It is noteworthy to mention that while sources, early warning signals and mitigating controls are closely related topics, they are discussed separately.

2.2 Defining liquidity risk

2.2.1 Introduction

The nature of the business of banks implies that often solvent banks may be subject to panic runs and, consequently, illiquidity (Davis, 2003:2). Central to liquidity in banks is the fact that most banks are in the business of liquidity transformation, in other words, they take deposits that are often payable to customers on demand or on notice over a short period of time and use it to fund credit facilities to borrowers over longer periods of time (FSC, 2005:2). Banks supply liquidity to both individuals and companies and they take on liquidity risks as an essential part of their lending and deposit-taking activities. Deposits that banks take are typically demand

deposits that can be withdrawn immediately, but banks normally re-lend such funds over longer terms, such as a five-year car loan. This creates a mismatch between the payment profiles for deposits and loans (Danmarks Nationalbank, 2006:98-99). This is essentially the origin of banking liquidity risk and this view is supported by Vinogradov (2006:22). According to Vinogradov (2006:22) Hübner suggested in 1854 that the Golden Rule of Banking did not allow for any mismatch between the maturities of assets and liabilities. In other words, if a debt is to be paid off, there should be a credit in the same amount which has to be paid on the same day. Theoretically, by ensuring this, liquidity risk would be eliminated, assuming no delays in payments or defaults.

It was mentioned in section 1.1 that credit risk is often considered to be the single largest risk facing banks, but more banks have failed because of liquidity risk than credit risk (Hoggarth *et al.*, 2003:109-111 and Champ 2003:2-3). The reason for this is that banks are particularly vulnerable to a sudden demand on them for funds and liquidity risk has previously been described as the assassin of banks (Syed, 2004:1). Diamond and Dybvig (1983:401) were of the same opinion and stated that bank runs have been common occurrences during the extreme crises that had played a prominent role in monetary history. Depositors rush to a bank during a bank run and withdraw all their funds because they expect the bank to fail. The sudden withdrawals can lead to the bank having to liquidate its assets in order to meet the customers' demand to withdraw funds. Often during a panic, banks have to liquidate their assets at a loss, which could lead to the bank failing. Liquidity problems experienced by a particular bank can quickly and easily spread to other banks and have dire consequences for the entire financial system (RBA, 1998:1).

When doing a study on liquidity risk, it is important to note that the term "liquidity risk" has various meanings, depending on the context in which it is used, e.g. market liquidity of financial instruments, liquidity in payment, clearing and settlement systems, monetary-policy liquidity and the financial liquidity of individual entities (Danmarks Nationalbank, 2006:97). It is therefore important to look at various definitions and their meanings in the broader context of liquidity risk management to distinguish the various types of liquidity risk.

Bessis (2002:16) identified three types of liquidity risk namely funding liquidity risk, market liquidity risk and asset liquidity risk. Each of these are briefly defined and discussed.

2.2.2 Funding liquidity risk

Matz and Neu (2007:5) divide funding liquidity risk into two components, namely:

i. ***Mismatch or structural liquidity risk.*** Mismatch or structural liquidity risk refers to the liquidity risk inherent in the bank's current balance sheet structure due to maturity transformation in the cash-flows of individual positions.

ii. ***Contingency liquidity risk.*** Contingency liquidity risk refers to the risk that a future event may require a significantly larger amount of cash than a bank's projections might suggest. This is the risk that the bank may not have sufficient liquidity to meet sudden and unexpected short-term obligations.

Clarke (2007:16) identifies two other components of funding liquidity risk, which are:

iii. ***Liquidity for growth.*** Liquidity for growth is described as funds that are available to take advantage of attractive business opportunities.

iv. ***Liquidity for survival.*** Liquidity for survival is funds that are available to meet financial commitments when they are contractually due.

The remainder of this section offers some definitions of liquidity risk which contain elements of both the types described above in an attempt to formulate a definition of liquidity risk that will apply to the rest of this study.

Funding liquidity risk depends on how risky the market perceives the issuer to be as well as its funding policy (Bessis, 2002:16). A bank going to the market with unexpected and frequent funding needs sends negative signals to the market, which may influence the market's willingness to lend funds to this bank. The cost of funds is also determined by the bank's credit standing, i.e. if the market's perception of a bank's credit standing deteriorates, the cost of funding for the bank increases. This is an important consideration because the cost of funds is a critical profitability driver (Bessis, 2002:16).

Decker (2000:6) defines this type of liquidity as an institution's ability to replace liability run-off and fund asset growth without delay and at a reasonable price. From this, liquidity risk is defined as the potential that an institution will not be able to meet its obligations as they become due. Kronseder (2003a:2) defines liquidity risk as the risk that a financial institution faces when it has an unexpected short-term cash-outflow at the end of the day. The BIS (2000b:1) describes liquidity as the ability to fund increases in assets and to meet obligations as they become due. Thus, liquidity risk is described as the risk that a bank is unable to accommodate decreases in liabilities or to fund increases in assets (BIS, 1997a:21-22). The HKMA (2004:3) defines funding liquidity risk as the risk that a bank may not be able to fund increases in assets or meet obligations as they fall due without incurring unacceptable losses. The Bank of America (2005:51) defines funding liquidity risk as a bank's inability to accommodate liability maturities and deposit withdrawals, fund asset growth and meet contractual obligations through unhindered access to funding at reasonable market rates. The Bank of Thailand (BOT) (2003:4) defines funding liquidity risk as the risk resulting from a bank's failure to pay its debts and obligations when due because of its inability to convert assets into cash, or its failure to obtain enough funding or, if it can, obtain sufficient funding that it comes at an unusually high cost which may

affect the bank's incomes and capital stock. Clarke (2007:13) defines funding liquidity risk as the ability to meet the bank's financial obligations when they are contractually due.

For this study, the following definition for funding liquidity risk is derived: *Funding liquidity risk is a risk when a bank faces a large volume of sudden and unexpected cash-outflows (a sharp decline in the bank's liabilities) or a net increase in a bank's assets or maturity/structural mismatches in the normal course of business of cash-flow transformation which cannot be funded and therefore the bank cannot meet its obligations as they become contractually due without incurring unacceptable losses.* When referring to liquidity risk, this study refers to funding liquidity risk.

2.2.3 Market liquidity risk

Fernandez (1999:1) describes liquidity as the lifeblood of modern financial markets. Adequate provision thereof is critical for the smooth functioning of an economy. Its sudden erosion in even a single market segment or in an individual instrument can stimulate disruptions that are transmitted through increasingly interdependent and interconnected financial markets worldwide. Bessis (2002:16) describes market liquidity risk as liquidity crunches that are caused by a lack of volumes. The lack of volumes traded in the market leads to prices becoming very volatile, sometimes trading at quite large discounts than usual because of counterparties' unwillingness to trade. The Financial Services Agency (2002:1) defines market liquidity risk as the risk that certain events, such as political upheavals, will impact on markets so that it will become almost impossible to trade, which will force a bank to engage in transactions at strikingly more unfavourable prices than usual.

Fayman (2004:10) identified endogenous and exogenous market liquidity risk. Endogenous market liquidity risk refers to the risk that the volume of a trade will have an adverse impact on the price at which the trade can be executed, in other words, when a bank block sells a large percentage of free floating shares of a certain company in a single trade it forces the price down in order to attract buyers. Thus, endogenous market liquidity risk can be described as the extent to which a bank influences the price at which it trades. Exogenous market liquidity, on the other hand, refers to a situation where market liquidity dries up and has an adverse impact on the price at which a trader can execute a trade, irrespective of its size. An example of this would be a market crash, where there are excess sellers and no buyers (liquidity providers), causing prices to drop excessively.

West (2004:6) identified normal/usual market liquidity risk and crisis market liquidity risk. According to the Institute of International Finance (IIF), market liquidity risk is often considered to be a component of market risk (IIF, 2007:19); therefore this study does not focus on market liquidity risk. *Normal market liquidity risk* refers to dealing in markets that are not at full liquidity in

their standard day-to-day operations. Normal market liquidity risk occurs in all financial markets, but is amplified in the financial markets of developing countries. In developing countries' financial markets, normal market liquidity risk is often the result of trading across different time zones. *Crisis market liquidity risk* refers to markets losing their normal levels of liquidity because of financial crises. This occurred frequently during the 1990s when many emerging-market countries experienced financial crises, such as the Mexican crisis, the Asian crisis and the Russian crisis.

2.2.4 Asset liquidity risk

Bessis (2002:17) states that asset liquidity risk results from a lack of liquidity related to the nature of certain assets, rather than to overall market liquidity. Algorithmics (1999:5) defines asset liquidity risk as the risk that an asset cannot be sold or hedged at the prevailing market price when required. Matz and Neu (2007:5) describes this risk as market liquidity risk and states that this is the risk that assets cannot be sold at or near its fair value. This risk is synonymous with both the cost of liquidation and the time to liquidate, and this type of liquidity risk can have several causes. Some assets, such as highly-traded Treasury Bills, are inherently more liquid than others. The BIS (2001c:17) states that asset liquidity risk represents the risk that an entity will be unable to unwind a position in a particular financial instrument at or near its market value because of a lack of depth or disruption in the market for that instrument. In South Africa, Johannesburg Interbank Agreed Rate (JIBAR) futures are inherently less liquid (Botha, 2005:100) because most futures are typically standardised and therefore restricted in terms of maturity dates (Faure, 2006:98). Eckbo and Norli (2002:1) describe liquid assets as those that trade with small direct transaction costs such as commissions and bid-ask spreads, with a minimal time delay in execution and with little or no price impact of the trade.

Position size, referring to the number of shares or bonds etc. that a bank can unwind in one day relative to that day's trading volume, plays a major role. Large fluctuations in daily trading volume can occur in the market without links to any specific events. The larger the position size relative to the market size, the more difficult it is to liquidate the position. Under stress situations where markets become volatile, liquidity also falls considerably as investors often become more risk averse and subsequently withdraws their funds. The size of the position may cause the bank to hold that position for a much longer time period, thereby increasing its liquidity risk (Algorithmics, 1999:5). This study focuses on funding liquidity risk, and therefore asset liquidity risk is not discussed further.

2.2.5 Conclusion

This section discussed the various types of liquidity risk and also described various definitions for each of the types of liquidity risk. This study focuses on funding liquidity risk and a definition for funding liquidity risk was derived from a variety of definitions and is used in the rest of this study:

> *Funding liquidity risk is the risk that a bank faces a large volume of sudden and unexpected cash-outflows (a sharp decline in the bank's liabilities) or a net increase in a bank's assets or maturity/structural mismatches in the normal course of business of cash-flow transformation which cannot be funded and therefore the bank cannot meet its obligations as they become contractually due without incurring unacceptable losses.*

2.3 Characteristics of liquidity risk

2.3.1 Introduction

In order for a bank to effectively manage its liquidity risk, it is extremely important that it thoroughly understands the sources of liquidity risk, early warning signals of potential liquidity problems and ways in which it can reduce its liquidity risk. Each of these are discussed in sections 2.3.2, 2.3.4 and 2.3.4, respectively.

2.3.2 Sources of liquidity risk

The BIS (2006f:6) states that liquidity risk can have many sources. Matz and Neu (2007:17) agree with this view and state that these sources can arise on both sides of a bank's balance sheet and, in order for a bank to be able to manage it sufficiently, it should first know and understand the possible sources of liquidity risk. This section examines the various sources of liquidity risk. It is discussed in general terms and not per type of liquidity risk that was identified and discussed in the previous section, as the source of the liquidity risk is inherent to the type of liquidity risk. Matz and Neu (2007:17) state that in most cases a trigger event meets an already existing vulnerability in a bank's balance sheet which causes liquidity problems. The BOT (2003:5-6) states that liquidity risk occurs as a result of either external or internal factors. Each of these sources, with examples, is discussed in greater detail.

2.3.2.1 External sources

External sources of liquidity risk are factors considered to be macro-factors exogenous to the bank (Syed, 2004:2). According to the BOT (2003:2) macro-factors may include:

i. ***Market volatility.*** Market movements may have negative effects on banks, for example, unexpected volatility in prices of collateralised over-the-counter (OTC) derivatives may lead to margin calls from the counterparties which will put strain on liquidity so that the bank can cushion such margins (Kronseder, 2003a:3). Clarke

(2007:10) and the BIS (2006f:8) identified this source of liquidity risk as market trends which lead to liquidity risk.

ii. ***Product driven.*** If a bank is experiencing a liquidity squeeze and has to liquidate a large position or an inherently illiquid instrument at short notice, it may have to incur losses. Furthermore, when the market realises that the bank has dealt at a loss, it may affect the bank's reputation in the market and may render it difficult for the bank to gain access to the backup loans that it would normally have access to (BOT, 2003:2). Clarke (2007:10) and the BIS (2006f:7) identified this type of liquidity risk as transaction and product driven.

iii. ***Competition.*** Competition is an important source of external liquidity risk, because depositors may decide to shift their deposits to another bank offering more favourable interest rates or lower banking charges. The main driver behind competition is a change in demographics, meaning that the general public is more knowledgeable and educated in terms of different offerings from different banks (BOT, 2003:2). In addition, timed payments strain intra-day liquidity because they increase competition in domestic and cross-border markets for high-grade collateral. The effect of such timed funding obligations on the demand for high-grade collateral is not yet fully understood. Competition may also be amplified in times of world economic recession, when many banks will be in pursuit of eroding liquidity (Kronseder, 2003b:3).

iv. ***Changes in the regulatory environment.*** When authorities change rules, for example allowing or promoting more competition, or increasing liquid assets and/or cash reserve requirements, liquidity will be affected (BOT, 2003:2).

Kronseder (2003a:4-5) added the following to external sources of liquidity risk:

v. ***The integration and interdependence of financial markets.*** This can lead to liquidity crunches that can be carried over to and from systems in countries across the world. Clarke (2007:10) stated that this type of liquidity risk is mainly event-driven, which is when liquidity is affected by a certain event. This happened after the Asian crisis when its "contagion" spread to the markets of various other emerging markets and again in August 2007 when the sub-prime crisis affected markets in the United States of America as well as in markets across Europe.

vi. ***Credit risk of a counterparty.*** If the credit-rating of a counterparty is downgraded, it might lead to a run on the counterparty, but normally a credit-rating downgrade will make it difficult for the counterparty to obtain funding at a reasonable cost or to obtain funding at all. These in turn may erode its ability to fulfil its commitments to the bank and may especially cause a severe problem to the bank if this is a close relationship where the counterparty may be considered as the lifeblood of the bank.

vii. ***Correlation with other risks.*** This is considered to be a critical external source of liquidity risk and is therefore discussed in section 2.3.2.2 below in some more detail (Kronseder, 2003b:4).

2.3.2.2 Correlation of liquidity risk with other risks

Matz and Neu (2007:15) stated that liquidity risk is a secondary risk as increases in liquidity risk always follow one or more spikes in other financial risks. Movements in interest rates, for example, directly affect the cost of funding and the cost of carry for the bank. The HKMA (2004:8) adds that liquidity risk is not mutually exclusive but is often caused by credit risk, operational risk, reputational risk, or strategic risk. For this reason liquidity risk should not be considered in isolation because real or perceived problems with any of the above risks may render it difficult for the bank to access funds when it needs to. The IIF (2007:20) adds that it is important that liquidity risk management practices are incorporated in a bank-wide, integrated risk management framework that also includes market, credit, operational and other appropriate risks. The correlation of liquidity risk with other risks ranging from credit risk of counterparties to traditional lending commitments is illustrated in Figure 2.1. The diagram highlights the critical importance of liquidity risk because of its interconnected nature with various other risks. The HKMA (2004:55-56) described how a bank's liquidity risk may be affected by other risks as follows:

i. ***Credit risk.*** Banks that take on more credit risk may be increasing their liquidity risk, because a significant increase in a bank's non-performing loans and bad debt charges may be perceived by rating agencies and providers of funds as signs of a deterioration of asset quality and potential liquidity problems (HKMA, 2004:55). These two factors are considered to be internal sources of liquidity risk and are discussed in section 2.3.2.3, following this discussion. The Office of the Comptroller of the Currency (OCC) (2001:4) states that the institution's own credit risk is also a large risk. If, for instance, rating agencies go a step further and downgrade the bank's credit-rating, it means that the bank will have to pay more for funds and that its reputation may be damaged severely.

ii. ***Operational risk.*** Operational risk is defined as the risk of loss resulting from inadequate or failed processes, people, systems, or external events (BIS, 2004b:137). This definition includes legal risk but excludes reputational and strategic risk. If operational systems fail to process or cause a delay in the execution of transactions, a bank's liquidity position may be affected significantly by its operational risk. If failures occur in the bank's funds transfer and clearing systems, its ability to make on-time value-date payments will be affected directly. Banks should also consider their operational capabilities to participate in repurchase-style transactions should they be in

a situation where they need liquidity. This is an important point because access to central bank funding is crucial for liquidity risk management, and the SARB system of accommodation is discussed in section 6.2.4.

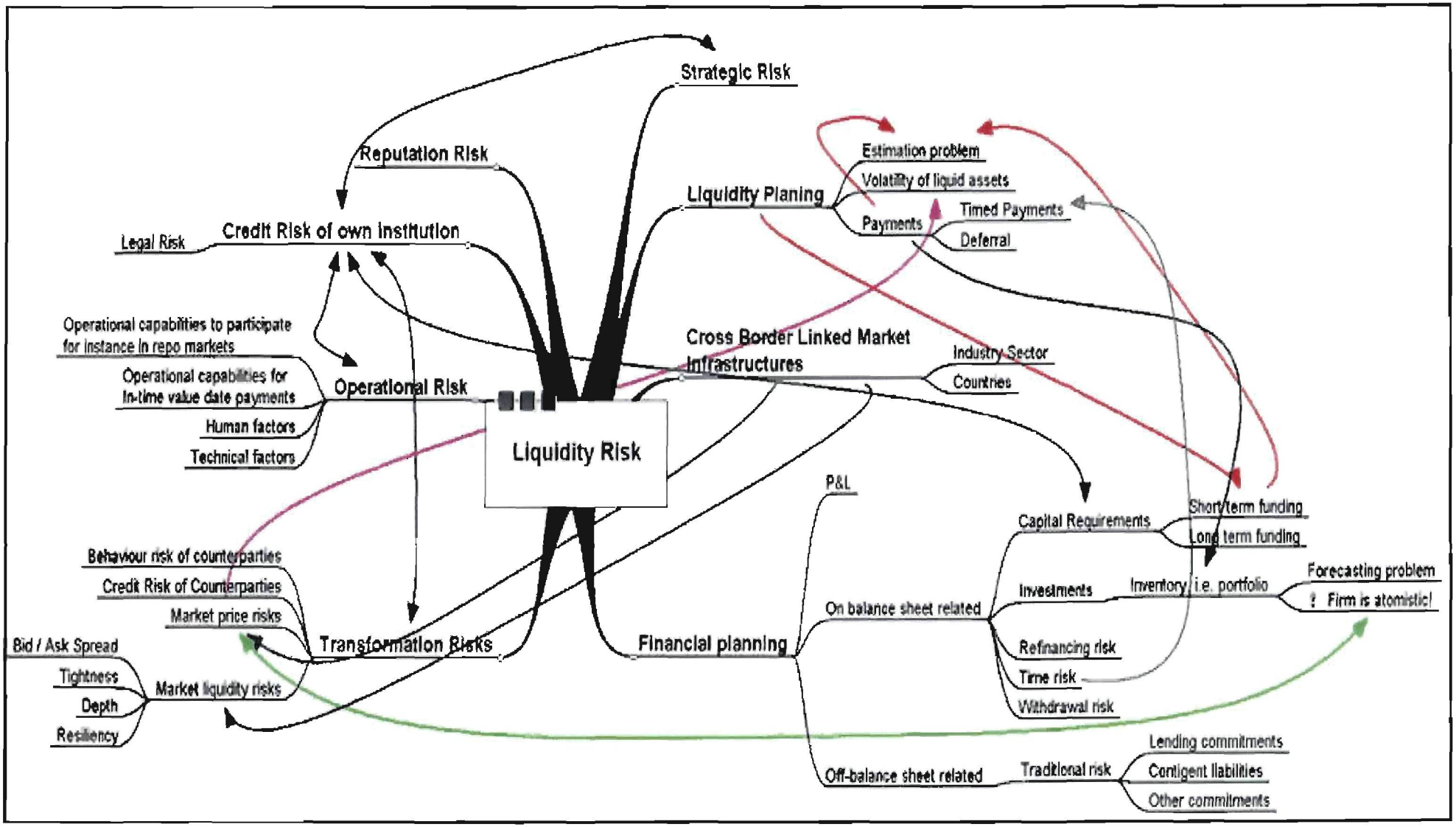
iii. ***Interest rates risk.*** A bank's liquidity position can be extensively influenced by interest rates. A bank's income earned from assets, the market value of interest rate sensitive assets and the cost of funding such assets are directly impacted on by movements in interest rates. Off-balance sheet items that are interest rate sensitive, such as swaps, may result in unexpected cash-outflows or unexpected funding requirements in conditions of interest rate volatility (OCC, 2001:5).

iv. ***Market risk.*** A bank's ability to generate liquidity from its trading portfolio of financial instruments may be influenced by market risk. If providers of funds perceive a bank to be subject to a high level of market risk, it may charge the bank higher rates for funds or may even refuse to provide it any funds in the first place. The BIS (2001c:17) states that asset liquidity risk is related to market risk and represents the risk that an entity will be unable to unwind a position in a particular financial instrument at or near its market value because of a lack of depth or disruption in the market for that instrument.

v. ***Reputational risk.*** The American Academy of Actuaries (AAA) (2000:5) states that banks face reputational risk and a bad reputation may lead to cash-outflows when rumours, whether they are true or not, about the bank start to spread. Negative publicity about the bank may lead to customers demanding higher returns for retaining their funds with the bank, or customers might withdraw their funds at a rapid rate, which may cause serious problems to the bank and may in extreme cases have a significant negative impact on the entire banking sector. Matz and Neu (2007:4) added that banks cannot survive if providers of funds do not have the confidence that they will get their funds back and that a bank faces liquidity risk when it is perceived as not having sufficient cash to meet its obligations.

vi. ***Strategic risk.*** This may also have an impact on a bank's liquidity position. Before implementing any new strategy or business activity, it is extremely important for the bank to consider the impact that planned activities may have on the bank's liquidity position. If the liquidity risk impact is misjudged or understated, the bank's strategic risk may increase (OCC, 2001:4).

Figure 2.1: Liquidity risk components



Source: Kronseder and Kubli (2003:4)

2.3.2.3 Internal sources

Internal sources of liquidity risk are described as factors inside the bank over which it has control in terms of financing and operational policies (Syed, 2004:2). According to the BOT (2003:2) internal factors may include the following:

i. ***Funding sources and structures.*** Funding sources and structures are important potential sources of liquidity risk. Too much reliance on *volatile funding,* such as overseas loans or borrowing from large creditors which are interest rate sensitive, may result in liquidity risk. Funding from numerous retail depositors is more stable. In addition, *concentrated funding sources* are likely to increase a bank's liquidity risk (AAA, 2000:6). Concentrated funding sources refer to a bank's deposits or loans originating mainly in the same currency, or with maturities within the same period, or funding from the same source or the same types of instruments (BOT, 2003:2). Kronseder (2003a:3) states that many funding arrangements seem to include option-like structures, especially if the provider of funds is allowed to withdraw funds with only a few days' notice, without having to disclose reasons for withdrawing funds. Funding with option-like structures increases the risk that these options may be exercised during periods of strain, leaving the option-buyers exposed (AAA, 2000:9-10).

ii. ***Business strategies/policies.*** Strategies such as changes in deposit rates, service fees or the structure of assets, liabilities and off-balance sheet transactions aimed to increase the bank's market share may unintentionally change a bank's financial structure. For example, deposits may flow in at an amount that far exceeds demand while the management of liquidity risk can become more complicated due to the maturity of transactions outside the balance sheet. In this sense, complications may include difficulty in pricing correctly, or service fees increasing to above market-related fees because of the new financial structure of the bank. Conversely, existing customers may move their deposits to competitors because of their lower service fees, for example.

iii. ***Off-balance sheet transactions.*** Examples of off-balance sheet transactions may include complicated derivatives instruments for which it is difficult to estimate liquidity (HKMA, 2004:8). Other examples of such transactions include obligations under letters of credit or guarantees, or credit facilities that have already been approved by the bank but not yet withdrawn by depositors such as mortgage loans, overdrafts and credit cards (BOT, 2003:6).

iv. ***Defective operating system.*** If the management reporting systems used by the various departments within the bank to send information to the bank's treasury for liquidity management, cause delayed or inaccurate information, a bank may be faced

with a liquidity crunch which may cause damage to its reputation in the market. In other words, this is operational risk.

Kronseder (2003a:4) adds the following as an internal source of liquidity risk:

v. ***The bank's own credit risk.*** A downgrading of the bank's credit-rating will lead to a higher cost of funds and a higher cost of carry because of the damage done to the bank's reputation in the market. A bank might immunise itself against credit downgrades by using collateral and repurchase transactions with high-grade collateral. Instruments that can be used as collateral in South Africa are described in section 6.2.4. According to Brar (2005:3) some industry experts believe that nobody has the capability to quantify the cost of funds in the event of a credit-rating downgrade, as this is necessarily an unknown factor. Therefore, banks are inevitably forced to rely on best estimates.

After identifying the sources of liquidity risk, it is important for banks to be aware of early warning signals which they should look out for. By investigating and reacting on early warning signals of liquidity risk, banks may avoid liquidity problems. Because of the importance of being able to identify early warning signals of liquidity risk, they are discussed in more detail in section 2.3.3.

2.3.3 Early warning signals of liquidity risk

The BOT (2003:3) states that most banks monitor both internal and external indicators of liquidity risk. This view is supported by the HKMA (2004:52) who refers to external indicators as market indicators. The State Bank of Pakistan (SBP) (2003:26) states that all the indicators may not necessarily indicate that a bank is having liquidity problems, but may have the potential to shed light on looming liquidity problems. Such indicators help bank management and the Board of Directors (Board) to monitor and analyse potential liquidity problems quicker and more efficiently. Internal and external factors identified by the SBP (2003:27) and the HKMA (2004:52) are now discussed in more detail.

2.3.3.1 Internal indicators

As with internal sources of liquidity risk, internal indicators have their origin inside the bank itself. The way in which the bank goes about conducting its business, includes the following internal factors (SBP, 2003:27):

i. ***Excessive concentrations.*** According to the OCC (2001:6) one of the most important early warning signals for potential liquidity risk is banks that have excessive

concentrations in certain asset or liability classes and funding sources. This was discussed in section 2.3.2.3.

ii. ***Products or transactions.*** Another early warning signal of potential liquidity risk may be when a bank starts trading in products or enters into transactions with higher levels of risk involved. An example is if a bank starts doing business in complex and highly-leveraged OTC derivatives (BOT, 2003:3).

iii. ***Rapid asset growth.*** Rapid asset growth in the form of aggressive credit extensions and/or an increasing rate of approved loans, which are funded by highly volatile wholesale liabilities, can cause enormous liquidity problems for banks (SBP, 2003:27).

iv. ***Decline in a bank's asset quality.*** This means that the bank gives credit to risky individuals or companies who might not be able to repay their loans (OCC, 2001:6).

v. ***Decrease in a bank's earnings.*** Liquidity problems might also emanate from a decrease in a bank's earnings, interest margins, or projected performance (SBP, 2003:27). When a bank does not have adequate liquidity, it cannot obtain sufficient funds, either by increasing liabilities or by converting assets on time, at a reasonable cost, thereby affecting profitability (BIS, 1997a:21-22).

vi. ***Worsening cash-flow position.*** Another early warning signal for potential liquidity risk may be when a bank experiences worsening cash-flow positions which can be seen in widening negative maturity mismatches, especially in the shorter-term time bands (HKMA, 2004:52).

vii. ***Large off-balance sheet exposures.*** According to the SBP (2003:27) banks that have relatively large off-balance sheet positions, have a relatively high level of liquidity risk.

2.3.3.2 External indicators

External or market indicators are factors outside the bank over which the bank has little or no control. According to the BOT (2003:3) external indicators include the following:

i. ***Credit-rating downgrades.*** Credit-rating downgrades on the bank itself, or on its counterparties is the first external indicator of potential liquidity risk that comes to mind. Credit-rating downgrades may, for example, lead to a bank's credit lines being cut by other banks and may lead to liquidity problems.

ii. ***Deteriorating reputation.*** A bank's deteriorating reputation in the market, which can be started by rumours that the bank is in trouble or about to fail, may cause a bank to experience liquidity problems. The reason for this is that, on hearing such rumours,

depositors will immediately spread the rumour and withdraw their funds which may cause a continuous trend in fund withdrawals.

iii. ***Bank's share price.*** A persistent fall in the bank's share price may lead to liquidity problems if a rumour about the reason for the fall in the bank's share price is spread, for example.

The HKMA (2004:52) added the following as external early warning signals:

iv. ***Widened spread.*** A widened spread on the bank's senior and subordinated debt.

v. ***Availability of credit lines.*** Correspondent banks reducing the bank's available credit lines and other counterparties becoming unwilling to extend unsecured or longer-dated funds to the bank, may lead to a general deterioration in the funds available to the bank.

In order for a bank to effectively manage liquidity risk, it must also take cognisance of and thoroughly understand the ways in which a bank can reduce its liquidity risk. To be able to reduce liquidity risk, banks should know the sources and early warning signals of liquidity risk. Ways in which liquidity risk can be mitigated are discussed in section 2.3.4.

2.3.4 Mitigating liquidity risk

Kronseder and Kubli (2003:4) state that there are two critical factors which must be recognised if liquidity risk is to be mitigated. These are the following:

i. Banks must have the appropriate measures in place to respond to the potential threat that liquidity risk poses.

ii. It is a necessity for banks to understand the drivers and other components of liquidity, in other words, those aspects that are not driven by market incidents alone, but rather by credit, operational and reputational risk. These factors were discussed in section 2.3.2 under the correlation of liquidity risk with other risks.

When attempting to mitigate or reduce a bank's liquidity risk, it is of critical importance to take into account the above-mentioned components. The IIF (2007:22) identified five ways to reduce liquidity risk:

i. ***Strong financial standing.*** Having a strong financial position is the best and cheapest mechanism for a bank to reduce liquidity risk. This involves a bank having a strong and reliable financial position in order to give the market assurance and to avoid large deposit runs. It is, however, noteworthy that past experiences have indicated that when a bank's financial status is declining and its reputation has been harmed, very high levels of liquidity may not be enough to cope with deposit runs, loan terminations or

demand for immediate payment by other financial institutions. As mentioned in section 1.1, high-profile financial disasters include those by Orange County Municipality, Barings Bank, Long Term Capital Management (LTCM), Enron and more recently that of Amaranth Advisors LLC.

ii. ***Stable funding sources.*** Banks with stable and reliable sources of funding are likely to have less liquidity risk than banks that rely on volatile funding sources. A means of obtaining stable funding sources is by way of irrevocable credit lines which are stable and less likely to be withdrawn in times of tight market conditions. Because stable funding sources can be considered of a higher quality than volatile funding sources, banks may have to pay a premium for these higher quality funding sources.

iii. ***Customer service.*** Banks can mitigate liquidity risk by ensuring that they deliver good customer service. This especially applies to banks that have a heavy reliance on deposits from small retail customers. If service quality declines, they will move to competitors, therefore the potential cost of poor customer service may outweigh the cost of investing in good quality customer service.

iv. ***Risk management.*** Effective and efficient risk management techniques assist banks in mitigating the liquidity risk that they face. This involves the adequate planning of liquidity, which is extremely important, whether management has opted for stable or volatile funding sources, or a number of funding sources. There are no set rules for the planning of liquidity because it may differ between banks depending on their financial structures. For example, a bank with stable and predictable cash-flows might not need a complicated tool for liquidity planning. Liquidity risk management is normally done through the Asset and Liability Management Committee and is discussed in section 3.2.

v. ***Structure of the balance sheet.*** Apart from managing risk from the liability side of the balance sheet, liquidity risk may be reduced by simply maintaining liquidity on the asset side of the balance sheet. The management of asset liquidity involves the maintenance or management of the levels of cash, loans and securities, the structuring of loans and the selling of credits (securitisation) to increase liquidity. Management must, however, take into account that in times of crises the selling of assets will not necessarily result in the expected return, therefore making this technique of mitigating liquidity risk expensive in some cases.

Kronseder (2003b:4) added the following ways in which a bank can mitigate its liquidity risk:

vi. ***Obtain high-grade collateral.*** Banks should have enough high-grade collateral available. The use of high-grade collateral may help to create an artificial credit enhancement to ensure that access to liquidity will be easier than it would have been when attempting to access it without high-grade collateral. Instruments that can be used as collateral in South Africa are described in section 6.2.4.

vii. ***Avoid embedded options in funding arrangements.*** Banks should, as far as possible, avoid embedded options in funding arrangements. As discussed in section 2.3.2 under internal sources of liquidity risk, funding with option-like structures increases the risk that these options may be exercised during periods of strain, leaving the option-buyers exposed. Marchbanks (2007:18) states that banks that enter into structured funding products without understanding the underlying risks may incur a large amount of liquidity risk.

viii. ***Diversify the sources of liquidity.*** Also discussed in section 2.3.2 under internal sources of liquidity risk, concentrated funding sources refer to a bank's deposits or loans originating mainly in the same currency, or maturing in the same period, or funding from the same source or the same types of instruments. It is better for banks to obtain funding from a diverse group of retail depositors as such funding is very stable. According to Brar (2005:3) funding diversification is crucial in ascertaining the level of inherent liquidity risk in an organisation. The IIF (2007:28) states that the diversification of funding sources is usually accomplished by having one or more of the following:

- A reliable and diversified retail and commercial deposit franchise.
- Maturity dates that are spread out through targets or limits on predefined periods.
- Varied funding programmes, including an internal infrastructure built and maintained to support such programmes, for example securitisation schemes.
- A variety of funding products.
- Different types of wholesale investors, such as central banks, pension funds, money market funds, money managers, etc.
- Diversification of depositors, in terms of sectors and geographies for example.
- Multiple currencies in which to issue.

ix. ***Global and local risk books.*** Banks should run a global risk book for global liquidity factors and a domestic risk book for domestic liquidity factors. This helps to manage cash-flows on a centralised basis and also takes advantage of netting possibilities. By doing this, the bank will reduce pockets of unused and usable liquidity and also reduce its credit risk and liquidity risk.

2.3.5 Conclusion

This section dealt with the characteristics of liquidity risk and included the sources of liquidity risk, early warning indicators of liquidity risk and means to mitigate liquidity risk. There are a variety of internal and external sources of liquidity risk, as well as internal and external indicators of liquidity risk. Banks have a variety of options available to them in their attempts to mitigate their liquidity

risk. It is important to thoroughly understand the characteristics of liquidity risk in order to effectively manage and measure it. Therefore, Chapter 3 focuses on liquidity risk management and measurement.

2.4 Conclusion

The objective of this chapter was to gain an understanding of the characteristics of liquidity risk. As its treatment under Basel II remains vague, it is necessary to thoroughly understand liquidity risk, its origins and how it can be mitigated.

This study focuses on funding liquidity risk and a definition for funding liquidity risk was derived from a variety of definitions. The following definition for funding liquidity risk is used for the rest of this study:

> *Funding liquidity risk is the risk that a bank faces a large volume of sudden and unexpected cash-outflows (a sharp decline in the bank's liabilities) or a net increase in a bank's assets or maturity/structural mismatches in the normal course of business of cash-flow transformation which cannot be funded and therefore the bank cannot meet its obligations as they become contractually due without incurring unacceptable losses.*

The characteristics of liquidity risk were discussed in order to gain some insight into the nature of liquidity risk. These characteristics included the sources of liquidity risk, early warning indicators of liquidity risk and means to mitigate liquidity risk. There are a variety of internal and external sources of liquidity risk, as well as internal and external indicators of liquidity risk. Banks have a variety of options available to them in their attempts to mitigate their liquidity risk. It is important to thoroughly understand the characteristics of liquidity risk in order to effectively manage and measure it. Therefore, Chapter 3 focuses on liquidity risk management and measurement.

Chapter 3
Liquidity Risk Management and Measurement

3.1 Introduction

This chapter ties in with characteristics and mitigation of liquidity risk and discusses the role of a bank's asset and liability management committee (ALCO) that is responsible for, among other things, the effective management of liquidity risk within a bank. A description of a typical ALCO is followed by a step-by-step discussion of an effective ALCO. Being able to measure liquidity risk is the most important step towards managing liquidity risk and the measurement requires a thorough understanding of incoming and outgoing cash-flows and their origins. Different banks use different methods to measure liquidity risk; methods vary from balance sheet liquidity analysis, liquidity ratios, the cash capital methodology and maturity mismatch analysis and newer methods such as liquidity-at-risk. All five these measures for liquidity risk are discussed in more detail in section 3.3.

3.2 The Asset and Liability Management Committee (ALCO)

3.2.1 Introduction

This section focuses on the asset and liability management committee or the ALCO. The ALCO is responsible for, among other things, liquidity risk management in a bank. Therefore decisions regarding the methodologies to measure and manage liquidity risk are taken at an ALCO level. The ALCO is described in terms of its typical structure and responsibilities after which the steps in the ALCO process are described in more detail.

3.2.2 Description of a typical ALCO

Banks need to have a comprehensive and fully functional framework to manage risk (Brar, 2005:2). The BOT (2003:20) describes the ALCO as a higher executive committee which is authorised by the Board to prescribe policies and practices regarding, among other things, liquidity risk management. An ALCO is also responsible for interest rate risk management, since the structure of a bank's liabilities relative to its assets can give rise to both funding liquidity risk and interest rate risk if the underlying maturity of a bank's assets and liabilities does not match (BIS, 2001c:11). The World Council of Credit Unions (WOCCU) (2002:1) broadly defines asset and liability management (ALM) as the continual rearrangement of the assets as well as the liabilities side of a bank's balance sheet in an attempt to remain reasonably profitable and in order to reduce interest rate risk and to provide adequate liquidity. Bothma (2000:1) states that this is one of the most important functions in a bank and for this reason most banks have an

ALCO. Usually the ALCO is responsible for the above-mentioned and, in order to be effective, consists of personnel from senior management, the treasury, risk management and any other businesses which could affect the bank's liquidity risk profile (HKMA, 2004:22). Goodspeed (2002:1) states that the ALCO usually consists of the Managing Director/CEO, the Financial Director, the Risk Manager, the Treasurer, the ALCO Officer and all divisional managers. These are usually the permanent members of the ALCO. Economists or risk consultants may attend the ALCO meetings by invitation or on request (Goodspeed, 2002:1). An ALCO is a committee where strategy, marketing, market risk, liquidity, etc. are all pulled into one, in other words, it is the right forum to include all aspects of a bank. With the most important being the management of interest rate mismatches. Because all businesses are included, all businesses plus the Chief Executive Officer plus the Chief Financial Officer are responsible for liquidity risk management. ALCO should track asset growth versus liability growth and should therefore involve the diversification of assets and the diversification of the investor/depositor base (Joachim, 2007).

The ALCO is usually responsible for and should subsequently have the power to determine the bank's strategy in terms of the mix of assets and liabilities as well as risk management strategies based on the bank's future expectations. The ALCO should, however, ensure that all strategies are in line with the overall risk appetite of the bank and that it conforms to the overall exposure levels determined by the Board Risk Committee (Goodspeed, 2002:1). The BOT (2003:20) considers the main responsibility of the ALCO to ensure that the bank's risk measurement system can identify and measure the bank's liquidity risk and that its reporting systems deliver accurate and timely information regarding the levels and sources of liquidity risk. The SBP (2003:33) adds that, in addition to the development and maintenance of appropriate risk management policies and procedures, the ALCO is usually also responsible for management information reporting, limit setting and monitoring/oversight programmes. The ALCO should meet at least monthly, but should be able to assemble more frequently if and when necessary. Bothma (2000:4) describes the main function of the ALCO as providing liquidity, managing interest rate risk within acceptable parameters, maintaining and enhancing the bank's capital position and maximising risk-adjusted returns to stakeholders over the long-term.

It is noteworthy that everything discussed up to now regarding a bank's ALCO falls into the strategic framework of a bank. The ALCO is responsible for the implementation and monitoring of a bank's strategic plan. The ALCO usually delegates its day-to-day responsibilities to the bank's treasury, but defines clear procedures and restrictions that govern the operations of the treasury before delegating its day-to-day responsibilities. The BOT (2003:21) adds that the bank's treasurer is normally responsible for managing and adjusting the bank's portfolios, which include the bank's securities and foreign exchange portfolios, term deposits, large local deposits and off-balance sheet transactions (derivatives). Bothma (2000:1) states that the ALCO should

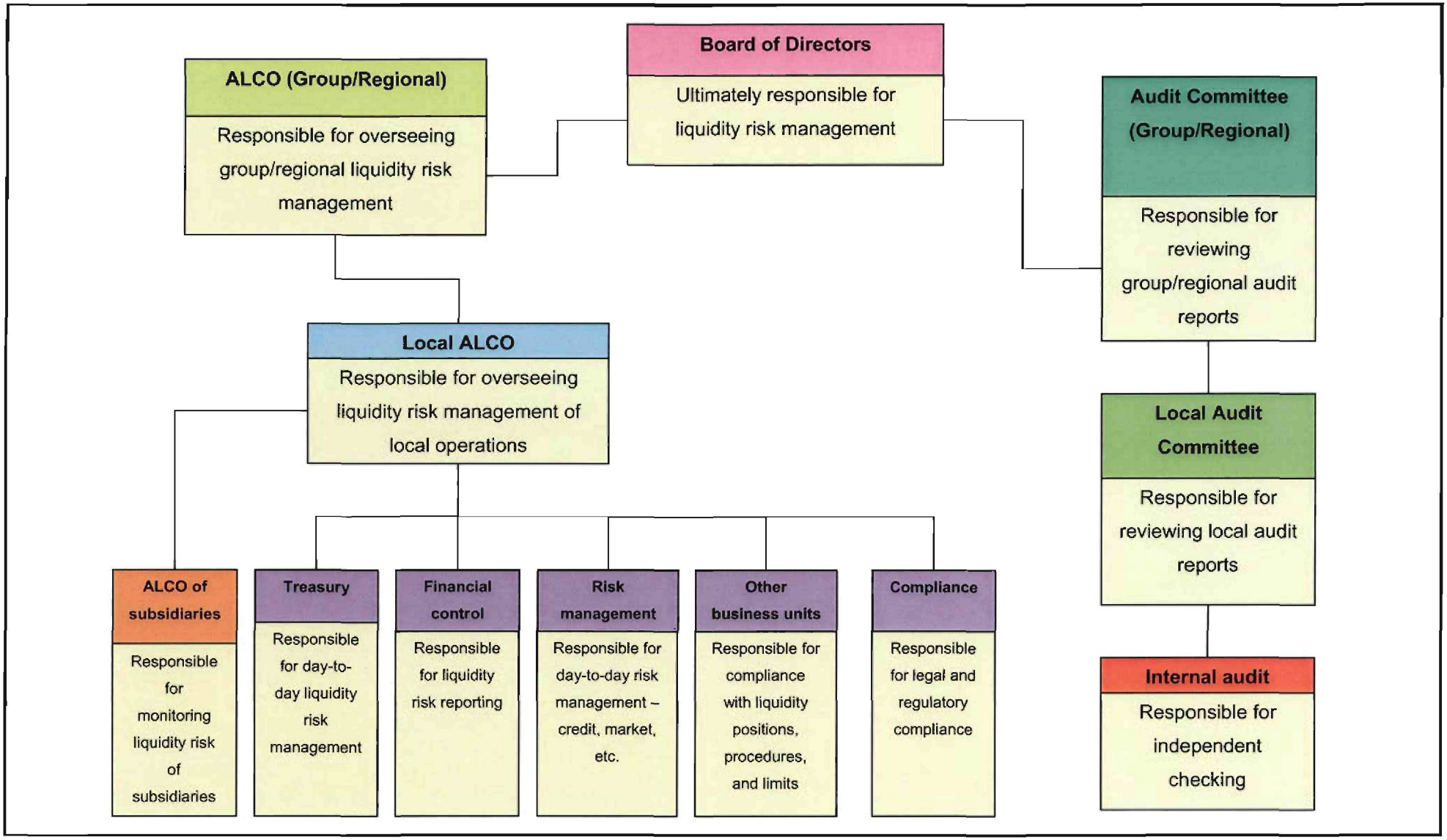
deliver real value to the operations of a bank and should not merely be an instrument which is used to highlight danger signals in the bank's operations. Instead, it should take a positive approach whereby scenario analyses are conducted in order for the bank to analyse and hedge its risks effectively, but also to enable the bank to exploit new opportunities.

The SBP (2003:33) states that because liquidity risk management is a highly technical task that requires specialised knowledge and skills, it is critical that management and the ALCO do not only have the relevant expertise, but that they should also understand the nature and level of liquidity risk assumed by the bank and also the appropriate means with which to manage it. To ensure that the ALCO can control liquidity risk arising from new products and future business activities, the ALCO should interact regularly with the bank's risk managers and strategic planners (BOT, 2003:20). Regular interaction is extremely important as liquidity risk management should not be conducted on an ad hoc basis and it should contribute to the overall vision and mission of the bank.

Figure 3.1 indicates what a typical international banking group's liquidity risk management structure looks like (HKMA, 2004:24). The diagram illustrates that the ALCO of the domestic bank delegates the responsibility of the day-to-day liquidity management to the bank's treasury. The Financial Control Department is responsible for the daily liquidity risk reporting and the Risk Management Department is responsible for the daily risk management of the other risks, such as credit risk and market risk. Other business units that may influence the bank's liquidity position must comply with the bank's liquidity positions, procedures and limits. The ALCO of the bank's subsidiaries reports to the local ALCO and reports on its liquidity risk for the month, for example this would be when a South African bank has banking subsidiaries in the rest of Africa. The local ALCO then reports to the Group/Regional ALCO which reports directly to the Board that is ultimately responsible for the bank's overall liquidity risk management. The bank's independent audit function performs its task to check and review the bank's ALCO processes and practices on all the reporting levels of the ALCO.

It is important to realise that banks are in the business of taking risk, thus they are not in the business of avoiding risk, but instead to manage it, therefore it is extremely important for risks to be made visible, measured and managed. It is also important to understand the interrelationships between these risks, for example, a change in interest rates changes the relationship between short and long-term rates and affects different instruments in different ways. According to Bothma (2000:1) the single most important tool to achieve the above is a powerful computer simulation model. For this reason, liquidity risk management system requirements are discussed in Chapter 5, section 5.2.5.

Figure 3.1: Typical liquidity risk management structure of an international banking group



Source: HKMA (2004:24)

3.2.3 Steps in the ALCO process

When a bank decides that it is in need of creating an ALCO to, among others, manage its liquidity risk, interest rate risk and foreign exchange exposures, it must plan thoroughly before implementing the ALCO. A successful liquidity risk management system includes systems to identify measure, monitor and control liquidity exposures. Management should be able to accurately identify and measure the bank's main sources of liquidity risk in a timely manner (SBP, 2003:30). The steps in the ALCO process will now be discussed. The first two steps deal with the creation of an ALCO, after which the process is discussed as steps 3-12. The steps (steps 3-12) in the ALCO process is then represented diagrammatically in Figure 3.2, as described by Bothma (2000:1-4) and Goodspeed (2002:1).

3.2.3.1 Step one: Define business units or models

The first step in setting up an ALCO may often turn out to be the most frustrating, because careful consideration should be taken of all the rate sensitive and non-rate products that are on the bank's books. The level of detail may vary from bank to bank, but it is normally considered that this forms part of the eventual report that will be presented to the executives. This step involves defining all the income accounts, expense accounts and other assets and liabilities. Defining the business units or models is typically not a one-off exercise, but should be a continuous process where all new rate sensitive and non-rate products in the bank's books are included.

3.2.3.2 Step two: Define reports

This step involves the defining of the desired output of the ALCO, in other words, liquidity and interest rate risk reports, income statements, balance sheets and cash-flow statements. The ALCO reports normally include more detail than routine financial statements and the level of intricate detail is dependent on what was decided in the first step.

3.2.3.3 Step three: Review previous period's results

The results of the previous period are reviewed to determine the accuracy and effectiveness thereof and to determine whether the bank's liquidity risk, among other things, was managed effectively during the period in question.

3.2.3.4 Step four: The bank's current balance sheet positions

The current positions of all the items that were defined in step one should be included in the reports. The collection of the necessary data may be done manually or transferred from sub-systems. The second method is preferable simply because automation means that there is a

smaller probability of human error occurring and faster processing. To properly identify the sources of liquidity risk, management should understand both existing as well as future risk that the bank may be exposed to (SBP, 2003:30). The next two steps involve the forecasting of possible future liquidity risk, which normally forms part of the preparations for the actual ALCO meeting. Steps 3 and 4 are often combined into a single step, but are discussed separately and are also indicated as separate steps in Figure 3.2.

3.2.3.5 Step five: Project the exogenous factors

This involves the forecasting of variables that are outside the direct control of the bank. The two most important factors that are usually forecasted are interest rates and exchange rates because both directly affect the bank's profitability and in some cases the values of certain products. For example, movements in interest rates directly influence the prices of bonds, and exchange rate movements may directly affect the values of certain foreign currency-denominated loans. This step used to be an intensive one as it required many forecasts to be made; at least a forecast per product per forecast period, as well as different scenarios for each of these. This has, however, changed in recent times and only key rates are forecasted from which all other product rates are derived.

3.2.3.6 Step six: Project the endogenous factors

This involves the forecasting of variables that can be controlled by the bank and where the bank can to a large extent control the outcomes. Examples of endogenous factors include asset and liability growth, capital adequacy and future cash-flows. Thus, in essence, these are the objectives as defined in the bank's strategic plan, expressed as figures in the bank's budget.

3.2.3.7 Step seven: Develop asset and liability strategies

Based on the projections done in the previous step, possible asset and liability strategies should be identified to cope with current conditions. It is extremely important to achieve the strategic objectives of the bank within acceptable risk profiles.

3.2.3.8 Step eight: Simulate asset and liability strategies

Once all the previous steps have been completed, simulations should be done for each forecasting period using different assumptions regarding interest and exchange rate movements and sources of funding in order for the ALCO to get an idea of which strategy would enable the bank to achieve its strategic objectives of the bank within acceptable risk profiles. It is important to note that all liquidity and liquidity risk management simulations should be cash-flow based for them to be meaningful.

3.2.3.9 Step nine: Determine the most appropriate strategy

The ALCO must ensure that risks are made visible, monitored and managed. This step is about doing exactly this. Once the risks are known, management can decide on steps to manage the risks, which may include hedging strategies, creating new products or investigating new market possibilities. After simulating various asset and liability strategies, the results are evaluated and the ALCO should be in a position to determine the best asset and liability strategy to achieve its strategic objectives of the bank within acceptable risk profiles. These include the sources of funding, or where to invest surplus funds. Management should decide how surplus funds will be invested and which funding sources to use in the case of deficits, i.e. liquidity risk management. The major decision facing management is that of deciding which sources to use, how much of each source and at what rates to pay each source. Rate forecasts may not be easy as rates are determined by the market, but allowance should be made for this.

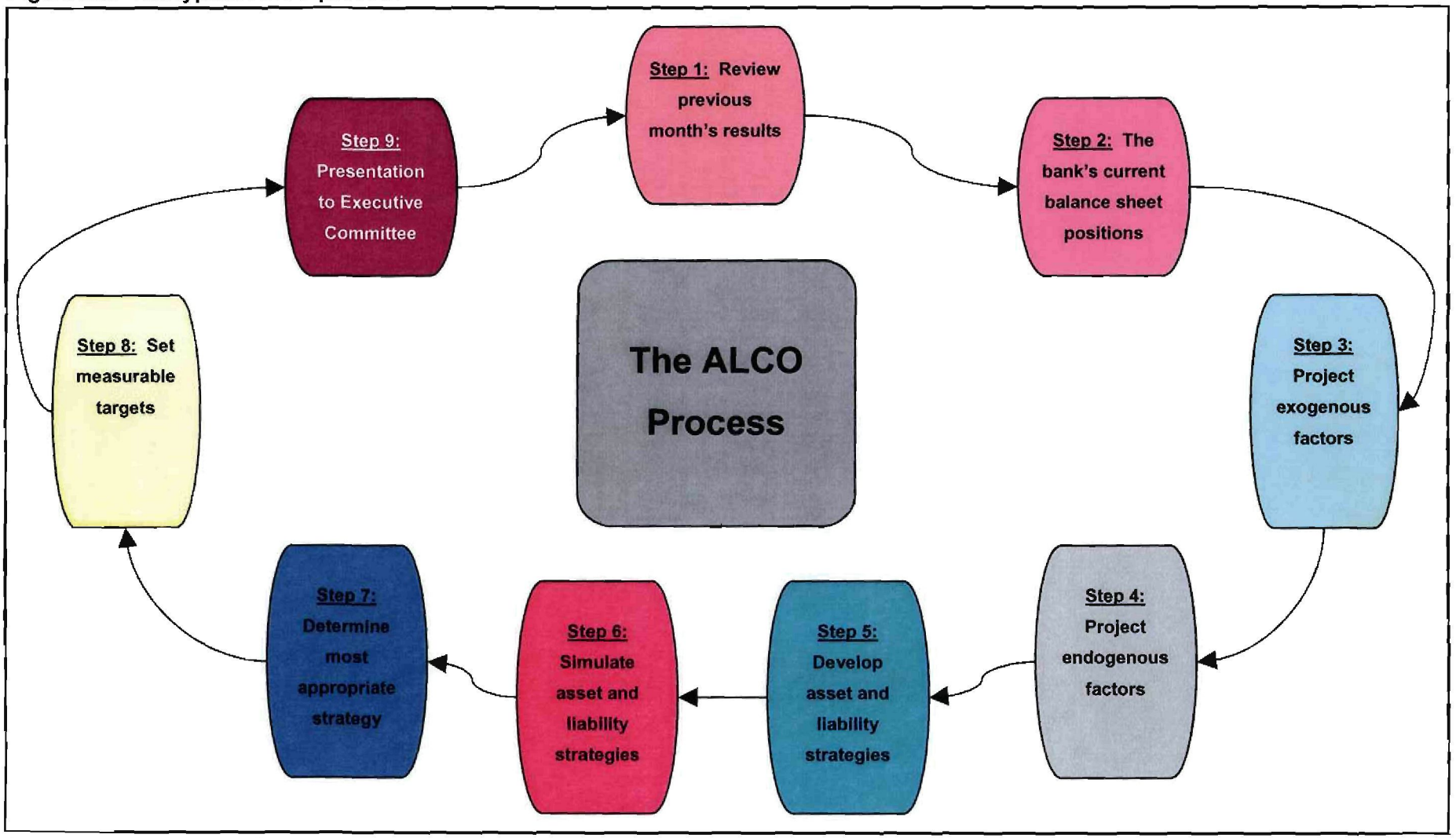
3.2.3.10 Step ten: Set measurable targets

Once a decision is made on the strategy to follow, the bank should set realistic and measurable targets in order for it to evaluate its performance and to be in a position to decide whether the current strategy is still valid. It is extremely important that these targets are clearly communicated to the appropriate managers to ensure their awareness of and commitment to achieving the targets.

3.2.3.11 Step eleven: Present results to Executive Committee

The final step before the process restarts is to present the results that were obtained to the ALCO for their information and approval. It is important that the most important results are presented in a short an efficient manner – colourful charts and diagrams will ensure that the document is easy to read so that the ALCO is in a position to take informed decisions whilst taking calculated risk (Bothma, 2000:3-4).

Figure 3.2: The typical ALCO process



Source: Adapted from Goodspeed (2002:1)

Following the above-mentioned steps will not guarantee a bank of having a dynamic and successful ALCO process, but they would make the implementation thereof easier. Other important factors that should be taken into consideration that would directly impact on the ALCO's operation and its effectiveness are the necessity of having the full support of the bank's CEO and the insurance the he regards the ALCO process in high priority to communicate this message of his support to other levels of management (Bothma, 2000:4). In addition, the major areas of the bank should be involved and it is extremely important to use sophisticated and powerful computers to assure the completeness and accuracy of the simulations.

3.2.4 Conclusion

As mentioned in section 3.2.2 the ALCO is responsible for, among other things, the effective management of liquidity risk and for ensuring the availability of funding for the bank. In order to do this, it is necessary to measure the liquidity risk that the bank faces. Section 3.3 focuses on the various techniques that banks can use to measure liquidity risk.

3.3 Measuring liquidity risk

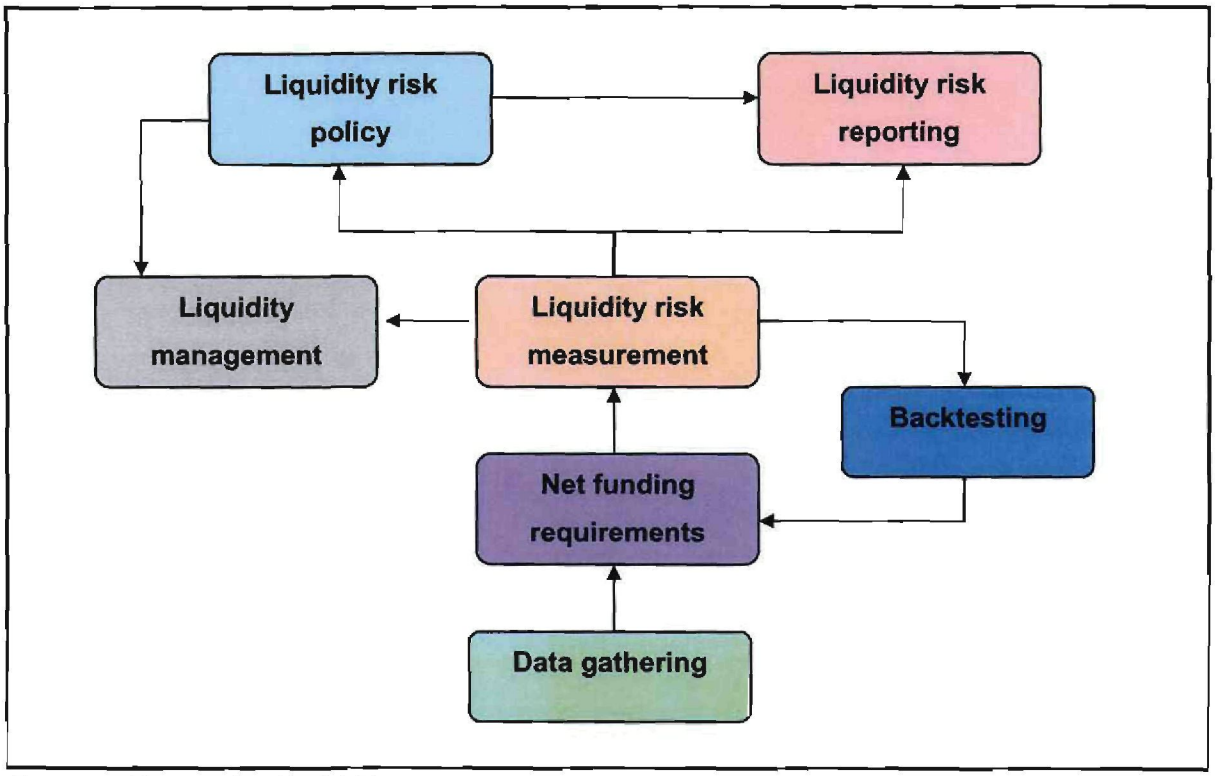
3.3.1 Introduction

Being able to measure liquidity risk is the most important step towards managing it (Kronseder and Kubli, 2003:1). Kronseder (2003c:1) states that the measurement of liquidity risk requires a thorough understanding of incoming and outgoing cash-flows and their origins. As a result, the net funding requirement at the end of the day is the variable that has to be quantified in order for the bank to understand the size of its liquidity risk. The net funding requirement and the liquidity that is or is not available at the end of the day to satisfy this requirement are the liquidity risks that the bank faces.

Kronseder (2004:3) states that liquidity risk measurement is central to liquidity risk management and this is illustrated in Figure 3.3. The figure indicates that the net funding requirement can be estimated after the gathering of all relevant data has taken place. Once the net funding requirement is known, the bank's liquidity risk can be measured.

The models that are used for liquidity risk measurement should also be subjected to backtesting[1] to ensure the validity and accuracy of the models. The method a bank uses to measure liquidity risk is a function of its liquidity risk policy for its liquidity risk management, but also impacts on the bank's liquidity risk management. The bank's liquidity risk policies, which should be aligned to the overall strategy of the bank, along with its liquidity risk measurement techniques impact its liquidity risk reporting.

Figure 3.3: Liquidity risk measurement is central to liquidity risk management



Source: Kronseder (2004:3)

Kronseder and Kubli (2003:1) state that liquidity risk measurement usually relies on the established gap analysis or the cash capital methodology and they also explore the usefulness of applying a liquidity-at-risk model to measure liquidity risk more accurately. Matz and Neu (2007:18) state that balance sheet liquidity analysis is usually also a popular method for banks to measure their liquidity risk. Balance sheet liquidity analysis only requires an evaluation of the liquidity of different balance sheet items, whereas the maturity mismatch approach uses extensive modelling and behavioural assumptions. Thus, the degree of sophistication and

[1] SARB (2006b:17) describes backtesting as the process of comparing actual trading results with model-generated risk measures to test the quality and accuracy of a bank's risk measurement systems. Although this description specifically applies to market risk, it can be generalised to include other risks. Backtesting for liquidity risk would therefore entail comparing actual liquidity outcomes with model-generated predictions.

accuracy increases when going from balance sheet liquidity analysis to the maturity mismatch approach. All five these measures for liquidity risk are discussed in more detail in this section.

3.3.2 Balance sheet liquidity analysis

Matz and Neu (2007:18) state that this approach places different balance sheet items on both the asset and liability side into relation, depending on whether the assets are liquid or illiquid and on whether their funding is stable or volatile. The desired balance sheet structure entails that stable assets are funded by stable liabilities and liquid assets by volatile liabilities.

Matz and Neu (2007:20) state that balance sheet analysis is quite simple as it only needs the bank's annual report to assess its liquidity risk in its balance sheet structure. Mainly as a result of this simplicity, the following are problems experienced with this approach:

i. ***Missing time dimension.*** Balance sheet positions are only classified as either liquid or illiquid. No assumptions are made about in which timeframe positions can be liquidated or become due. Management do not get a clear picture of whether its funding requirement can be met, for example, bonds are typically considered to be stable funding, yet when its time to maturity is only eight days, it cannot be considered to be long-term funding.

ii. ***Marketability of securities.*** Securities positions are reflected on the balance sheet according to their current market or book value. But for liquidity risk, haircuts[2] for future market value volatility and liquidity discounts must be considered, which depends on the credit quality, central bank eligibility and the market depth of the security to be sold. Those characteristics in turn depend on the economic, market and bank-specific conditions at a future time. Haircuts should also be applied to securities financing businesses for counterparty risk.

iii. ***Impact of accounting rules.*** Accounting rules determine the way in which balance sheet figures are shown, which may not necessarily reflect the economic cash-flows of the bank. Securities are usually partly shown at book value and not at market value and the structure of the balance sheet may change from one day to the next if the bank has securities, repurchase agreements or reverse repurchase agreements, or unsecured interbank funding in its books.

iv. ***Off-balance sheet commitments.*** As discussed in section 2.3, off-balance sheet items are sources of liquidity risk, the reason for this is that off-balance sheet items are not

[2] The RBA (2003:2) defines a haircut as the difference between the market value of a security and its collateral value. The AAA (2000:16) adds that haircuts are considered to comprise of two components, one to reflect the difference between book value and fair value, and the other to reflect estimated liquidation costs or effects. According to the RBA (2003:2) haircuts are taken by a lender of funds, that has taken collateral as security, in order to protect the lender, should the need arise to liquidate the collateral, from losses owing to declines in the market value of the security.

reflected on the balance sheet and should therefore be reviewed thoroughly as they may expose the bank to contingent liquidity risk.

v. ***Commercial paper.*** Stable and volatile products are grouped under some balance sheet liabilities. Bonds and commercial paper are often classified together, but for liquidity risk, commercial paper should be treated like unsecured money market funding.

vi. ***Non-bank deposits.*** *Although non-bank deposits are to a large extent considered to be* stable long-term funding, a part thereof will always be volatile and should therefore rather be treated like unsecured money market funding under liquidity risk management. It should be analysed and classified as either core or volatile deposits.

The cash capital methodology is discussed in section 3.3.3 and it will become clear that it addresses some of the shortcomings of the balance sheet analysis methodology discussed above.

3.3.3 Cash capital methodology

Cash capital liquidity measures (also known as "working capital") originated within the securities industry. The objective is to maintain sufficient cash capital (long-term funding sources i.e., equity plus long-term debt maturing beyond 12 months) to fund illiquid assets (Clarke, 2007:59). The cash capital methodology was originally developed by Moody's to analyse the liquidity structure of a bank's balance sheet as part of its external credit-rating process (Matz and Neu, 2007:24). The Royal Bank of Canada (2003:62A) states that the cash capital methodology can be used to assist in the evaluation of balance sheet liquidity and in the determination of the *appropriate term structure of debt financing.*

The intention of the cash capital methodology is to measure a bank's ability to fund its assets on a fully collateralised basis, assuming that the access to unsecured funding has been lost, which may occur after the downgrade of the bank's short-term credit-rating (Matz and Neu, 2007:22). *The Royal Bank of Canada* (2003:62A) adds that the cash capital methodology provides a comprehensive formula-based approach to assessing a bank's ability to continue as a going concern during prolonged periods of liquidity strain. According to Decker (2000:8), under the cash capital methodology, the model assumes that the bank is unable to secure any outside funding and this methodology is designed to indicate how long the bank can continue to meet its short-term funding obligations through asset sales. Weinberg (2007a:7) adds that the cash capital methodology helps banks to maintain structural long-term liabilities to fund illiquid assets.

Therefore, cash capital is described as the gap between the collateral value of unencumbered assets[3] and the volume of short-term interbank funding and non-core parts of non-bank deposits (Matz and Neu, 2007:22). In other words, this methodology allows banks to measure and monitor the relationship between illiquid assets and core funding (Royal Bank of Canada, 2003:62A). This methodology calculates how long the bank can continue to meet its short-term funding obligations through asset sales by assessing the marketability of all of the bank's assets and applying suitable haircuts to each (Decker, 2000:8). Cash capital is therefore defined as the aggregate of long-term debt, core deposits, equity and a bank's contingency funding capabilities minus bank-wide haircuts, contingent outflows and illiquid assets (Matz and Neu, 2007:22-23). The collateral value is determined by subtracting haircuts, which are determined by the marketability of the securities, from the current market value of the unencumbered securities (Matz and Neu, 2007:22-23). Decker (2000:8) adds that once the discounted value of the assets is found, management sets its benchmarks and limits. This model usually has a general limit, which is frequently expressed in terms of a management set limit on the percentage of the discounted value of the bank's assets to total short-term funding. This general limit is then broken down to a more granular level with sub-limits for different types of short-term funding.

According to Matz and Neu (2007:23) it is noteworthy that borrowed securities can be counted as unencumbered securities in the cash capital framework. This is because they can be used as collateral, for instance, in repurchase transactions. However, under the mismatch framework that will be discussed in section 3.3.4, they only provide liquidity for the time window between the borrowing and returning of the borrowed securities. It is also interesting to note that the accounting classification of the securities; whether classified as trading assets, available-for-sale, or held-to-maturity, is irrelevant. This is because even a bond that is held-to-maturity, for example, can be used in a repurchase transaction, although it cannot be sold.

According to Clarke (2007:60), the net cash capital and the liquidity ratio (loan value of unencumbered marketable assets/unsecured obligations maturing within twelve months), are complementary and constitute the core elements of funding and liquidity risk management within the securities industry. The Royal Bank of Canada (2003:62A) adds that the cash capital methodology allows banks to more accurately estimate their exposures to and make the necessary contingency plans for, a prolonged loss of unsecured funding as well as to quantify their longer-term financing requirements.

[3] Matz and Neu (2007:22) define unencumbered assets as assets that are available to be used as collateral and are usually calculated as the market value of the net security positions after taking into account bond or equity financing transactions.

Matz and Neu (2007:260) add that this measure still has shortcomings even though it is considered to be rather comprehensive. Various assumptions used to keep the measure simple and useful for most banks (although precision is reduced) include:

i. ***Snapshot.*** The cash capital methodology is considered to be a snapshot of a bank's liquidity position at a given point in time. It is, however, noteworthy that no snapshot measure can fully capture all the mitigating activities that can be undertaken by a bank's management to enhance liquidity in stress conditions.

ii. ***Unfunded loan commitments.*** Unfunded loan commitments which a bank is generally obligated to fund at any time are not included. Commitments that banks make to asset-backed commercial paper programmes are also not included.

iii. ***Cash earnings.*** Cash earnings expected to be generated by the bank's normal operations are excluded.

iv. ***Long-term debt.*** Long-term debt maturing within one year is included as long-term funding.

v. ***Too onerous haircuts.*** Some haircuts may be considered as being overly conservative; especially the 100 percent rating that is given to mortgage-backed securities. The reason for this is that no distinction is made between the more liquid short-term securities with a proven track record of market liquidity and less liquid and more interest rate-sensitive bond structures.

vi. ***Haircuts may be too small.*** Haircuts may be too small and may increase at a time of greater liquidity. The supply of secured financing by type of collateral can also change because of the haircut, depending on the counterparty's appetite for collateral.

vii. ***Obscurities to banks.*** Some of the items are quite obscure to bank management because they are often regulatory descriptions of asset categories.

3.3.4 The maturity mismatch approach

Matz and Neu (2007:24) describe the maturity mismatch approach as a quantitative approach of measuring liquidity risk, where the net cumulative cash-outflow of a bank and the unencumbered assets to cover the net cumulative cash-outflow must be estimated per time period and under different circumstances. According to the Deutsche Bundesbank (Bundesbank) (2007b:1-2), under the maturity mismatch approach the expected inflows of funds from certain on-balance sheet and off-balance sheet asset items as well as outflows from certain on-balance sheet and off-balance sheet liability items are recorded in maturity bands depending on their residual maturities or assumed call probabilities. According to Brar (2005:2) this is the traditional method of managing liquidity risk and measures the difference or gap between the volume of interest earning assets and interest bearing liabilities repricing over various time periods. According to Kronseder (2003c:2) this is an approach where net funding requirements are calculated from the cash inflows and outflows for every end-of-day value, or the time at which the treasurer starts to

square off the bank's positions for the day. For this reason, the use of a value ladder or maturity ladder is useful, because it helps banks to understand trends in their cash-flows. Many financial institutions use these ladders in order to manage the day-to-day business. This method is, according to Brar (2005:2), the most commonly used technique today.

The SBP (2003:33) adds that in order to being able to assess demand for liquidity, cash-flow estimates should be done. Cash-flow projections estimate a bank's inflows and outflows, hence the net surplus or deficit (gap) over a time horizon. For this purpose, liquidation cash-flows from all liquefiable balance sheet and off-balance sheet items are mapped to a maturity ladder and this is often referred to as a laddered or staggered maturity strategy (Koch and MacDonald, 2006:468). The SBP (2003:33) adds that a maturity ladder is a useful tool to compare cash inflows and outflows on a day-to-day basis as well as over a series of specified time periods. According to Matz and Neu (2007:24) there are four different categories of cash-flows, depending on whether the timing and amount of cash-flows are deterministic or stochastic:

i. ***Category one: Cash-flow amount and cash-flow timing are deterministic.*** Examples of these are cash-flows from secured and unsecured money market funds, coupon and amortisation payments of fixed-rate loans and bonds, and term deposits.

ii. ***Category two: Cash-flow amount is stochastic and cash-flow timing is deterministic.*** Examples of such cash-flows are coupon payments from floating-rate loans and bonds, variation margins on futures contracts, share dividend payments, future swap floating-leg payments, zero-bond repayments with structured yields and settlement payments of European options.

iii. ***Category three: Cash-flow amount is deterministic and cash-flow timing is stochastic.*** These cash-flows include repayments of loans with flexible amortisation schedules, repayments of callable bonds and traveller's cheques.

iv. ***Category four: Cash-flow amount and cash-flow timing are stochastic.*** Examples of these cash-flows are savings and demand deposits, collateral value of marketable assets such as bonds, funds and shares, draw-downs on committed credit lines and revolving loans and settlement payments of American options.

The cash-flow mapping of the first category of assets is straight forward, as it only requires a good data infrastructure that provides the correct balance sheet position. The other three categories do, however, require additional model and behavioural assumptions depending on the scenario under consideration. Figure 3.4 illustrates a liquidity gap profile of a bank's balance sheet. From the figure it is clear that that this bank divides its time buckets into categories from overnight or sight out to larger than two years.

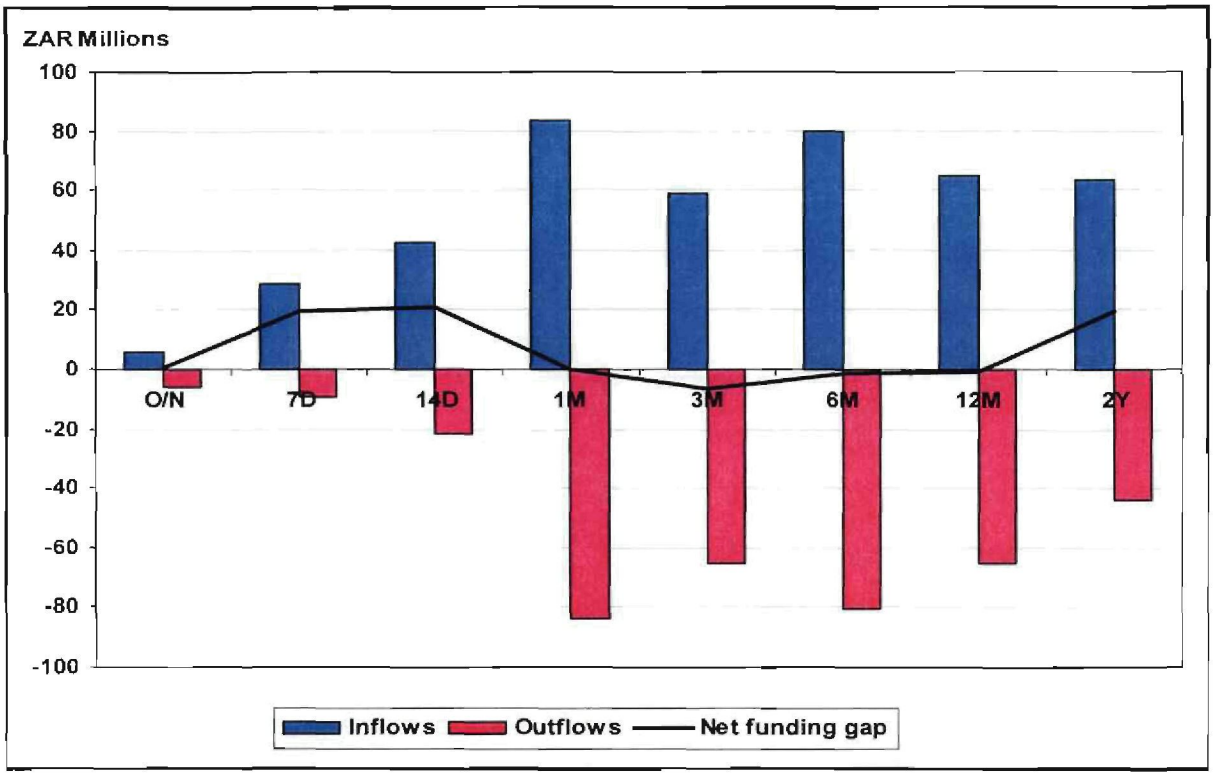
Figure 3.4: Example of a liquidity gap profile

Liquidity gap profile of ABC Bank															
ZAR millions		O/S	O/N	2-7	8-15	16d-EOM	2M	3M	3 Months total	3 Months % R/O	4-6M	7-12M	1Y-2Y	<2Y	Total
ASSETS (sources)															
Third party:															
1	Cash and due	46	1	-	-	-	-	-	1	2%	-	-	-	45	46
2	Placements/FFS/reverse repos	1536	835	22	-	-	-	108	965	63%	214	358	-	0	1535
3	Trading securities	186	-	-	-	-	-	-	0	0%	-	-	-	186	186
4	Available for sale (AFS) non-discretionary	212	-	-	-	-	-	-	0	0%	-	-	-	212	212
5	AFS discretionary	586	-	-	-	-	-	-	0	0%	-	-	-	586	586
6	Consumer loans/leases	0	-	-	-	-	-	-	0	#DIV/0!	-	-	-	-	0
7	Commercial loans/leases	960	-	-	-	-	-	-	0	0%	-	-	-	960	960
8	Revaluation gain	220	-	-	-	-	-	-	0	0%	-	-	-	220	220
9	Other assets	77	-	-	-	-	-	-	0	0%	-	-	-	77	77
10	Sub-total third party assets	3823	836	22	0	0	0	108	966	25%	214	356	0	2286	3822
Inter-company:															
11	Placements	1790	1672	15	-	18	35	2	1742	97%	6	20	22	-	1790
12	Revaluations/deferred items	55	-	-	-	-	-	-	0	0%	-	-	-	65	65
13	Investments in subsidiaries	0	-	-	-	-	-	-	0	#DIV/0!	-	-	-	-	0
14	Sub-total inter-company assets	1855	1672	15	0	18	35	2	1742	94%	6	20	22	65	1855
15	TOTAL ASSETS	5678	2508	37	0	18	35	110	2708	48%	220	376	22	2351	5677
LIABILITIES (uses)															
Third party:															
16	Wholesale/market-based (secured)	81	100	-20	-	-	-	-	80	99%	-	-	-	-	80
17	Wholesale/market-based (unsecured)	81	53	1	-	1	2	1	58	72%	-	12	-	10	80
18	Retail/insured	0	-	-	-	-	-	-	0	#DIV/0!	-	-	-	-	0
19	Corporate	4364	436	-	-	-	-	-	436	10%	-	-	-	3928	4364
20	Long-term debt	33	-	-	-	-	-	-	0	0%	-	-	-	33	33
21	Other liabilities	63	-	-	-	-	-	-	0	0%	-	-	-	63	63
22	Revaluation loss	184	-	-	-	-	-	-	0	0%	-	-	-	184	184
23	Capital	0	-	-	-	-	-	-	0	#DIV/0!	-	-	-	-	0
24	Subtotal third party liabilities	4806	589	-19	0	1	2	1	574	12%					574
Inter-company:															
25	Borrowings	493	16	-109	109	116	230	9	371	75%	68	46	-	8	493
26	Revaluations/deferred items	92	-	-	-	-	-	-	0	0%	-	-	-	92	92
27	Capital	286	-	-	-	-	-	-	0	0%	-	-	-	286	286
28	Sub-total inter-company liabilities	871	16	-109	109	116	230	9	371	43%	68	46	0	386	871
29	TOTAL LIABILITIES	5677	605	-128	109	117	232	10	945	17%	68	46	0	386	1445
30	Total sources (uses)	1	1903	165	-109	-99	-197	100	1763	176300%	152	330	22	1965	4232
OFF-BALANCE SHEET															
31	Assets	22612	1910	4812	2623	1265	4493	2710	17813	79%	3365	1227	191	16	22812
32	Liabilities	22599	2916	4493	2636	950	4104	2678	17777	79%	3445	1223	140	15	22800
33	Net off-balance sheet	13	-1006	319	-13	315	389	32	36	277%	-80	4	51	1	12
34	Net gap prior to incremental	14	897	484	-122	216	192	132	1813	12950%	72	322	73	-2252	14
35	Cumulative gap prior to incremental		897	1381	1259	1475	1667	1799	8476		1871	2193	2266	14	

Source: Adapted from Clarke (2007:46)

Subtracting the net cumulative inflows from the net cumulative outflows provides the net cumulative liquidity gap per time bucket. This is illustrated in Figure 3.5. The blue bars indicate inflows, the red bars outflows and the thick black line indicates the net cumulative gap. Matz and Neu (2007:26) state that a positive net cumulative gap indicates that the bank can roll over all its outflows by liquidating its unencumbered assets. A negative gap, as experienced by the bank in Figure 3.5 between the one-month and one-year period, does not necessarily mean that the bank is insolvent, it merely indicates that the liquidation of the bank's inventory will not be enough to cover its outflows in terms of today's balance sheet positions without any rollover of funding and new assets and for the scenario assumed for the cash-flow modelling (Koch and MacDonald, 2006:469).

Figure 3.5: Example of a net cumulative gap profile



Source: Adapted from Matz and Neu (2007:27)

Kronseder (2003c:2) states that what makes a maturity ladder especially useful is the fact that a treasurer already has some understanding of future trends, unlike a portfolio manager managing market risk, which should basically help to determine the net funding requirements at a fairly accurate level for the future end-of-day values. The SBP (2003:33) adds that an analysis for distant time periods maximises the opportunity for the bank to manage the liquidity gap well before it crystallises. If a pure run-off gap scenario is used, the net cumulative gap eventually becomes negative because banks fund parts of their long-term assets in the money market. Prudent liquidity management requires that this point where the liquidity gap is equal to zero lies

between fourteen days and one month, even during a crisis (Matz and Neu, 2007:27). The number of timeframes in a maturity ladder is of significant importance and it depends to some extent on the nature of a bank's liabilities or sources of funds, in other words, the number of timeframes used will not necessarily be the same for different banks. The SBP (2003:33) adds that banks relying on short-term funding typically concentrate on managing liquidity over the very short term, whereas other banks might actively manage their net funding requirements over a slightly longer period. In the short term, banks' cash-flows could be estimated more accurately and estimates are more important as such estimates provide an indication of corrective actions that should be taken immediately.

Matz and Neu (2007:27) state that a liquidity gap analysis is usually done for different scenarios. Scenarios may include business-as-usual, a general market disruption, a national macroeconomic disruption, a banking industry-wide disruption, a bank-specific crisis, such as a bank run, a credit-rating downgrade, etc. Brar (2005:2) adds that the current challenge for banks is to build in all realistic scenarios, but this is difficult because of constantly changing market conditions. The RBA (1998:3) prescribes that banks should construct maturity profiles of its cash-flows to identify cumulative net funding positions at selected maturity dates under both the going-concern and name crisis scenarios. The Reserve Bank of Fiji (RBF) (2006a:7) describes a going-concern scenario as one where the bank operates without difficulties in a stable banking system, earns sufficient profit and shows no danger of running into insolvency. The RBF (2006a:7) continues to describe a crisis scenario as one where the bank is unable to meet all or a portion of its liabilities at maturity and shows signs of a public loss of confidence in either or both the institution or the financial system which may cause it to go into insolvency.

According to Matz and Neu (2007:27) such scenarios influence the cash-flow modelling of each deal-type differently. For example, under a business-as-usual scenario backup lines are unlikely to be drawn upon, whereas under a general market disruption scenario backup credit lines may have to be funded. Koch and MacDonald (2006:384-385) add that some banks also include new assets and/or rollovers of funding in their gap analyses. If this is done, the net cumulative gap must always be positive. Such an analysis is considered to be more realistic, but it requires even more assumptions regarding future cash-flows. For this reason, many other banks do not use this, but instead use a pure run-off profile. A possible reason for this is that banks should be in a position to justify their assumptions used for determining cash-flows and maturities for assets and liabilities for going-concern as well as for crisis scenarios (RBF, 2006a:8).

Matz and Neu (2007:28-29) add that some deal types can be modelled using fixed cash-flow amounts and fixed cash-flow timing. Examples of these deals include term loans with fixed

amortisation schedules or short-term money market funding. Most other deal types, however, require behavioural adjustments and cash-flow modelling.

3.3.5 Liquidity ratios

Koch and MacDonald (2006:381-382) state that banks use a variety of ratios derived from figures on the balance sheet to quantify liquidity risk and to set liquidity risk limits. Brar (2005:2) adds that banks use ratios to measure their ability to meet their short-term obligations, under normal as well as stressed market conditions. The BOT (2003:14) adds that it is important for ratios to be implemented regularly and that they are used in conjunction with other qualitative factors for them to be of any value, such as the depositor's borrowing capacity, a reduction in credit limits, smaller transactions, or shorter maturities of structured funds. An example of such a ratio is the loans-to-deposits ratio, but it may still be meaningless because two banks with the same ratio do not necessarily imply that both of them do not have a liquidity problem. One of them, for example, may be too reliant on short-term deposits to fund longer-term loans. The BOT (2003:14) adds that because of inconsistencies between the ratio components calculated by banks, ratio analysis may be misleading and makes it hard to compare figures across banks or even across different time periods for a single bank. The SBP (2003:14) identified some examples of ratios:

i. ***Cash-flow ratios and limits.*** Banks may face serious liquidity problems if they cannot roll over maturing liabilities. Cash-flow ratios and limits attempt to measure and control the amount of maturing liabilities during a specific period.

ii. ***Liquidity concentration ratios and limits.*** Limits help banks to ensure that their funding sources are not too concentrated in the same currency or with maturities within the same period, or in funding from the same source or the same types of instruments. Limits are normally expressed as a percentage of liquid assets or as an absolute amount, but may in some cases be expressed more indirectly as a percentage of deposits, purchased funds, or total liabilities (SBP, 2003:14).

iii. ***Other balance sheet ratios.*** Common ratios used by banks to monitor current and potential funding levels include: total loans/total equity; total loans/total deposits; borrowed funds/total assets; and also, as identified by Dick et al. (2001:5), net non-core funding dependence, net short-term liabilities/assets, on-hand liquidity/total liabilities and reliance on wholesale funding, etc.

Dick et al. (2001:38) state that liquidity ratios alone are not effective measures of liquidity risk and that, at best, ratios provide point-in-time measures and provide little insight into how well existing funding sources can meet funding needs. Balance sheet ratios are deemed not to capture the following:

i. Expected funding needs or commitments.

ii. Available borrowing sources.

iii. A bank's ability to convert assets to cash.

Brar (2005:2) states that many banking institutions pay close attention to ratios, which are monitored and in most cases reported at the end of each day. An analysis on liquidity risk in South Africa using various liquidity ratios is conducted and discussed in section 6.5. According to Kronseder (2003c:1) current methods of managing liquidity risk rely largely on established methods such as the cash capital methodology, liquidity ratios and the maturity mismatch approach. These techniques do, however, have weaknesses in capturing the liquidity risk of non-linear products such as options (which were discussed in section 2.3.4). A newer method that can measure the liquidity risk on such non-linear products, the "liquidity-at-risk" technique, is discussed in more detail in section 3.3.6.

3.3.6 Liquidity-at-risk

In a speech given in Washington in 1999, Greenspan (1999) introduced the term "liquidity-at-risk" (LaR) to the world. This speech has since been the subject of much discussion and speculation. In this speech, Greenspan (1999) quoted Guidotti (1999) who suggested that countries should manage their external assets and liabilities (as opposed to domestic assets and liabilities) in such a way that they are always able to live without new foreign borrowing for up to one year. That is, usable foreign exchange reserves should exceed scheduled amortisations of foreign currency debts (assuming no rollovers) during the following year.

LaR is typically calculated at a country level and according to Piterman (2000:96) it can be calculated by considering a country's liquidity position under a range of possible outcomes for relevant financial markets variables (exchange rates, commodity prices, credit spreads, etc.) and the probabilities of these outcomes. A country can manage its LaR position by different combinations of reserves, debt and maturity. Greenspan (1999) adds that an acceptable debt structure can have an average maturity in excess of a certain limit. In addition, countries could be expected to hold sufficient liquid reserves to ensure that they could avoid new borrowing for one year with a certain ex ante probability, such as 95 percent of the time. Piterman (2000:98) adds that the concept introduced by Greenspan (1999) is stochastic. Although the proposal that was made by Greenspan (1999) specifically dealt with country-wide liquidity risk, it can still be calculated and applied on a bank-wide level. Kronseder and Kubli (2003) described the calculation of LaR, even though there have not been many studies on the validity and implementation pitfalls of such an approach.

According to Kronseder (2003b:1), although current methods of managing liquidity risk by banks are valuable, they are coming under increasing scrutiny. Because most liquidity management

models were derived before the advent of derivatives in financial markets, they do not take into account the role of non-linear derivatives such as options. Kronseder (2003c:1) adds that the dynamic behaviour of non-linear derivatives is difficult to factor into models and, for this reason, they are left out completely by the majority of institutions that engage in liquidity risk management. Consequently, safety margins are introduced in some models as an approximation for the effects of non-linear derivatives and also to serve as a safety valve to absorb their effects. Examples of safety margins are illustrated in Table 3.1. Kronseder (2003b:1) adds that using this strategy may have dire consequences in the near term because safety margins are not always necessarily determined on a mathematical or scientific basis and may not be sufficient to cover liquidity risk when there is a high degree of leveraging[4].

Table 3.1: Safety margins

Cash-flow amount	Time/value date: Known	Time/value date: Unknown
Known	Deterministic cash-flows or conservative adjustments for incoming and outgoing cash-flows	Probability distribution along the time continuum including conservative adjustments for incoming and outgoing cash-flows
Unknown	Probability distribution along the (contract) value continuum including conservative adjustments for incoming and outgoing cash-flows	Probabilities along the time and value continuum including conservative adjustments for incoming and outgoing cash-flows

Source: Kronseder and Kubli (2003:2)

Brar (2005:2) adds that for this reason, some of the largest organisations in the world are developing LaR models to complement the more familiar VaR techniques. Piterman continues to state that because the concept of value-at-risk (VaR)[5] is already well-known, liquidity-at-risk approaches are best developed at institutions that are familiar with calculating VaR. LaR is used for determining the values of the cash-flows associated with various on- and off-balance sheet assets and liabilities. When keeping in mind the definition of VaR, LaR shows the amount of liquidity that may be withdrawn at a certain confidence interval over a specified period of time, for example a year. According to Kronseder (2003c:5) LaR is a measure indicating that there is a

[4] Du Toit (2005:110) simply describes leveraging as trading with borrowed funds. The value of transactions engaged in is higher than the amount that the investor has on margin.

[5] Tsai (2004:1) defines VaR as the loss that can be expected with a given probability over a specified period of time during which a portfolio is held.

95 percent probability, for example, that an extraordinarily large amount will require funding at least once a year.

Frese (2005:3) adds that with LaR, within the context of the gap analysis, non-deterministic cash-flows are foreseeable but the corresponding forecasts differ ex post from reality. However, in the same way as for VaR, it is possible to estimate an error in the forecast. This view is supported by Matz and Neu (2007:184) who state that a forecast error can be estimated ex ante to estimate the expected quality of the forecast. When designing a LaR model, it is also necessary to include stress testing, because liquidity crunches are typically scenario-driven. Scenario-driven liquidity crunches may constitute stress events.

Kronseder and Kubli (2003:1) argue that LaR is determined by two factors, namely the ability to raise funds, including the shiftability phenomenon, and the ability to understand the volatility of the daily cash-flows and thus cash-flow-at-risk (CFaR):

i. ***Ability to raise funds.*** The shiftability theory argues that a seller of assets might be forced to accept the price that the market is prepared to pay, causing him to incur a loss although the assets may be worth more (Vinogradov, 2006:28). In other words, the shiftability theory refers to the probability of access to liquidity, or the ability to access the required amount at a reasonable cost. The ability to raise funds is a function of liquid assets in a portfolio (Kronseder, 2003c:4). Typically, treasurers aim to liquidate money market instruments with the highest liquidity first, then bonds, equities, etc. It is however important to note that in South Africa the liquidation of money market instruments is typically seen as the last resort to raise liquidity. Banks would normally first attempt to create new liabilities by issuing certificates of deposits (CDs) into the market after determining the receptiveness of the market to such instruments based on the market's perception of the bank, which in turn determines the cost of the funding. According to the National Bank of the Republic of Macedonia (NBRM, 2004:15) banks can, when determining the probability for executing certain asset and liability transactions, do the following:

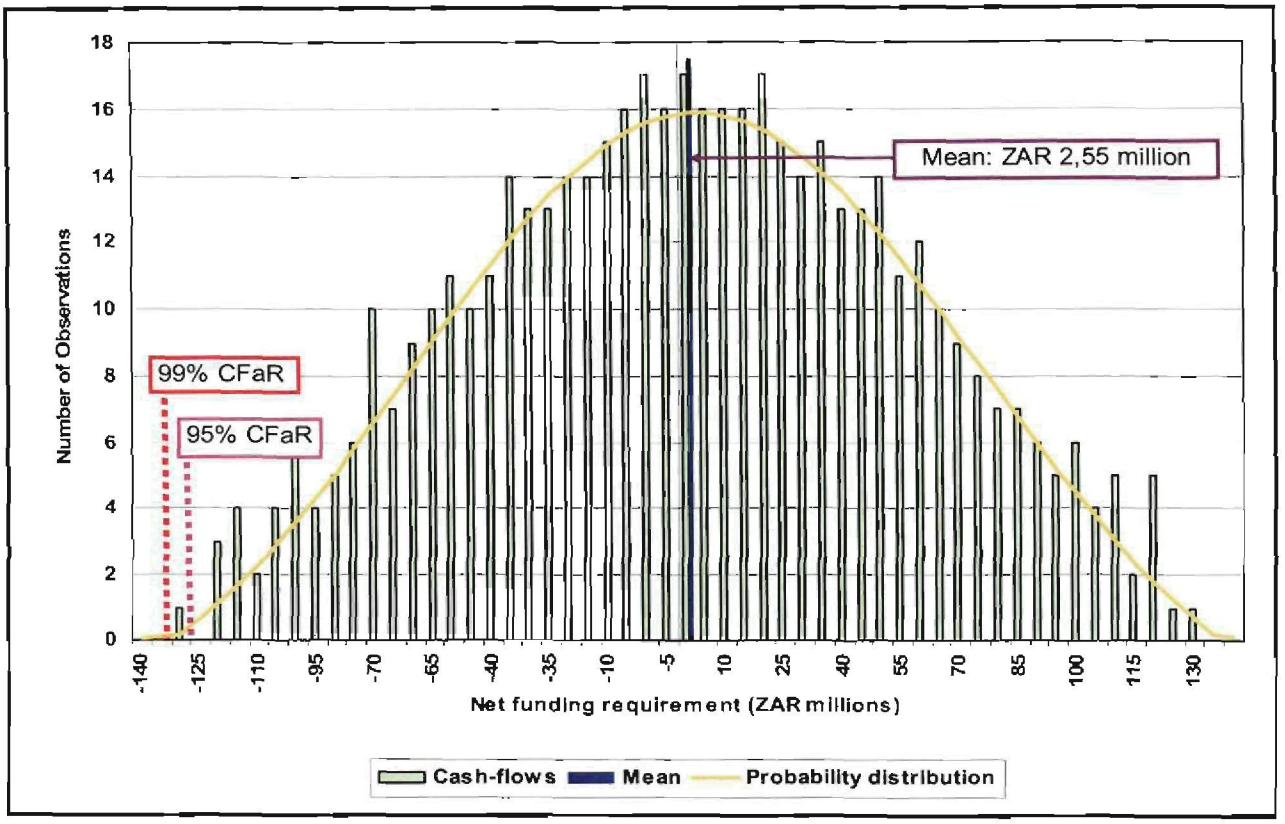
- Use their historical experience for credit and deposits rollovers, the level of used credit lines, new loan applications and increases in deposits.
- Use statistical analysis for seasonal and other influences on demand for credit, the sensitivity of interest rates and the movements of deposits.
- Assess the conduct of each client/depositor, taking into account the experience from their mutual co-operation, especially in the case of large and significant clients/depositors.

By doing this, banks can determine the probabilities of assets and liabilities being cash inflows or cash outflows. It is also important for banks to similarly determine the probabilities of off-balance sheet transactions.

ii. ***Cash-flow-at-risk (CFaR).*** Blanco (2003:4) states that CFaR is associated with investing and financing activities that are not included in the cash-flow requirements from operations under normal day-to-day conditions, in other words, a bank's extreme funding requirements. CFaR measures the expected maximum decrease in expected cash-flows resulting from an adverse market move, within a given confidence level, for a given period (Dusic and Rieggert, 2005:7). Dusic and Rieggert (2005:9) add that calculating CFaR requires the following process:

- Setting the time horizon and the confidence interval, such as 1 year and 99 percent.
- Cash-flow mapping, i.e. allocating cash-flows to tenors.
- Identification and simulation of risk factors.
- Revaluation of cash-flows.
- Constructing the probability distribution of cash-flows. This is done by creating buckets for the sizes of cash-flows, in other words, a bucket is created for every million rand, for example. The actual net funding amounts for a defined period are placed into relevant buckets. For example, over a period of one year, a net cash inflow of between R1,5 million and R2 million happened 12 times, and one of R1 million and R5 million happened twice, etc.
- Reading the value of the particular quantile of the cash-flow distribution based on the confidence level. In other words, assuming that a distribution can be fitted to the frequency analysis, the treasurer can allocate a probability to having to fund R125 million, for example (Kronseder, 2003c:3). Figure 3.6 illustrates how a bank's funding requirements can be plotted according to its frequency, based on funding requirements for 500 days. In Figure 3.6 a normal distribution was fitted to the data, allowing the treasurer to estimate the bank's CFaR based on a confidence level. This is indicated in the chart as the net funding requirement that the treasurer could expect at a 95 percent as well as at a 99 percent confidence interval.

Figure 3.6: Funding requirement distribution frequency



Source: Adapted from Dusic and Rieggert (2005:7)

Thus, according to Kronseder and Kubli (2003:2), in order to effectively manage liquidity risk, the liquidity risk manager and/or treasurer needs to:

i. Understand CFaR by differentiating the cash-inflows and cash-outflows in the amount/time quadrants.

ii. Investigate the probability of access to funding per period for each liquidity or liquidity risk factor.

LaR includes CFaR plus an additional buffer to support demand for liquidity triggered by credit or market stresses (Blanco, 2003:4). According to Kronseder (2003c:2) the following equation follows from this:

$$LaR = P(Liquidity) - CFaR \qquad (3.1)$$

In the equation, *CFaR* represents the potential extreme net funding requirements of a bank over a period and *P(Liquidity)* represents the probability of accessing liquidity multiplied by the amount of liquidity available. For example, for a bank with an extreme funding requirement of R80 million and a probability of accessing R120 million of 0,8, the LaR is R16 million (R96 million - R80 million).

According to Kronseder (2003c:2), for a correct analysis of CFaR, historical cash-flows have to be split into cash-flows from operations of the bank and cash-flows from former liquidity sources. By doing so, a returning pattern of high liquidity risk may be identified. Should a returning pattern of former liquidity sources due to non-obvious business cycles of the bank be identified, this information can be used for a better forecast of the bank's financial needs. However, in forecasting future situations using the cash-flow amount/time quadrants in Table 3.1, an analysis of historical cash-flows is not necessary if all the business areas of the bank can be detailed.

Kronseder and Kubli (2003:2) add that in order to increase the granularity of the CFaR analysis, CFaR can be calculated for different timeframes, in other words, CFaR is not only determined on a daily basis but can also be calculated on a weekly, monthly or semi-annual basis. In doing this, the bank will gain a better understanding of how its potential extreme net funding requirements develop over time. Kronseder (2003b:2) adds that time series analyses of extreme net funding requirements can be based on historical data analysis and are therefore a practical starting point for this analyses. Banks could increase their levels of accuracy by including its knowledge of potential future cash-flows in this analysis.

In addition, future cash-flows based on known contracts can be incorporated into the analysis. Based on contractual characteristics, cash-flows may be deterministic or may show an uncertain outcome. Deterministic cash-flows dominate the assumed CFaR distribution if they occur frequently, while cash-flows with uncertain outcomes introduce an element of uncertainty and they can indicate how big the potential swings in a bank's net funding requirements might be, and as a result, heavily influence its CFaR (Kronseder, 2003b:3). The results enable the liquidity risk manager and/or treasurer to take a more cautious and conservative stance with regard to the bank's expected net funding requirements (Kronseder and Kubli, 2003:3).

Kronseder (2003b:3) states that by using the same approach as in Table 3.1 for the calculation of available liquidity over time, *P(Liquidity)* is then defined as:

$$P(Liquidity) = \sum_{i=1}^{n} P_t P_{v(t)}(Liquidityprovider_i) \qquad \textbf{(3.2)}$$

P_t is the probability that the cash-flow occurs in time period t and is the probability that the asset sold or the liability increased provides the expected value estimated for the *Liquidityprovider*. *Liquidityprovider* is the value of an asset that can be sold or a liability that can be drawn on under normal market conditions in order for the bank to receive cash-inflows. By including this, the possibilities of the framework are extended to enable scenario-building. For example, for stress

scenarios, $P_{v(t)}$ may take the value of zero for some of the situations, but will reduce the value of the *Liquidityprovider* significantly. The reason for this is that it can be expected that the value at which an asset can be sold or liability that can be drawn upon will decrease significantly during a stress scenario. For scenarios including a local market close period, P_t may take the value of zero as the probability of cash-flows when the market cannot be accessed is zero.

Kronseder (2003b:3) adds that the investigation of scenarios leads to different LaR values, whereas the worst-case scenario is the LaR value that would most interest liquidity risk managers and/or treasurers. Kronseder (2003c:5) states that investigating LaR values for different timeframes helps liquidity risk managers and treasurers to understand the bank's liquidity risk profile over time and helps them to identify potential dangers in the liquidity structure of a bank. By using this framework, a term-structure for LaR can be derived, where it can be expected that *P(Liquidity)* is increasing and CFaR asymptotically increases to a positive level, defined by the longer-term asset and liability management policy of the financial institution.

Kronseder and Kubli (2003:4) concede that the implementation of a LaR model is quite complex and that appropriate probability matrices for the behaviour of all the cash-flows have to be estimated. Kronseder (2003b:4) adds that the concept of LaR is relatively new and that further investigation and research have to be done to be able to fully quantify the scenarios for these assets and liabilities. In addition, the dynamics of CFaR are dependent on the business model of the bank. Therefore, the probabilities assigned within CFaR may differ significantly among different banking models, for example between retail and investment banks.

3.3.7 Conclusion

There is a wide variety of ways to measure liquidity risk and for this reason different banks use different methods to measure their liquidity risk. More sophisticated banks often use more sophisticated techniques and vice versa. It is critical that banks' liquidity risk measurement approaches are aligned with their overall strategic objectives. For these reasons, it is difficult for regulators to impose specific liquidity measurement approaches on banks.

3.4 Conclusion

The ALCO is responsible for, among other things, the effective management of liquidity risk and for ensuring the availability of funding for the bank. In order to do this, it is necessary to measure the liquidity risk that the bank faces.

Being able to measure liquidity risk is the most important step towards managing liquidity risk and the measurement requires a thorough understanding of incoming and outgoing cash-flows and

their origins. Different banks use different methods to measure liquidity risk; methods vary from balance sheet liquidity analysis, liquidity ratios, the cash capital methodology, maturity mismatch analysis and newer methods such as liquidity-at-risk. All five these measures for liquidity risk were discussed and can be summarised as follows:

i. ***Balance sheet liquidity analysis.*** Balance sheet analysis sets different balance sheet items on both the asset and liability side into relation, depending on whether the assets are liquid or illiquid and on whether their funding is stable or volatile. The desired balance sheet structure entails that stable assets are funded by stable liabilities and liquid assets by volatile liabilities.

ii. ***The cash capital methodology.*** The intention of the cash capital methodology is to measure a bank's ability to fund its assets on a fully collateralised basis, assuming that the access to unsecured funding has been lost, which may occur after the downgrade of the bank's short-term credit-rating.

iii. ***The maturity mismatch approach.*** The maturity mismatch approach can be described as a quantitative approach to measuring liquidity risk, where the net cumulative cash-outflow of a bank and the unencumbered assets to cover the net cumulative cash-outflow must be estimated per time period and under different circumstances.

iv. ***Liquidity ratios.*** Banks use a variety of liquidity ratios derived from figures on the balance sheet to quantify liquidity risk and also to set liquidity risk limits. Banks use ratios to measure their ability to meet liquidity needs under normal as well as stressed market conditions.

v. ***Liquidity-at-risk (LaR).*** LaR is determined by two factors, namely the ability to raise funds, including the shiftability phenomenon and the ability to understand the volatility of the daily cash-flows and thus cash-flow-at-risk (CFaR). The implementation of a LaR model is quite complex and the appropriate probability matrices for the behaviour of all the cash-flows have to be estimated. The concept of LaR is relatively new and further investigation and research have to be done to be able to fully quantify the scenarios for these assets and liabilities.

Liquidity risk is an extremely large and complicated field. Chapter 2 and Chapter 3 served as a theoretical overview of liquidity risk and its related concepts. With these chapters serving as background, this study continues by looking at how liquidity risk is treated under Basel II, including a discussion on economic and regulatory capital.

Chapter 4
Liquidity Risk and Basel II

4.1 Introduction

Chapter 2 and Chapter 3 defined and discussed the characteristics of liquidity risk. They also discussed how liquidity risk forms part of the responsibility of a bank's ALCO and methods that banks use to measure liquidity risk. This chapter focuses on the regulatory treatment of liquidity risk with specific reference to Basel II.

According to Brar (2005:1) one of the primary reasons why there has been increased attention on liquidity risk in recent years has been the anticipated impact of Basel II. Basel II will have a significant impact on current practices with regard to liquidity risk management and, more specifically, funding liquidity risk. Basel II is intended to ensure that financial institutions have sufficient capital to cover their risks. Because banks are in the business of taking risks, regulators should ensure that banks have sufficient levels of capital to serve as a buffer for potential losses that may be experienced as a result of these risks. For this reason, regulators require banks to hold regulatory capital to ensure the soundness and stability of the banking sector through guaranteeing that individual banks are adequately capitalised to prevent individual banks causing a crisis in the whole banking system. It is, however, noteworthy that regulators require banks to hold capital only for a few risks, liquidity risk not explicitly being one of them. As will be seen, this is known as Pillar 1 of Basel II.

Regulatory capital is central to Basel II, therefore this chapter begins by defining regulatory capital after which the elements of regulatory capital are discussed. After the section on regulatory capital, this chapter turns its attention to economic capital. It is important to define economic capital as it plays a central role under Pillar 2 of Basel II. Economic capital will be defined, even though it is not always easy to define because different banks use different components of capital for economic capital. A brief comparison between economic capital and regulatory capital is made in order for the differences to become clear.

Basel II is discussed in general terms with the focus on the determination of how liquidity risk is expected to be treated under Basel II. After a complete overview of Basel II, this chapter discusses liquidity risk in relation to Basel II and how and where it fits into the Basel II picture.

4.2 Regulatory capital

4.2.1 Introduction

Regulatory capital is a level of capital that banks are required by their regulators to maintain in order for banks to have sufficient capital to act as a buffer for the risks that they face (Elizalde and Repullo, 2004:1). This section discusses regulatory capital by defining the term and also by briefly discussing the elements of regulatory capital as defined by the Basel Committee on Banking Supervision (BCBS).

4.2.2 Regulatory capital defined

Before defining and discussing regulatory capital and economic capital, it is important to note what book capital is. Rosen (2004:4) states that book capital is the total amount of actual physical capital that is held by a bank, as reflected in its balance sheet, which should strictly speaking be equity capital, but it generally includes liquid debt and hybrid instruments.

Elizalde and Repullo (2004:1) define regulatory capital as the minimum capital that a bank is required by its regulator to hold for different kinds of risk. According to Rosen (2004:4) regulatory capital is defined as the capital that regulators require banks to hold in order for the bank to operate, or as an accounting measure, defined by regulators to act as a proxy for economic capital. Holton (2004:2) states that the purpose of regulatory capital is to assess the overall viability of a bank. Richardson and Stephenson (2000:43) add that regulatory capital requirements are requirements imposed on banks by their regulatory authorities. Because regulatory capital is imposed on banks by regulators, it is hard to customise on a case-by-case basis. In other words, all banks using a certain approach to calculate their regulatory capital are considered to be homogenous, although the risks they face and the business they conduct may differ considerably (Chorafas, 2004:64). Estrella (2000:8) states that the techniques to calculate regulatory capital are not universal, but there are several that are widespread.

According to Richardson and Stephenson (2000:17) regulatory capital should, in principle, be derived from the maximisation of a social welfare function that takes into account the costs (such as the increase in the cost of credit) and the benefits (such as the reduction in the probability of bank failure). In other words, adequate regulatory capital cushions individual banks against expected losses and, through doing this, it contributes to the stability of the banking system as a whole (Rosen, 2004:4). Lachapelle and Lenormand (2007:5) agree with this view and state that the main objective of regulatory capital is to ensure the stability of the financial system, to promote equal competition and to be more considerate of risks. Koch and MacDonald (2006:312) add that a bank's risk positions determine the level of regulatory and economic capital that it needs to hold and therefore the amount of available capital limits the extent to which banks

take risks through their activities. It is, however, important to note that the level of regulatory capital is determined by the confidence level, or level of risk, determined by the regulator. It is important to emphasise that the objective of having regulatory capital requirements is to cover expected losses, which normally occur more frequently but have lesser impact than unexpected losses (Chorafas, 2004:63).

4.2.3 The components of regulatory capital

In the banking industry, the definition of capital requirements was established with the 1988 Capital Accord. The definition has since been expanded upon and Basel II identifies three categories of capital that differ in their ability to cover losses (Chorafas, 2004:66). According to the BIS (2006b:14-18) these are:

i. ***Tier 1 or core capital.*** Equity capital and disclosed reserves are considered by the BIS to be the key element of capital on which most emphasis should be placed to secure a suitable quality and level of total capital resources maintained by major banks (BIS, 1988:2). According to Chorafas (2004:67) there used to be confusion about this term, because core capital was previously known as economic capital, and what is known today as economic capital was known as entrepreneurial capital, but these terms have faded in recent years. The BIS (1988:2-3) adds that this important element of capital is the only element common to banking systems in all countries. It is completely visible in the published accounts of banks which form the basis on which most market evaluations of capital adequacy are made. It also has a great effect on banks' profit margins and competitiveness. According to the SBP (2006:2) Tier 1 capital includes, firstly, only permanent shareholders' equity, which is issued and fully paid ordinary shares/common stock and perpetual non-cumulative preference shares. Secondly, Tier 1 capital includes disclosed reserves, which are created or increased by appropriations of retained earnings or other surpluses such as share premiums, retained profits, general reserves and legal reserves (Monetary Authority of Singapore (MAS), 2005:B-12). In the case of consolidated accounts, this also includes minority interests in the equity of subsidiaries that are less than wholly owned. This basic definition of capital excludes revaluation reserves and cumulative preference shares. The BIS (2006b:14) requires of a bank that at least 50 percent of its capital base should consist of a core element comprised of equity capital and published reserves from post-tax retained earnings. In South Africa this requirement is 75 percent (South African Reserve Bank (SARB), 2007d:618).

ii. ***Tier 2 or supplementary capital.*** Capital elements included under Tier 2 capital include undisclosed reserves, revaluation reserves, general provisions/loan-loss reserves, hybrid debt/capital instruments and subordinated term debt (MAS, 2005:B-23-

B27). Tier 2 capital is limited to 100 percent of Tier 1 capital, with subordinated term debt limited to 50 percent of Tier 1 capital (Koch and MacDonald, 2006:318).

iii. ***Tier 3 or short-term subordinated debt covering market risk.*** Capital used to cover market risk consists of shareholders' equity and retained earnings (Tier 1) along with Tier 2 capital under certain conditions (Richardson and Stephenson, 2000:26). In addition banks may, at the discretion of their regulators and subject to certain conditions, also use Tier 3 capital consisting of short-term subordinated debt for the sole purpose of meeting a proportion of their market risk requirements (BIS, 2005a:5-6). This condition is supported by the SARB (2007d:620).

4.2.4 Conclusion

Regulatory capital has been defined and the elements of which it is comprised have been described briefly. This section serves as background because Pillar 1 of Basel II focuses on regulatory capital. Methods according to which banks are required to calculate regulatory capital are discussed in the subsequent sections that deal with Basel II.

Economic capital is discussed in section 4.3, as it plays an important role under Pillar 2 of Basel II.

4.3 Economic capital

4.3.1 Introduction

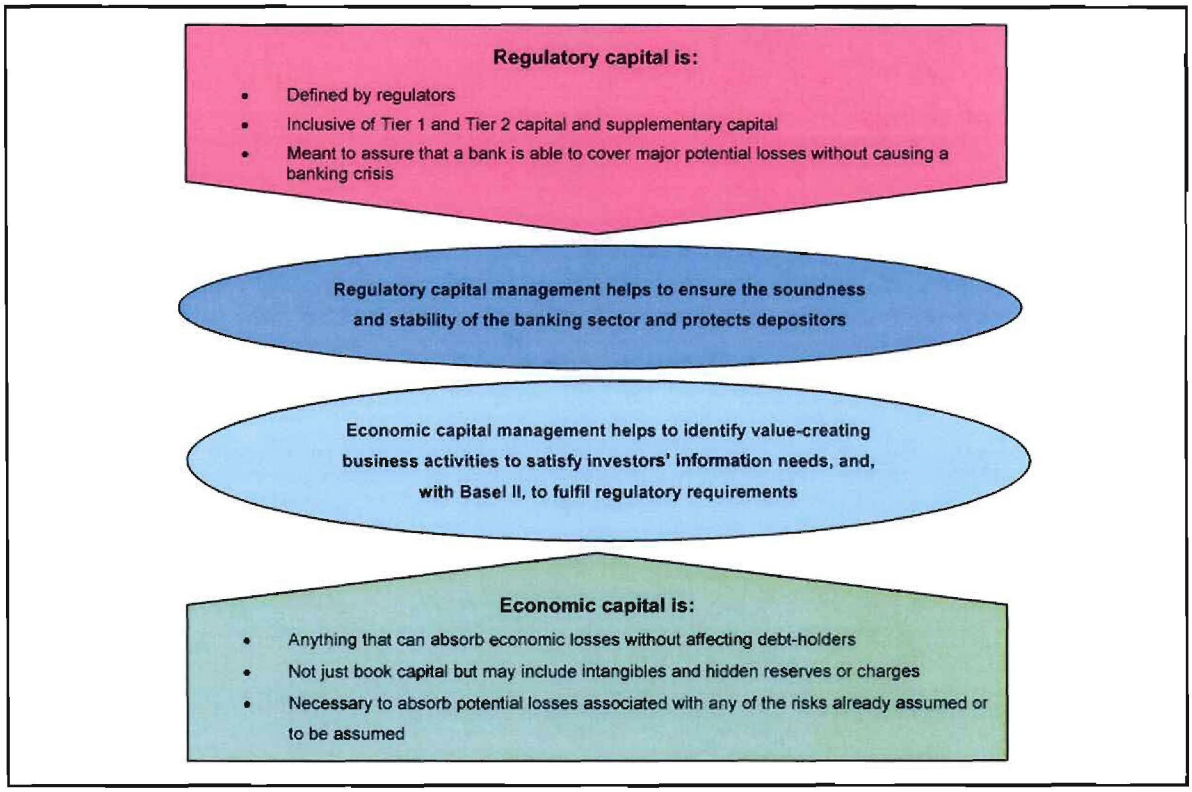
As mentioned in the previous section, economic capital plays a prominent role in Pillar 2 of Basel II. It is therefore important to have an understanding of what economic capital is and to compare economic capital with regulatory capital before discussing Basel II.

4.3.2 Economic capital defined

According to Chorafas (2004:107) it is more difficult to define economic capital and its components than defining regulatory capital and its components. The reason for this is that some banks use their core capital as their gage, whereas other banks add additional components such as preferential shares and unrealised profits. Elizalde and Repullo (2004:1) define economic or internal capital as the capital level that bank shareholders would prefer in the absence of regulatory capital requirements. According to KPMG International (KPMG) (2004:1) economic capital is the capital that banks set aside as a buffer against potential losses inherent in any business activity, whether corporate lending or currency trading. McLaughin and Segal (2006:3) add that economic capital represents an estimate of the level of capital that a bank requires to survive based on sophisticated risk modelling. In other words, a bank's economic capital represents the level of capital needed by the bank to remain solvent and to stay in

business. Brar (2005:2) states that organisations allocate economic capital to reflect their risk exposure more precisely. In this context, economic capital refers to the capital that banks have on one side as a safeguard against potential losses that can naturally occur in any business activity. In other words, economic capital supports transaction-level decision-making (Holton, 2004:2). Chorafas (2004:107) summarises the difference between regulatory capital and economic capital by stating that regulatory capital is the level of capital that is required by a bank to have a banking licence and economic capital is the level of capital that is required by a bank to be in business. In contrast to regulatory capital, economic capital is allocated to cover unexpected losses, which are typically low frequency but high impact events (KPMG, 2004:5-7). According to KPMG (2004:3) the main differences between regulatory capital and economic capital are illustrated in Figure 4.1.

Figure 4.1: Regulatory capital vs. economic capital



Source: KPMG (2004:3)

The figure shows that regulators define regulatory capital and, as mentioned in section 4.2.3, it consists of Tier 1 and Tier 2 capital as well as supplementary capital. Regulatory capital is meant to ensure that a bank can cover significant potential losses without causing a banking crisis. In other words, regulatory capital management helps to ensure the stability and soundness of the banking sector and to protect depositors. Economic capital, on the other hand, is almost anything that can absorb losses without affecting debt-holders. It is noteworthy that economic capital is not just book capital, but that it also includes intangibles and hidden reserves or

charges. Economic capital is necessary to absorb potential losses associated with risks already being assumed or those still to be assumed. Economic capital management helps to identify value-creating business activities to satisfy investors' information needs and, with Basel II, to fulfil regulatory requirements. According to Hall (2006:6) this last point is important as one of the requirements of Basel II is that regulators should ensure that banks have an internal capital adequacy assessment process (ICAAP).

There is a wide variety of ways in which to calculate and allocate economic capital, but as it falls outside the ambit of this study, they are not discussed.

4.3.3 Conclusion

The discussion of economic capital in the previous section was necessary, as it forms part of Pillar 2 of Basel II. Economic capital is the capital that banks set aside as a buffer against potential losses inherent in any business activity, whether corporate lending or currency trading. A bank's economic capital represents the level of capital needed by the bank to remain solvent and to stay in business. Regulatory capital is meant to ensure that a bank can cover significant potential losses without causing a banking crisis. In other words, regulatory capital management helps to ensure the stability and soundness of the banking sector and to protect depositors. Economic capital, on the other hand, is almost anything that can absorb losses without affecting debt-holders. As regulatory capital and economic capital have been defined and the differences between the two highlighted, the use of each will become clearer in the discussion of Basel II.

4.4 Basel II

4.4.1 Introduction: Basel II

According to Lachapelle and Lenormand (2007:5) the Basel Committee for Banking Supervision (BCBS) was established by the Central Bank Governors of the Group of Ten countries at the end of 1974 as a result of serious turbulence in international currency and banking markets, which was partly caused by the collapse of the Bretton Woods system of fixed exchange rates. After the initial meeting was held in February 1975, regular meetings have been held three to four times per year ever since (BIS, 2007b:1)

Lachapelle and Lenormand (2007:5) state that the BCBS provides a forum for regular co-operation on banking regulatory matters between member countries. The member countries are: Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom and the United States (BIS, 1999a:4). The BIS (2007b:1) adds that countries are represented by their respective central banks and/or the

nominated authority responsible for the prudential supervision of banking business in that country.

According to Styger and Vosloo (2005:1) it is significant that the BCBS does not possess any formal supranational regulatory authority or legal force. Instead, its conclusions serve as broad regulatory standards, guidelines and recommendations of international best practice in the expectation that individual regulators will take steps to implement them, whether making them mandatory or not, depending on which will be best suited to their own national systems (Lachapelle and Lenormand, 2007:5). In this way, the BCBS supports convergence towards common approaches and standards without attempting to achieve detailed harmonisation between the regulatory techniques of its members (Cognos, 2003:1). In addition, more than 100 documents providing regulatory guidance on a variety of topics are available on the website of the BIS (BIS, 2007b:1-2).

During the early 1980s the BCBS became concerned that the capital ratios of the main international banks were deteriorating just when international risks, particularly those in comparison with heavily indebted countries, were growing (Styger and Vosloo, 2005:1). The BIS (1999a:4) adds that, for this reason, most of the BCBS' time in recent years has been devoted to capital adequacy and the BCBS decided to work towards stronger convergence in the measurement of capital adequacy worldwide. The BIS (2007b:2) states that the work done around capital adequacy has been to ensure that gaps are closed in international regulatory practices in pursuit of two basic principles, namely that no foreign bank should escape supervision; and secondly that supervision should be sufficient. The idea was that, with a capital buffer against unforeseen losses, the risk of crises in the banking system would be reduced and the stability of the system would increase (Finansinspektionen, 2005:3).

According to Styger and Vosloo (2005:1) the result was the materialisation of a broad consensus on a weighted approach for the measurement of risks for both on and off- balance sheet activities and the identification of the need for a multinational accord for the implementation thereof. This led to the birth of such an accord titled *International Convergence of Capital Measurement and Capital Standards* (BIS, 1988). According to Filenet (2007:2) this document was intended to level the playing field in international banking by addressing geographic inequality in regulation and to establish consistent minimum regulatory capital requirements for banks. This document has generally become known as the Basel Capital Accord, or the 1988 Accord, whereby a minimum regulatory capital standard for member countries of 8 percent of their risk-weighted assets was introduced by the end of 1992 (Oesterreichische Nationalbank, 2007:2). This framework has been progressively introduced not only in member countries since 1988, but also in practically all other countries with active international banks (Mendoza and Stephanou, 2005:3).

According to the Shadow Financial Regulatory Committees (SFRC) (1999:1) the 1988 Accord was not intended to be static but to evolve over time and, for this reason, the BIS issued a proposal in June 1999 for a new capital adequacy framework to replace the 1988 Accord. Cognos (2003:1) adds that the rationale for the new framework came from the significant changes to approaches in financial markets, banking, risk management and general management practices since 1998. The BIS (2007b:3) adds that the refinement of this proposal has been taking place ever since, which has concluded in the release of the comprehensive version of the New Capital Framework in June 2006. The New Capital Framework is called *International Convergence of Capital Measurement and Capital Standards*, but it has become widely known as Basel II (BIS, 2006b).

According to the BIS (1999a:9) the stated purpose of Basel II was to promote world-wide financial stability by co-ordinating supervisory definitions of capital, risk assessments and standards for capital adequacy across countries. Another stated purpose was to link a bank's capital requirements systematically to the risk level of its activities, including various off-balance sheet forms of exposure (Cognos, 2003:1). According to the BIS (2007b:3) Basel II was designed to improve the way in which regulatory capital requirements reflect fundamental risks and to provide better coverage of the financial innovation that has occurred in recent years. The changes from the 1988 Accord were aimed at rewarding the advancements made in the field of risk measurement and providing incentives for improvements to continue (SFRC, 1999:2). In other words, Basel II intends to bring a greater rigor to risk measurement and management practices in banks and to better align capital reserves with actual risk exposures (Filenet, 2007:2). Van Roy (2005:7) states that Basel II is often described as being more risk-sensitive than the previous Accord.

The BIS is also retaining key elements of the 1988 Accord, including the general requirement for banks to a hold total regulatory capital equivalent to at least 8 percent of their risk-weighted assets (BIS, 2005b:2). In addition, the basic structure of the 1996 *Amendment to the Capital Accord to Incorporate Market Risks* (BIS, 1996) regarding the treatment of market risk and the definition of eligible capital remains the same (BIS, 2004b:2). As will be seen in section 4.4.3.4, the 8 percent minimum regulatory capital requirement will also be applied in South Africa from 1 January 2008 along with certain add-ons. The Oesterreichische Nationalbank (2007:2) adds that the main changes in the Basel II framework from the 1988 Accord are in the approaches to credit risk and in the inclusion of explicit regulatory capital requirements for operational risk. A range of risk-sensitive options for addressing both risks are available for banks to use depending on their sizes and levels of sophistication in terms of their businesses (BIS, 1999a:50).

According to the BIS (1999a:6) Basel II consists of three pillars, namely:

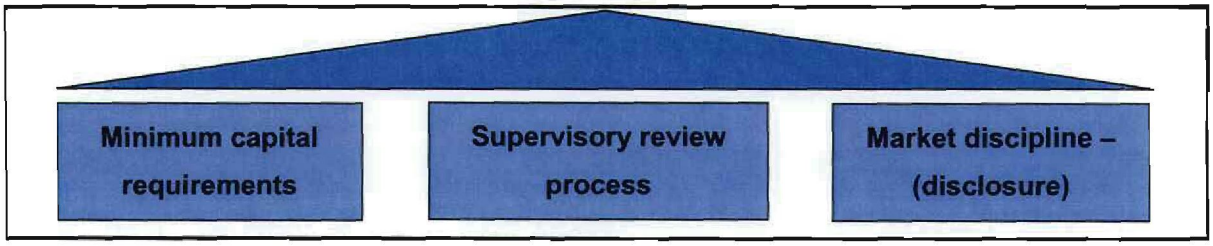
i. ***Pillar 1: Minimum regulatory capital requirements.*** Pillar one requires banks to hold a minimum level of regulatory capital and seeks to develop and expand on the standardised rules as contained in the 1988 Accord.

ii. ***Pillar 2: The supervisory review process.*** This means the supervisory review of a bank's capital adequacy and internal assessment processes, including its ICAAP.

iii. ***Pillar 3: Market discipline.*** This pillar involves the effective use of market discipline to strengthen disclosure of information by banks and to encourage safe and sound banking practices.

According to Van Roy (2005:7) the BIS believes that these three elements collectively are the essential pillars of an effective capital framework and that banks and other interested parties have welcomed the concept of the three-pillar approach. According to Joshi (2005:2) the three-pillar approach can be represented in a diagram as follows:

Figure 4.2: The three pillars of Basel II



Source: Joshi (2005:2)

The first pillar of Basel II is discussed in order to gain a better understanding of what is required from banks under the Basel II regime in terms of calculating regulatory capital to ensure that they are adequately capitalised. It is, however, important to notice that liquidity risk is not one of the risks covered under the first Pillar. For this reason, the methods for calculating regulatory capital requirements for each of the risks that are covered under the first pillar are discussed briefly. It is useful to discuss these approaches in order to gain an understanding of the type of detail in which these risks are covered in Basel II compared to liquidity risk. Pillar one regulatory capital requirements apply only to credit risk, operational risk and market risk.

4.4.2 Pillar 1: Minimum capital requirements

4.4.2.1 Introduction

According to the BIS (2005b:12) the first pillar of Basel II involves the calculation of minimum regulatory capital requirements for credit risk, market risk and operational risk and adds that the

capital ratio is calculated using the definition of regulatory capital and risk-weighted assets. The total capital ratio must not be lower than 8 percent, meaning that regulatory capital divided by risk-weighted assets may not be less than 8 percent (Joshi, 2005:2). The BIS (2004b:12) adds that the total risk-weighted assets are determined by multiplying the capital requirements for market risk and operational risk by twelve and a half (in other words, the reciprocal of the minimum capital ratio of 8 percent) and adding the resulting figures to the sum of risk-weighted assets for credit risk.

As mentioned earlier, Basel II provides for a variety of risk-sensitive options for calculating regulatory capital requirements for each of the risks mentioned above. The calculation of regulatory capital requirements under Pillar 1 for each of these risks will be described briefly, since liquidity risk is not included under Pillar 1.

4.4.2.2 Credit risk

According to Joshi (2005:2) Basel II defines credit risk as the potential that a bank borrower or counterparty fails to meet the financial obligations on the agreed terms. For credit risk, banks have the option of using a Standardised Approach or an Internal Ratings Based (IRB) Approach, of which the latter is divided into the Foundation IRB Approach and the Advanced IRB Approach (Van Roy, 2005:2). Each of these is described briefly:

i. ***Standardised Approach.*** According to the Standardised Approach, credit risk is measured in a standardised manner, supported by external credit-rating assessments (Natter, 2006:1-5).

ii. ***IRB Approach.*** In contrast with the Standardised Approach, the IRB Approach is subject to the explicit approval of the bank's regulator and allows banks to use their internal credit-rating systems for the determination of its credit risk regulatory capital requirement (BIS, 2004b:48).

Following Joshi (2005:2), the approaches for credit risk are summarised in tabular format in Table 4.1.

Table 4.1: Approaches for credit risk under Basel II

Standardised Approach	Internal Ratings Based Approach	
	Foundation IRB	Advanced IRB
Calibrated on the basis of the external credit-ratings.	Function provided by the BIS.	Function provided by the bank.

Source: Joshi (2005:2)

4.4.2.3 Operational risk

Operational risk is defined as the risk of loss resulting from inadequate or failed processes, people, systems, or external events (BIS, 2004b:137). Banks have the option of using one of three methods to calculate its capital requirements for operational risk, namely the Basic Indicator Approach, the Standardised Approach and the Advanced Measurement Approach (AMA) (Natter, 2006:5-6). Each of these approaches is described briefly:

i. ***Basic Indicator Approach (BIA).*** According to the BIA, banks must hold an amount of capital for operational risk equal to the average over the previous three years, of a fixed percentage (15 percent) of positive annual gross income (BIS, 2004b:137-138). It is noteworthy that years in which gross income was zero or negative should be excluded from both the numerator and denominator when calculating the average (Styger and Vosloo, 2005:25).

ii. ***Standardised Approach (SA).*** Banks using the SA are required to divide their activities into eight business lines defined by the BIS, where within each business line gross income is a broad indicator that serves as a proxy for the scale of business operations and therefore the likely scale of operational risk exposure within each of these business lines. The capital charge for each business line is calculated by multiplying gross income by a factor assigned to that business line, this factor being between 12 and 18 percent (BIS, 2005b:143).

iii. ***Alternative Standardised Approach (ASA).*** In addition, there is an Alternative Standardised Approach (ASA) available to banks on regulatory approval (MAS, 2005:B-41). A bank will be allowed to use this approach if it can satisfy their regulator that this alternative approach provides an improved basis by, for example, avoiding double counting of risks. Once a bank has been given approval by the regulator to use the ASA, it cannot revert back to the SA without regulatory approval (BIS, 2006b:146). Under the ASA the operational risk capital charge and methodology to calculate it is the same as for the SA, except for two of the eight business lines, namely retail banking and commercial banking. For these business lines, loans and advances multiplied by a fixed factor 'm' replaces gross income as the exposure indicator (BIS, 2004b:139).

iv. ***Advanced Measurement Approach (AMA).*** Styger and Vosloo (2005:34) state that more rigorous quantitative and qualitative standards are required before a bank is permitted to qualify to use the AMA. The reason for this is because it is considered to be the most difficult approach for operational risk (Lachapelle and Lenormand, 2007:9). The BIS (2005b:145-150) prescribes the quantitative and qualitative criteria to which banks should comply for them to use the AMA. These criteria have been adopted by the SARB (SARB, 2007d:658-660). Under the AMA, the regulatory capital requirement

is equal to the risk measure generated by the bank's own internal operational risk measurement system, which should be based on the following:

- Internal loss data.
- External loss data.
- Scenario analysis.
- Business environment and internal control factors.

The SARB (2007d:492) permits banks to use the AMA for some parts of their operations and the BIA or SA for other parts, subject to regulatory approval.

Business Control Solutions (BCS) (2005:4) summarised the approaches for operational risk as follows:

Table 4.2: Approaches for operational risk under Basel II

Basic Indicator Approach	Standardised Approach	Advanced Measurement Approach
Capital charge = 15 percent of the three years' average gross income.	Capital charge = 12-18 percent of the gross income per regulatory business line.	Capital charge = Internally generated data on internal and external loss data, scenario analysis, business environment and internal controls.

Source: BCS (2005:4)

4.4.2.4 Market risk

According to the BIS (2005a:1) market risk is defined as the risk of losses in on and off-balance sheet positions arising from movements in market prices. The risks subject to this requirement are the risks pertaining to interest rate-related instruments and equities in the trading book; and foreign exchange risk and commodities risk throughout the bank.

South Africa (SA) (1998:6) defines a bank's trading book as proprietary positions in financial instruments that are held for resale or that are taken on by the bank with the intention of benefiting, in the short term, from actual or expected movements in prices, or from other price or interest rate variations, or positions in financial instruments arising from matched principal broking, or positions taken in order to hedge other elements of the trading book. In addition,

exposures due to unsettled transactions and free deliveries and OTC derivative instruments, including exposures resulting from:

i. Repurchase agreements and securities lending based on securities included in the trading book.

ii. And resale agreements and securities borrowing transactions.

According to SA (1998:6) the definition of a trading book is subject to the following conditions:

i. Exposures are marked to market on a daily basis.

ii. Collateral is adjusted in order to take account of material changes in the value of the underlying securities involved in the agreement or transaction in question.

iii. An agreement exists that allows the claims of the bank to be automatically and immediately offset against the claims of its counterparty in the event of default exposures, in the form of fees, commissions, interest, dividends and margins on exchange traded derivatives.

Basel II prescribes one of two approaches for banks to calculate their capital requirements for market risk, namely the Standardised Approach and the Internal Models Approach (IMA). These approaches are discussed briefly:

i. ***Standardised Approach (SA).*** Under the Standardised Approach banks conducting less complex business use measurement matrices and frameworks prescribed by the BIS. Joshi (2005:3) adds that this approach specifies the standards to calculate a capital requirement into five categories, namely interest rate risk, equity position risk, foreign exchange risk, commodities risk and options risk.

ii. ***Internal Models Approach (IMA).*** The IMA allows banks to use their internal models (VaR models) to calculate the capital charge for market risk. To calculate the capital requirement according to the IMA, the highest number of the previous day's (the day before the final day of the month) VaR figure or the average VaR figure over the preceding sixty business days multiplied by a multiplication factor of between three and four is used as the capital requirement (SARB, 2006c:23). The BIS (2005a:35-41) prescribes quantitative and qualitative criteria to which banks wishing to use the IMA should comply. According to the BIS (1998:38-48) such criteria can be divided into the following sections to which banks must comply:

- General criteria, where the approval from the regulator of the bank is compulsory.
- Qualitative standards regarding the maintenance of the bank's independent risk management unit.
- Quantitative standards.

- The specification of market risk factors by the bank.
- The treatment of specific risk.
- Stress testing to identify events that could have an adverse impact on the bank.
- External validations done by external auditors and regulatory authorities.

The approaches available to calculate the regulatory capital requirement for market risk can be represented in tabular format as in Table 4.3:

Table 4.3: Approaches for market risk under Basel II

Standardised Approach	Internal Models Approach
Use measurement matrices and frameworks prescribed by the BIS.	Banks allowed to use their own internal VaR models subject to regulatory approval.

Source: BIS (2006b:166-203)

Considering that two of the objectives of Basel II are to level the playing fields in terms of global banking regulation and to ensure a stable and sufficient global banking system through regulatory capital adequacy requirements, it can, however, also be argued that the current Pillar 1 capital requirements may not necessarily be enough to guarantee that all risks are covered sufficiently should adverse disturbances occur. This is the reason for the existence of Pillar 2, which is discussed in section 4.4.3. From the above it becomes clear that liquidity risk is not included under Pillar 1 of Basel II. As will be seen in section 4.4.3 liquidity risk is, to some extent, included under Pillars 2 and 3 of Basel II.

4.4.2.5 Conclusion

Basel II includes credit risk, operational risk and market risk under Pillar 1. Each of these risks can be calculated using different approaches depending on the size and complexity of the bank. Risks that are not included under Pillar 1, such as liquidity risk, are expected to be included under Pillar 2 which will now be discussed.

4.4.3 Pillar 2: The supervisory review process

4.4.3.1 Introduction

According to the Van Roy (2005:7) the supervisory review process (SRP) of Basel II is intended to ensure that banks have adequate capital to support all the risks in their business and also to encourage banks to develop and use better risk management techniques. The Committee of European Banking Supervisors (CEBS) (2005:2) adds that the underlying objective of the Pillar 2 process is to improve the link between a bank's risk profile, its risk management and risk mitigation systems and its capital. The HKMA (2006:6) adds that the SRP provides the impetus for banks to adopt a more active approach to capital planning and management practices.

The SRP is proposed to cover specific risks as defined by the BIS and should be conducted according to four principles that are prescribed by the BIS. The BIS issued a consultative document in January 2001 titled *Pillar 2 (Supervisory Review Process)* in which the principles by which regulators should conduct reviews are discussed (BIS, 2001b). Each of these four principles is discussed to gain a better understanding of what Pillar 2 entails.

According to the BIS (2001b:2) the SRP emphasises the important role that bank management has to play in the development of an ICAAP and the setting of capital targets that are commensurate with the bank's risk profile and control environment. Accordingly, banks' management are responsible, under Basel II, to ensure that their banks have adequate levels of capital above the minimum regulatory capital requirements (BIS, 2006b:204). In other words, banks are expected to have an adequate assessment process that encompasses all the key elements of capital planning and management and generates an adequate amount of capital to set against those risks – an ICAAP process (CEBS, 2006:2). According to BCS (2005:6) the inclusion of this element emphasises the need for strong risk assessment capabilities by both banks and supervisors. Therefore, as will be seen later, Pillar 2 can be viewed as having two components, namely the supervisory review and evaluation process (SREP) and an ICAAP conducted by banks.

From Chapter 3 it is widely accepted that it would not make sense to include liquidity risk as a Pillar 1 capital requirement because banks use widely divergent methodologies to manage and quantify the liquidity risks that they face. The IIF (2007:42) supports this view and states that regulatory and economic capital should preferably not be tied directly to liquidity risk, but instead regulators should rather assess banks' liquidity positions and risk management practices, taking into account that different banks use different metrics and face different internal and external factors. Weinberg (2007b:5) agrees and states that liquidity risk regulation should be based on Pillar 2 risk management guidance and not quantitative Pillar 1 guidance. Another factor may

be that when a bank is faced with liquidity problems, the amount of capital that it may need to cater for the liquidity risk that it faces may be the bank's entire capital base. In other words, it is extremely hard to determine how and at what level a capital requirement should be set to cover liquidity risk. The BIS (2001c:19) supports this view and states that liquidity risk cannot be measured as objectively as credit risk or market risk. In general, banks establish liquidity goals which they use as benchmarks to measure against their actual liquidity. The risk is then measured in terms of the ratio between actual liquidity and desired liquidity. For this reason liquidity risk should be assessed under Pillar 2 and specific reference is made to liquidity risk under Principle Two of the SRP, where it is required of banks to do a comprehensive assessment of the risks that they face. More specifically, banks are expected to have adequate systems for measuring, monitoring and controlling liquidity risk. In addition, banks are expected to evaluate the adequacy of their capital given their own liquidity profile and the liquidity of the markets in which they operate.

The BIS (2005b:170) identified three types of risks that would especially be suited for review under Pillar 2. These are: risks considered under Pillar 1 that are not fully captured by the Pillar 1 process (such as credit concentration risk), factors not taken into account by the Pillar 1 process (such as interest rate risk in the banking book, business and strategic risk and liquidity risk) and factors external to the bank such as business cycle effects.

The SARB (2007d:660) states that banks should have a sound capital assessment process in place that includes Board-approved policies and procedures designed to ensure that the bank identifies, measures, and reports all its material risk exposures. The BIS (2004b:161) identified specific concerns that should be addressed under Pillar 2 of Basel II. These include:

i. ***Interest rate risk in the banking book.*** The BIS describes interest rate risk in the banking book as a concern, but is unable to attach a Pillar 1 capital requirement to it because banks use a variety of means to manage and measure this risk (BIS, 2005b:170). For this reason, it is up to regulators to determine whether the nature and level of this risk warrant a capital charge under Pillar 2. The BIS published a paper called *Principles for the Management and Supervision of Interest Rate Risk* in July 2004 that prescribes to regulators how interest rate risk in the banking book should be supervised (BIS, 2004c).

ii. ***Credit risk.*** The following are included under credit risk:

- *Credit concentration risk.* The BIS (2005b:171-175) describes what banks are required to do in terms of credit concentration risk and adds that banks should ensure that they comply to a document published by the BIS in September 2000 called *Principles for the Management of Credit Risk* (BIS 2000a).

- *Counterparty credit risk.* Previously this risk was in the paradigm of market risk, but has subsequently moved to Pillar 2 of credit risk under Basel II. The BIS (2006b:215-217) discusses this risk and describes to regulators what to look out for.
- *Residual risk.* These risks refer to risk that arise as a result of banks making use of credit mitigation techniques, such as legal risk, documentation risk and ***liquidity risk.***

iii. ***Operational risk.*** The BIS (2004b:168) states that regulators should determine whether the capital charge for operational risk under Pillar 1 provides a consistent picture of a specific bank's operational risk and refers to a publication of the BIS called *Sound Principles for the Management and Supervision of Operational Risk* (BIS, 2002).

iv. ***Market risk.*** Regulators are entitled to apply a Pillar 2 capital add-on based on banks' stress testing results, valuation methodologies, banks' policies for trading book eligibility and banks' treatment of specific risk under market risk.

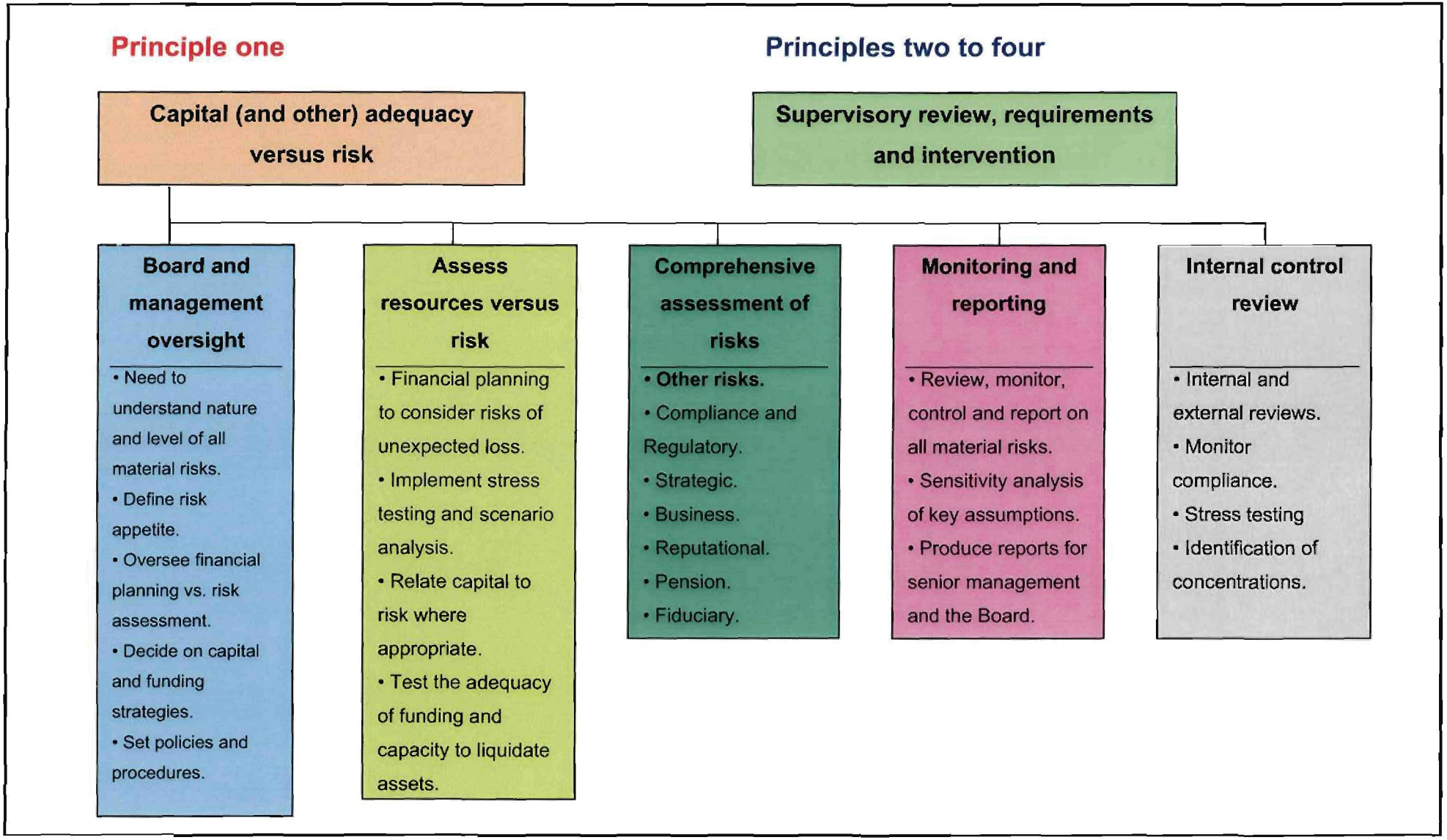
The BIS (2006b:219) describes other aspects of the SRP, such as supervisory transparency and accountability, international co-operation and communication. In addition, the SRP for securitisation is also discussed (BIS, 2004b:169-173). It is important to note that the liquidity risk mentioned as a residual risk under Pillar 2 may form part of and have an effect on the overall funding liquidity risk of a bank, but it can be reasonably expected that liquidity risk generated as a result of the use of credit risk mitigation techniques will only contribute in a minor way to a bank's overall liquidity risk profile.

Another important feature of Pillar 2 is the assessment of banks' compliance with the minimum standards and disclosure requirements of the more advanced methods in Pillar 1, in other words, the IRB Approaches for credit risk, the AMA for operational risk and the IMA for market risk. Regulators must ensure that these requirements are being met as qualifying criteria and on a continuous basis (BIS, 2005b:168).

As alluded to earlier, as liquidity risk is not explicitly included under Pillar 1 of Basel II it has to be treated under Pillar 2 of Basel II. For this reason, Sharma (2004:5) is of the opinion that liquidity risk has perhaps for too long been overlooked as a focus of attention for regulatory reform. This view is supported by the BCBS who issued a press release on 9 October 2007 emphasising the need for "strengthening supervision and risk management practices in areas like liquidity risk" after the liquidity crunch experienced by Northern Rock in September (BIS, 2007a:1). The BIS issued a consultative document in January 2001 titled *Pillar 2 (Supervisory Review Process)* (BIS, 2001b) in which the principles by which regulators should conduct

reviews are discussed. This paper is discussed in order to determine where liquidity risk fits in with the second pillar of Basel II. According to Quigley (2005:19) there are four key principles to the SRP, which are summarised in Figure 4.3. Each of these principles is discussed in order to gain an understanding of how liquidity risk should possibly be treated under Basel II, after which the ICAAP and the SREP will be discussed.

Figure 4.3: The principles of Pillar 2



Source: Quigley (2005:19)

4.4.3.2 Principle one: Process for assessing overall capital adequacy

Principle one prescribes that *banks should have a process for the assessment of their overall capital adequacy in relation to their risk profiles and a strategy for maintaining their capital at adequate levels* (BIS, 2001b:3).

Meister (2005:1) simply refers to this as a bank's ICAAP, which is discussed in more detail in section 4.4.4. In simple terms, a bank's ICAAP involves the calculation of economic capital for all the material risks that if faces. The SARB (2007f:38) states that this principle prescribes that banks must be able to demonstrate that the chosen internal capital targets are well substantiated and consistent with their overall risk profile and operating environment and that the bank's management is responsible for ensuring that the bank has adequate capital to support its risks.

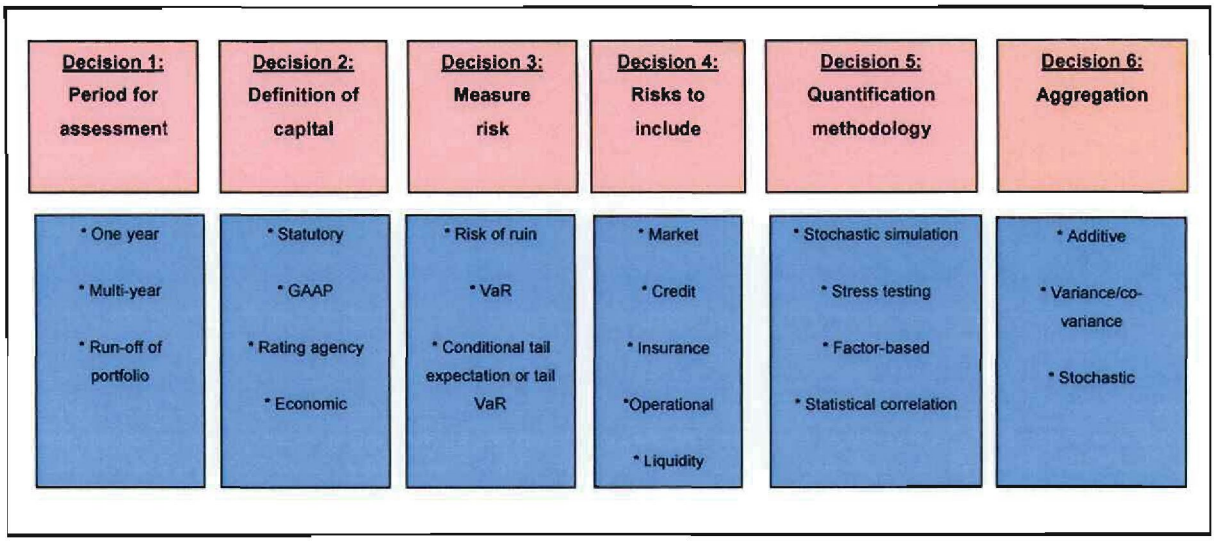
According to the BIS (2001b:4) it is expected under Pillar 2 that the level and complexity of a bank's own measurement of what represents adequate capital are proportionate with the nature of the bank's activities and the risks involved. In other words, banks are required to align their capital level to the level of risk that they assume. According to Quigley (2005:21), to be able to do this effectively banks should at the minimum:

i. Consider unexpected events in the setting of internal capital levels.
ii. Cover a wide range of external conditions and scenarios.
iii. Establish a process that relates capital to the level of risks.

Quigley (2005:21) adds that all risk types should be incorporated in the ICAAP, aggregated to a final capital figure, to provide the basis for strategic planning, limit setting and business line performance.

The BIS (2001b:4) adds that, although there is no single correct way to design or apply an ICAAP, regulators are required to make banks aware of their requirements for such a process. The fact that banks face a variety of choices on how to conduct an ICAAP is represented by Figure 4.4. From the diagram it becomes clear that banks face a variety of choices in conducting an ICAAP. Banks should determine for what period to do an assessment, how to define capital, how to measure the risk, what risks to include and exclude, what methodology to use in quantifying the risk, and how to aggregate risk numbers. Because of the variety of choices that banks face on how to conduct an ICAAP, it is important that regulators make clear their requirements for such a process. The process prescribed by the BIS on how banks should conduct an ICAAP is discussed in section 4.4.4.

Figure 4.4: Several choices for calculating economic capital



Source: Towers Perrin (2006:1)

4.4.3.3 Principle two: Evaluation of banks' internal capital assessments and strategies

The second principle prescribes that *regulators should review and evaluate banks' internal capital adequacy assessments and strategies and also their ability to monitor and ensure their compliance with regulatory capital ratios. In addition, regulators should take appropriate action if they are not satisfied with the result of this process* (BIS, 2005b:167).

The monitoring of a bank's capital adequacy, in relation to the risks inherent in its activities, is mainly the responsibility of bank management and this monitoring should be performed through the bank's ICAAP process (BIS, 2001b:8). According to Styger and Vosloo (2005:41) regulators should frequently review the process by which banks assess their capital adequacy, risk positions, and resulting capital levels and quality of capital held. The SARB (2007f:8) adds that the regulators are also responsible for the evaluation of the degree to which a bank has a sound internal process to assess capital adequacy. According to the BIS (2001b:8) regulators should never be expected to function as bank management, and therefore, the emphasis of the review should be on the quality of the bank's risk management and controls. The BIS (2005b:167) states that such reviews can be one or a combination of the following:

i. On-site examinations or inspections.
ii. Off-site review.
iii. Discussions with bank management.
iv. Review of work done by external auditors (provided it is adequately focused on the necessary capital issues).
v. Periodic reporting.

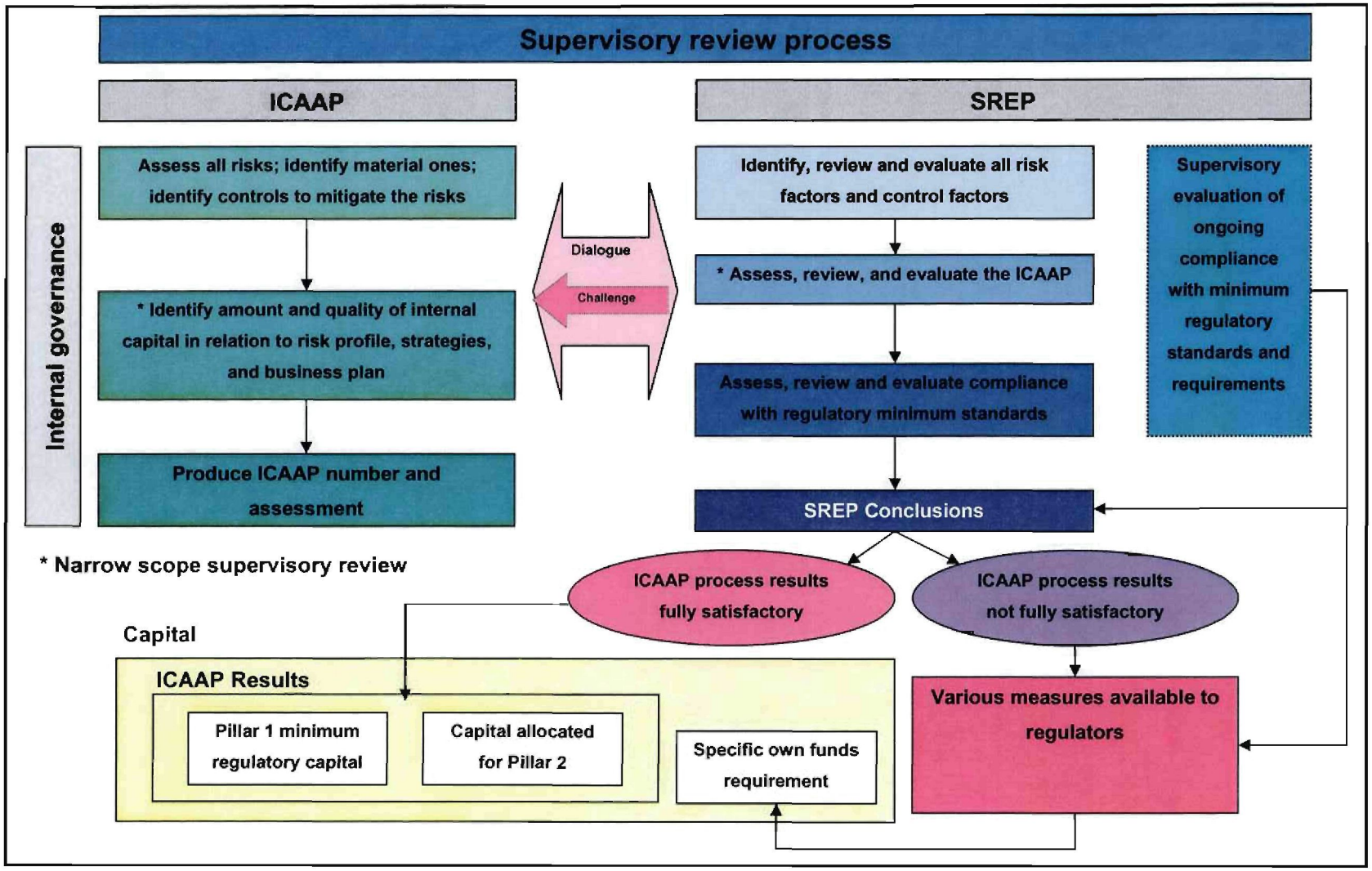
The BIS (2006b:209) adds that errors in the methodology or assumptions of formal analyses can have a significant impact on the resulting capital requirements and, therefore, a detailed review by the regulators of each bank's internal analysis is required. Such a review is called the supervisory review and evaluation process (SREP) and is discussed in section 4.4.5. From the first two principles it becomes apparent that the SRP consists of two components, namely the ICAAP and SREP. This is illustrated in Figure 4.5 and each of these will be discussed in sections 4.4.4 and 4.4.5, respectively.

4.4.3.4 Principle three: Capital assessment

Principle three requires *regulators to expect banks to operate above the minimum regulatory capital ratios and should have the ability to require banks to hold capital in excess of the minimum* (SARB, 2007f:8).

The SARB (2007f:8) states that Pillar 1 capital requirements are subject to including a buffer for uncertainties surrounding the Pillar 1 regime that affect the banking population as a whole and that bank-specific uncertainties are to be treated under Pillar 2. According to the BIS (1999a:54) regulators should have the ability to require banks to hold capital in excess of the minimum regulatory capital ratios. According to the SARB (2007f:8) a bank should have good internal systems and controls, a well-diversified risk profile and a business profile well covered by Pillar 1 capital requirements, and which operates with capital equal to Pillar 1 requirements. Additional buffers should provide reasonable assurance that banks complying with the above will meet the minimum goals for soundness embodied in Pillar 1 (BIS, 2001b:10). The BIS (2006b:211) adds that regulators are required to consider whether the particular features of the markets for which they are responsible are adequately covered by capital.

Figure 4.5: The two components of Pillar 2



Source: CEBS (2006:8)

According to the BIS (1999a:53) regulators will typically require or encourage banks, depending on the country's legislative framework, to operate with a buffer over and above the Pillar 1 standard. The BIS (2005b:169) identified the following reasons why banks should maintain this buffer:

i. ***Creditworthiness.*** Pillar 1 minimums are anticipated to be set to achieve a level of bank creditworthiness in the markets that is below the level of creditworthiness sought by many banks for their own reasons. An example is that most international banks prefer to be highly rated by internationally recognised ratings agencies and, therefore, banks want to operate above Pillar 1 minimums for competitive reasons.

ii. ***Fluctuations in capital ratio.*** In the course of doing normal business, the type and volume of activities that banks undertake will change, and also the different risk exposures, causing fluctuations in the overall capital ratio.

iii. ***Capital is expensive.*** Capital is very expensive, but may prove to be even more expensive when banks have to raise it in a short period of time when they need to do so.

iv. ***Risks not taken into account under Pillar 1.*** There may be risks, either specific to individual banks, or more generally to an economy at large, that are not taken into account in Pillar 1.

v. ***Banks falling below minimum requirements.*** In many cases, banks that fall below the minimum requirement will be in breach of the law and will trigger serious responses from the relevant authorities.

According to Styger and Vosloo (2005:42) numerous means are available to regulators for ensuring that individual banks are operating with adequate levels of capital. Among other methods, regulators may set trigger and target capital ratios or define categories above minimum ratios for identifying the capitalisation level of banks.

4.4.3.5 Principle four: Early regulatory intervention

Principle four requires *regulators to seek to intervene at an early stage to avoid capital from falling below the minimum required levels to support the risk characteristics of a particular bank and should require quick corrective action on the bank's part if capital does fall below minimum required levels* (BIS, 2006b:212).

When regulators become concerned that a bank is not complying with the minimum capital requirements as set out above, they should consider a range of options. These actions may include intensifying the monitoring of the bank, restricting the payment of dividends, requiring the bank to prepare and apply an acceptable capital adequacy restoration plan and requiring

the bank to raise supplementary capital without delay (BIS, 2006b:212). Regulators should have the discretion to use the tools best suited to the circumstances of the bank and its operating environment (BIS, 2001b:13).

Capital should not necessarily be viewed as the first option, because an increased capital requirement cannot address deficiencies in the control and risk management processes (SARB, 2007f:9). For this reason, an increase in a bank's required capital may be considered as an interim measure, until the true problems are solved (Styger and Vosloo, 2005:37).

In South Africa, the Bank Supervision Department (BSD) of the SARB (the South African Regulator), has taken into account that the big five banks in the South African banking sector make up about 90 percent of the total market and own 80-85 percent of its total assets, which represents a significant concentration and systemic risk. Therefore, based on this consideration, an across-the-board additional 1,5 percent capital requirement will be imposed on all banks in South Africa with the implementation of Basel II. This is evident in the new proposed BA 700 return in lines 1-3 (SARB, 2007d:603). The framework for setting an individual capital requirement for banks is described by SARB (2007b:1) as follows:

Pillar 1	8,00%	
+Pillar 2(a)	1,50%	(systemic risk)
	9,50%	
+Pillar 2(b)	varies (x%)	(idiosyncratic risk)
Minimum required capital ratio	9,50% + x%	
+ Buffer	y%	(Principle three, Pillar 2)

Total capital ratio > 9,50% + x% + y% **(4.1)**

The Pillar 2(b) capital which varies in terms of its percentage is based on the outcomes of the regulator conducting an SREP. It is a capital add-on based on concerns that the regulator might have.

4.4.3.6 Conclusion

The BIS identified three types of risks that would be especially suited for review under Pillar 2, these are: risks considered under Pillar 1 that are not fully captured by the Pillar 1 process, such as credit concentration risk; factors not taken into account by the Pillar 1 process such as

interest rate risk in the banking book, business and strategic risk and liquidity risk; and factors external to the bank such as business cycle effects.

The BIS prescribed four principles which should be followed under the supervisory review process of Basel II as follows:

i. Principle one: Process for assessing overall capital adequacy.

ii. Principle two: Evaluation of banks' internal capital adequacy assessments and strategies.

iii. Principle three: Capital assessment.

iv. Principle four: Early regulatory intervention.

From the above, it can be concluded that liquidity risk is not explicitly covered under Pillar 2 of Basel II. Even though liquidity risk is included under Pillar 2 according to Basel II, it does not prescribe how it should be treated under banks' ICAAPs or how regulators should assess its inclusion under Pillar 2 when carrying out an SREP. To gain a better understanding of what an ICAAP and SREP entail, each is discussed in sections 4.4.4 and 4.4.5, respectively.

4.4.4 The internal capital adequacy assessment process (ICAAP)

4.4.4.1 Introduction

This section focuses on the detail of what an ICAAP should entail in terms of the main features that are prescribed by the BIS. This section also highlights where liquidity risk is expected to be included in banks' ICAAPs.

4.4.4.2 Features of an internal capital adequacy assessment process (ICAAP)

The BIS (2005b:163) described five main features of the meticulous process that banks should follow when conducting an ICAAP, namely, Board and senior management oversight, sound capital assessment, comprehensive assessment of risks, monitoring and reporting and internal control review. These five features are briefly discussed below.

i. ***Board and senior management oversight.*** According to the BIS (2004b:241) a sound risk management process is the basis for an effective assessment of a bank's capital adequacy. The BIS (2001b:4) adds that bank management is responsible for understanding the nature and level of risk being taken by the bank and how these risks relate to adequate levels of capital. Bank management is also responsible for ensuring that the formality and sophistication of the risk management processes are appropriate in light of the risk profile and business plan of the bank. According to Styger and Vosloo (2005:38) the analysis of a bank's current and future capital requirements in

relation to its strategic objectives, is an essential element of the strategic planning process. In addition, a bank's strategic plan should clearly outline its capital needs, expected capital expenditures, desirable capital level and external capital sources (BIS, 2005b:164). Styger and Vosloo (2005:38) state that the Board and bank management should consider capital planning a vital element in being able to achieve the desired strategic objectives. The BIS (2001b:4) added that the bank's Board has a responsibility for setting the bank's tolerance for risks. The Board should also ensure that management establishes a framework for assessing the various risks, develops a system to relate risk to the bank's capital level and establishes a method for monitoring compliance with internal policies. It is equally important that the Board adopts and supports strong internal controls and written policies and procedures and that these are communicated effectively throughout the bank by management (BIS, 2004b:241).

ii. ***Sound capital assessment.*** According to the BIS (2001b:5) the formality of the fundamentals of a sound capital adequacy assessment process will vary among banks, depending on the nature of the bank's risks and the sophistication of its holdings and activities. For smaller banks where the business is less complex and senior management is involved with its daily operations, reliance on less formal processes may be acceptable. However, if no formal analysis is performed internally, management should acquire and consider an analysis performed for similar banks. According to the BIS (2005b:164) the fundamental elements of a sound capital assessment include the following:

- Policies and procedures intended to guarantee that the bank identifies, measures and reports all material risks.
- A process that ensures that capital is related to risk.
- A process that states the capital adequacy goals with respect to risk, taking account of the bank's strategic focus and business plan.
- The ensuring of the integrity of the overall management process through a process of the overall management process.

iii. ***Comprehensive assessment of risks.*** According to Styger and Vosloo (2005:39) all material risks faced by a bank should be addressed under the SRP of Pillar II. Risks that could be included in this are credit concentration risk, interest rate risk in the banking book and other risks such as strategic and reputational risks. It is also here where the comprehensive assessment of liquidity risk should take place. Martin (2007:6) describes ***liquidity*** as being crucial to the ongoing viability of any bank. Styger and Vosloo (2005:38) add that banks' capital positions can affect their ability to obtain liquidity, especially during times of crisis. For this reason, the BIS (2006b:208) prescribes that banks should have proper systems for measuring, monitoring and controlling liquidity risk. In addition, banks are expected to evaluate the adequacy of

capital, given their own liquidity profiles and the liquidity of the markets in which they operate.

iv. ***Monitoring and reporting.*** According to the BIS (2005b:166-167) banks should establish adequate systems for monitoring and reporting risk exposures and for assessing how the banks' changing risk profiles affect the need for capital. A bank's senior management or Board should, on a regular basis, receive reports on the bank's risk profile and capital needs (Styger and Vosloo, 2005:40). According to the BIS (2001b:7) the bank's level and types of risk and the potential that the level of risk could change may drastically affect the frequency of reporting. The BIS (2004b:243) states that these reports should allow senior management to:

- Assess the level and trend of material risks and their effect on capital levels.
- Assess the sensitivity and reasonability of the major assumptions used in the capital assessment measurement system.
- Determine whether the bank holds enough capital against the various risks and that it is in compliance with established capital adequacy goals.
- Assess its future capital requirements based on the risk reported by the bank and make necessary adjustments to the bank's strategic plan accordingly.

v. ***Internal control review.*** According to the BIS (2004b:162) the bank's internal control structure is crucial to the capital assessment process. Effective control of the capital assessment process includes an independent review and, where appropriate, the involvement of internal and/or external audits (BIS, 2001b:7). The bank's Board is responsible for ensuring that management establishes a system for evaluating the various risks, develops a system to relate risk to the bank's capital level and establishes a method for monitoring compliance with internal policies (Styger and Vosloo, 2005:41). In addition, the Board should regularly confirm that the bank's system of internal controls is sufficient to ensure well-organised and prudent conduct of business (BIS, 2001b:7-8). Styger and Vosloo (2005:41) state that banks should perform periodic reviews of their risk management process to ensure their integrity, accuracy and reasonableness. According to the BIS (2005b:167) areas that should be reviewed include the following:

- The suitability of the bank's capital assessment process given the nature, scope and complexity of its activities.
- The identification of large exposures and risk concentrations.
- The precision and completeness of data inputs into the bank's assessment process.
- The sensibleness and soundness of scenarios used in the assessment process.
- Stress testing and analysis of assumptions and inputs used for stress testing.

According to Nedbank (2007:111) economic capital should not be held for liquidity risk, as it is difficult to quantify and it becomes impractical to hold capital for liquidity risk at a 99,99 percent or similar confidence interval. Nedbank (2007:111) adds that liquidity risk is best managed by a rigorous control framework and ALCO process. The Bundesbank (2006:1-14) prescribes to banks the use of liquidity ratios on which the adequacy of a bank's liquidity position is assumed. In addition, the Bundesbank (2006:14) allows banks to use their own internal liquidity measurement and management techniques subject to regulatory approval after certain criteria have been met.

4.4.4.3 Conclusion

Banks should pay attention to five main features of the meticulous process to follow when conducting an ICAAP, namely, Board and senior management oversight, sound capital assessment, comprehensive assessment of risks, monitoring and reporting and internal control review. Although it is mentioned that liquidity risk is considered important and that it should be included in banks' ICAAPs, the description of its treatment remains vague. The BIS simply prescribes that banks should have proper systems for measuring, monitoring and controlling liquidity risk. In addition, banks are expected to evaluate the adequacy of capital, given their own liquidity profiles and the liquidity of the markets in which they operate. Because of the lack of substance in terms of prescribing the treatment of liquidity risk under Pillar 2, banks and regulators hold different views.

4.4.5 The supervisory review and evaluation process (SREP)

4.4.5.1 Introduction

Styger and Vosloo (2005:37) state that regulators are responsible for the evaluation of banks' ICAAPs and that regulators can intervene to ensure that deficiencies are identified so that prompt and decisive actions can be taken to reduce or restore banks' capital levels. As mentioned earlier, capital should not necessarily be viewed as the first option, because an increased capital requirement cannot address deficiencies in the control and risk management processes. Accordingly, regulators can adopt an approach to give more attention to banks with higher risk profiles or operational experience that warrant more attention. CEBS (2005:2) adds that this dialogue between banks and their regulators form a key part of the SRP. The BIS (2001b:2) adds that countries' regulators adopt a variety of ways to ensure that this dialogue takes place, including the following:

i. On-site inspections and examinations.

ii. Off-site reviews and evaluations.

iii. Requirements for banks to have policies on risk management issues.

iv. Discussions and meetings with bank management.

v. Commission and review of work done by external auditors if it is adequately focused on the necessary capital issues.

vi. Requirements on banks for periodic reporting.

4.4.5.2 Features of a supervisory review and evaluation process (SREP)

According to Styger and Vosloo (2005:42) a detailed analysis of each bank's internal risk analysis by regulators should include the following:

i. ***Review of adequacy of risk assessment.*** According to the BIS (2001b:10), regardless of the type of review, regulators should evaluate the degree to which internal targets and processes include the full range of material risks faced by the bank. The Financial Services Authority (FSA) (2006c:7) states that in this step of the SREP process, regulators should assess to which degree a bank's ICAAP covers all the risks to which a bank is exposed, namely Pillar 1 risks, risks not covered fully under Pillar 1 and risks not covered under Pillar 1 (including liquidity risk). Regulators should also review the adequacy of risk measures used in assessing internal capital adequacy and the extent to which these risk measures are used operationally in setting limits, evaluating business line performance and evaluating and controlling risks more generally (BIS, 2001b:8-9). The results of sensitivity analyses and stress tests conducted by the institution and how these results relate to capital plans should also be taken into account by the regulators (BIS, 2004b:163).

ii. ***An assessment of capital adequacy.*** According to the BIS (2006b:210) regulators should review the bank's processes to determine that:

- Target levels of capital chosen are comprehensive and relevant to the current operating environment.
- These levels are properly monitored and reviewed by senior management.
- And that the composition of capital is appropriate for the nature and scale of the bank's business.

Regulators should also consider the degree to which the bank has made provision for unexpected events in setting its capital levels. This analysis should cover a wide range of external conditions and scenarios and the complexity of techniques and stress tests used should be commensurate with the bank's activities (BIS, 2005b:168). The FSA (2006c:7) states that the economic capital amount should be stressed using 1 in 25 events through an economic cycle. In other words, the data used for stressing the economic capital amount should cover a full range of economic conditions, such as a full business cycle (SARB, 2007f:7).

iii. ***Assessment of the control environment.*** The BIS (2006b:210) requires regulators to consider the quality of banks' management information reporting and systems, the

manner in which business risks and activities are aggregated and management's record in responding to emerging or changing risks. The BIS (2004b:163) continues to state that the capital level at an individual bank should be determined according to the bank's risk profile and adequacy of its risk management process and internal controls, while external factors, such as business cycle effects and the macroeconomic environment should also be considered.

iv. ***A supervisory review of compliance with minimum standards.*** According to the BIS (2001b:9), in order for certain internal methodologies, credit risk mitigation techniques and asset securitisations to be recognised for regulatory capital purposes, banks will need to meet a number of requirements. Requirements include risk management standards and disclosures and, particularly, disclosure of features of their internal methodologies used in calculating minimum capital requirements (BIS, 2005b:168). As part of the SRP, regulators must ensure that these conditions are being met on an ongoing basis (BIS, 2001b:9). The BIS (2006b:210) regards this review of minimum standards and qualifying criteria as an essential part of the SRP under Principle 2. These standards do not only pertain to internal methodologies, but have an important role for the supervisory review of fulfilment of certain conditions and requirements set for standardised approaches (BIS, 2004b:164). In this context, there is a specific need to ensure that the use of various instruments that can reduce Pillar 1 capital requirements are utilised and understood as part of a sound, tested and properly documented risk management process (BIS, 2005b:169).

v. ***A supervisory response.*** The BIS (2001b:9) states that regulators, having carried out the review process described in the four steps above, should take appropriate action if they are not satisfied with the results of the bank's own risk assessment and capital allocation. A range of possible actions is available to regulators, as discussed in Principles Three and Four in sections 4.4.3.4 and 4.4.3.5.

4.4.5.3 Conclusion

When conducting a supervisory review and evaluation process, regulators are prescribed by the BIS to do a number of things. These are summarised as follows: review of adequacy of risk assessment, an assessment of capital adequacy, assessment of the control environment, a supervisory review of compliance with minimum standards and a supervisory response.

CEBS (2006:8) illustrated Pillar 2 of Basel II as in Figure 4.5. This figure summarises the discussion above. Banks' ICAAP processes require them to assess all the risks and to identify the material risks that they face. The bank should then ensure that it has an adequate level and quality of capital to serve as an internal buffer for these risks, in line with its risk profile,

strategies and business plan. This is then used to produce its ICAAP number and will represent the number according to which the bank's ICAAP process is assessed by its regulator.

The SREP involves regulators identifying, reviewing and evaluating all risk factors and the relevant control factors associated with each of these risk factors. Regulators will then be in a position to assess, review and evaluate the bank's ICAAP. After doing this, the regulator reviews and evaluates the bank's compliance with regulatory minimum standards, which will bring it to its conclusions about the bank involved. It is important to note that regulators should constantly evaluate banks' compliance with minimum regulatory standards and requirements. When regulators evaluate the internal capital determined by banks, and in doing so do a detailed assessment of the bank's ICAAP, it is considered to have quite a narrow regulatory focus. Depending on the regulator's satisfaction with the bank's ICAAP process, it has two options available. Firstly, if the regulator is satisfied with the conclusions from the SREP, the bank involved will have to comply with the Pillar 1 minimum capital requirements, along with any add-ons under Pillar 2 that will apply to the country involved. Secondly, if the regulators are not satisfied with the conclusions from the ICAAP process, they have a variety of means available to them such as discussions with bank management and requirements for ICAAP policies to be in place. This may ultimately lead to the regulator imposing a specific capital charge on that bank.

Even though the BIS describes what regulators are expected to do when conducting an SREP, it is unclear what specifics they should look for. It is even more vague when focusing on liquidity risk as there is no description on whether assessments should be quantitatively or qualitatively based. Section 4.4.6 closes the discussion on Basel II by briefly describing Pillar 3.

4.4.6 Pillar 3: Market discipline

4.4.6.1 Introduction

Joshi (2005:4) describes Pillar 3 of Basel II as being complementary to Pillar 1 and Pillar 2 as its objective is to encourage market discipline and public disclosure to provide key information about banks' risk profiles and available capital resources to banks' shareholders, stakeholders and other market players.

4.4.6.2 Brief description of Pillar 3

According to BCS (2005:6) Pillar 3 encourages market discipline by developing a set of disclosure requirements regarding a bank's risk profile and its level of capitalisation. The BIS (1999a:60) adds that the risks to which banks are exposed and the techniques used by banks to

identify, measure, monitor and control those risks are significant factors that market participants take note of when assessing an institution. According to Styger and Vosloo (2005:49), as a general disclosure principle, Pillar 3 requires banks to have a formal disclosure policy that is approved by its Board. Such a disclosure policy should address the bank's approach for determining what disclosures it will make and the internal controls over its disclosure process (SARB, 2007d:673). The BIS (2004b:178) adds that banks should institute a process for assessing the appropriateness of their disclosures, including the validation and the frequency of them.

The BIS (2006b:229-231) provides tables in which quantitative and qualitative disclosure requirements are described for:

i. The scope of the application, containing a description that disclosure requirements are to be compiled at a consolidated group level.
ii. Capital structure.
iii. Capital adequacy.

The BIS further describes in a *"Risk exposure and Assessment"* section the quantitative and qualitative requirements for the disclosure of certain risks (BIS, 2006b:231-242). The risks for which quantitative and qualitative disclosure requirements are prescribed are the following:

i. Credit risk, including credit risk mitigation, counterparty credit risk and securitisation.
ii. Market risk.
iii. Operational risk.
iv. Equity risk in the banking book, or investment risk.
v. Interest rate risk in the banking book.

4.4.6.3 Conclusion

Under Pillar 3 banks are, as is practice already, expected to provide information on their liquidity risk management techniques in their annual reports and other media.

4.4.7 Conclusion: Basel II

The foundation of Basel II is a three-pillar approach, the three pillars of which are set out as follows:

i. ***Pillar 1: Minimum regulatory capital requirements.*** Pillar 1 requires banks to hold a minimum level of regulatory capital and seek to develop and expand on the standardised rules as contained in the 1988 Accord.

ii. ***Pillar 2: The supervisory review process.*** This means the supervisory review of a bank's capital adequacy and internal assessment processes, including its internal capital assessment process (ICAAP).

iii. ***Pillar 3: Market discipline.*** This pillar involves the effective use of market discipline to strengthen disclosure of information by banks and to encourage safe and sound banking practices.

Basel II includes credit risk, operational risk and market risk under Pillar 1. Each of these risks can be calculated using different approaches depending on the size and complexity of the bank. Risks that are not included under Pillar 1, such as liquidity risk, are expected to be included under Pillar 2.

The BIS identified three types of risks that would be especially suited for review under Pillar 2, these are: risks considered under Pillar 1 that are not fully captured by the Pillar 1 process, such as credit concentration risk; factors not taken into account by the Pillar 1 process such as interest rate risk in the banking book, business and strategic risk; and liquidity risk, and factors external to the bank such as business cycle effects.

Liquidity risk is not explicitly covered under Pillar 2 of Basel II. Although liquidity risk is included under Pillar 2 according to Basel II, it does not clearly prescribe how it should be treated under banks' ICAAPs or how regulators should assess its inclusion under Pillar 2 when carrying out an SREP.

The BIS described five main features of the meticulous process that banks should follow when conducting an ICAAP, namely Board and senior management oversight, sound capital assessment, comprehensive assessment of risks, monitoring and reporting and internal control review. Although it is mentioned that liquidity risk is considered to be important and that it should be included in banks' ICAAPs, the description of its treatment remains vague. The BIS simply prescribes that banks should have proper systems for measuring, monitoring and controlling liquidity risk. In addition, banks are expected to evaluate the adequacy of capital, given their own liquidity profiles and the liquidity of the markets in which they operate. Because of the lack of substance in terms of prescribing the treatment of liquidity risk under Pillar 2, banks and regulators have different views.

When conducting a supervisory review and evaluation process, regulators are prescribed by the BIS to do a number of things. These are summarised as follows: review of adequacy of risk assessment, an assessment of capital adequacy, assessment of the control environment, a supervisory review of compliance with minimum standards and a supervisory response. Although

the BIS describes what regulators are expected to do when conducting an SREP, it is unclear what specifics they should look for. It is even more vague when focusing on liquidity risk as there is no description on whether assessments should be quantitatively or qualitatively based.

Liquidity risk is not specifically mentioned under Pillar 3 of Basel II, but rather as a residual risk that can occur as a result of credit risk mitigation techniques. According to Sharma (2004:5) this has been the aspect of the regulation of liquidity risk that has received the least attention of all internationally. Under Pillar 3 banks are, as is practice already, expected to provide information on their liquidity risk management techniques in their annual reports and other media.

4.5 Conclusion

As mentioned in section 2.2.1, liquidity risk is often described as the assassin of banks. The reason for this description is that banks can experience liquidity problems suddenly and without warning and may then face exceptionally large losses or even failure in extreme cases. Despite the obvious dangers of liquidity risk and the importance of correctly measuring and managing liquidity risk, clearly articulated principles on liquidity risk supervision is an almost glaring omission from Basel II. This is emphasised by the fact that the term "liquidity risk" appears only three times in the Basel II document that is almost 350 pages long. After the liquidity crunch experienced in markets across the world and the run on Northern Rock, the BCBS has emphasised the need for strengthening the regulation of risks such as liquidity risk.

From Chapter 3 it is widely accepted that it would not make sense to include liquidity risk as a Pillar 1 capital requirement because banks use widely divergent methodologies to manage and quantify the liquidity risk that they face. Except for divergent methodologies used by banks to measure liquidity risk, it is difficult to measure liquidity risk as objectively as credit risk or market risk. For this reason liquidity risk should be assessed under Pillar 2 of Basel II. Specific reference is made to liquidity risk under Principle Two of the SRP, where it is required of banks to do a comprehensive assessment of the risks they face. More specifically, banks are expected to have adequate systems for measuring, monitoring and controlling liquidity risk. In addition, banks are expected to evaluate the adequacy of their capital given their own liquidity profile and the liquidity of the markets in which they operate. Because of the lack of substance in terms of prescribing the treatment of liquidity risk under Pillar 2, banks and regulators hold different views.

Although requirements for the management and measurement of liquidity risk are not included explicitly in Basel II, the BIS has published two papers describing the management of liquidity risk in banking organisations and financial groups, which are discussed in section 5.2. As it can be assumed that liquidity risk should be treated under Pillar 2 of Basel, Chapter 5 explores prescribed principles for the management of liquidity risk. It is important to take note of such principles for

regulators to be aware of what to look for in the regulation of liquidity risk from a theoretical perspective.

Chapter 5
Liquidity Risk Regulation

5.1 Introduction

Chapter 2 and Chapter 3 defined liquidity risk, described characteristics of liquidity risk, liquidity risk management, a typical ALCO process and ways in which to measure liquidity risk. Chapter 4 examined Basel II and focused specifically on Pillar 2 where liquidity risk is supposed to fit into the framework. It also highlighted that guidance regarding the treatment of liquidity risk has almost been left out completely from Basel II. For this reason, this fourth chapter of the literature review focuses on theoretical guidelines that have been prescribed to ensure sound liquidity risk management and regulation.

The management and measurement of liquidity are considered to be among the most important activities undertaken by banks. A bank must assure itself that it can meet its obligations when they become due in order to reduce the probability of irreparable damage being caused to it as a result of liquidity problems. In addition, a bank's liquidity position determines the time that it has available to address problems even when such problems originate in other areas of the bank. Because of the critical importance that sound liquidity risk management play not only in banks, but also in the entire financial system of a country from a regulatory perspective, this chapter reviews published literature that describes ways in which banks can prudently manage liquidity risk and also what is expected from regulators regarding the supervision of liquidity risk from a theoretical perspective. The following published papers, along with other literature, were considered in the writing of this chapter:

i. *A Framework for Measuring and Managing Liquidity* (BIS, 1992).

ii. *Sound Practices for Managing Liquidity Risk in Banking Organisations* (BIS, 2000b).

iii. *The Managing of Liquidity Risk in Financial Groups* (BIS, 2006f).

iv. *Principles of Liquidity Risk Management* (IIF, 2007).

The context and detail of each of these papers are described in the following section, after which the fourteen principles from the 2000 BIS paper are discussed indirectly to provide an overall perspective.

After discussing sound principles for managing and measuring liquidity risk, the chapter turns its attention to the *Core Principles for Effective Banking Supervision* (the Basel Core Principles). The

Basel Core Principles were developed by the BIS in co-operation with fellow regulators, and have effectively become the standard for sound prudential regulation and supervision of banks.

Assessment of compliance with the Core Principles is done by the International Monetary Fund (IMF) and it uses a rating scale consisting of the following four degrees of compliance: compliant, largely compliant, materially non-compliant and non-compliant (IMF, 2006). The Core Principles are minimum standards to be applied by all banking regulators. Each of the twenty-five Core Principles sets out essential and additional criteria with which regulators should comply before they can be fully compliant with the entire principle in question. The Core Principle discussed in this chapter is Principle number Fourteen as it explicitly deals with liquidity risk and what is expected from regulators in terms of the regulation of liquidity risk.

5.2 Sound principles for managing liquidity risk

5.2.1 Introduction

The BIS (1992:3) states that the management and measurement of liquidity are considered to be among the most important activities undertaken by banks. A bank must assure itself that it can meet its obligations when they become due in order to reduce the probability of irreparable damage being caused to it as a result of liquidity problems. In addition, a bank's liquidity position determines the time that it has available to address problems even when such problems originate in other areas of the bank. Since 1992, when they published a paper called *A Framework for Measuring and Managing Liquidity*, the BIS has been focused on developing a better appreciation for the way in which international banks manage their liquidity on a worldwide basis. This paper was based on the presumption that the supervision of liquidity risk is most effective if it is based on regular interaction between the banks involved and their regulators (BIS, 1992:1).

However, after the publication of this paper, technological and financial innovations provided banks with new and different ways of funding their activities and managing their liquidity. Furthermore, banks' declining ability to rely on core deposits, along with its increased dependence on wholesale funds and the turmoil in financial markets across the world in the mid to late-1990s changed banks' views on liquidity. A combination of all these changes left banks facing new challenges regarding the management and measurement of liquidity risk. For this reason the BIS published a paper in 2000 which served as an update of the 1992 paper and was called *Sound Practices for Managing Liquidity in Banking Organisations* (BIS, 2000b). This paper sets out fourteen key principles that the BIS recommended to banks in their management and measurement of liquidity risk. Principles one to four deal with the establishment of a structure for the management of liquidity risk, Principles five to seven with the management and measurement of a bank's net funding requirements, Principle eight with the management of market access,

Principle nine with contingency planning, Principles ten and eleven describe the management of foreign currency liquidity, Principle twelve deals with the internal controls for effective liquidity risk management, Principle thirteen with the role and importance of public disclosure and reporting of liquidity risk, and Principle fourteen deals with the role of regulators.

In 2006 the BIS published another paper in which liquidity risk management in financial groups was the topic. The paper was called *The Management of Liquidity Risk in Financial Groups* (BIS, 2006f) and focused on the best practices of managing liquidity risk in multinationals which were engaged in banking, insurance and securities activities.

In March 2007 the IIF published a paper named *Principles of Liquidity Risk Management* (IIF, 2007). This paper was published based on work done by a Special Committee that was established by the IIF late in 2005 that represented about forty of the largest banks in the world. The objective of the Special Committee was to develop a perspective and recommendations on liquidity risk measurement, monitoring, management and governance at financial institutions (Weinberg, 2007b:2). The Special Committee made forty-four recommendations for the sound management of liquidity risk. The first thirteen recommendations address the governance and organisational structure for managing liquidity risk, recommendations fourteen to thirty address the analytical framework for measuring, monitoring and controlling of liquidity risk and recommendations thirty-one to forty-four address liquidity stress testing and contingency planning.

Principles for sound liquidity risk management are discussed in detail as a combination of the recommendations and Principles from the above-mentioned four papers.

5.2.2 Principle one: Liquidity management strategy

The first Principle states that *banks should have an agreed strategy that is communicated throughout the bank for the daily management of its liquidity* (Cayman Islands Monetary Authority (CIMA), 2003:1).

As mentioned earlier, most banks are in the business of liquidity transformation, i.e. they take deposits that are often payable to customers on demand or on notice over a short period and use it to fund credit facilities to borrowers over longer periods of time (FSC, 2005:2). Many banking activities depend directly or indirectly on a bank's ability to provide liquidity to customers, making them vulnerable to liquidity problems which may originate from inside the bank or which may be caused by market-wide disturbances (BIS, 2000b:3-4). Liquidity problems experienced by a particular bank can quickly and easily spread to other banks and have dire consequences for the financial system as a whole (RBA, 1998:1).

The IIF (2007:19) recommended that a bank should first define the different forms of liquidity risk that the bank is exposed to and also clearly differentiate between funding and market liquidity risk. The CIMA (2003:1) states that a bank's liquidity strategy should identify the approach that the bank will follow in terms of its liquidity risk management, including various quantitative and qualitative targets. Weinberg (2007b:4) states that banks should have an agreed upon strategy for the day-to-day management of all kinds of liquidity risk that they may need to manage.

The CIMA (2003:1-2) stated that the liquidity strategy should address the bank's goal of protecting its financial strength and its ability to survive demanding events in the marketplace. In doing this, the strategy should identify specific policies regarding specific components of liquidity risk management such as the composition of its assets and liabilities, how to manage liquidity in different currencies between different countries, the bank's reliance on certain specific instruments and/or concentrations of funds and the liquidity of its assets. According to the NBRM (2004:4) the bank's overall liquidity strategy should also include the strategy that the bank will follow when it experiences short-term or longer-term liquidity problems.

The second part of Principle one is that the bank's liquidity management strategy must be documented in a liquidity policy and communicated throughout the bank, and the policy should be reviewed periodically to ensure its continued validity (CIMA, 2003:2). The BIS (2000b:4) states that business units in the bank that conduct business which may impact on the bank's liquidity position should be completely aware of the bank's overall liquidity strategy and conduct its business according to the approved policies, procedures and limits.

5.2.3 Principle two: Liquidity management strategy must be Board-approved

The second Principle states that *a bank's Board of Directors should approve the strategy and all significant policies that a bank wishes to implement for its liquidity risk management. It is also the Board's responsibility to ensure that senior management take the necessary steps to monitor and control liquidity risk. Furthermore, the bank's liquidity position should be communicated to the bank's Board on a regular basis and immediately if there are any significant changes in the bank's current or future liquidity position* (NBRM, 2004:7).

The HKMA (2004:21) and the SBP (2003:28) state that in order for a bank to effectively manage liquidity risk, it is extremely important for it to have an informed and knowledgeable Board, competent management, staff with the necessary skills and expertise and efficient systems and procedures. In addition, the Board should understand the nature and level of the bank's liquidity risk as well as tools available to manage liquidity risk and be confident that the bank's fund-seeking strategies and practices are in line with the size and complexity of the bank's operations (Central Bank of the Bahamas (CBB), 2005:2).

The Board of a bank is responsible for the determination of the bank's strategy and tolerance levels for liquidity risk because of the critical importance of liquidity risk management to the continuity of any bank (OCC, 2001:27), therefore it should also approve all significant policies relating to liquidity risk (HKMA, 2004:21) and review and approve such policies annually (IIF, 2007:20). According to the SBP (2003:28-29) the liquidity risk management strategy that the Board determines should normally focus on certain aspects of liquidity risk management, such as the following:

i. ***The composition of assets and liabilities.*** This strategy normally highlights the mix of assets and liabilities that a bank should maintain to remain liquid.

ii. ***Diversification and stability of liabilities.*** As discussed in Chapter 2, too much reliance on volatile funding such as overseas loans or borrowing from large creditors, which are interest rate sensitive, may result in liquidity risk. Funding from numerous retail depositors is more stable. In addition, concentrated funding sources are likely to increase a bank's liquidity risk and were discussed in section 2.3.2.3. The CBB (2005:4) states that it is for this reason that banks should strive to build up stable sources of funds and to minimise its reliance on volatile liabilities.

iii. ***Managing access to the interbank and other wholesale markets.*** This may be an important source of liquidity, but it should be taken into account that access to these markets during times of crisis may be difficult and very costly (HKMA, 2004:23). For this reason, the CBB (2005:3) states that it is important for banks to test their presence in the markets from time to time in order for them to gain a better understanding of their capability to tap into funds in the interbank market. Banks should not just assume that it would be capable to raise such funds as and when needed. In other words, banks should know how much funds they will be able to raise from the market under normal as well as adverse conditions.

The HKMA (2004:23) added that a bank's liquidity risk management strategy should also focus on the following:

iv. ***The bank's approach to managing liquidity in different currencies.*** According to the European Central Bank (ECB) (2002:24) the bank's liquidity risk management policy should include aggregate foreign currency needs as well as acceptable mismatches.

v. ***Management of intra-group liquidity.*** The CBB (2005:4) states that a branch or subsidiary of a foreign bank should be able to gain access to additional liquidity if needed from its parent institution or head office. The HKMA (2004:48) adds that banks should, therefore, have sufficient policies and systems to manage their intra-group liquidity arrangements. An important factor is that banks should specify in their liquidity management strategy the treatment of intra-group liquidity as well as assumptions made on intra-group liquidity dependencies (OCC, 2001:29).

The Board should also ensure that the bank has an appropriate liquidity risk management structure in place whereby the lines of authority and responsibility for the different levels of management are established and policies and practices are set up to effectively manage liquidity risk (BOT, 2003:20). The NBRM (2004:7) adds that the Board should continuously be aware of the bank's operating results and liquidity profile. For this reason information presented to the Board should be adequate enough and in sufficient detail for it to be able to understand the liquidity of the bank's important portfolios as well as the bank's overall liquidity risk. The SBP (2003:28) adds that through its awareness of the bank's liquidity risk, the Board ensures that liquidity risk is identified, measured, monitored and controlled. The Board should also review the contingency plans of the bank for handling disruptions to its ability to fund some or all of its activities in a timely manner and at a reasonable cost (BIS, 2000b:5).

5.2.4 Principle three: Effective management structure

Principle three states that *all banks should have a management structure in place to effectively execute the bank's liquidity strategy. The management structure should include the ongoing involvement of members of senior management, who must ensure that liquidity is effectively managed and that appropriate policies and procedures are established to control and limit liquidity risk. Banks should set and regularly review limits on the size of their liquidity positions over particular time horizons* (CIMA, 2003:1).

The OCC (2001:27) states that senior management are responsible for the day-to-day management of liquidity risk and that they should set up their own processes and procedures that translate the Board's goal and objectives for liquidity risk into operating standards. The NBRM (2004:8) states that the Board is responsible for determining which part of the bank's management are responsible for the operational implementation of the liquidity risk management strategy. The IIF (2007:20) adds that this structure should include the ongoing involvement of senior management, who must ensure that liquidity is effectively managed on a regular and timely basis and that suitable policies and procedures are established to limit and control the material sources of liquidity risk.

The BIS (2000b:5) states that the responsibility for managing the overall liquidity of the bank should be placed with a specific group within the bank. According to the Irish Financial Services Regulatory Authority (IFSRA) (2006a:7) this might be in the form of an ALCO comprising of senior management, the treasury function or a risk management department. The ALCO was discussed in section 3.2. The SBP (2003:28) adds that management should adhere to the lines of responsibility and authority established by the Board for the management of liquidity risk and should also ensure that operating standards are well understood by the bank's staff and that they are in line with the Board's intent. The IIF (2007:24) recommended that banks' senior

management ensure that the right incentives, policies and procedures are in place to elicit appropriate behaviour within each business that incurs liquidity costs (e.g. collateral, term funding), in order to consider and manage these costs effectively.

The bank should establish a schedule of frequent liquidity reviews and less frequent, but more detailed, reviews. Reviews provide the bank with the opportunity to re-examine and refine a bank's liquidity policies and practices to take into account new activities, changes in risk management approaches and systems (BIS, 2000b:5). It is important that the Board and senior management/ALCO review policies at least annually and when there are any material changes in the bank's current and prospective liquidity risk profile (CBB, 2005:2).

The OCC (2001:28-29) and the BIS (2006f:3) state that a bank's liquidity management can either be centralised or decentralised, or a combination of the two. The structure to be chosen depends on the bank's size and the complexity of its operations. Large banks or banking groups often tend to have a more centralised structure in which liquidity for individual business units, including branches and subsidiaries, is managed on a consolidated basis. In a decentralised structure, business units are assigned responsibility for their own liquidity, subject to limits imposed by senior management (BIS, 2000b:5). The IIF (2007:23) states that, in general, banks appear to prefer centralisation although they do recognise that hurdles exist that make it difficult to fully achieve centralisation. The BIS (2000b:5) adds that whatever structure is used, it is very important that close links exist between individuals responsible for liquidity and those monitoring market conditions, as well as other individuals with access to important information such as credit risk managers.

The ECB (2002:23) prescribes that a bank's management should set limits to guarantee adequate liquidity and that regulators should review such limits. In addition, banks should analyse the likely impact of different stress scenarios on their liquidity position and set their limits accordingly. Limits should be commensurate with the size, complexity and financial condition of the bank and management should define the specific procedures and approvals necessary for exceptions to policies and limits (OCC, 2001:34). The complexity of the balance sheet structure is a factor that determines whether it will be necessary to establish risk limits and what types of risk limits a bank should comply with on a daily basis and in the long run (IFSRA, 2006a:8).

Senior management are also responsible for overseeing the implementation and maintenance of management information and other systems which identify, monitor, measure and control the bank's liquidity risk (HKMA, 2004:21) and to establish effective internal controls over the liquidity management process (CIMA, 2003:4). Principle four covers the information systems needed for effective liquidity risk management.

5.2.5 Principle four: Information systems

Principle four prescribes that *banks should have sufficient information systems for measuring, monitoring, controlling and reporting of liquid assets and funding requirements. And in addition, reports should be provided on a timely basis to the bank's Board of Directors, senior management and other appropriate personnel* (CBB, 2005:4-5).

As mentioned earlier, an extremely important factor for the management of liquidity is the information systems which should provide accurate information of the bank's liquidity position to its Board, senior management and other relevant parties in a timely fashion (IFSRA, 2006a:9). According to Carre (2007:5) the daily liquidity risk reporting and the associated limits structure are the main controls of liquidity risk and, therefore, effective information systems lead to appropriate decision-making. Information should be readily available for day-to-day liquidity management and risk control, but systems should be flexible and powerful enough to fulfil the same role during times of stress (CIMA, 2003:4).

According to the NBRM (2004:10) liquidity risk management systems should cover all significant causes of liquidity risk, including those associated with new products and business activities, and also be capable of evaluating the effects of such causes on a bank's cash-flows and liquidity ratios. According to the HKMA (2004:27) systems should in particular be capable of the following:

i. ***Calculating cash-flows and maturity mismatches.*** Systems should be capable of calculating cash-flows and maturity mismatches arising from the full range of the bank's assets, liabilities and off-balance sheet positions on a daily basis over a series of specified time periods (NBRM, 2004:10).

ii. ***Analysing cash-flows and maturity mismatches.*** Systems should be capable of analysing cash-flows and maturity mismatches in all currencies in which the bank does business, both on a currency-by-currency basis and on a consolidated basis (BOT, 2003:23).

iii. ***Calculating and projecting various limits and ratios.*** Systems should also be capable of calculating and projecting various limits and ratios in relation to liquidity for both regulatory and internal risk management purposes (HKMA, 2004:27).

iv. ***Compliance with liquidity risk policies.*** It is important that a bank's systems can check the bank's compliance with its liquidity risk management policies and limits and generate exception reports (IFSRA, 2006a:9).

v. ***Management reporting.*** Systems should be capable of reporting risk measures and liquidity trends to management on a timely basis (NBRM, 2004:10).

vi. ***Emphasising behavioural assumptions.*** Systems should clearly emphasise the behavioural assumptions and limitations underlying the cash-flow management reports and stress testing analyses (HKMA, 2004:27).

It is important for the bank to be capable of providing on a timely basis accurate and relevant liquidity reports to senior management and/or the ALCO and other responsible personnel for them to evaluate the level of liquidity risk under different operating circumstances (CIMA, 2003:2). For the day-to-day management of liquidity risk, management should regularly consider how detailed and complicated information could be summarised for senior management or the Board (SBP, 2003:31). Management should be able to prepare these reports in times of bank-specific and systemic business contingencies (IIF, 2007:20). The HKMA (2004:28) states that liquidity risk reports should enable senior management and/or ALCO to review and monitor the following aspects of liquidity:

i. ***Bank's maturity profiles***. The maturity profiles of the bank's cash-flows under normal as well as stressed scenarios.

ii. ***Stock of liquid assets.*** The stock of liquid assets available to the bank and its market value.

iii. ***Concentrations.*** The concentrations in various sources and the applications of funds.

iv. ***Compliance with strategies.*** The bank's compliance with the liquidity risk management strategies and risk tolerance levels set by the Board.

v. ***Borrowing ability.*** The bank's ability to borrow or to sell assets in various markets.

vi. ***Potential sources of volatility.*** Potential sources of volatility in assets and liabilities (and claims and obligations arising from off-balance sheet activities).

vii. ***Intra-group cash-flows.*** The analysis of intra-group cash-flows and accessibility to such funding.

viii. ***Providers' capacity.*** The capacity of providers of standby facilities to meet their obligations.

ix. ***Impact of adverse trends.*** The impact of adverse trends, such as a decline in asset quality, on future cash-flows and market confidence.

The BIS (2000b:6) states that any assumptions made by the liquidity risk information systems should be set out clearly in order for management to be able to assess and evaluate the validity and consistency of key assumptions and to understand the impact of various possible stress scenarios.

5.2.6 Principle five: Ongoing measurement and monitoring of net funding requirements

According to the fifth Principle, *all banks should establish a process for the ongoing monitoring and measurement of its net funding requirements* (IFSRA, 2006a:7).

The BIS (2000b:6) states that an effective measurement and monitoring process is crucial for sufficient liquidity risk management. Liquidity measurement basically involves assessing all a bank's cash inflows against its cash outflows to identify the potential for any net shortfalls going forward. This includes funding requirements for off-balance sheet commitments (NBRM, 2004:15). The IIF (2007:22) recommended that banks should implement a framework of limits, targets, or triggers to ensure that they operate within these specified tolerances. Potential cash outflow and the ability to generate liquidity should be the basis of calculation of liquidity risk tolerance and should feed into limit setting.

A number of techniques are available to banks to monitor and measure their liquidity positions (SBP, 2003:31), which may range from simple calculations and static simulations based on a bank's current liquidity holdings to highly sophisticated and complicated modelling techniques (BIS, 2000b:6). It is particularly important to have an effective risk monitoring and measurement technique of a bank's liquidity because all banks are affected by changes in the economic climate and market conditions (BIS, 2000b:6). Matz and Neu (2007:18) identified some of the most popular techniques used to monitor and measure liquidity risk, which include the following three:

i. Balance sheet liquidity analysis.

ii. Cash capital analysis.

iii. Maturity mismatch analysis.

Liquidity risk measurement techniques were discussed in detail in section 3.3.

5.2.7 Principle six: Analysing liquidity risk using "what if" scenarios

Principle six prescribes that *banks should analyse liquidity using a variety of "what if" scenarios* (BIS, 2000b:8).

Although scenario analysis has been discussed briefly in section 3.3.4, it is repeated in this section for the sake of clarity. According to Brar (2005:2) liquidity risk should not be a business-as-usual issue. The key issue for banks is to make sure that they are fully prepared in situations where liquidity risk does become a problem. It is important for banks to develop a variety of "what if" scenarios because when evaluating the liquidity position of a bank, it will depend on the behaviour of cash-flows under different conditions (BIS, 2000b:8). When management develop scenarios, they can make assumptions about both the internal and external sources of liquidity risk in order for them to generate such scenarios (BOT, 2003:14). The CBB (2005:5) identified

two scenarios that normally provide useful benchmarks, namely a bank's "going-concern" condition, and a bank-specific crisis. The BIS (1992:16) prescribed an additional scenario that banks should take into account, namely a general market crisis. Under each scenario banks should evaluate significant positive and negative changes in their liquidity positions. Each of these three scenarios is discussed briefly:

i. ***Going-concern scenario.*** Under the going-concern scenario the bank assumes a business-as-usual situation in cash-flows. This scenario is useful in managing a bank's use of deposit and other debt markets. By applying this assumption, banks can manage their net funding requirements so that they are not faced with large needs on any given day and, in doing so, may avoid short-term liquidity constraints (CBB, 2005:4).

ii. ***Liquidity crisis at the individual bank level.*** Under a liquidity crisis at the individual bank level, it is assumed that many of the bank's liabilities could not be rolled over or replaced and would have to be repaid at maturity so that the bank would have to wind down its books to some degree (Cassidy et al., 2007:7). According to the CBB (2005:4) such a scenario provides a bank with a "worst case" benchmark. Severe liquidity crises in individual banks often stem from causes other than liquidity risk, but by assuming such a situation, the bank may establish a process whereby remedial action is taken to address the underlying problem.

iii. ***Market-wide liquidity crisis.*** This last scenario assumes a market-wide liquidity crisis where all banks are affected in one or more markets (BIS, 2000b:8). According to Carre (2007:9) indicators of a market-wide liquidity crisis include the failure of a competitor, a domestic currency crisis, a sovereign debt downgrade and the outbreak of war. As severe market disruptions have occurred quite often in the past, it is important for banks to apply such assumptions (BIS, 2000b:8).

Banks should not be limited to only these three scenarios, but these may be considered as the minimum. The IIF (2007:34) states that banks should analyse liquidity using a variety of bank-specific and market-related scenarios and/or sensitivity analyses, or a combination of the above. The BIS (2006f:9) adds that stress testing may be appropriate at a group level, by geographic region and at a subsidiary level. The rationale behind the assumptions in terms of time horizons over which a crisis is to be measured and the severity levels of crises considered should be appropriately documented.

The BIS (2000b:8-9) stated that the evolution of a bank's liquidity profile under one or more scenarios can be displayed graphically or in tabular form, by aggregating the balance of expected cash-inflows and cash-outflows at several points in time as well as for a focus period each day. Such representations may provide further insights into a bank's liquidity and are useful to check

how reliable and reasonable the assumptions are for the specific bank. For example, a high quality bank may seem liquid under normal conditions and remain so in a general market crisis, suffering from illiquidity only in a bank-specific crisis.

5.2.8 Principle seven: Frequent review of assumptions

Principle seven prescribes that *banks should frequently review the assumptions used for managing liquidity to ensure the continued validity of such assumptions* (RBA, 1998:3).

Banks should regularly review their assumptions because banks are often influenced by external factors over which they have no control and market and economic conditions change rapidly (BIS, 2000b:9). The BIS (2000b:9-12) broadly categorised such assumptions into four categories, as follows:

i. ***Asset assumptions.*** Assumptions that a bank makes about its future stock of assets include the ability to transform such assets and its ability to use it as collateral to increase cash-inflows, the extent to which assets will be originated and sold through securitisation programmes and renewed assets upon maturity and new assets acquired (BIS, 2000b:9). The BOT (2003:16) adds that when estimating a possible amount of assets, a bank must know the following:

- The ratio of renewed assets upon maturity.
- The amount of credits expected to be approved.
- The obligation or limit expected to be withdrawn for which financial institution must set aside reserves.

The BIS (2000b:10) states that assets' marketability can be determined by categorising assets into four categories based on their relative liquidity. These categories are:

- The most liquid category consists of cash and government securities and other securities that can be used as collateral under the central bank's open market operations. This category may also include securities that can be used in the market as collateral.
- The second category consists of securities that are not as liquid as those mentioned in the first category and these may include equities and interbank loans which may be sold but that may lose liquidity during adverse market conditions.
- The third category consists of less-liquid assets and may typically involve assumptions about how quickly a bank will be able to sell its saleable loan portfolio.

- The fourth category is the least liquid category and typically consists of loan portfolios or bad credits that cannot be sold, bank premises or investments in subsidiaries.

Assets pledged to third parties must be deducted from each category above. Different banks may categorise the same or similar assets under different categories, depending on assumptions made about the bank's ability to sell its assets (BOT, 2003:17).

ii. ***Liability assumptions.*** The BIS (2000b:10) states that when banks analyse the liability side of the balance sheet, it is important for them to understand the characteristics of their funding sources and funding instruments. In order for a bank to evaluate cash-outflows from its liabilities, it should first analyse the behaviour of its liabilities under normal business conditions by analysing the following according to the BOT (2003:17):

- The renewal levels of deposits and other liabilities.
- The normal growth rate of newly-opened deposit accounts.
- Estimated maturity of deposits with uncertain maturities, such as demand deposits and various types of savings accounts.

On analysing these three points banks should also analyse which funding sources will stay with the bank under any circumstances and whether stable sources can be increased. The bank should also analyse which liabilities will run off gradually and which will be withdrawn immediately at the first signs of trouble, and whether there are early-withdrawal options on funds that are likely to be exercised during times of crisis. Lastly, banks should determine whether they have backup facilities which they can draw on and should determine under what circumstances these backup facilities can be used (BIS, 2000b:11).

iii. ***Off-balance sheet activities.*** The BOT (2003:18) states that banks should analyse the possibility of cash-flows arising from outside the balance sheet. The BIS (2000b:12) adds that the contingent nature of most off-balance sheet activities adds to the complexity of managing off-balance sheet cash-flows. Off-balance sheet cash-flows may place severe strain on a bank's liquidity during times of stress.

iv. ***Other assumptions.*** The BOT (2003:19) states that a bank may not only need liquidity to support its business activities, but also to support other operations. For example, if the bank provides clearance and settlement operations to other banks, some amounts that may be required to pay might be so large that it will have an impact on the overall liquidity of the bank. For this reason, it may be beneficial for banks to request customers of clearance and settlement operations to estimate their cash-inflows and outflows in order for the bank to be able to have an idea of its liquidity needs for these operations. However, a certain degree of uncertainty will still exist, because its customers may not

make accurate estimations and/or systems may fail and cause delayed payments (BIS, 2000b:13).

5.2.9 Principle eight: Capacity to sell assets and market access

Principle eight prescribes that *a bank should frequently review its efforts to establish and maintain relationships with liability holders in order for it to maintain its diversification of liabilities and to ensure its capability of selling assets if needed* (CIMA, 2003:8).

The importance of the diversification of funding sources and ways to do so were mentioned and described in section 2.3.2.3. It is extremely important for banks not to rely too heavily on volatile funding sources or have concentrated funding sources, i.e. source of funding concentrated in certain currencies, products, or maturities. It is better for banks to obtain funding from a diverse group of retail depositors because retail funding is very stable.

In addition to diversifying funding sources the BOT (2003:19) states that it is extremely important for a bank to assess its funding sources, particularly in the money market, as well as possible funding alternatives available to it. The bank must assess how much money it will be able to receive from the market under both normal and crises conditions (IFSRA, 2006a:11). In doing so, Principle six plays a role since "what if" scenarios will have to be applied to define normal and crisis situations. The CIMA (2003:8) adds that committed facilities given by other institutions should be tested regularly in order to assess the extent to which the bank can rely on such facilities when in need. A bank's access to funding in the market also largely depends on its reputation and how risky the market perceives the bank to be, this was also mentioned in section 2.2.2.

The BIS (2000b:15) states that other means of managing market access involves the development of markets for asset sales or exploring arrangements under which the bank can borrow funds against assets. The BIS adds that the inclusion of loan-sale clauses in loan documentation and the frequency of use of some asset-sales markets are two possible indicators of a bank's ability to sell assets under adverse conditions.

5.2.10 Principle nine: Contingency planning

Principle nine deals with *the importance of banks having contingency plans in place to address the strategy for handling liquidity crises and should include a procedure for making up cash-flow shortfalls in emergency situations* (IFSRA, 2006a:11-12).

According to Brar (2005:2) contingency funding plans must be drawn up to ensure that alternative funding strategies are in place to meet any unexpected liquidity needs of the bank. Matz and Neu (2007:121) state that contingency liquidity planning is extremely important because, even though management may focus on the day-to-day management and monitoring of liquidity, the true risk lies in the low frequency but high impact events. The RBA (1998:7) states that banks must formulate a formal contingency plan that sets out a strategy for dealing with a liquidity crisis and the procedures for making up cash-flows in emergency situations. The SBP (2003:31) describes such a formal plan as a contingency funding plan (CFP) that describes how a bank will meet its funding needs in a timely manner and at a reasonable cost. The IIF (2007:35-36) states that a CFP should address the early warning signals of a crisis, the strategy and tactics that will be used in the bank's normal course of business to prevent liquidity problems, and the possible strategies for dealing with different levels of severity and types of liquidity events that cause liquidity problems.

Matz and Neu (2007:123) prescribe that the need for a robust CFP is driven by the following three elements:

i. ***Liquidity risk is unavoidable.*** It is noteworthy that banks cannot avoid liquidity risk as it is an inherent part of their normal business of liquidity intermediation.

ii. ***Liquidity risk is normally not hedged.*** In general, banks do little to hedge their liquidity risk. Normally contingent lending arrangements exist, but very few remain in place as a bank in trouble's risk increases.

iii. ***A bank is never guaranteed that liquidity will be enough.*** Most importantly, no bank can hold sufficient liquidity to survive a severe or prolonged funding crisis. An event with a low probability of occurring may lead to the failure of a bank, yet risk managers cannot justify the cost of holding enough liquidity to cover such events. A CFP is therefore the bridge between the liquidity that the bank chooses to hold and the maximum it might need. The SBP (2003:32) adds that a robust CFP may help a bank to prudently and efficiently manage routine and extraordinary liquidity fluctuations.

The BIS (2000b:14) indicates that a CFP consists of a wide variety of components. Matz and Neu (2007:126-129 prescribe eleven guidelines for a proper CFP, which are now discussed. These may be considered only guidelines since the complexity of a bank's CFP varies according to its risk profile, transactions, products and organisational structure.

i. ***Preparedness.*** A bank's CFP should include separate actions for different need environments because different crises require different preparation. Some sources of liquidity are less available or unavailable in different types of crises.

ii. ***Early warning system.*** A good early warning system is essential because enhancing liquidity is extremely difficult after the early stages of a liquidity crisis (IFSRA, 2006a:12). In order for a bank to develop an early warning system, it should understand the characteristics of liquidity risk that were discussed in detail in section 2.3.

iii. ***Planning in advance.*** Measures, responsibilities and plans to handle a liquidity crisis must be well-defined by senior management before a crisis situation occurs (BOT, 2003:26).

iv. ***Flexibility.*** A CFP should not be considered a recipe, but should consist of a choice of recipes that can be used depending on the causes, nature and duration of the liquidity crisis.

v. ***Previous experiences.*** Contingency liquidity planning should not be influenced too much by previous experiences because future crises might be completely different than past ones.

vi. ***Detail.*** A CFP should include enough detail to be able to act early, quickly and effectively to deteriorating liquidity conditions, but it should be kept in mind that too much detail can slow down the decision-making process significantly.

vii. ***Living plan.*** The CFP should be a living plan that is reviewed periodically upon changes to internal and external conditions.

viii. ***Integration with other policies.*** The CFP should be closely aligned to the bank's overall risk management and risk monitoring activities, especially for credit risk, since a bank's liquidity may be adversely affected by concerns over its credibility or reputation, especially when it experiences a credit-rating downgrade (BOT, 2003:26).

ix. ***Multiple currencies.*** Banks that obtain funding in multiple currencies should create separate contingency plans for the funds' sources and uses in each currency.

x. ***Other business monitoring.*** Banks that form part of organisations that have other businesses such as insurance or real estate should monitor these other markets in addition to financial markets.

xi. ***Consolidation.*** Banks with subsidiaries, holding companies or other affiliates must address and define important issues regarding the consolidated and unconsolidated elements of its CFP. It is important that the measurement and monitoring of liquidity risk should always be done at a fully consolidated level. At the same time, potential funding disturbances should be managed on a legal entity basis.

The CIMA (2003:9) adds that CFPs should include plans for acquiring liquidity under adverse conditions. In this, the previous principle is very important, because a bank should have a plan of

how it will obtain backup liquidity in adverse conditions (Martin, 2007:22). Banks that are involved in secondary market credit activities, such as selling parts of their books to asset securitisation vehicles, should have well-defined plans to obtain funds in the case of early amortisation of outstanding asset-backed securities.

The OCC (2001:40) adds that well-constructed CFPs should include a way to effectively identify triggers of a liquidity crisis at an early stage. Early warning signals of liquidity risk were discussed in section 2.3.3. In addition, plans for communication with staff and the public, including customers, key market participants and the media, should be realistic and all inclusive (HKMA, 2004:54).

5.2.11 Principle ten: Foreign currency liquidity management

Principle ten prescribes that *banks should have measurement, monitoring and control systems for the major currencies in which it is active. In addition to analysing its aggregate foreign currency needs in combination with its domestic currency needs, banks should do analyses of its strategy for each currency individually* (RBA, 1998:7).

The BOT (2003:11) states that it is important for internationally active banks to have measurement, monitoring and control systems for liquidity in foreign currencies because of the currency problems that were experienced in various markets in the 1990s and also because a bank may not be able to convert enough of its domestic and foreign currencies into liquidity during times of crisis. The BIS (2000b:16) states that banks that trade in foreign currencies are exposed to the risk that a sudden movement in exchange rates and/or market liquidity could significantly increase their mismatches that are being run. Sudden movements in exchange rates may be the result of domestic factors or from contagion caused by developments in other countries as was experienced with many countries as a result of the Asian crisis. Such events may cause banks' funding gaps to increase significantly, or foreign currency assets may be impaired, especially where borrowers have not hedged their foreign currency risk sufficiently.

The BOT (2003:11) states that foreign currency liquidity management differs between banks and that it depends on the nature of the bank. The BIS (2000b:16) adds that some banks might fund foreign currency assets with the domestic currency while other banks might fund domestic currency assets with foreign currency.

Banks that fund foreign currency assets with the domestic currency should take into account various factors and analyse various risks carefully (BIS, 2000b:17). The BOT (2003:12) states that where a bank extends foreign currency loans to domestic customers, for example, it should be aware of the risk it faces should the currency depreciate suddenly leaving borrowers

unable to service their debt, which might leave the bank with cash-flow problems. The NBRM (2004:16-17) adds that because of this, banks should closely analyse and monitor foreign currency exposures, built-up borrowers, patterns among borrowers and the extent to which borrowers have access to foreign currency earnings in order for them to service their debt.

The BIS (2000b:17) states that some banks might decide that currencies that make up a significant part of its liquidity needs warrant a separate liquidity backup. The BOT (2003:12) adds that in such cases the head office or the regional treasurer for each currency will be responsible for developing contingency strategies and negotiating backup facilities in such currencies. It is important for the bank to analyse whether these backup facilities will still be available during times of crises.

The CIMA (2003:10-11) states that ***banks that fund domestic assets with foreign currency,*** should carefully analyse factors which may affect access to the foreign currency involved and that such banks should understand that foreign currency depositors and lenders often withdraw their funds quicker than domestic borrowers and lenders. The NBRM (2004:16-17) adds that banks should have access to alternative sources of funding in order for them to repay foreign currency liabilities.

A variety of foreign exchange market scenarios should be assessed where banks assume that domestic currency deposits could easily be transformed into foreign currency in order for them to repay foreign currency liabilities (BIS, 2000b:16). The BOT (2003:12) adds that such markets may be difficult to access or be illiquid, or that the exchange rate may fall rapidly, which are all factors that might lead to a widening of the mismatch that is already being run by the bank.

5.2.12 Principle eleven: Review of size of cash-flow mismatches in foreign currencies

Principle eleven prescribes that *banks should set and regularly review limits on the size of its cash-flow mismatches over certain time horizons for foreign currencies on an aggregate basis as well as on a currency-by-currency basis for significant currencies in which the bank deals* (CIMA, 2003:10).

The IFSRA (2006a:11) states that banks should analyse the likely impact of different stress scenarios on its liquidity positions, broken down by currency. This principle applies specifically to currencies that are not actively traded, rendering them illiquid. It is, however, noteworthy that under extreme stress events even currencies that are normally perceived to be liquid and stable may be illiquid. The BOT (2003:11) adds that based on this, banks should make a judgement call on which currencies should be subject to individual limits in line with changing environments

and regulatory rules and requirements. Because of an ever-changing environment, such limits should be reviewed regularly.

The BIS (2000b:16) adds that cash-flow mismatches in foreign currencies would normally be smaller than those experienced in the domestic currency. Tolerance levels of mismatches in foreign currencies must take into account the bank's ability to raise funding in foreign currency markets and the availability of foreign currency backup facilities in domestic markets (CBB, 2005:3). The BOT (2003:11) adds that a simple yet effective strategy in many cases may be to hold foreign currency assets and liabilities in relatively small amounts.

5.2.13 Principle twelve: Adequate system of internal controls

According to the twelfth Principle, *each bank should have an adequate system of internal controls over its liquidity risk management process. An essential component of the internal control system involves regular independent reviews and evaluations of the effectiveness of the system and, where necessary, ensuring that appropriate enhancements or revisions to internal controls are made. The results of such reviews should also be made available to regulators* (IFSRA, 2006a:9).

The IIF (2007:60) states that banks should have effective systems of internal control over their liquidity risk management processes, including regular independent reviews and evaluations of the effectiveness of these systems. The OCC (2001:34) states that regular reviews should be conducted by people that are independent from the funding areas. The BIS (2000b:18) states that banks ensure the integrity of its liquidity risk management process by having adequate internal controls and adds that internal controls should promote effective and efficient operations, reliable and accurate financial and regulatory reporting and compliance with applicable laws, regulations and institutional policies. The CIMA (2003:11) adds that an effective internal control system for liquidity risk management includes a sound internal control environment, a process to identify and assess liquidity risk and the establishment of controlling measures such as prescribing policy and operational procedures, having adequate information systems and conducting regular reviews to ensure that performance is in adherence with the prescribed policies and procedures. The BIS (2000b:18) states that banks must ensure that all aspects of the internal control system are effective, including both aspects that are directly and those that are not directly related to the liquidity risk management process.

The BOT (2003:19) states that an integral part of a bank's internal control system for its liquidity risk management process is to ensure that it is subjected to regular evaluation and review. This includes ensuring that personnel follow the established policies and procedures and also ensuring that the procedures that were established fulfil the intended objectives. Such reviews

and evaluations should also address any significant change that may impact on the effectiveness of controls (CIMA, 2003:12) and should be conducted at least annually (IFSRA, 2006a:9). The SBP (2003:34) states that persons that are independent of the funding areas should perform these reviews. The IIF (2007:60) adds that banks should ensure that the frequency and scope of reviews are consistent with and supported by their internal risk assessments. Where revisions or improvements to internal controls are justified, there should be a method in place that ensures that revisions and improvements are implemented in a timely manner (BIS, 2000b:19).

The BOT (2003:19) states that although processes to determine risk limits methods of implementation of such processes differ from bank to bank, every bank should regularly review its practice to ensure that it complies with the prescribed liquidity risk policies and procedures. Non-compliance with limits and/or operating procedures should be reported immediately to senior management or the Board so that the necessary actions can be taken. The BIS (2000b:19) adds that periodic reviews should also address any significant changes in the types and/or nature of instruments acquired, and limits and internal controls that have occurred since the last review.

The IFSRA (2006a:9) states that the liquidity risk management process should be reviewed frequently by the internal audit function as a matter of course in order for any weaknesses or problems to be identified. Weaknesses or problems should, in turn, be addressed by management in a timely and efficient manner. According to Marchbanks (2007:6) sound liquidity risk management requires adequate internal controls and internal audit processes. The SBP (2003:24) describes the role of internal audit as an essential element of the internal control process.

5.2.14 Principle thirteen: Mechanism for disclosure of information

According to the thirteenth principle, *banks should have a mechanism in place that ensures that there is an adequate level of disclosure of information about the bank in order for the bank to able to manage the public perception of the bank and its soundness* (BIS, 2000b:19).

The BIS (2000b:19) states that public disclosure is an important element of liquidity risk management. As mentioned earlier, negative public perceptions may cause a run on a bank that may lead to the bank experiencing liquidity problems. This principle has a link with Basel II, where public disclosure is required under Pillar 3. The HKMA (2004:54) adds that banks should provide information on an ongoing basis to the public, major creditors and counterparties.

As mentioned in Principle nine, banks should decide as part of its contingency planning how to deal with the press and broadcast media when the bank receives negative publicity (HKMA,

2004:54). Good public relations are extremely important since good relations may ultimately avoid a run on a bank and spare it from experiencing liquidity problems (OCC, 2001:36).

5.2.15 Principle fourteen: Independent evaluations by supervisors

Principle fourteen prescribes that *regulators should conduct independent evaluations of banks' strategies, policies, procedures and practices. In addition, regulators should also require banks to have effective systems to identify, monitor and measure liquidity risk. Banks should also be required to submit sufficient and timely information to the regulator to enable regulators to evaluate banks' liquidity risk. Regulators should also ensure that banks have sufficient contingency plans* (BIS, 2000b:19-20).

The BIS (2000b:20) states that regulators are responsible to ensure that banks comply with all thirteen previous principles and that all these processes are adhered to in practice. Regulators should evaluate the effectiveness of banks' management of its net funding requirements when conducting independent evaluations of banks' strategies, policies, procedures and practices (HKMA, 2004:10). Thus, this principle is also aligned to Basel II, as regulators are responsible to conduct independent evaluations of banks' strategies, procedures and practices.

Regulators should also evaluate the effectiveness of banks' processes to monitor and measure liquidity risk. This also involves that regulators independently evaluate the "what if" scenarios used by banks when estimating its net funding requirements (BIS, 2000b:20).

The BIS (2000b:20-21) adds that banks' liquidity risk should be considered in conjunction with its capital adequacy. To be able to do this, regulators need to obtain accurate and timely information from banks which would allow regulators to assess a particular bank's situation and may require it to increase its capital holdings or to structurally decrease its liquidity risk levels. As recommended by the IIF (2007:42) regulatory and economic capital should preferably not be tied directly to liquidity risk, but regulators should rather assess banks' liquidity positions and risk management practices, taking into account that different banks use different metrics and face different internal and external factors.

Regulators should also review banks' internal control processes on a regular basis and ensure that internal control processes take place in practice. The regulator should ensure that improvements and/or revisions to the internal control process are implemented on a timely basis (BIS, 2000b:21).

It is also important that regulators have their own contingency plans on how to deal with banks that experience liquidity problems and with the market as a whole. Regulators will only be able to

execute their contingency plans effectively if they obtain timely and accurate information from banks during times of crisis (BIS, 2000b:21).

Essentially, Principle fourteen prescribes to regulators that they should comply with the Basel Core Principles and with Core Principle Fourteen: Liquidity Risk. The Basel Core Principles are discussed in more detail in section 5.3.

5.2.16 Conclusion

As the treatment of liquidity risk under Basel II is vague, this section examined sound principles for the management and measurement of liquidity risk by reviewing published literature from a variety of sources. It was set out as fourteen principles, each of which was discussed in some detail in order to gain an understanding of the complications and expectations that both banks and regulators should have regarding the management and measurement of liquidity risk.

Principles one to four deal with the establishment of a structure for the management of liquidity risk, Principles five to seven with the management and measurement of a bank's net funding requirements, Principle eight with the management of market access, Principle nine with contingency planning, Principles ten and eleven describe the management of foreign currency liquidity, Principle twelve deals with the internal controls for effective liquidity risk management. Principle thirteen deals with the role and importance of public disclosure and reporting of liquidity risk and Principle fourteen deals with the role of regulators. The last two Principles are aligned with what is required under Basel II.

5.3 The Basel Core Principles

5.3.1 Introduction

The Core Principles for Effective Banking Supervision, developed by the BIS in co-operation with fellow regulators, have effectively become the standard for sound prudential regulation and supervision of banks (BIS, 2006a:1). The Basel Core Principles were first introduced in 1997 and revised in 2006. These Principles determine the fundamental factors for banking supervision and represent the measures used for assessing the performance of the BSD of the SARB against international standards and they are used as a yardstick for supervising the performance of banks.

5.3.2 The Basel Core Principles

The intention of the Core Principles is mainly to help countries evaluate the quality of their financial systems and to allow them to offer input in their own reform programmes (Nouy,

2000:5). A majority of countries has endorsed the Core Principles and have declared their intention to implement them (BIS: 2006a:1).

As stated previously, assessment of compliance with the Core Principles is done by the IMF and it uses a rating scale consisting of the following four degrees of compliance: compliant, largely compliant, materially non-compliant and non-compliant. The Core Principles are minimum standards to be applied by all banking regulators. Each of the twenty-five Core Principles sets out essential and additional criteria with which regulators should comply before they can be fully compliant with the entire principle in question. In implementing some of these principles, regulators need to take into account the risk profile, size and complexity of individual banks, particularly for those Core Principles where regulators have to determine the adequacy of banks' risk management policies and processes (BIS, 2006a:4). In the 1997 version of the Basel Core Principles there was not a Core Principle explicitly dedicated to liquidity risk, instead it was encapsulated under Core Principle Thirteen: Other Risk Management (BIS, 1997b:28) according to which:

> *Banking regulators must be satisfied that banks have a complete risk management process that includes appropriate Board and senior management oversight to identify, measure, monitor and control all other substantial risks and to hold capital against these risks, where appropriate.*

Principle Thirteen of the 1997 Core Principles grouped liquidity risk with interest rate risk and operational risk. The BIS described the purpose of liquidity risk management was to ensure that the bank would be able to fully meet its contractual obligations when they became due. The BCBS stated that key essentials for effective liquidity risk management included proper management information systems, central liquidity risk management, analyses of the bank's net funding requirements under various different scenarios, the diversification of funding sources and sufficient contingency planning. Banking regulators had to expect banks to manage their assets, liabilities and off-balance sheet positions with a forward-looking view to maintain adequate liquidity. In addition, the BCBS prescribed that banks had to hold enough liquid assets and that they had to ensure the diversification of their funding both in terms of sources and in terms of maturity structures (BIS, 1997b:28-29).

As mentioned earlier, the Basel Core Principles were revised in 2006 and the revised Core Principle Fourteen is now explicitly dedicated to liquidity risk (BIS, 2006a:23-24). This core principle is discussed in more detail in section 5.3.3.

5.3.3 Basel Core Principle Fourteen: Liquidity Risk

The Revised Core Principle explicitly dedicated to liquidity risk was derived from the key essentials identified in the 1997 Core Principles document and prescribes that (BIS, 2006a:23-24):

> *Regulators must be satisfied that banks have a proper liquidity management strategy that considers the risk profile of the bank, with prudent policies and processes to identify, measure, monitor and control liquidity risk and to manage liquidity on a daily basis. Regulators call for banks to have contingency plans for handling unexpected liquidity problems.*

Core Principle Fourteen prescribes six essential criteria and two additional criteria with which regulators should comply in order for them to be compliant with this Principle. The BIS (2006a:23-24) identified the following criteria:

i. ***Essential criterion one.*** Regulators must set liquidity guidelines for banks. These guidelines should take into account undrawn commitments and other off-balance sheet liabilities, as well as existing on-balance sheet liabilities of the bank.

ii. ***Essential criterion two.*** Regulators must confirm that banks have a well-defined liquidity management strategy, along with policies and processes for managing liquidity risk which have been approved by the Board. Regulators must also confirm that the Board plays an oversight role in ensuring that policies and processes for risk-taking are developed to monitor, control and manage liquidity risk and that policies and processes are effectively implemented by the bank's management.

iii. ***Essential criterion three.*** Regulators must determine whether a bank's senior management has defined or established appropriate policies and processes to monitor, control and manage liquidity risk; that they effectively implement policies and processes; and that they understand the nature and level of liquidity risk being taken by the bank.

iv. ***Essential criterion four.*** Regulators must require a bank to establish policies and processes for the ongoing measurement and monitoring of its net funding requirements. The policies and processes must take into account how other risks such as credit, market and operational risk might impact on the bank's overall liquidity strategy. Furthermore, policies and processes must require an analysis of the bank's funding requirements under alternative scenarios, the diversification of its funding sources, a review of concentration limits, stress testing and a frequent review of underlying assumptions to determine that they continue to be valid.

v. ***Essential criterion five.*** Regulators must acquire adequate information to identify banks that carry out significant foreign currency liquidity transformation. Where a bank

or banking group's foreign currency business directly or indirectly, through lending in foreign currencies to domestic borrowers, is deemed to be significant, or where a specific currency in which the bank has a material exposure is experiencing problems, regulators must require the bank to carry out a separate analysis of its strategy for each currency individually and, where appropriate, set and regularly review limits on the size of its cash-flow mismatches for foreign currencies for each currency individually and on an aggregated basis.

vi. ***Essential criterion six.*** Regulators must determine whether banks have contingency plans in place for managing liquidity problems, including informing the regulator.

vii. ***Additional criterion one.*** Regulators must determine that where a bank conducts business in multiple currencies, the bank's foreign currency liquidity strategy is stress tested separately and that the results of stress tests are taken into account in determining the appropriateness of mismatches.

viii. ***Additional criterion two.*** Regulators must confirm that a bank from time to time reviews its efforts to establish and preserve relationships with liability holders, maintains the diversification of its liabilities and aims to ensure its capacity to sell assets.

5.3.4 Conclusion

Core Principle Fourteen of the Revised Core Principles deals with liquidity risk. It describes what is expected from regulators in the regulation of liquidity risk. For regulators to comply with this Core Principle, they have to comply with six essential criteria and two additional criteria.

5.4 Conclusion

This chapter investigated theoretical sound principles for the management and measurement of liquidity risk by reviewing published literature from a variety of sources. It was set out as fourteen principles, each of which was discussed in some detail in order to gain an understanding of the complications and expectations that both banks and regulators should have regarding the management and measurement of liquidity risk.

Principles one to four deal with the establishment of a structure for the management of liquidity risk, Principles five to seven deal with the management and measurement of a bank's net funding requirements, Principle eight deals with the management of market access, Principle nine deals with contingency planning, Principles ten and eleven describe the management of foreign currency liquidity, Principle twelve deals with the internal controls for effective liquidity risk management, Principle thirteen deals with the role and importance of public disclosure and reporting of liquidity risk and Principle fourteen deals with the role of regulators.

The chapter proceeded to briefly discuss the Basel Core Principles in general, after which specific attention was given to Core Principle Fourteen: Liquidity risk. Core Principle Fourteen requires that regulators must be satisfied that a bank has a proper liquidity management strategy that considers the risk profile of the bank, with prudent policies and processes to identify, measure, monitor and control liquidity risk and to manage liquidity on a daily basis. Regulators call for banks to have contingency plans for handling unexpected liquidity problems. Core Principle Fourteen also prescribes six essential criteria and two additional criteria that have to be complied with in order for regulators to be considered as being in compliance with this Core Principle.

The four chapters up to here represents the literature study that was undertaken in order to gain a thorough understanding of the complexity of liquidity risk, the deficiencies in Basel II regarding the treatment of liquidity risk and sound principles for the management, measurement and regulation of liquidity risk. Chapter 6 conducts an analysis on liquidity risk in South Africa to reach a conclusion regarding the proposed regulatory treatment of liquidity risk in South Africa. This chapter described theoretical aspects on how liquidity risk could be regulated, and after an analysis is conducted on liquidity risk in South Africa in Chapter 6, practical aspects of the proposed regulation of liquidity risk in South Africa are discussed in Chapter 7.

Chapter 6
Liquidity Risk and South Africa

6.1 Introduction

Regulators should be aware of the liquidity situation in a country before they make decisions on how liquidity risk should be regulated. Before a conclusion can be reached on the regulatory treatment of liquidity risk in South Africa, it should be analysed. The objective of this chapter is to determine whether liquidity risk poses a serious threat to the South African banking sector and whether it would make sense for regulators to require banks to hold capital for liquidity risk.

This chapter starts by describing the South African banking sector, including causes of previous banking failures in South Africa, after which the SARB accommodation system and prudential requirements in South Africa are discussed to highlight the environment in which banks operate in South Africa. The chapter then continues to discuss liquidity risk in the South African banking sector by analysing the aggregated balance sheet as well as the aggregated liquidity risk returns for all banks in South Africa. After the analysis of the aggregated banks' figures, a ratio analysis is conducted on ten different banks in the South African banking sector, after which liquidity risk in South Africa is discussed from a practical point of view in terms of responses received to a questionnaire that was compiled. Conclusions and proposals for the regulatory treatment of liquidity risk can only be set forward once liquidity risk in South Africa has been analysed.

6.2 Practical aspects of the South African banking system

6.2.1 Introduction

This section aims to foster a broad understanding of the South African banking sector and its operations. It starts by describing the South African banking system and the so-called "four-pillar" approach that is followed after which recent banking failures and their main causes are discussed. The SARB accommodation system and prudential requirements in South Africa are then discussed to highlight the environment in which banks operate in South Africa.

6.2.2 South African banking system

The South African banking system currently (2007) consists of 13 South African controlled banks, 7 non-resident controlled banks (subsidiaries), 14 local branches of foreign banks, 2 mutual banks and 30 authorised representative offices of foreign banks (representative offices may not

take deposits). As mentioned in section 4.4.3.5, the banks that are considered the big four in South Africa owns more than three quarters of all banking assets and this is known as the "four-pillar" policy. The "four-pillar" policy relates to having a minimum number of substantial banks on which a banking system relies. The primary reasons for such a policy relate to the maintenance of minimum levels of competition, in the interests of prudential and systemic stability, in order to avoid the spread of risk and to promote reliance on a broader platform of institutions (Mboweni, 2004).

Despite the "four-pillar" policy, this represents a significant concentration in a small number of banks and two opposing views exist regarding large concentrations in banking systems (SARB, 2004b:12). The first view is one of *concentration-stability* where banking systems with many small banks are considered more prone to be struck by financial crises because larger banks are able to diversify better than small banks, large banks make more profits, it is easier to regulate a handful of large banks and large banks are able to employ better management and risk managers. The opposing view is one of *concentration-fragility* where banking systems with a couple of large banks are considered to be more vulnerable because such a system is not driven by market forces but rather by implicit "too big to fail"[6] perceptions. Despite these opposing views, the South African banking sector is considered to be robust and able to withstand considerable adverse shocks (SARB, 2006a:14). Despite this, there have been bank failures in the recent past. Section 6.2.3 describes banking failures that occurred in the recent past in South Africa along with the major causes of those failures.

6.2.3 Recent history of bank failures in South Africa

Banking failures do not necessarily point to problems within a system, but may point to the fact that a market-based capitalist system ultimately rids itself of inefficient and ineffective participants that are not soundly structured and operated. This section does not attempt to describe each of the cases in detail, but rather to examine the major causes of well-recorded banking failures in South Africa in the recent past. Each of these bank failures was described in more detail by Okeahalam (1998:36-38). Table 6.1 illustrates the bank failures that have taken place in South Africa since 1990.

There are 13 well-documented bank failures in South Africa in the past 17 years. The SARB revoked banks' licences in some instances, but these were not well-documented and hence not included in the failures that are highlighted. The central theme from these bank failures in South

[6] Okeahalam (1998:33) describes the term "too big to fail" as a situation where a bank may consider itself as being too big to fail because its failure will lead to a disruption in the country's economy. Ngaujake (2003:9) adds that this is when big banks assume that the central bank will always intervene and rescue the banking system from imminent collapse.

Africa in the past 17 years was that bad management and poor management decisions, fraud and liquidity risk caused banks to fail in South Africa. Although most of the banks listed in the table experienced liquidity problems prior to failing (Ngaujake, 2003:89), liquidity risk was the underlying cause of failure in only two of the cases. In other words, from available evidence in South Africa, more banks have failed as a result of internal factors such as fraud or mismanagement than as a result of liquidity risk.

Table 6.1: Bank failures in South Africa since 1990

Name of Bank	Year of failure	Reason for failure	Curatorship	Final liquidation
Alpha Bank	1990	Fraud, insider lending	4 years	Depositors paid according to implied BSD standard in 1994
Cape Investment Bank	1991	Fraud, disclosure irregularities	1 year	A total of R5 million paid to all depositors in 1992
Pretoria Bank	1991	Poor strategic management (linked to failure of Masterbond)	6 months	In 1991 the SARB repaid all depositors
Sechold Bank	1993	Derivatives exposure (R180m loss)	<1 year	Acquired by Investec Bank Holdings (1994)
Prima Bank	1994	Liquidity problems and non-performing loans	1 year	1994 assets transferred to UniBank
African Bank	1995	Inadequate management and capital	<1 year	Assets acquired by NBS
Community Bank	1995	Liquidity problems and inefficient management	<1 year	Acquired by UniBank
Islamic Bank of South Africa	1997	Bad management, fraud, insider unsecured lending, and non-performing assets	1 year	Depositors compensated to a maximum of R50 000
New Republic Bank	1999	Failure of strategic alliance with Mawenzi Holdings led to a run on deposits	<2 years	All depositors paid out R1,04 for every R1,00 (reflecting interest during period of inactivity)
FBC Fidelity	1999	Non-performing loans	<18 months	Acquired by Nedcor
Regal Treasury Bank	2001	Fraud and mismanagement (lack of corporate governance) led to a run on deposits	<18 months	Depositors partly repaid
Saambou Bank	2001	Fraud, non-performing loans	>2 years	Part of assets sold to FNB
Board of Executors (BoE) Bank	2002	Liquidity risk led to a run on deposits	<6 months	Taken over by Nedcor Bank

Source: Ngaujake (2003:90)

According to SASFIN (2002:7), in analysing the main causes of bank failures in South Africa, the major underlying causes can be summarised as follows:

i. ***Poor lending disciplines.*** Poor lending decisions in both micro-lending as well as in business lending were the largest cause of banking failure in South Africa.

ii. ***Competitive pressures.*** This involves small and medium-sized banks trying to compete with the big banks by offering products such as mortgage lending that require an extremely strong financial standing.

iii. ***Speculative derivative trading.*** Although only one of the banks that failed in the period 1990-2007 failed because of speculative trading in derivatives by a wholly owned subsidiary, it is worth mentioning because speculative derivative trading can lead to major problems as was evidenced by the collapse of LTCM.

iv. ***The use of deposits for activities not related to lending.*** This would involve a banks not doing its normal disintermediation function of transforming deposits into loans, but rather using deposits for other activities, such as speculation in derivatives.

All the above causes of banking failures in South Africa point to mismanagement and poor management decisions. It is important to note that liquidity risk does not necessarily happen overnight when caused by poor management. Arrogant directors and senior management cause banks to fail through unwanted actions. A liquidity crisis can happen as a result of a bad position when there is a market shock, but it may also build up over time as a result of poor management. The problem is that employees in banks are measured in terms of return on assets (ROA), meaning that they have the incentive to put assets onto the balance sheet without necessarily considering the liabilities side thereof. This makes it difficult to manage the banking book in terms of assets versus liabilities. If a bank has maturing liabilities it will have to raise new funds and often at higher rates to attract investors. When the market sees these higher rates, the market may become suspicious and start to spread rumours, which may in turn lead to a liquidity crisis (Joachim, 2007).

This section briefly discussed the main reasons for bank failures in South Africa in the recent past. The major reasons identified for banking failures in South Africa did not include liquidity risk. Rather, the central theme from previous banking failures was that more banks fail as a result of internal factors such as fraud or poor management than as a result of liquidity risk.

In discussing the South African banking system and liquidity risk, it is important to discuss the role of the SARB in the banking system. For this reason, the SARB accommodation procedure is discussed in section 6.2.4.

6.2.4 South African Reserve Bank system of accommodation

The monetary policy framework currently implemented by the SARB is an inflation-targeting framework, which was formally adopted on 6 April 2000 (Aziakpono et al., 2005:2). The purpose of the operations of the SARB in the money market is to implement its interest rate policy as determined by the Monetary Policy Committee (MPC), with the aim of achieving its inflation target (SARB, 2005b:84). Previously, when the SARB targeted the money supply and when it followed a more eclectic approach to monetary policy, the operations of the SARB in the money market were aimed at variables other than inflation (SARB, 1998:5). Through these money market

operations, the SARB aims to promote financial stability by managing the liquidity needs of the banking system as a whole (SARB, 2004c:108-109). It also contributes to the development and efficiency of the domestic financial markets, in particular the interbank market (SARB, 2007h:2). The main instrument used by the SARB to implement its monetary policy, or targeting the inflation rate, is the repurchase (repo) rate. The repo rate is the rate that the SARB charges for borrowing cash reserves and it is the most significant rate in the financial markets, because an increase in the repo rate influences all other lending rates (Aziakpono et al., 2005:2).

The SARB creates a money market shortage which it then refinances at the repo rate. This creation of a money market shortage ensures that the repo rate, and hence monetary policy, is effective because banks are indebted to the SARB at all times (Faure, 2002:157). The SARB therefore has to transact regularly in the money market to create such a shortage, that is, it has to drain excess liquidity from the money market. In addition to levying cash reserve requirements on banks, it also uses various types of instruments, known as open market instruments, such as SARB debentures, longer-term reverse repos and foreign exchange swaps to drain excess liquidity (SARB, 2004c:106-107).

The SARB is in the best position to estimate the daily liquidity requirement, because it is the sole creator and destroyer of liquidity and because it has the best overall market information about the factors that influence liquidity (SARB, 2005b:86). The liquidity shortage is estimated on a daily, weekly and monthly basis (SARB, 2007h:2), but only the estimated weekly liquidity requirement is available to the public and is published on the SARB's website.

The liquidity shortage is refinanced through what is known as the main refinancing auctions that take place at 12:00 to 12:15 every Wednesday afternoon (SARB, 2004c:108). It is done on a tendering basis and this tendering system replaced what was previously known as the discount window in March 1998 (Standard Bank, 2007:23). The SARB's estimation of the liquidity requirement is not disclosed prior to the auctions, which means that the banks do not know what their collective need is (SARB, 2004a:7). The SARB provides liquidity to banks by means of repurchase agreements[7], or repos, involving Category 1 and Category 2 securities. In May 2007, the Financial Markets Department of the SARB issued a list of eligible collateral that would be accepted by the SARB as of 23 May 2007 (SARB, 2007c:1). It divides eligible collateral into two categories, namely category 1 and category 2 collateral (SARB, 2007d:11).

[7] Botha (2005:118) defines a repurchase agreement as the selling of an existing security, or the underlying asset, at an agreed price with the simultaneous agreement by the seller to repurchase the same security plus interest on a specified date.

Category 1 collateral consists of the following:

i. ***Treasury bills.***

ii. ***Rand-denominated government bonds.***

iii. ***Land Bank bills.***

iv. ***SARB debentures.***

v. ***Separate trading of registered interest and principle securities (STRIPS).*** STRIPS are issued in terms of the Public Finance Management Act, No. 1 of 1999. The Act provides the Minister of Finance with the authority to borrow money and to convert such loans into any other loan with the concurrence of the lender. These strips trade as zero-coupon instruments (SARB, 2007d:12).

According to the SARB (2007c:2-3) category 2 collateral consists of the following:

i. ***Eskom bonds.*** These are fixed interest-bearing securities issued in terms of Eskom's Domestic Multi-Term Programme and represent a liability of Eskom.

ii. ***Transnet bonds.*** These are fixed interest-bearing securities issued under the Public Finance Management Act, No. 1 of 1999, and represent a liability of Transnet.

iii. ***Trans-Caledon Tunnel Authority bonds.*** These are fixed interest-bearing securities issued under Government Notice, No 21017 of 24 March 2000, issued under the National Water Act, 1999 and represent a liability of the Trans-Caledon Tunnel Authority.

iv. ***Development Bank of South Africa bonds***. These bonds are fixed interest-bearing securities issued under the Development Bank of Southern Africa Limited Act, No. 13 of 1997, and represent a liability of the Development Bank of South Africa.

v. ***South African National Roads Agency bonds.*** These bonds are fixed interest-bearing securities issued under the South African National Roads Agency Limited and National Roads Act, No. 7 of 1998, and represent a liability of the South African National Roads Agency.

Although these securities are included as eligible collateral for the refinancing operations of the SARB, it is important to note that all these instruments are not included in instruments eligible for liquid asset reserve requirements, which are discussed in 6.2.5.3. Under special circumstances home loans can also be used at the SARB repo facilities, which is where a lending bank receives money through a loan mechanism facilitated by the SARB. When this happens, it is done at a discount and banks may run the risk that the outstanding amount is not covered by cash reserve requirements or liquid asset reserve requirements, both of which are discussed in section 6.2.5. In such a case there would still be a shortfall which the bank will have to finance (Joachim, 2007).

The maturities of these repos are for seven days, after which the seller buys back the securities (SARB, 2005b:87). It can happen that the estimate of the daily liquidity shortage may be incorrect due to a variety of factors, meaning that the daily liquidity requirement is different from the amount allotted at the main repo auction (SARB, 2004c:108-109). In these cases banks can make use of either supplementary repo auctions or standing facility repos. Although supplementary repo auctions were abolished in 2005, the SARB has the option to conduct a supplementary auction if some unexpected developments cause a significant shift in liquidity requirements leading to the SARB over or under-estimating the liquidity requirement. A supplementary repo auction is announced to provide additional liquidity to the banks or any excess liquidity is drained by means of a supplementary reverse repo auction (SARB, 2004a:9). The difference between supplementary repo auctions and standing facility repos is that supplementary repo auctions are conducted at the repo rate, while standing facility repos are conducted at penalty rates, either 50 basis points above or below the prevailing repo rate, depending on whether liquidity is drained or supplied. In contrast to the seven-day main repos, these repos mature on the next working day (SARB, 2007h:2-3). In addition to the facilities described above, the banks also have automatic recourse to their cash reserve balances at the SARB, which is discussed in section 6.2.5.2.

Another facility available to banks is the facility in the South African payment system, the South African Multiple Options Settlement System, or SAMOS. This facility was previously known as the marginal lending facility, but was abolished and replaced by the SAMOS penalty facility in 2004. The SAMOS penalty facility is an additional facility which banks can use to square off their short positions at the end of the settlement cycle (SARB, 2007h:4). Liquidity is provided against specified collateral at a rate of 500 basis points above the repo rate. This facility is not used frequently, because the rate is extremely high and cheaper funding is available in the form of the standing facility repos (SARB, 2004c:110). It is mainly used for the automatic funding of banks' short positions on their SAMOS settlement accounts at the end of the settlement cycle, which happens mainly as a result of administrative errors on the side of the banks and the amounts involved are small and insignificant (SARB, 2004a:11-12). As the lender of last resort, the SARB may also provide special assistance to banks in distress, in which case it can provide liquidity against a broader range of collateralised assets. The type and conditions of this assistance vary on a case-by-case basis (SARB, 2007h:4).

This brief discussion serves as background to the functioning of the accommodation system of the SARB, as it is central not only to the implementation of monetary policy, but also to the management of liquidity risk in South Africa. Prudential requirements in South Africa will now be discussed: cash reserve requirements, liquid asset reserve requirements and capital adequacy.

6.2.5 Prudential requirements in South Africa

6.2.5.1 Introduction

Bamber et al. (2001:12) state that prudential regulation focuses on the solvency, safety and soundness of financial institutions. Prudential regulation is needed because of imperfect consumer information, agency problems associated with the type of business conducted by financial institutions and because the behaviour of a financial firm affects the value of consumers' stake in such a firm. Bamber et al. (2001:53,103) add that prudential requirements for capital and liquidity are considered to be the backbone of any regulatory regime because financial stability depends on three pillars namely: proper infrastructure, sound markets and robust financial institutions.

Although monetary policy may ultimately depend on interest rates and efficient markets, financial stability mainly depends on prudential requirements and financial gearing. A variety of prudential requirements exist, including: capital and liquidity requirements, investment rules, financial disclosure and auditing regulation, company structure regulation, and regulation determining the extent of interaction between various firms in the sector (Genesis Analytics (GA), 2004:8). For the purpose of this study, cash reserve requirements, liquid asset reserve requirements and capital adequacy are discussed.

6.2.5.2 Cash reserve requirements

According to Moolman (2004:23) the SARB attempted to slow down an excessive expansion of liquidity in the banking sector during the 1960s by introducing a required cash reserve ratio in the Banks Act of 1965 and a supplementary reserve requirement in 1968. In other words, statutory provisions were introduced, forcing commercial banks to maintain minimum reserve balances depending on the amount of the commercial banks' time and demand liabilities (Nel, 2000:63). SA (1989:8) states that banks are required to maintain non-interest earning accounts at the SARB into which it must deposit funds in order to comply with set requirements. Luüs (2007:1) adds that, in South Africa, this requirement is currently 2,5 percent of total liabilities to the public with certain adjustments. According to the SARB (2007h:2) the amount of cash reserves held at the SARB is referred to as the structural liquidity requirement. It is known as such, because it is the amount that the liquidity requirement would have been if all the other factors influencing liquidity in the money market had a combined zero balance. Nel (2000:65) states that the need for cash reserve requirements in South Africa has become imperative because of the development of sophisticated financial markets, the enhanced ability of banks to raise short-term funds and the role of the SARB as the banking regulator.

The cash reserve requirements, or minimum reserve balances, are calculated in the DI 310 return that is completed by banks and submitted to the SARB. Adjusted liabilities (line 10) are calculated as reduced liabilities (line 5) less the average daily amount of funding received under repurchase agreements (line 6) less the average daily amount of liabilities relating to transactions in derivatives (line 7) less the average daily amount owing by banks in OECD countries plus the average daily amount of funding received from head office or branches in the same group (line 9). Minimum reserve requirements (line 11) are then calculated as 2,5 percent of adjusted liabilities (SARB, 2007a).

According to Luüs (2007:1) the percentages of such requirements vary from country to country and can be from 0 percent (e.g. Australia) to as high as 80 percent (e.g. Jordan). When converting the cash reserve requirement amounts to percentages of total balance sheet size as reported to the SARB in the DI 100, the average percentage from May 2002 to April 2007 was 1,55 percent (refer to Appendix A). This means that banks had to hold, on average, 1,55 percent of their balance sheets per month in non-interest bearing accounts at the SARB over the period analysed. Typically, banks do not deposit amounts in excess of this requirement into the accounts at the SARB, simply because it represents a cost to them as these amounts do not earn interest.

As alluded to earlier, banks have access to their cash reserves as an additional mechanism for banks to manage their short-term liquidity needs. Banks have to adhere to the minimum amount as averaged over the maintenance period, which is typically one month, meaning that banks cannot use this facility over an extended period of time. If a bank continues to have a liquidity shortage for some time, it has to obtain liquidity either in the interbank market or through the SARB's refinancing facilities (SARB, 2007h:4).

6.2.5.3 Liquid asset reserve requirements

The SARB (1999:2) states that liquid asset reserve requirements are a prudential requirement aimed at ensuring the liquidity and safety of the banking system. As mentioned above, one of the functions of the SARB is to act as the lender of last resort. This means that it makes funds available to finance the shortage in the banking sector against collateral provided by the banks that require such funding (Marcus, 2000). Therefore, the smooth functioning of liquidity in the banking system is dependent upon the availability of adequate levels of instruments that are eligible to qualify as liquid assets and to be pledged as security against accommodation. The prudent management of such instruments plays an important role in their availability (SARB, 1999:2).

The SARB (2007d:391) prescribes that banks should hold an average daily amount of liquid assets not less than 5 percent of their reduced liabilities. Reduced liabilities, along with liquid assets reserve requirements, are calculated in the DI 310 which is the minimum reserve balance and liquid assets return that is completed by banks and submitted to the SARB. The amount for reduced liabilities (line 5) is calculated as capital and liabilities from the balance sheet (line 1) less capital and reserve funds also from the balance sheet (line 2) less other funding received from head office or branches in the group (line 3) less the average daily amount owing by banks, branches and mutual banks in South Africa. The liquid asset reserve requirement is then calculated as 5 percent of the reduced liabilities amount (SARB, 2007a).

Although liquid asset reserve requirements are based on an average balance of 5 percent throughout the month, it may not be less than 75 percent of the average daily amount required to be held by banks at close of business on any day (SARB, 1999:2). SA (2000:58) adds that such balances may also at no point fall below 50 percent intra-day, and at least 95 percent of liquid assets required to be held by any bank on any day at close of business should be owned outright by the bank, in other words, be unencumbered.

According to SA (2003:9) the term "liquid assets" means:

i. ***SARB notes, subsidiary coin, coin and bullion.*** SARB notes and subsidiary coin exclude notes or coin to the extent to which it is taken into account in the calculation of the cash reserve requirement that banks are required to maintain in an account with the SARB.

ii. ***Credit balance in clearing account at SARB.*** Any credit balance in a clearing account with the SARB.

iii. ***Treasury bills.*** Short-term government securities.

iv. ***Government bonds.*** Securities issued to fund the National Government.

v. ***Land Bank bills.*** Land Bank bills are issued by the Land Bank for purposes of extending short-term financing to agricultural co-operatives or to a control board established to purchase agricultural products.

vi. ***SARB securities.*** Securities of the SARB with a maturity of not more than three years to the last redemption date thereof.

As liquid asset reserve requirements are calculated as 5 percent of reduced liabilities, it is important to convert them back to a percentage of total balance sheet size, as per the DI 100 return submitted to the SARB, in order to make them comparable with other percentages. A spreadsheet containing the conversion of liquid asset reserve requirements, cash reserve

requirements and capital adequacy ratios to percentages of the total balance sheet size is included as Appendix A. In South Africa, over the period May 2002 to April 2007, the average monthly liquid asset reserve requirement amounted to 4,09 percent of the aggregate banks' balance sheet. This means that 4,09 percent of banks' balance sheets were tied up for the purpose of complying with the liquid asset reserve requirements on an average monthly basis. It is important to note that banks might hold more than just the 5 percent requirement in liquid assets, but the additional liquid assets might have third party claims on them, or not be unencumbered, therefore making them ineligible for the sake of liquid asset reserve requirements. The reason for this is that such instruments are still the banks' investments and they earn returns on these investments, unlike cash reserve requirements which were discussed in section 6.2.5.2.

6.2.5.4 Capital adequacy

Okeahalam (1998:30) considers capital requirements to be the prime practical example of prudential requirements. As discussed in section 4.4.2, the foundation of Basel II is capital adequacy for all banks. Currently, under Basel I, South Africa has a required capital adequacy ratio of 10 percent of risk-weighted assets for all banks (Luüs, 2007:1). As mentioned in section 4.4.3.5, this will change with the implementation of Basel II, when different banks will have different capital requirements depending on the outcomes of Pillar 2 assessments.

An analysis was done using the total banks' DI 400 return, which is the capital adequacy return. The return illustrates banks' overall capital adequacy percentages in line 89, which are calculated by dividing the sum of total capital allocated to banking activities (line 47 column 1) and total capital allocated to trading activities (line 53 column 1) by the sum of risk-weighted assets (line 13 column 11) and 10 times capital and reserve funds allocated for trading activities (line 79 column 1). When capital requirements are expressed as a percentage of total balance sheet size as per the DI 100 submitted to the SARB, the average for all banks amounted to 7,60 percent over the 60 months analysed. This means that 7,60 percent of banks' balance sheets were tied up for capital adequacy purposes (refer to Appendix A).

6.2.5.5 Conclusion: Prudential requirements in South Africa

Liquid asset reserve requirements are a prudential requirement implemented to ensure the smooth functioning of liquidity in the banking system through the prudent management of liquid assets to ensure the availability of adequate levels of instruments that are eligible to qualify as liquid assets and to be pledged as security against accommodation. Liquid asset reserve requirements amount to about 4,09 percent of the total banks' balance sheet. Cash reserve

requirements are balances kept in non-interest bearing accounts at the SARB and amount to about 1,55 percent of the total banks' balance sheet. This means that about 5,64 percent of total banks' balance sheets in South Africa are tied up specifically for addressing liquidity needs. Capital adequacy ratios represent about 7,60 percent of total banks' balance sheets in South Africa. This means that, when added to other prudential requirements, banks hold back about 13,64 percent of their balance sheets to address a variety of risks.

From the above, the amount that banks are required to hold for various risks represents a significant size of the aggregated banks' balance sheet.

6.2.6 Conclusion

The aim of this section was to foster a broad understanding of the South African banking system and the environment in which it operates. The structure of the South African banking system was described before causes of major banking failures in the past 17 years in South Africa were identified. From this it was set forward that internal factors such as fraud and poor management are responsible for banking failures more often than liquidity risk, although most banks experienced liquidity risk before failure. This section continued with a description of the SARB system of accommodation. Banks can finance their liquidity requirements through the main weekly repo auctions, supplementary auctions, standing facility repos or the SAMOS penalty facility. This description of the SARB accommodation system was followed by a discussion of prudential requirements including cash reserve requirements, liquid asset reserve requirements and capital adequacy where it was concluded that banks hold a significant portion of their balance sheets for prudential requirement purposes.

Now that background on the South African banking sector has been provided, the study continues by analysing liquidity risk in South African banks.

6.3 Analysis of total banks' balance sheet

6.3.1 Introduction

In order to determine the state of funding liquidity and, therefore, the degree of funding liquidity risk in a country's banking sector, the analysis of an aggregated balance sheet of all the banks in that country could prove useful. For doing this, data was gathered from the SARB website where all DI returns that are submitted by the banks to the SARB are available in an aggregated version. Data was collected from the DI 100 for the 60 months from May 2002 to April 2007.

A regulatory balance sheet is a data-rich financial statement, consisting of 13 columns and 145 lines (SARB, 2007a). For this reason, not only lines considered pertinent to this analysis were used. This section firstly describes the methodologies used to analyse the liabilities and assets sides of the balance sheet before the results of the analysis are presented.

6.3.2 Methodology: Capital and liabilities

As mentioned in section 2.2.1, the liabilities side of the balance sheet of banks represents, among other things, deposits made by customers that can be withdrawn with or without a pre-agreed notice period. If the liabilities side of a bank's balance sheet consists largely of short-term deposits which are used to fund long-term assets, or loans granted by a bank to its customers, the bank may run into trouble when customers unexpectedly start to withdraw their funds. This is the essence of liquidity risk and is known as the term mismatch which is the key to liquidity management at banks. For this reason, the aggregate South African banking sector balance sheet was analysed in terms of the components of liabilities as well as the maturities of each of the components. It is however important to note that the liabilities side of banks' balance may be expected to consist mainly of short-term items simply because of the short-term nature of liabilities. Depositors typically place money at banks for short periods to ensure that funds are available when it is needed. Depositors very rarely, if at all, place funds in the form of deposits at banks for thirty-year periods, for example.

Lines 1 to 42 represent capital and liabilities in the balance sheet (SARB, 2007a). Each of these lines was not analysed, but instead the sub-totals or components of total liabilities were analysed in nominal terms as well as in percentage terms. The sub-totals that were used in this analysis were:

i. ***Line 1: Funding-related liabilities to the public.*** This line represents the total of line 2 (Deposits and Loans Repayable in South African Rand), line 16 (Deposits and Loans Repayable in Foreign Currency) and line 19 (Funds Transfer for Trading Activities). It is noteworthy that each of these lines also represents totals of a further level of sub-totals or components, but these sub-components were not analysed individually.

ii. ***Line 20: Acknowledgements of debt endorsed and rediscounted; but still outstanding on behalf of clients per contract.*** This line represents the total of lines 21-24 which are: acceptances outstanding; commercial paper; bills; and promissory notes or similar acknowledgements of debt.

iii. ***Line 25: Other liabilities and trade creditors, including tax liabilities.*** This line represents the total of lines 26-27 which are derivative instruments and other liabilities, including valuation deficits.

iv. ***Line 28: Capital and reserves.*** This line represents the total of lines 39-41 which are net qualifying capital and reserves; profits not formally appropriated by Board resolution for banking activities; and non-qualifying capital and reserves; including impairments, revaluations and other reserves and debt instruments not qualifying as capital and reserve funds.

v. ***Line 42: Total capital and liabilities.*** The totals of the above-mentioned lines, i.e. lines 1, 20, 25 and 28 make up total capital and liabilities. The totals are calculated by adding all the above lines from top to bottom.

As mentioned earlier a bank's balance sheet, as reported to the SARB on the DI 100, has 13 columns into which different figures are entered (SARB, 2007a). The current analysis focused on the term structure of the aggregate South African balance sheet and for this reason only columns 1-4 were used. These columns are:

i. ***Column 1: Liabilities at month-end: Short-term.*** SA (2000:272) defines a short-term liability as a liability (including a loan from or a deposit by another bank) that is payable on or before the thirty-first day as from that date, or which on that date is subject to notice that makes it payable on or before the thirty-first day as from that day.

ii. ***Column 2: Liabilities at month-end: Medium-term.*** SA (2000:270) defines a medium-term liability as a liability (including a loan from or a deposit by another bank) that is payable on or after the thirty-second day as from that date but not later than the day on which a period of six calendar months as from that date expires, or that on that date is subject to notice that makes it payable on or after the thirty-second day as from that date but not later than the day on which a period of six calendar months as from that date expires.

iii. ***Column 3: Liabilities at month-end: Long-term.*** SA (2000:270) defines a long-term liability as a liability (including a loan from or a deposit by another bank) that is payable after the expiration of more than six calendar months as from that date or that on that date is subject to notice that makes it payable after the expiration of more than six calendar months as from that date.

iv. ***Column 4: Liabilities at month-end: Total.*** This column simply represents the total of all of the above by aggregating figures from left to right (from short-term to long-term liabilities).

An example of the spreadsheet that was used for this analysis on the liabilities side is included as Appendix B. This spreadsheet is attached only as an example and covers only the last month of the analysis, but the same spreadsheets were used for all the other months – the complete data

set that was used is available from the author on request. The data in the spreadsheet are taken directly from the aggregated balance sheet and, as illustrated in the spreadsheet, lines 28 and 42 are only included under column 4 (the Total column). The line under line 42 calculates the totals of each column and the table below that contains percentage composition calculations for the data contained in the top table. This data was mapped into a separate spreadsheet in order to do a chart analysis. The results and charts of this analysis are discussed later in this section.

6.3.3 Methodology: Assets

The assets side of the balance sheet of banks represents, among other things, loans that are granted by banks to customers that can also include long-term loans made to finance the purchasing of motor vehicles and/or houses, for example. As mentioned in section 6.3.2, banks may experience liquidity problems if long-term assets are funded by short-term liabilities which are unexpectedly withdrawn. For this reason, the aggregate South African banking sector balance sheet was analysed in terms of the components of assets in the banking book as well as in the trading book. Maturities of assets are not explicitly reported by banks on the balance sheet, but it is still useful to analyse the assets side of the balance sheet. From the analysis on the assets side of the aggregated banks' balance sheet, it may be expected that it would consist largely of long-term assets, simply because of the typical nature of banks' assets. Bank assets include asset and vehicle financing and mortgage bonds, which are repaid over long periods of time.

Lines 43 to 85 represent assets in the balance sheet (SARB, 2007a). Each of these lines was not analysed, but instead the sub-totals or components of total assets were analysed in nominal terms as well as in percentage terms. The sub-totals that were used in this analysis were:

i. ***Line 43: Money.*** This line represents the total of line 44 (Legal Tender in South Africa), line 45 (Gold Coin and Bullion and Non-RSA Currency) and line 46 (Deposits with the SARB).

ii. ***Line 47: Loans and advances.*** This line represents the difference between line 62 (Total Loans and Advances) and line 63 (Specific Provisions).

iii. ***Line 64: Investment and trading positions after mark-to-market adjustments where applicable.*** This line represents the total of 65-69 minus line 70. Lines 65-69 are interest bearing instruments, equities, bank-related investments and other (including unlisted equities) and line 70 is specific provisions.

iv. ***Line 71: Non-financial assets.*** This line represents the total of lines 72-76 which are premises of the bank, other fixed property, computer equipment (including peripherals at book value), computer software and other assets including vehicles, furniture and fittings, all at book value.

v. ***Line 77: Clients' liabilities for acknowledgements of debt outstanding per contract.*** This line represents the total of lines 78-81 which are: acceptances outstanding; commercial paper; bills; and promissory notes or similar acknowledgements of debt endorsed.

vi. ***Line 82: Deferred tax.*** Deferred tax is defined by regulation in South Africa as the gross amount of debit items on a deferred tax account (SA, 2000:37).

vii. ***Line 83: Assets repossessed or bought in to protect an advance or investment.*** This line is defined by SA (2000:38) as assets bought in to protect an advance or investment and not yet disposed of, such as movable property, immovable property, or companies of which the main object is the acquisition and holding or development of immovable property. This line may also contain investments in shares of companies, of which the main object is not the holding of fixed property and, which were bought in to protect an advance or investment.

viii. ***Line 84: Other assets (including remittances in transit).*** The net inter-branch and head office debit balances resulting from entries that originate or require response outside the head office or outside any particular branch must be included under this item. Remittances in transit is defined by SA (2000:38) as the amounts of cheques or other orders to pay, drawn on one of a bank's branches in South Africa or on another bank in South Africa or on the SARB and with which another such branch or bank in South Africa has credited a client or which it has paid out but with which the first-mentioned branch or bank or the SARB has not yet debited a client, as well as the amount of a warrant voucher that the reporting bank has paid out but for which it has not yet received repayment from the Secretary to the Treasury. Other assets such as postal and money orders, service deposits and stamps, tax overpaid and any other assets that are not reported elsewhere in the DI 100.

ix. ***Line 85: Total assets.*** The totals of all the above-mentioned lines, i.e. lines 43, 47, 64, 71, 77, 82, 83, 84 and 28 make up total assets. The totals are calculated by adding all the above lines from top to bottom.

As mentioned earlier, a balance sheet does not explicitly include the term structure of assets, therefore the only columns used were for total month-end balances, month-end balances in the banking book and month-end balances in the trading book (SARB, 2007a). The remainder of the columns on the assets side of the balance sheet would not have proved useful in this study and included average daily balances for total, banking and trading book, annualised gross yields and risk weightings. The columns used are:

i. ***Column 1: Month-end balances total.*** This column simply represents the total of all of the following columns, i.e. banking book total plus trading book total.

ii. ***Column 2: Month-end balances banking.*** This line represents the month-end balance of total assets held in the banking book.

iii. ***Column 3: Month-end balances trading.*** This line represents the month-end balance of total assets held in the trading book.

An example of the spreadsheet that was used for this analysis on the assets side is included as Appendix C. This spreadsheet is attached only as an example and covers only the last month of the analysis, but the same spreadsheets were used for all the other months included – the complete data set that was used is available from the author on request. The table below line 85 contains percentage composition calculations for the data contained in the top table. This data was mapped into a separate spreadsheet in order to do a chart analysis. The results and charts of this analysis are discussed in the following sub-section.

6.3.4 Results: Liabilities and capital

When analysing the results of the analysis done on the liabilities side of the aggregated banks' balance sheet, it is important to keep in mind that because the nature of bank liabilities, which are typically deposits, the overall term structure of the liabilities side of the balance sheet may be expected to be short-funded. Separate charts were constructed for each of the components of total liabilities in order to gain an indication of the term composition of each of these. All of the charts presented are stacked area charts where the total is represented by the top of the area and shows the composition of this total in terms of the maturities of these funds broken up into short-term, medium-term and long-term.

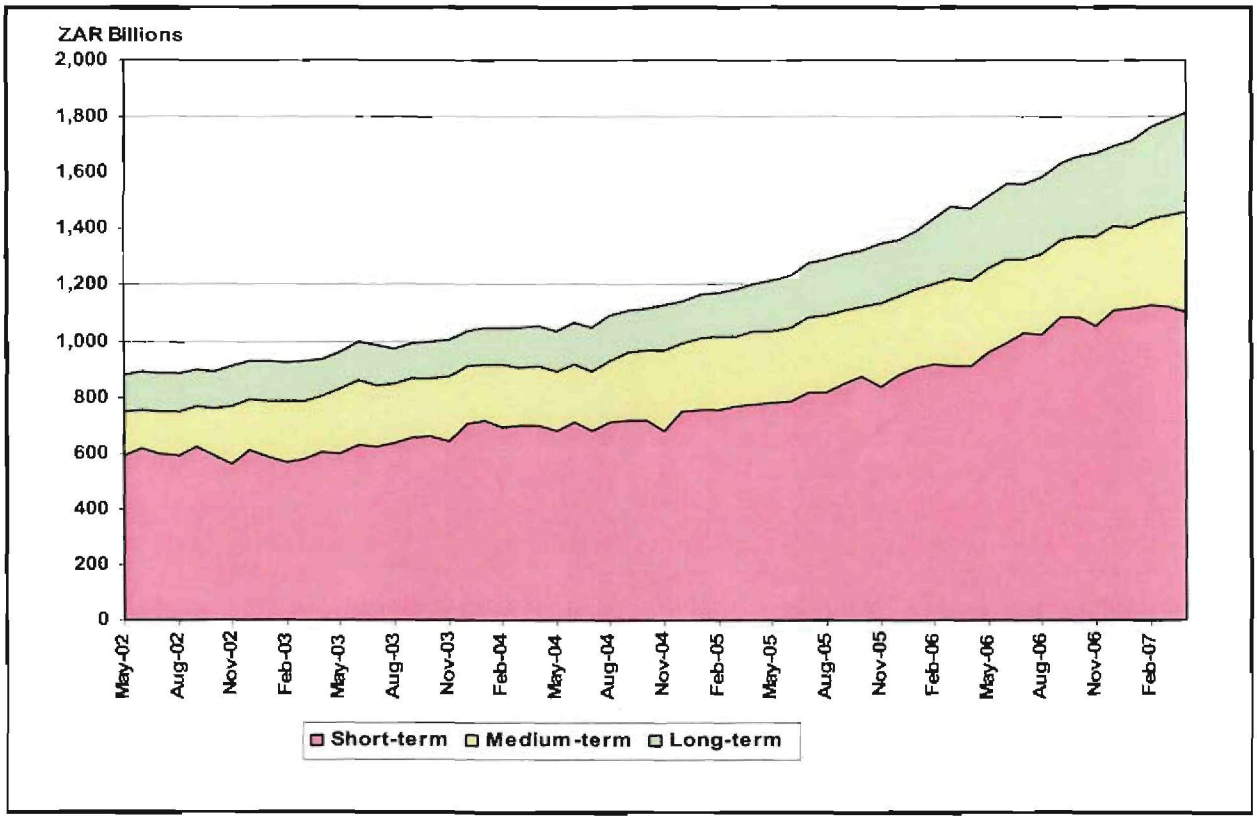
6.3.4.1 Funding-related liabilities to the public

Figure 6.1 represents the nominal composition of funding-related liabilities to the public, or line 1 from the balance sheet. From the chart it is apparent that funding-related liabilities to the public has increased significantly over the past five years from around R800 billion in May 2002 to R1,80 trillion in April 2007, with an average value of R1,21 trillion over the 60 months analysed.

The significant increase in funding-related liabilities to the public over the five years cannot be ascribed specifically to an increase to one of the term categories, which is illustrated in Figure 6.2, where the percentage composition of each of the term components has remained more or less at the same levels over the past five years: 64,69 percent, 20,19 percent and 15,12

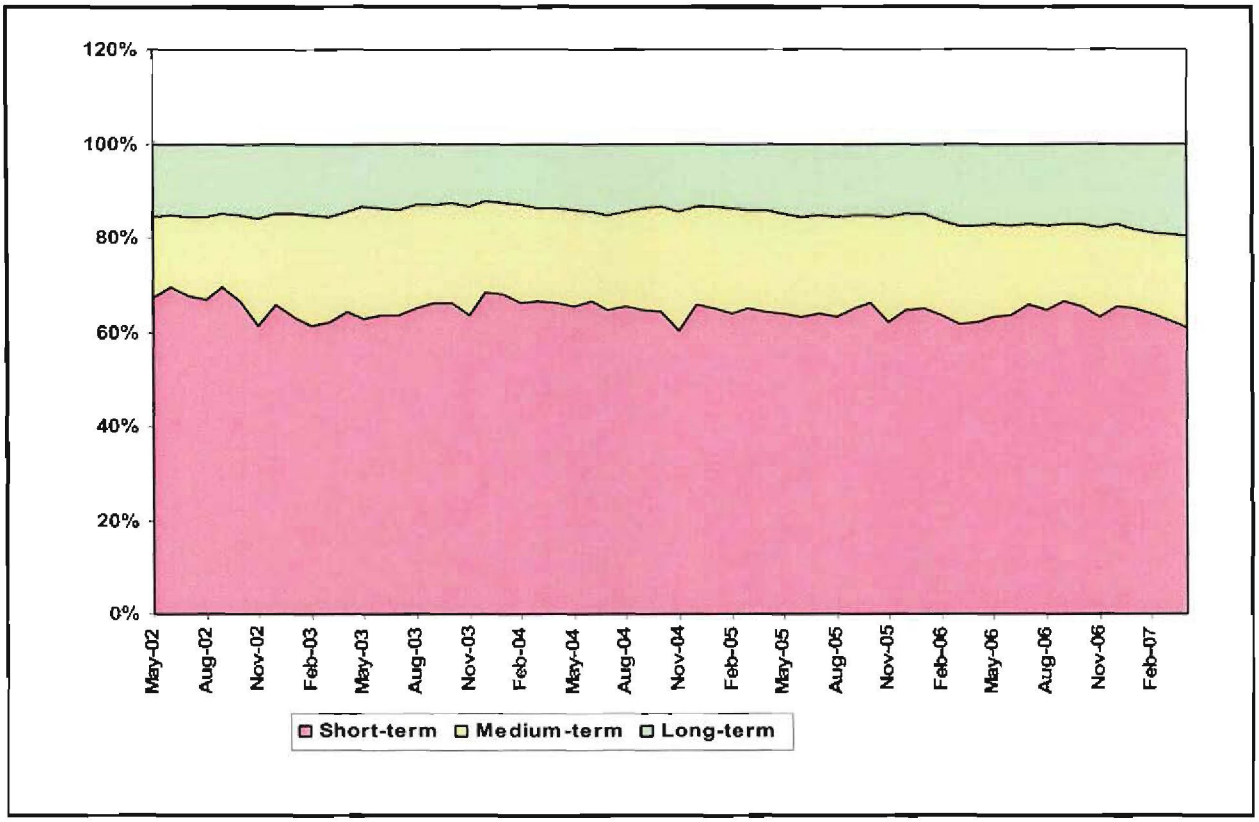
percent for the short-term, medium-term and long-term buckets, respectively . It is concerning that short-term funding in this category of liabilities has remained at levels between 60-70 percent over this period, as this represents a significant concentration in one time bucket, which could be exposed during a liquidity crisis.

Figure 6.1: Funding-related liabilities to the public (nominal composition)



Source: SARB (2007a)

Figure 6.2: Funding-related liabilities to the public (percentage composition)



Source: SARB (2007a)

Growth in funding-related liabilities to the public is depicted in Table 6.2. From the table it is apparent that this category of liabilities has grown at an average of 14,49 percent over the five years in question and that short-term funding grew at a slower rate than medium and long-term funding. Short-term funding grew at an average of 12,77 percent, medium-term at an average of 16,17 percent and long-term at an average of 21,47 percent.

Table 6.2: Growth in funding-related liabilities to the public

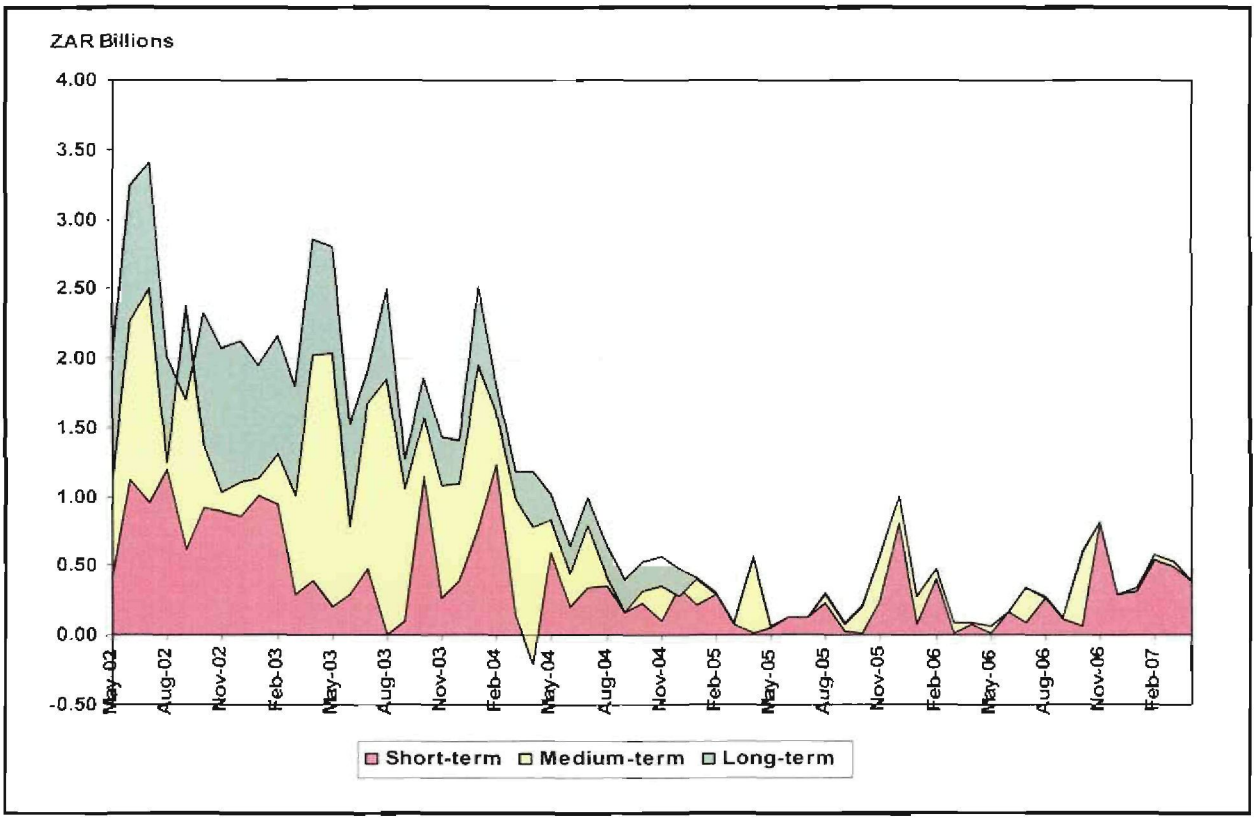
Funding-related liabilities to the public	Short-term	Medium-term	Long-term	Total
2002/03	1,58%	30,87%	-1,54%	6,17%
2003/04	15,70%	-7,71%	11,86%	9,58%
2004/05	14,19%	22,45%	15,04%	16,00%
2005/06	17,25%	17,31%	45,13%	21,33%
2006/07	15,13%	17,92%	36,85%	19,39%
Average per annum	12,77%	16,17%	21,47%	14,49%

Source: SARB (2007a)

6.3.4.2 Acknowledgements of debt endorsed and rediscounted but still outstanding on behalf of clients per contract

Acknowledgements of debt endorsed and rediscounted but still outstanding on behalf of clients per contract (line 20) of the balance sheet, are presented by Figure 6.3. The part of the chart where the total is negative in April 2004 can be ascribed to a reporting error by one of the banks. Similar occurrences can also be observed in September and December 2002 and although up to 98 percent of this category of liabilities consisted of short-term liabilities, there was no clear trend and the absolute amounts involved in this category were extremely small with respect to the overall picture of liabilities – an average of just over R1,06 billion over the 60 months. For this reason, further analysis into this category of liabilities does not take place because it is considered to be immaterial in terms of the overall analysis of liabilities. It is, however, important to note that even though it is considered to be immaterial to analyse it on its own, this category of liabilities is included in the total liabilities figures and has not been ignored completely.

Figure 6.3: Acknowledgements of debt endorsed and rediscounted (nominal composition)

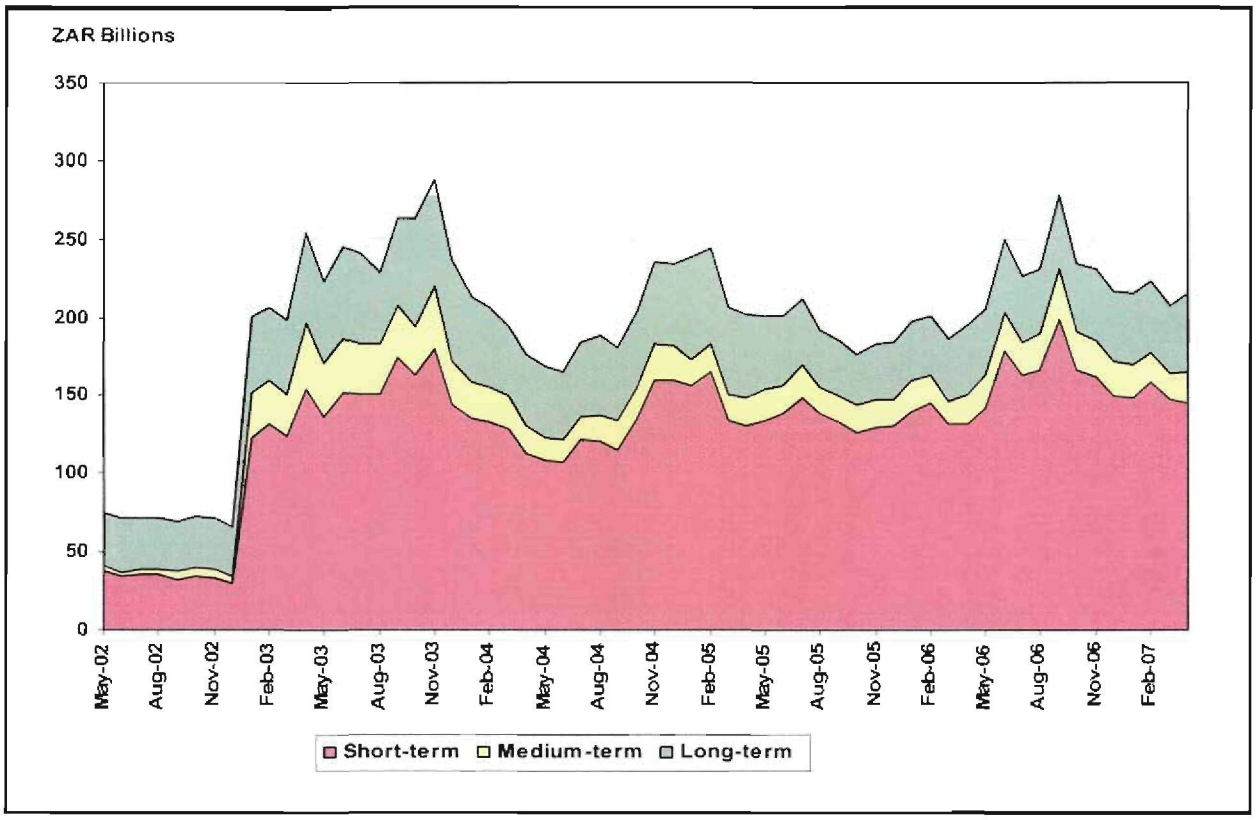


Source: SARB (2007a)

6.3.4.3 Other liabilities and trade creditors, including tax liabilities

The nominal composition of other liabilities and trade creditors, including tax liabilities (line 25), is presented by Figure 6.4. From the chart it becomes apparent that this category of liabilities is the second largest one with an average over the 60 months analysed of R194,96 billion. Although it is still relatively small compared to the amounts involved in funding-related liabilities to the public, a more detailed analysis takes place on this category of liabilities. From Figure 6.4 it becomes apparent that growth in other liabilities and trade creditors, including tax liabilities, was relatively erratic over the 60 months and varied from year to year.

Figure 6.4: Other liabilities and trade creditors, including tax liabilities (nominal composition)



Source: SARB (2007a)

Growth in each of the buckets of this category of liabilities is summarised in Table 6.3. Short-term liabilities grew at an annual average of 61,81 percent, medium-term liabilities at 292,24 percent and long-term liabilities at 16,79 percent. Overall, this category of liabilities grew at an average annual rate of 47,69 percent. Over the four years excluding 2002/03 the average growth rates were 1,15 percent (short-term), -9,17 percent (medium-term), 3,78 percent (long-term) and 0,18 percent (total), respectively.

Table 6.3: Growth in other liabilities and trade creditors, including tax liabilities

Other liabilities and trade creditors, including tax liabilities	Short-term	Medium-term	Long-term	Total
2002/03	304,43%	1497,89%	68,84%	237,73%
2003/04	-16,92%	-49,77%	-13,36%	-21,16%
2004/05	20,98%	16,57%	18,76%	19,99%
2005/06	-1,50%	-3,55%	-7,85%	-3,20%
2006/07	2,04%	0,06%	17,56%	5,08%
Average per annum	61,81%	292,24%	16,79%	47,69%

Source: SARB (2007a)

A large jump took place between December 2002 and January 2003 and because of this sudden increase, which is also illustrated in Figure 6.4, all the growth figures for this category of liabilities are distorted. The reason for this large and sudden increase in other liabilities and trade creditors, including tax liabilities, can be attributed to changes that took place in the Amended Regulations Relating to Banks (Amended Regulations) as per SA (2002:6). In the Amended Regulations (SA, 2000:33) other liabilities and trade creditors including tax liabilities included the following:

i. Balances due to head office and branches in the Republic, that is, when the net inter-branch and head office balances resulting from entries that originate or require response outside the head office or outside any particular branch are credit balances.

ii. A balance representing deferred income that cannot be deducted from the asset in question. This item must also include suspense accounts arising from credit balances resulting from the revaluation of forward exchange contracts or other trading assets, but must exclude unearned finance charges, accrued interest and rebates.

iii. The gross amount of credit items on a deferred tax account.

iv. All provisions not included elsewhere in the statement.

v. All credit items in transit.

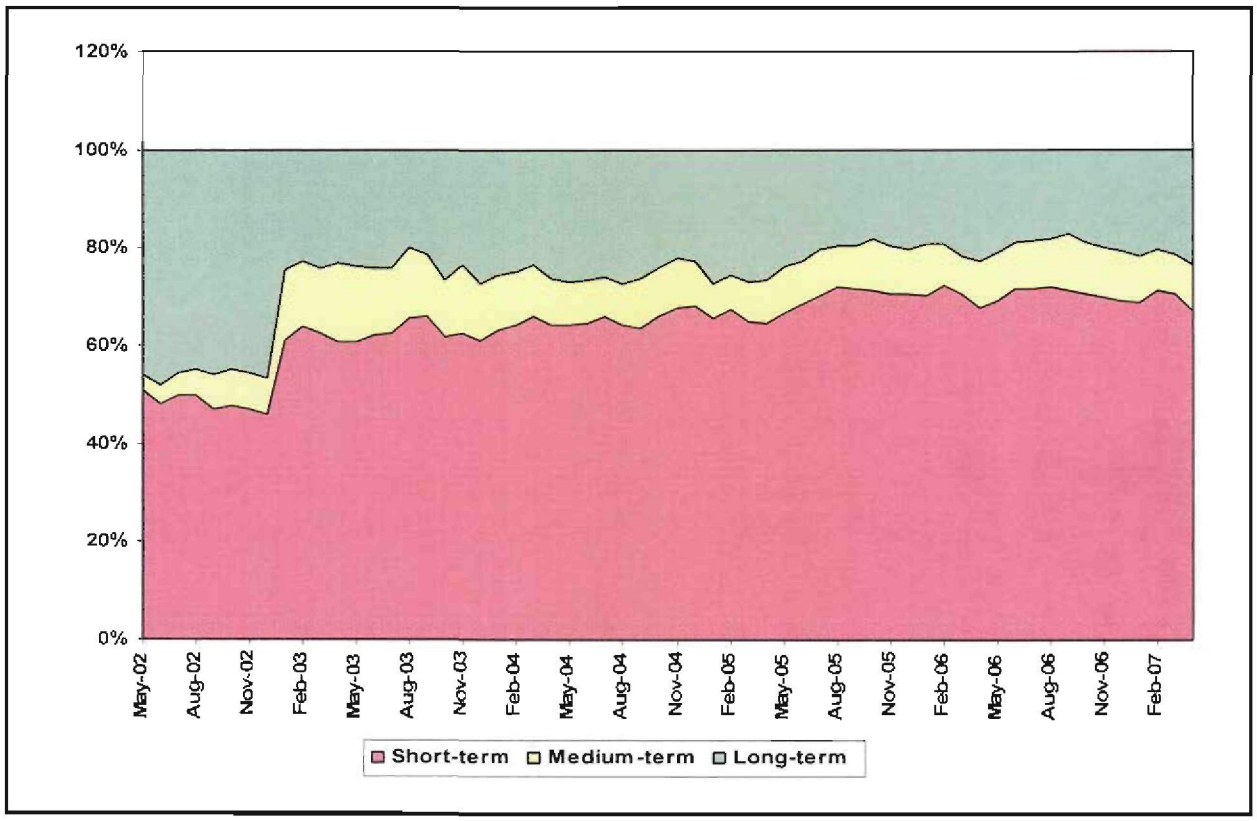
vi. A net credit balance originating from mark-to-market adjustments in accordance with regulation 13 (trading activities).

vii. Any liability of banks at month-end due to a commitment resulting from a short position in any financial asset.

In the Amended Regulations, other liabilities and trade creditors including tax liabilities had to consist of all of the above, except for number ***vi***, which was repealed (SA, 2002:33). This item allowed for the netting of a credit balance which was due to mark-to-market adjustments. Under the new Regulations this was not allowed anymore and because of this, derivatives liabilities increased from R24,16 billion in December 2002 to R149,15 billion in January 2003.

The percentage composition of other liabilities and trade creditors including tax liabilities is depicted in Figure 6.5. It basically tells the same story as that of the nominal composition and the sharp increase as a result of the netting of derivative positions that was not allowed as of 2003. Short-term liabilities in this category averaged 64,44 percent, medium-term liabilities 9,81 percent and long-term liabilities 25,75 percent over the 60 months.

Figure 6.5: Other liabilities and trade creditors, including tax liabilities (percentage composition)

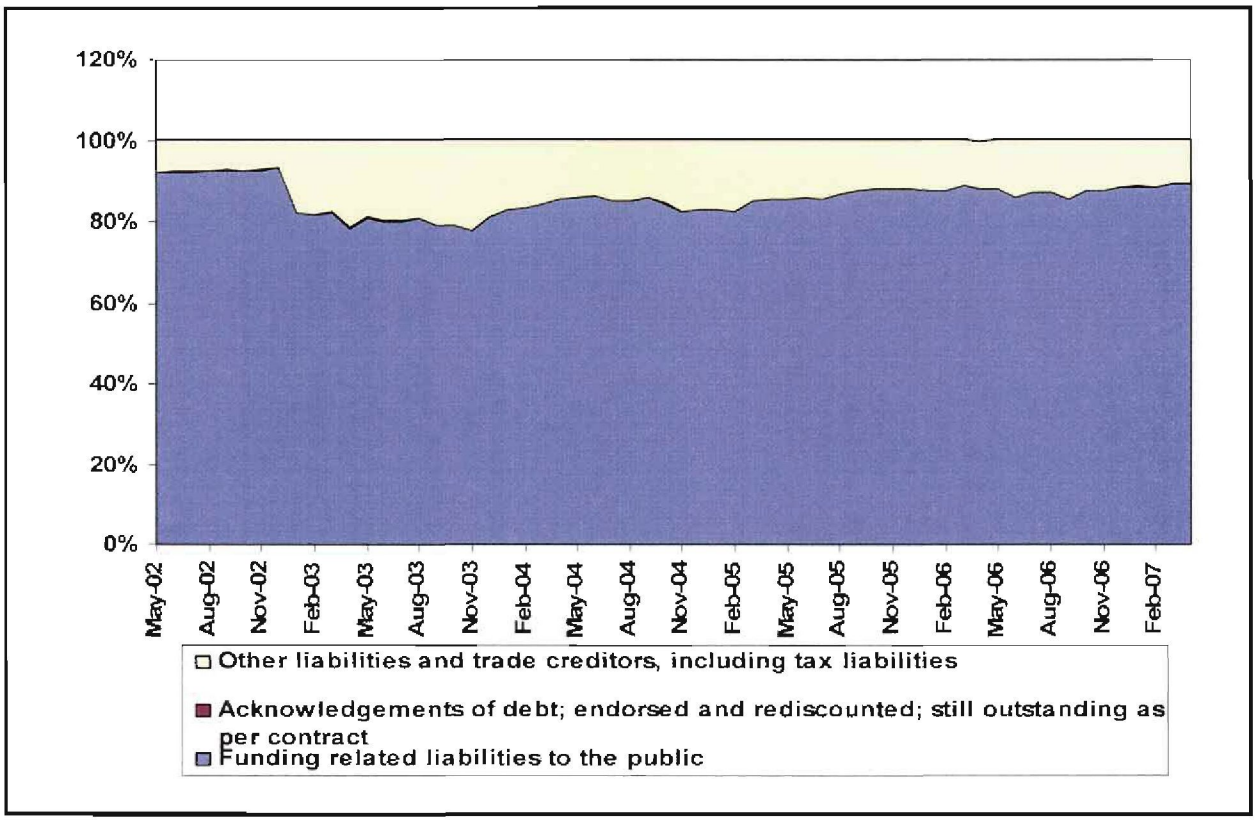


Source: SARB (2007a)

6.3.4.4 Total liabilities

The composition of liabilities in terms of each of the above components is shown in Figure 6.6. This is shown simply to confirm what the nominal charts of each of the liability categories showed. The chart is again a stacked percentage chart and illustrates that funding-related liabilities to the public make up the largest contribution of total liabilities and averaged 78,86 percent over the 60 months analysed. Other liabilities and trade creditors is the second largest component and made up an average of 12,80 percent. As mentioned in section 6.3.4.2, acknowledgements of debt was the smallest component of total liabilities and averaged only 0,08 percent and is almost invisible on the chart. Therefore, any movements in funding-related liabilities to the public automatically had the biggest impact on total liabilities.

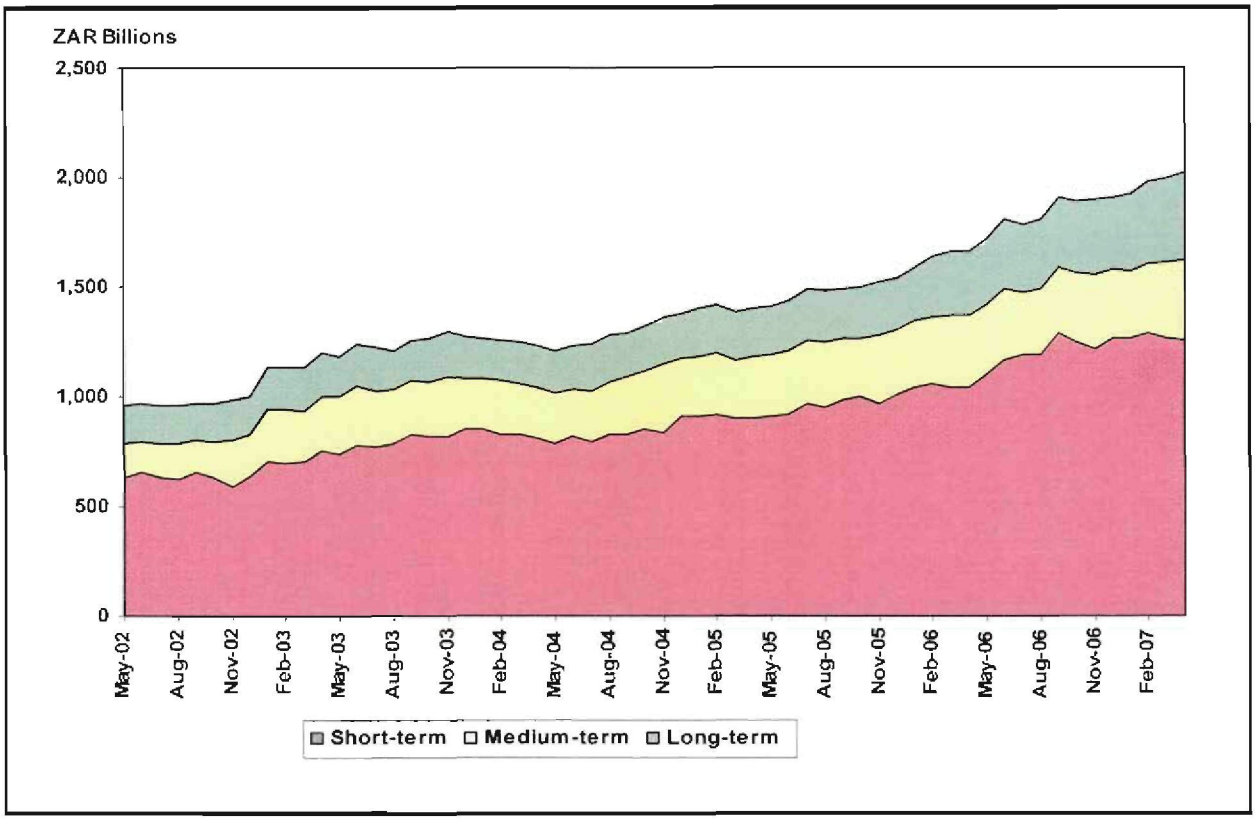
Figure 6.6: Composition of total liabilities per liability components



Source: SARB (2007a)

Total liabilities are presented in terms of the term structure of liabilities in order to assess whether the aggregate balance sheet of South African banks is short-funded or not. Figure 6.7 presents the nominal composition of total liabilities per maturity bucket. As can be expected because of its large contribution to total liabilities, the total liabilities chart takes much the same form as that of funding-related liabilities to the public.

Figure 6.7: Total liabilities (nominal composition)



Source: SARB (2007a)

The growth in total liabilities per time bucket is presented in Table 6.4. From the table it becomes apparent that short-term liabilities grew at an average annual rate of 14,49 percent over the 60 months analysed.

Table 6.4: Growth in total liabilities

Total liabilities	Short-term	Medium-term	Long-term	Total
2002/03	19,83%	55,90%	12,65%	24,41%
2003/04	9,63%	-13,42%	4,26%	3,63%
2004/05	15,04%	22,18%	15,81%	16,50%
2005/06	14,50%	15,87%	33,88%	17,84%
2006/07	13,48%	16,74%	34,11%	17,70%
Average per annum	14,49%	19,45%	20,14%	16,02%

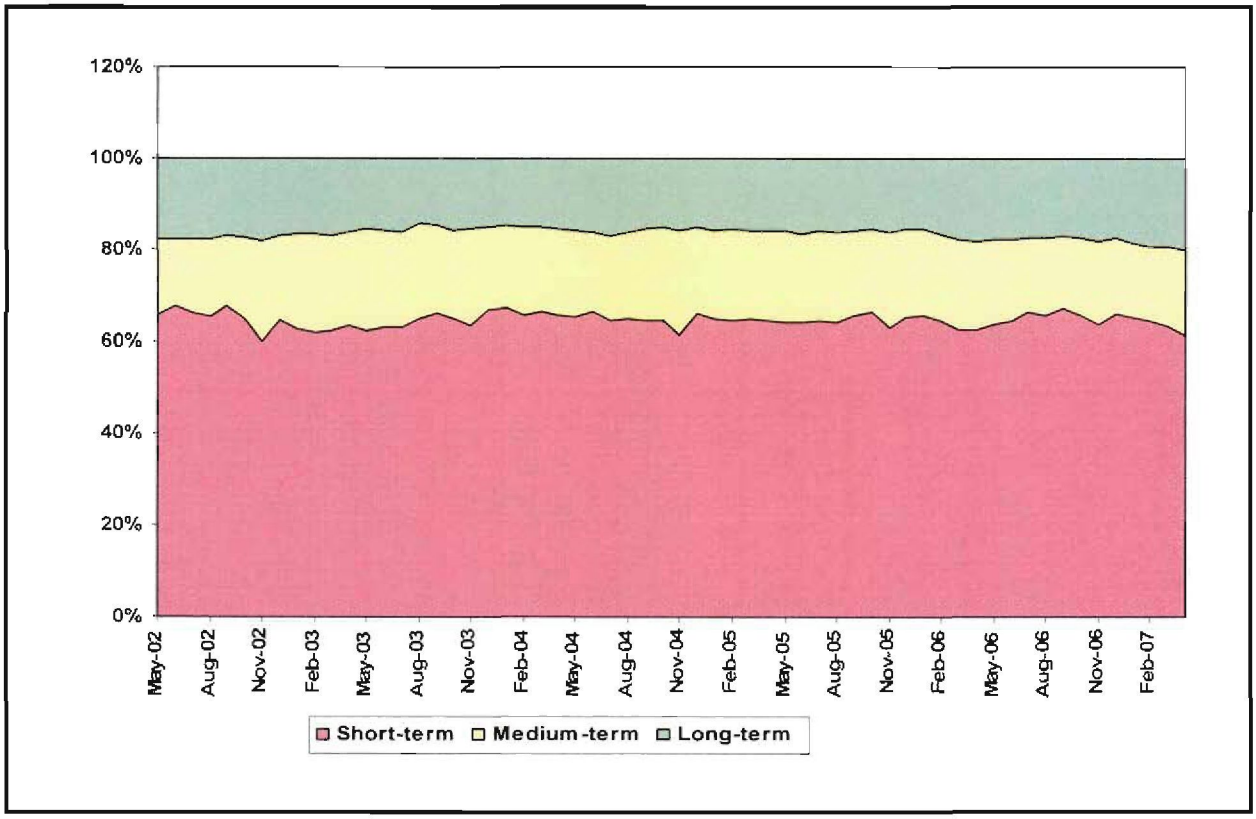
Source: SARB (2007a)

Short-term liabilities grew at a less erratic rate than the other term structures, at 19,83 percent in 2002/03, 9,63 percent in 2003/04, 15,04 percent in 2004/05, 14,49 percent in 2005/06 and

13,48 percent in 2006/07. Medium-term liabilities grew at an average annual rate of 19,45 percent, but growth rates fluctuated widely. As with short-term liabilities, there was not a clear trend. They grew at 55,90 percent in 2002/03, -13,42 percent in 2003/04, 22,17 percent in 2004/05, 15,87 percent in 2005/06 and 16,74 percent in 2006/07.

Long-term liabilities grew at an average annual rate of 20,14 percent. It grew at 12,65 percent in 2002/03, after which it grew at 4,26 percent in 2003/04. This was followed by a strong increasing growth trend of 15,81 percent, 33,88 percent and 34,11 percent in 2004/05, 2005/06 and 2006/07, respectively. Overall total liabilities grew at an average annual rate of 16,02 percent, also showing a trend of increasing growth in 2004/05, 2005/06 and 2006/07. Long-term liabilities have been growing at a significantly faster rate than short-term liabilities, but will have to do so for many years to reduce the domination of short-term liabilities on the balance sheet because it is growing from a small base compared to short-term liabilities.

Figure 6.8: Total liabilities (percentage composition)



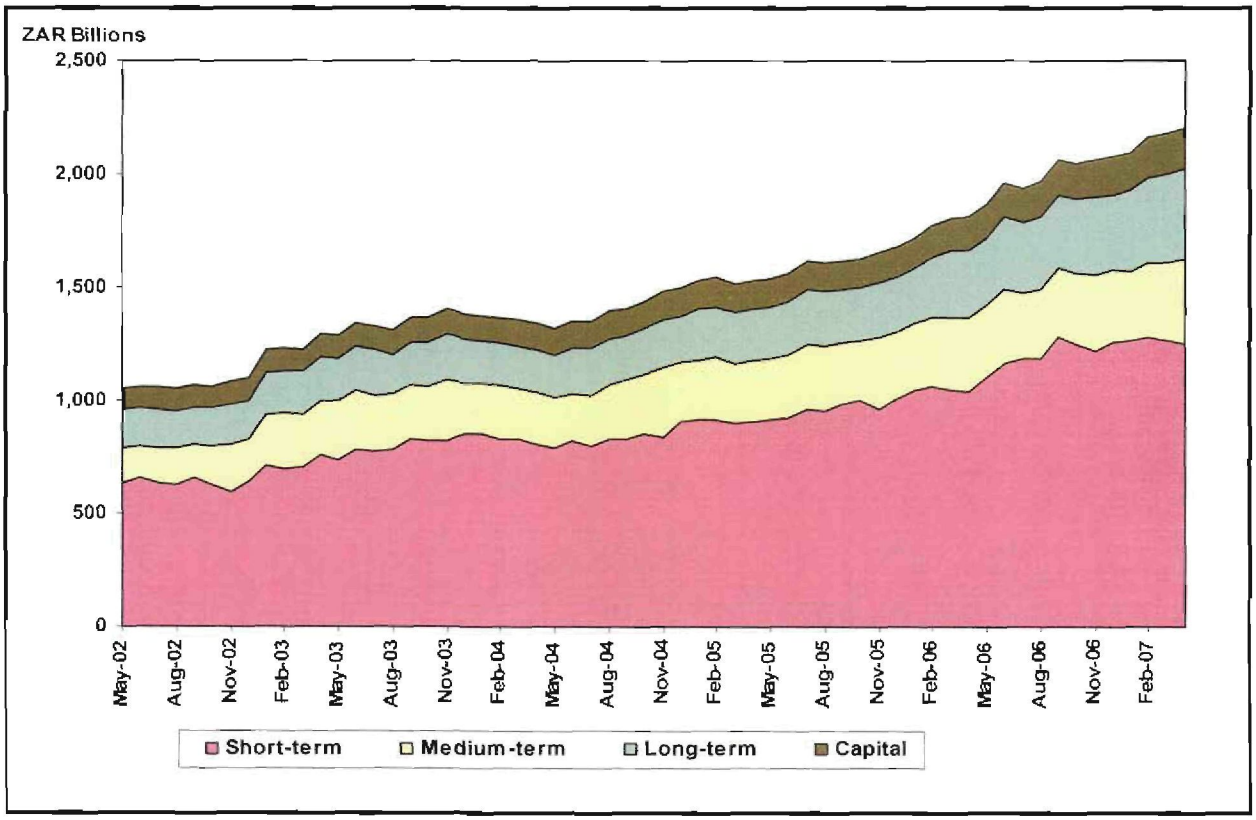
Source: SARB (2007a)

Section 6.3.4.5 analyses and discusses the growth in capital and adds capital to liabilities in order to determine whether growth in capital has kept up with the growth in liabilities.

6.3.4.5 Total liabilities and capital

When adding capital to the nominal composition of total liabilities, the chart once again takes on the same form as the funding-related liabilities to the public charts (Figure 6.1 and Figure 6.2), simply because of the latter's dominance. Figure 6.9 shows the nominal composition of total liabilities and capital.

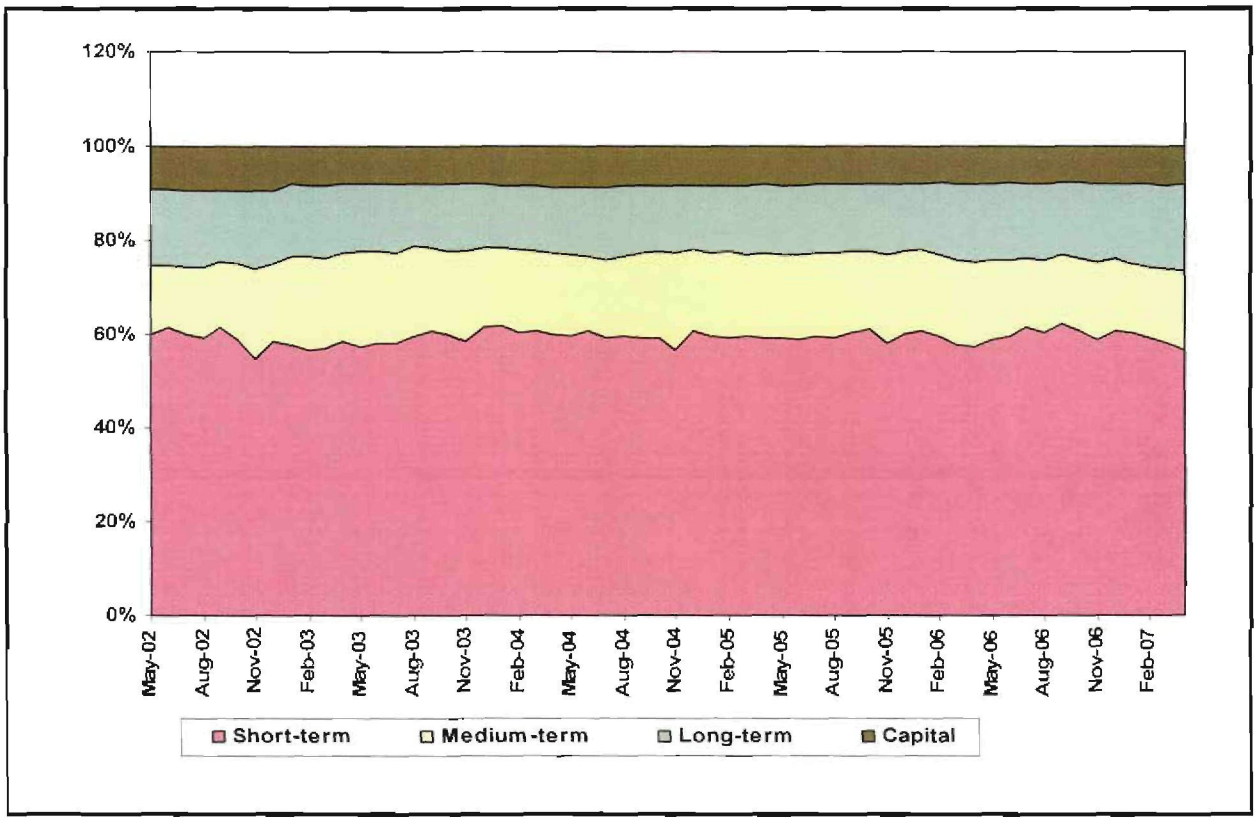
Figure 6.9: Total liabilities and capital (nominal composition)



Source: SARB (2007a)

An analysis of the percentage composition of total liabilities and capital is illustrated in Figure 6.10. The chart indicates that capital maintains a small proportion of total liabilities and capital. The chart is similar to the percentage composition of liabilities on its own. Over the five years that were analysed, short-term liabilities dominated and averaged 59,39 percent. Medium-term liabilities averaged 17,24 percent and long-term liabilities averaged 15,12 percent over the five years. Capital was the smallest component of total capital and liabilities and averaged 8,26 percent over the five years. This chart reinforces the fact that the liabilities side of the aggregate South African balance sheet is extremely short funded.

Figure 6.10: Total liabilities and capital (percentage composition)



Source: SARB (2007a)

Growth in capital is compared to growth in liabilities to gain a better idea of whether growth in capital has kept up with that of liabilities. Table 6.5 illustrates the growth in total liabilities and capital. The first column in the table has been shown in Table 6.4 and shows that total liabilities grew at an average annual rate of 16,02 percent. Growth in capital over the five years that were analysed grew at a slower pace, averaging 11,73 over this period.

Table 6.5: Growth in total liabilities and capital

Total liabilities and capital	Growth in total liabilities	Growth in capital	Growth in total liabilities and capital
2002/03	24,41%	5,33%	22,66%
2003/04	3,63%	10,55%	4,19%
2004/05	16,50%	7,02%	15,68%
2005/06	17,84%	14,64%	17,58%
2006/07	17,70%	21,12%	17,97%
Average per annum	16,02%	11,73%	15,61%

Source: SARB (2007a)

There is no clear trend in growth in capital, but on average it did not match the growth in liabilities. The table also shows that the growth in total liabilities and capital combined shrunk dramatically in 2003/04 but was almost constant after that. Growth in total liabilities and capital averaged 15,61 percent over the five years that were analysed.

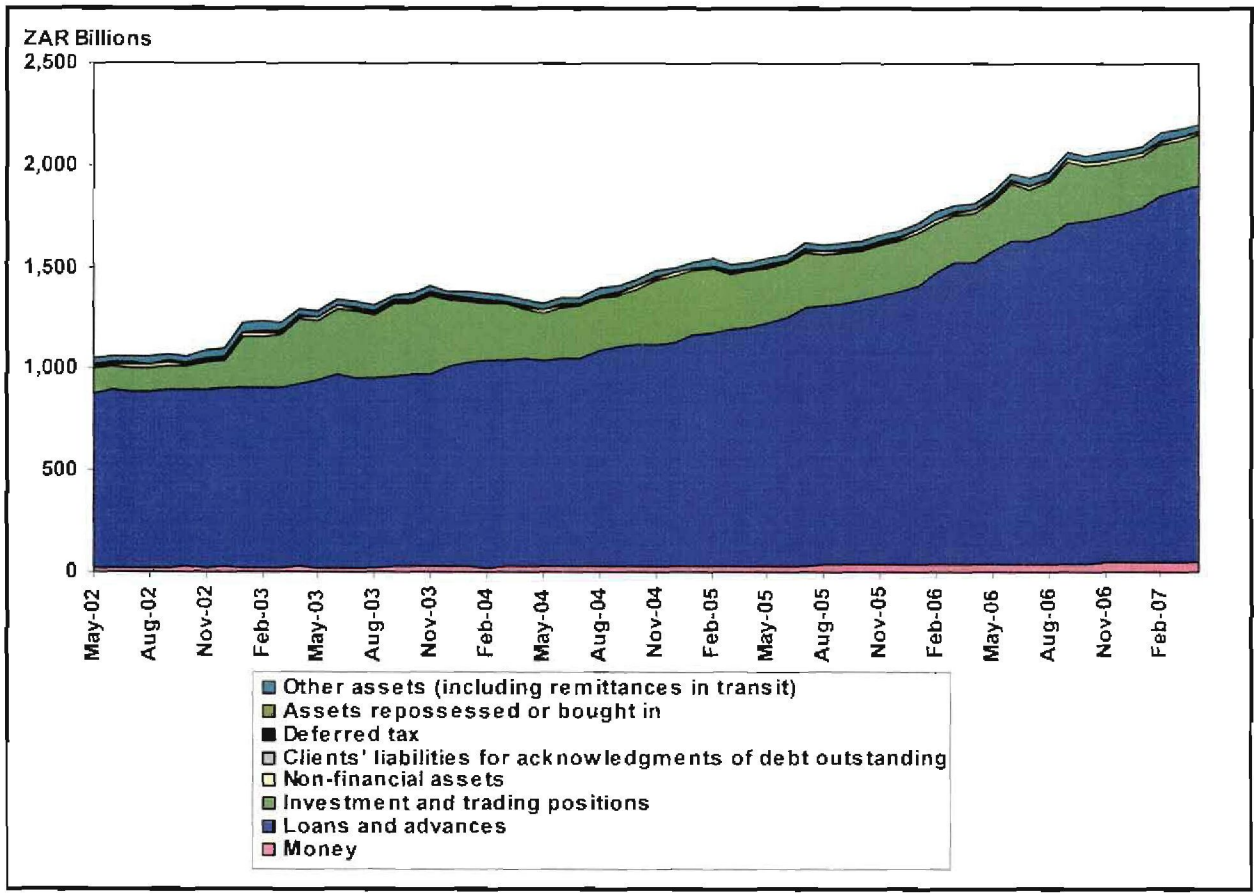
6.3.5 Results: Assets

Once again, it is important to keep in mind that from the analysis on the assets side of the aggregated banks' balance sheet, it may be expected that it would consist largely of long-term funds, simply because of the typical nature of banks' assets. Bank assets include asset and vehicle financing and mortgage bonds, which are repaid over long periods of time. Separate charts were not constructed for each of the components of assets on the balance sheet, as the term structure of assets is not included.

6.3.5.1 Total assets

Figure 6.11 displays the nominal composition of total assets. The largest two components of total assets are loans and advances, and investment and trading positions.

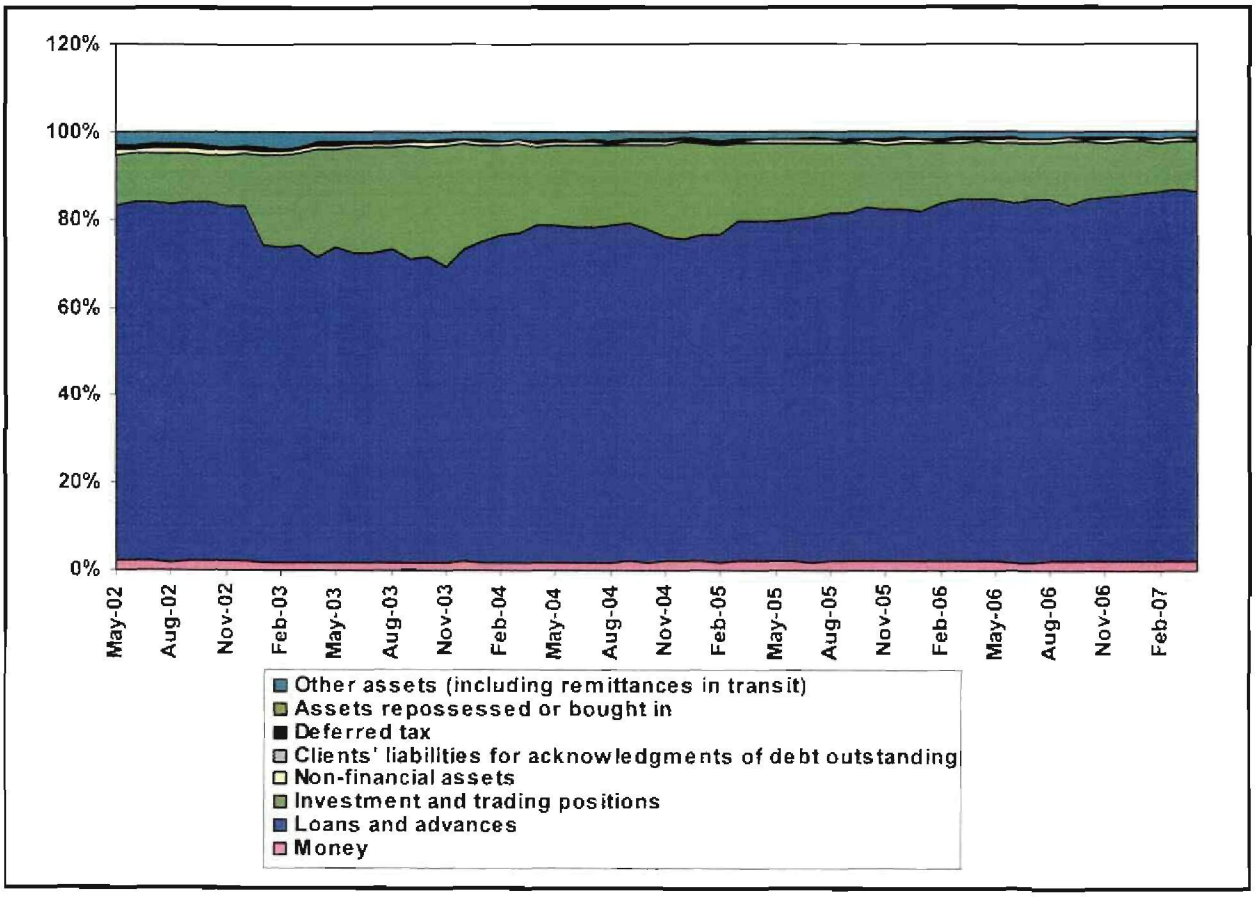
Figure 6.11: Total assets (nominal composition)



Source: SARB (2007a)

Figure 6.12 illustrates that loans and advances make up the largest portion of total assets at an average of 77,58 percent over the 60 months that were analysed. Trading and investment positions was the second largest component and averaged 17,03 percent over the 60 months. The other components cumulatively only made up 5,40 percent and are therefore considered to be negligible.

Figure 6.12: Total assets (percentage composition)



Source: SARB (2007a)

The growth in total assets is illustrated in Table 6.6. As with liabilities, total assets grew relatively quickly over the 60 months that were analysed. Because of the small contributions of the other classes of assets, only growth in loan and advances, and investment and trading positions are discussed. Loans and advances grew at an average annual rate of 15,59 percent and investment and trading positions grew at an average annual rate of 29,03 percent. As was illustrated previously, these two categories of assets make up about 95 percent of the total banks' balance sheet. Although slightly faster, the growth in these two items is in line with the growth rate in total assets, which was 15,61 percent. The growth figures of investment and trading positions are distorted by a large increase in 2002/03 because of changes in accounting standards that took place. Accounting Standard AC 133 was implemented and affected

companies' year-ends commencing on or after 1 July 2002. The objective of AC 133 is to establish principles for the recognition, measurement and disclosure of information relating to financial instruments in the financial enterprises, including banks (SARB, 2002a:30). Standard Bank (2003:3) adds that the new accounting policies required the grossing-up of derivative positions, hence the dramatic increase in investment and trading positions.

Table 6.6: Growth in assets

Growth in assets	Money	Loans and advances	Investment and trading positions	Non-financial assets	Clients' liabilities for acknowledgements of debt outstanding	Deferred tax	Assets repossessed or bought in	Other assets (including remittances in transit)	Growth in total liabilities and capital
2002/03	15,2%	5,1%	156,5%	-1,4%	41,4%	3,2%	-29,2%	-8,1%	22,7%
2003/04	16,5%	11,3%	-18,5%	-2,5%	-57,9%	-42,5%	-28,8%	10,7%	4,2%
2004/05	21,4%	16,4%	14,4%	1,7%	-44,1%	51,6%	-25,6%	3,2%	15,7%
2005/06	14,1%	24,8%	-11,1%	13,4%	34,8%	40,2%	-8,5%	-6,1%	17.5%
2006/07	19,8%	20,3%	3,8%	8,4%	526,9%	-44,9%	-1,4%	21,0%	18,0%
Average per annum	17,4%	15,8%	29,0%	3,9%	100,2%	1,5%	-18,7%	4,1%	15,6%

Source: SARB (2007a)

The reason why the composition of assets is not split between banking and trading books is because the trading book contributes a small portion to total assets (an average of 12,35 percent over the 60 months analysed). It can also not be assumed that all short-term assets are held in banks' trading books.

It is assumed that a large majority of loans and advances are long-term assets according to the definition used for liabilities, i.e. longer than 6 months. When considering that mortgage loans as well as asset and vehicle financing are included in this figure, short-term loans can reasonably be expected to contribute a relatively small portion of loans and advances. It becomes apparent that the South African banks' aggregate balance sheet is extremely short-funded. This means that long-term assets are funded by short-term liabilities, creating a liquidity mismatch, hence reinforcing the prevalence of liquidity risk.

6.3.6 Conclusion

In summary, funding-related liabilities had the largest contribution to total liabilities, averaging 78,86 percent over the 60 months analysed. It was followed by other liabilities and trade creditors that made up an average of 12,80 percent. Acknowledgements of debt was the

smallest component of total liabilities and averaged only 0,08 percent. Therefore, any movements in funding-related liabilities to the public automatically have the greatest impact on total liabilities.

The composition of the term structure of the liabilities side of the balance sheet showed that the aggregate South African banking sector balance sheet is, as expected, dominated by short-term liabilities that made up an average of 59,39 percent of total liabilities and capital over the 60 months that were analysed. Medium-term liabilities averaged 17,24 percent and long-tem liabilities averaged 15,12 percent over the five years. Capital was the smallest component of total capital and liabilities and averaged 8,26 percent over the five years.

Growth figures for all of the categories of liabilities did not show clear trends in general. Short-term liabilities grew at an average annual rate of 14,49 percent, medium-term liabilities at an average annual rate of 19,45 percent and long-term liabilities grew at an average annual rate of 20,14 percent over the 60 months analysed. Even though medium and long-term liabilities have been growing at a significantly higher rate than short-term liabilities, this trend will have to continue for many years to reduce the domination of short-term liabilities on the balance sheet. Growth in capital did not match growth in total liabilities and grew at an average annual rate of 11,73 percent, whereas total liabilities grew at an average annual rate of 16,02 percent over the five years analysed.

Loans and advances make up the biggest portion of total assets at 77,58 percent over the 60 months that were analysed. Trading and investment positions was the second largest component and averaged 17,03 percent over the 60 months. The other components cumulatively only made up 5,40 percent and are therefore considered negligible.

As with liabilities, total assets grew relatively quickly over the 60 months that were analysed. Loans and advances grew at an average annual rate of 15,59 percent and investment and trading positions grew at an average annual rate of 29,03 percent. Although slightly faster, the growth in these two items is in line with the growth rate in total assets, which was 15,61 percent. The growth figures of investment and trading positions are distorted by a large increase in 2002/03 because of the adoption of new accounting practices that took place.

The term structure of assets is not divided into buckets as is the case for liabilities, but it can be assumed that a large majority of loans and advances are long-term assets according to the definition used for liabilities, i.e. longer than 6 months. When considering that mortgage loans as well as asset and vehicle financing are included in this figure, short-term loans can reasonably be expected to contribute a relatively small portion of loans and advances. When making such

assumptions, it becomes apparent that the South African banks' aggregate balance sheet may be extremely short-funded. This means that long-term assets are funded by short-term liabilities, creating a liquidity mismatch, hence reinforcing the prevalence of liquidity risk. Although it may be assumed that liquidity risk in other countries will look the same because of the business that banks do, the analysis on an aggregated banks' balance sheet in South Africa proved the presence of elements of significant liquidity risk.

Section 6.4 conducts a further analysis on liquidity risk in South Africa by analysing banks' liquidity risk returns.

6.4 Analysis of total banks' liquidity risk returns

6.4.1 Introduction

As mentioned, balance sheet analysis does not explicitly indicate the term structure of assets. Therefore assumptions are required regarding its components to determine the term structure. The DI 300 is the liquidity risk return completed and submitted to the SARB which divides assets and liabilities into their term structures to determine the liquidity mismatches (SARB, 2007a). Data was gathered from the SARB website where all DI returns that are submitted by the banks to the SARB are available in an aggregated version. Data was collected from the DI 300 for the same time period as was used previously, namely the 60 months from May 2002 to April 2007.

6.4.2 Methodology

The DI 300 return consists of 36 lines and 5 columns (SARB, 2007a). The first 7 lines represent what is known as the contractual mismatch, which is the mismatch between the term structures of assets and liabilities according to categories of contracts. In other words, it is assumed that a 5-year loan will be repaid over the full 5 years and a 32-day notice deposit will not be withdrawn before the 32 days, for example. Lines 8-19 show the anticipated net money market funding requirement as calculated by the bank's ALCO model, lines 20-26 illustrate the theoretical mismatch between assets and liabilities. The theoretical mismatch is calculated by applying certain assumptions to the bank's assets and liabilities, for example, 25 percent of demand deposits are not withdrawn over the course of a month. Lines 27-36 represent various memorandum items to the return.

The analysis conducted on the aggregated DI 300 used only lines 1-7, or the contractual mismatch (SARB, 2007a). The reason for this is that different banks use different ALCO models and apply different assumptions to arrive at their theoretical mismatch figures, whereas contractual mismatches are not subject to any assumptions.

The lines used in this analysis were the following:

i. ***Line 1: Contractual maturity of assets as per DI 100.*** The figures contained in this line carry over from the DI 100 return, which is the balance sheet.

ii. ***Line 2: Contractual maturity of liabilities as per DI 100.*** The figures contained in this line carry over from the DI 100 return, which is the balance sheet.
SA (2000:54-55) states that lines 1 and 2 must show the contractual maturity of assets and liabilities based on the remaining period until maturity.

iii. ***Line 3: On-balance sheet contractual maturity.*** Calculated as the difference between line 1 and line 2.

As mentioned earlier, a balance sheet has 13 columns in which different figures are entered (SARB, 2007a). This analysis, however, focused on the term structure of the aggregate South African balance sheet and for this reason only columns 1-4 were used. These columns are:

i. ***Column 1: 0-31 days.*** Assets and liabilities with a remaining time to maturity between 0 and 31 days must be reported under this column.

ii. ***Column 2: 32-60 days.*** Assets and liabilities with a remaining time to maturity between 32 and 60 days must be reported under this column.

iii. ***Column 3: 61-91 days.*** Assets and liabilities with a remaining time to maturity between 61 and 91 days must be reported under this column.

iv. ***Column 4: 92-181 days.*** Assets and liabilities with a remaining time to maturity between 92 to 181 days must be reported under this column.

It is interesting to note that the medium-term category as defined in the balance sheet is divided into 3 categories, namely 32-60 days, 61-91 days and 92-181 days. There is not a long-term (i.e. longer than six months) category in this return.

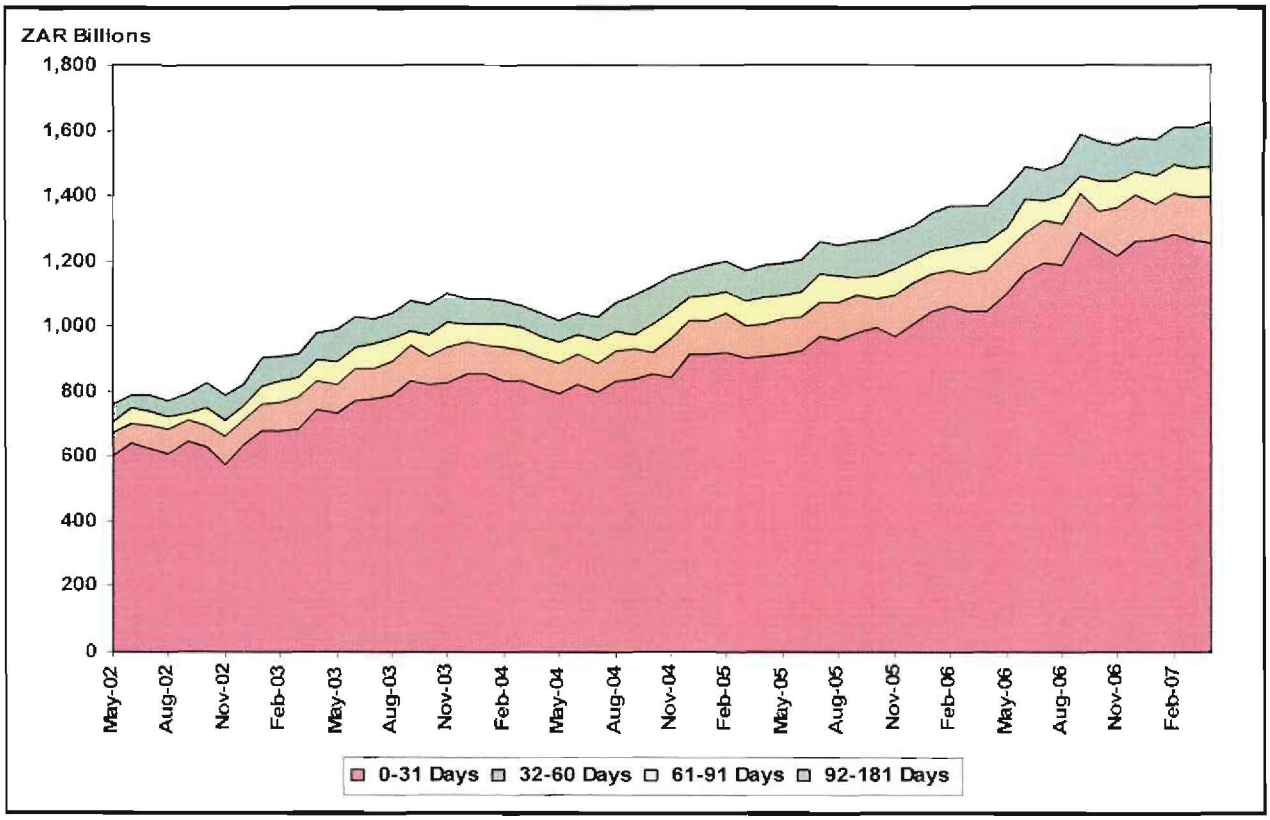
An example of the spreadsheet that was used for this analysis for assets is included as Appendix D. This spreadsheet is attached only as an example and covers only the assets part of the analysis, but the same spreadsheets were used for all of the other months included – the complete data set that was used is available from the author on request.

6.4.3 Results: Liabilities

In order to compare assets and liabilities from the DI 300, it was necessary to construct a chart for liabilities, even though results will largely be the same as for the balance sheet analysis. As mentioned, the difference is that the DI 300 does not have a column for long-term assets and liabilities.

Figure 6.13 illustrates the nominal composition of liabilities per time bucket as contained in the DI 300. It looks basically the same as the liabilities chart from the balance sheet, except that the amounts are smaller because long-term liabilities from the balance sheet are not included.

Figure 6.13: Contractual maturity of liabilities (nominal composition)



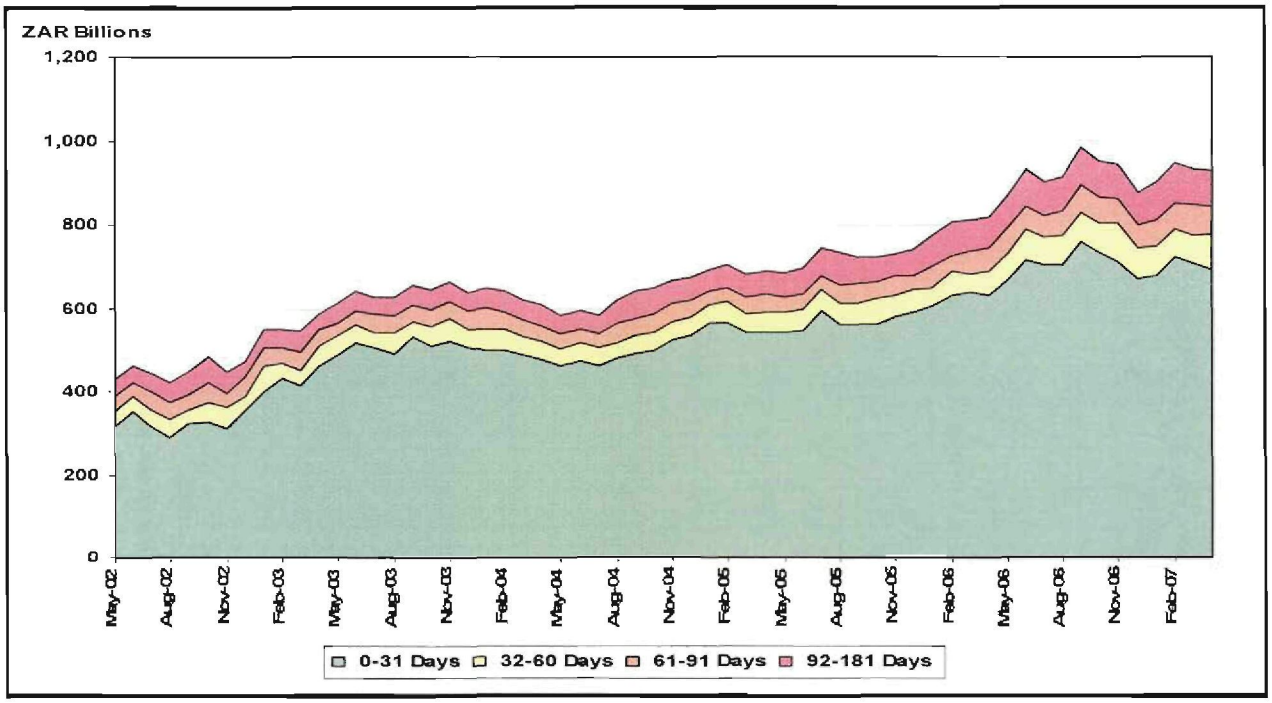
Source: SARB (2007a)

Further analysis of liabilities will not take place, as it was illustrated that liabilities are short-funded. Figure 6.13 was simply included to illustrate that the overall effect is the same as it was for the data from the balance sheet.

6.4.4 Results: Assets

As mentioned, the DI 300 divides assets into maturity buckets, which is not done on the balance sheet. Figure 6.14 shows the term structure of assets. In the figure, the longer-term maturities are coloured from red to green, since in the case of assets, long-term assets represent greater risk. The overall trend corresponds with the findings thus far, but the amounts involved are smaller than those from the balance sheet because long-term assets are not included.

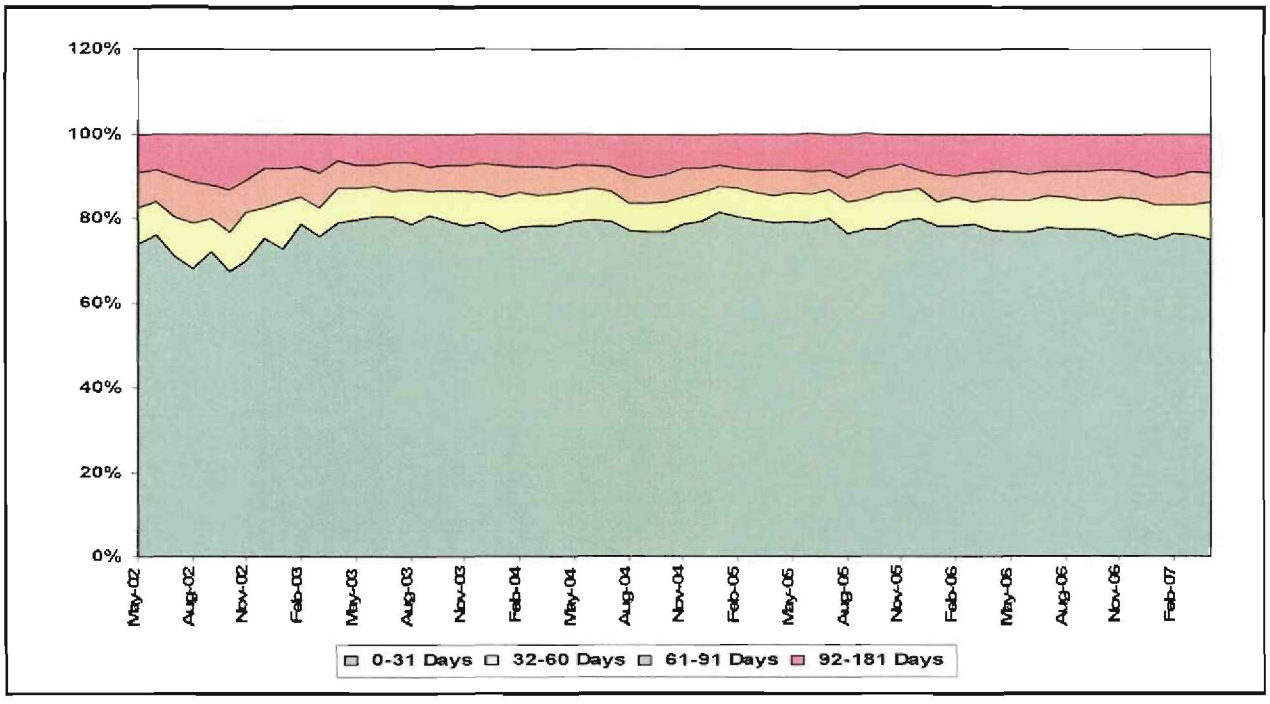
Figure 6.14: Contractual maturity of assets (nominal composition)



Source: SARB (2007a)

Figure 6.15 shows the percentage composition of the term structure of assets. Although the composition of assets looks similar to that of liabilities, on closer scrutiny the significant liquidity risk inherent in the South African banking sector becomes apparent.

Figure 6.15: Contractual maturity of assets (percentage composition)



Source: SARB (2007a)

In percentage terms, assets and liabilities seem to be quite well matched. Over the 60 months analysed, the average results obtained are illustrated in Table 6.7. The percentages are of assets and liabilities as a proportion of total assets and liabilities, respectively.

Table 6.7: Matching assets and liabilities in percentage terms

Matching of assets and liabilities (percentages)	0-31 days	32-60 days	61-91 days	92-181 days	Total
Average assets	77,20%	7,54%	6,62%	8,63%	100,00%
Average liabilities	77,44%	8,83%	5,90%	7,82%	100,00%
Mismatch	-0,24%	-1,29%	0,72%	0,81%	0,00%

Source: SARB (2007a)

The 0-31-day time bucket had a contractual mismatch of -0,24 percent, the 32-60-day bucket a mismatch of -1,29 percent, the 61-91-day time bucket a mismatch of -0,72 percent and the 92-181-day bucket a positive mismatch of 0,81 percent. These figures are deceiving, because the nominal amounts involved are significant. Table 6.8 illustrates that the small percentage differences in assets and liabilities convert back to significant amounts.

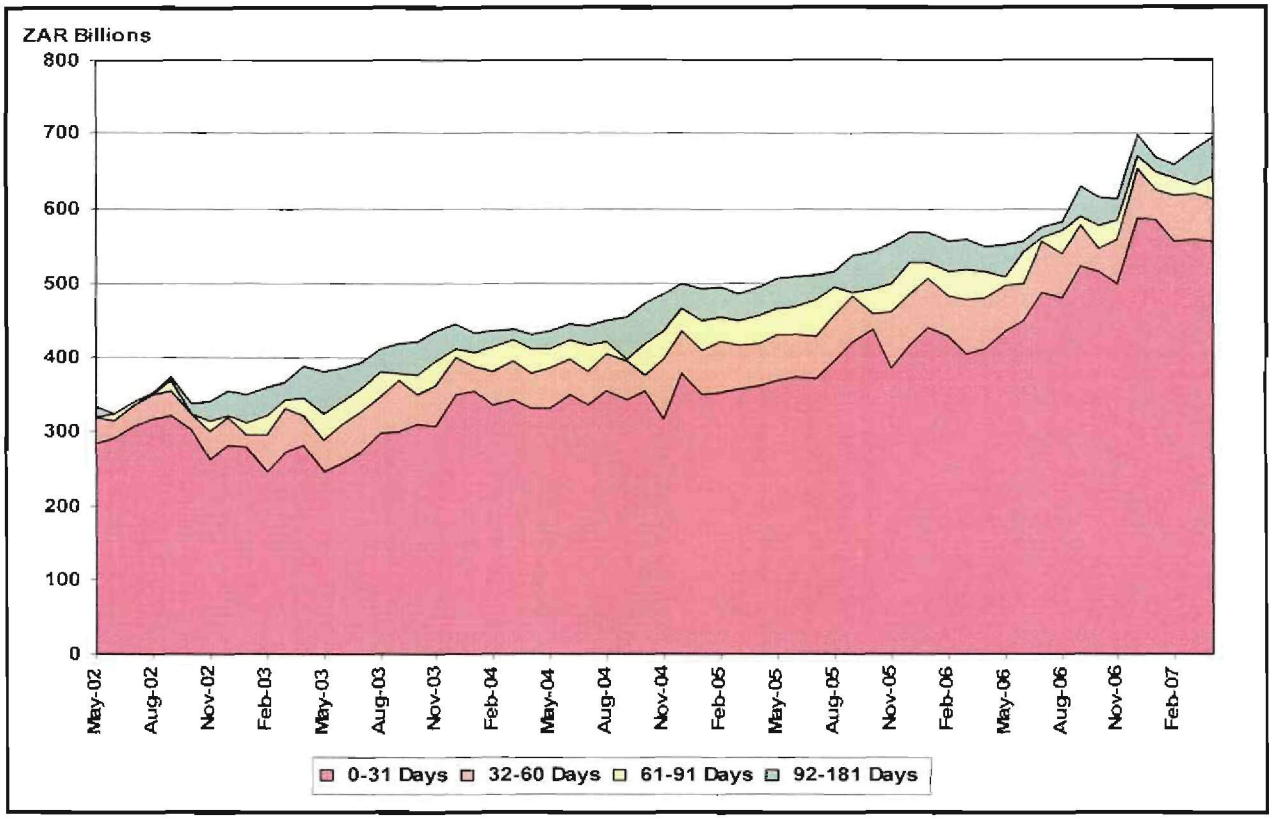
Table 6.8: Matching assets and liabilities in nominal terms

Matching of assets and liabilities (nominal R'000)	0-31 days	32-60 days	61-91 days	92-181 days	Total
Average assets	533 227 455	51 425 146	44 860 689	59 416 290	688 929 579
Average liabilities	907 050 282	102 504 939	68 705 235	91 405 447	1 169 665 903
Mismatch	-373 822 827	-51 079 794	-23 844 546	-31 989 156	-480 736 323

Source: SARB (2007a)

The table illustrates that the South African banking sector is extremely short-funded, due to a R373,82 billion negative mismatch in the 0-31-day maturity bucket. It is interesting to note that positive mismatches in percentage terms in the 61-91 and 92-181-day buckets relate to a negative mismatch in nominal terms. Figure 6.16 illustrates the nominal values of the mismatch between assets and liabilities per time bucket over the 60 months that were analysed. In this chart, the short-term bucket is coloured red to represent the increased liquidity risk in the short-term maturity mismatch.

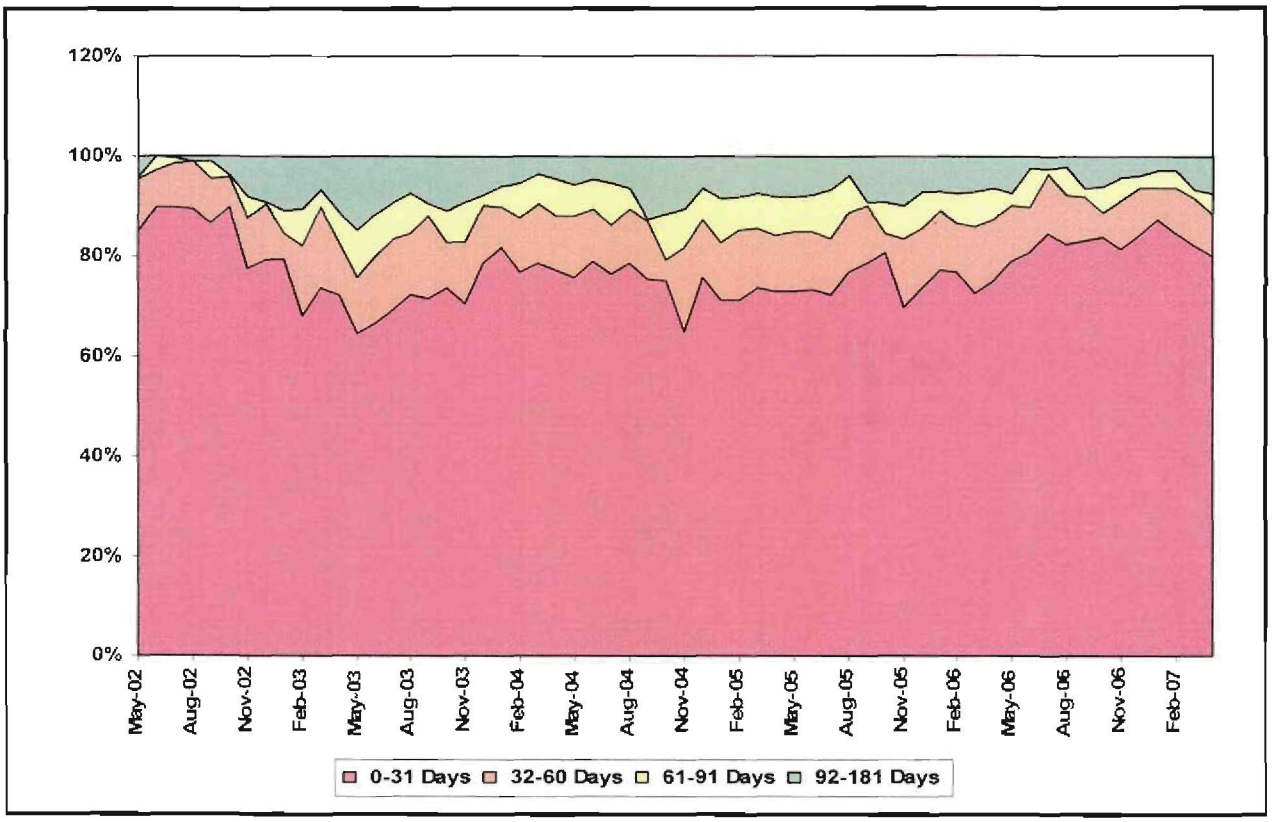
Figure 6.16: Total contractual mismatch per time bucket (absolute values)



Source: SARB (2007a)

Absolute values of the mismatches were used in constructing the chart simply to illustrate the real size of the growing mismatch. The chart illustrates that the most significant portion of the mismatch between assets and liabilities in South Africa occurs in the short term, or the 0-31-day time bucket and that it has increased steadily over the 60 months of sample data, while there is no consistent trend in the other tenures of mismatch. Figure 6.17 illustrates the percentage values of the total mismatch per time bucket as a proportion of the total mismatch.

Figure 6.17: Total contractual mismatch per time bucket (percentage absolute values)



Source: SARB (2007a)

6.4.5 Conclusion

From the analysis conducted on the DI 300 liquidity risk returns for the South African banking sector, the suspicion that arose from the balance sheet analyses was confirmed. The conclusion that can be drawn from this analysis is that short-term liabilities are increasingly used to fund long-term assets, which represents significant growing liquidity risk in the South African banking sector. An analysis on the aggregated figures of the South African banking sector does not, however, indicate exactly where the liquidity risk lies. For this reason, section 6.5 conducts an analysis on the liquidity positions of individual banks.

6.5 A liquidity ratio analysis on individual banks

6.5.1 Introduction

As mentioned, an analysis on the aggregated figures of the South African banking sector does not indicate exactly where the liquidity risk lies. The DI 900 is a return completed and submitted to the SARB which indicates the institutional and maturity breakdown of liabilities and assets. Data was gathered from the SARB website where all DI returns that are submitted by the banks to the SARB are available in an aggregated version, as well as those of individual banks. Data was collected from the DI 900 for five quarterly periods from April 2006 to April 2007. Each return represents data only for the month in which it is submitted.

6.5.2 Methodology

The DI 900 return consists of 257 lines and 9 columns (SARB, 2007a). The analysis conducted on the DI 900 was similar to the analysis done by Saayman (2003), because the ratios used in that study fell perfectly into the paradigm of this study. Data was collected from the DI 900 for five quarterly periods from April 2006 to April 2007 and not for the same period of time as was the case for the analyses on the DI 100 and DI 300 returns to avoid the onerous exercise of calculating eleven ratios for eleven institutions for sixty months. Each return represents data only for the month in which it was submitted. The liquidity positions of ten different banks as well as that of the total banking sector in South Africa are calculated, including three large banks from Peer Group 1[8], one bank from Peer Group 2[9], three banks from Peer Group 3[10], two banks from Peer Group 4[11] and one from Peer Group 5[12]. Five months' information was used, namely April 2006, July 2006, October 2006, January 2007 and April 2007. The most widely used ratios to measure the banks' liquidity positions include the loan-to-deposit ratio, the loan-to-liability ratio, the liquid-asset-to-liability ratio as well as the volatile dependency ratio (Saayman, 2003:5). The liquidity ratios were calculated as follows:

i. ***The loan-to-deposit ratio.*** The categories of loans included in the analysis are loans and advances within the same group (line 101 column 3), instalment debtors (line 113 column 3), mortgage advances (line 118 column 3), credit card debtors (line 126 column 3), other overdrafts and loans to the public sector (line 154 column 3) and other private sector loans and advances (line 163 column 3). The deposits include deposits over all terms and to all counterparties (line 1 column 8) (SA, 2000:228-238). A higher loan-to-deposit ratio indicates lower liquidity (Olson Research (OR), 2000:12). From the definition, a loan-to-deposit ratio of one or more would indicate extremely low, or even negative liquidity.

ii. ***The loan-to-liability ratio.*** The same loans used to calculate the loan-to-deposit ratio were used again. Total liabilities were calculated as the sum of total funding-related liabilities to the public (line 63 column 4), outstanding liabilities on behalf of clients (line 64 column 4) and other liabilities (line 65 column 4) (SARB, 2007a). A higher ratio indicates lower liquidity, because this ratio indicates the contribution of loans to total liabilities (Saayman, 2003:5).

iii. ***The liquid-asset-to-liability ratio.*** All items that can easily be turned into cash were viewed as liquid assets (Saayman, 2003:5). These assets include central bank money

[8] Peer Group 1 consists of banks that are considered to be systemically important to the South African financial system.

[9] Peer Group 2 consists of foreign branches of banks with trading operations.

[10] Peer Group 3 consists of banks that are involved in micro-financing and/or Islamic banking.

[11] Banks that are included in Peer Group 4 are considered to be "niche banks" or banks that operate in certain niche markets, such as high-value low-volume markets for more affluent clients, for example.

[12] Peer Group 5 consists of foreign branches of banks without trading operations.

and gold (line 86 column 3), SA bank group funding, including negotiable certificates of deposit (NCDs) (line 96 column 3), South African interbank group funding, including NCDs (line 102 column 3), loans granted under resale agreements (line 109 column 3), liquid bills, notes and acceptances (line 131 column 3), deposits with and advances to the SARB (line 142 column 3), deposits with and advances to South African banks (line 143 column 3), marketable South African government stock (unexpired maturity of up to three years), other public sector interest-bearing securities (line 187 column 3) and debentures and other interest-bearing security investments (line 194 column 3) (SA, 2000:228:238). A lower ratio indicates lower levels of liquidity, but this ratio can be expected to be around 0,20 in South Africa, because of the liquid asset reserve requirements that are 5 percent of banks' reduced liabilities (Saayman, 2003:5).

iv. ***The volatile dependency ratio.*** The volatile dependency ratio is the difference between volatile liabilities and liquid assets, relative to earning assets (Saayman, 2003:5). It measures the relationship between long-term earnings assets and net short-term funds (OR, 2000:13). Liquid assets were calculated as described above, and the volatile liabilities were calculated as the sum of cash managed, cheques and transmission deposits (line 1 column 1), other demand deposits (line 1 column 2), short-term savings (line 1 column 3) and other short-term deposits (line 1 column 4). Earning assets are the sum of deposits, loans and advances (line 95 column 3) and the investments (line 176 column 3) of the bank. A negative sign indicates more liquid assets than volatile liabilities (OR, 2000:13).

In addition to the above-mentioned general measures of liquidity, liability liquidity measures can also be calculated. Liability liquidity refers to the bank's ability to raise liquid funds through borrowings in the money market (Saayman, 2003:4). Three liability liquidity ratios for the ten selected South African banks were calculated. These ratios include the total deposit-to-total-liability ratio (as a measure of the bank's asset composition), the equity-to-total-assets ratio (as a measure of the capital base) and the percentage composition of deposits (Saayman, 2003:6).

i. ***The total-deposit-to-total-liability ratio.*** The total deposit number from the DI 900 returns (line 1 column 8) was used and the total liabilities were calculated as above. Higher ratios indicate more reliance on deposits (Saayman, 2003:6).

ii. ***The equity-to-total-asset ratio.*** The equity-to-total-asset ratio was calculated by dividing the capital and reserve funds of the bank (line 71 column 1) by the total assets of the bank (line 224 column 3) (SARB, 2007a). A lower equity-to-total-asset ratio indicates that capital is applied more effectively (Saayman, 2003:6).

iii. ***The percentage composition of deposits.*** In calculating the percentage composition of deposits, the different types of deposits were determined relative to the total deposit value (line 1 column 8) of each bank – much the same as the percentage composition of

liabilities calculated for the aggregated banks balance sheet. Cash managed, cheque and transmission deposits (line 1 column 1) and other demand deposits (line 1 column 2) were added to calculate the value of total demand deposits. Short-term deposits are the sum of short-term savings (line 1 column 3) and other short-term deposits (line 1 column 4). Medium-term deposits are calculated as the sum of medium-term savings (line 1 column 5) and other medium-term deposits (line 1 column 6) and long-term deposits are indicated separately in the DI 900 (line 1 column 7).

iv. ***Net liquid assets.*** Net liquid assets are calculated as the difference between liquid assets and volatile liabilities. Liquid assets and volatile liabilities were calculated in the same way as above. A positive liquid asset figure highlights the importance of assets as a source of liquidity for these banks.

6.5.3 Results

The results of the general measures of liquidity and liability liquidity ratios are presented in Appendix E. In terms of the ***loan-to-deposit ratio***, a higher ratio indicates lower levels of liquidity. The total banking sector had a loan-to-deposit ratio of between 0,85 and 0,90, meaning that liquidity was a relatively large risk in the South African banking system. Bank 5 was the only bank that really stood out and indicated an extremely large level of liquidity risk.

The results for the ***loan-to-liability ratio*** also differed between banks. Again, a larger ratio presents lower levels of liquidity. In general, the loan-to-liability ratio was at relatively low levels, meaning that liquidity levels were relatively high. Bank 5 was once again the only bank with a relatively low level of liquidity.

For the ***liquid assets-to-liability ratio***, most of the banks that were analysed displayed low levels of liquidity as most of them had quite low ratios. For the liquid assets-to-liability ratio, Bank 6, Bank 7, Bank 8 and Bank 10 exceptionally good ratios. As for the total banking sector, this ratio is quite low, but around the expected 0,20 mark.

A negative sign for the ***volatile dependency ratio*** indicates more liquid assets than volatile liabilities. The total banking sector was found to have more liquid assets than volatile liabilities. Nine of the ten banks that were analysed had negative signs, the only one that had a positive sign was Bank 7, meaning that it was the only one analysed that had more volatile liabilities than liquid assets.

A higher ***total-deposit-to-total-liability ratio*** indicates a higher dependency on deposits. This ratio was found to be very high in the South African banking sector. Only Bank 5 and Bank 9 had

low dependencies on deposits. All the other banks that were analysed had a large dependence on deposits.

The total banking sector applies its capital effectively because it has a low ***equity-to-total-asset ratio***. The banks analysed were split on this ratio with six banks applying capital effectively and four not as effectively.

The ***composition of deposits*** for the total banking sector revealed similar results to the analysis that was done on the total banks' balance sheet. A significant portion of deposits are made up of demand deposits and short-term deposits for the total banking sector. Bank 1 to Bank 4 and Bank 10 displayed similar characteristics to the whole banking sector, whereas the composition of deposits for the other banks differed from bank to bank. But, as mentioned previously, it would be extremely difficult to receive thirty-year deposits that would fund thirty-year loans.

The main finding from conducting a liquidity ratio analysis on different banks is that liquidity risk varies from one bank to the next, meaning that a universal Pillar 1 capital charge for all banks would not make sense, but that liquidity risk should rather be assessed by regulators on a case-by-case basis under Pillar 2 of Basel II. It was also found that the South African banking sector relies quite heavily on demand and short-term deposits. This confirmed the results from the analysis done on banks' aggregated figures, i.e. that the South African banking sector is extremely short-funded.

6.5.4 Conclusion

The ratios differed from bank to bank, with each bank maintaining more or less the same ratio throughout the 5 months that were analysed. This means that, even though there is a perception of a significant amount of liquidity risk in the South African banking sector, liquidity risk should be analysed and evaluated on an individual bank basis, and not on an overall basis. Ratios that proved to be cause for concern were the asset-to-liability ratio, the total-deposit-to-total-liability ratio, and the composition of deposits. The South African banking sector relies quite heavily on demand and short-term deposits, enforcing the results obtained from the analysis on banks' aggregated figures, i.e. that the South African banking sector is extremely short-funded. This analysis provided a basis for an argument against a universal capital charge under Pillar 1 of Basel II, simply because liquidity risk differs between different banks. It is therefore proposed that liquidity risk be assesses by regulators under Pillar 2 reviews on a case-by-case basis.

6.6 Liquidity risk in South Africa

6.6.1 Introduction

The analysis of the aggregated banks' balance sheet and liquidity risk returns showed that short-term liabilities are, to a large extent, used by banks to fund long-term liabilities. In other words, there are elements of significant liquidity risk in the South African banking system. The analysis of liquidity risk ratios for different banks highlighted the fact that liquidity risk differs from bank to bank and that it should be assessed by regulators on a case-by-case basis. These figures, however, do not explicitly describe liquidity risk and the perceptions thereof in South Africa. Therefore, before concluding this study, the need exists to discuss liquidity risk and the perceptions thereof in South Africa.

6.6.2 Methodology

Because of the difficulty in measuring and "seeing" liquidity risk, a short questionnaire was compiled in order to gauge different views on liquidity risk and the regulation thereof. The questionnaire was tested on a number of bankers before it was sent to 8 experienced professionals including liquidity risk managers, treasurers, ex-treasurers, market risk managers and analysts. Although 8 professionals does not constitute a large enough sample to make meaningful conclusions, the purpose of the questionnaire was not to draw definitive conclusions, but rather to gauge different views among respondents. Some respondents responded to the questionnaire in written format after which answers to questions were discussed with them. The questionnaire also served as the basis for structured interviews conducted with other respondents via telephone. The questionnaire is attached as Appendix F. The responses of all the respondents were combined and the results are presented in the subsequent sections.

6.6.3 Results: Liquidity risk questionnaire

6.6.3.1 Do you perceive liquidity risk to pose a threat to your bank/banks?

Liquidity risk is generally not perceived to be a threat, but respondents categorically stated that banks would be naïve to ignore liquidity risk. Liquidity is extremely important and is considered as the essence of any bank or company. Liquidity mismatches may cause immense discomfort only by balancing the books from one day to the next, and this may not even be due to how the bank has gone about its business. Liquidity risk is described as the "silver bullet" because a liquidity crisis can strike and sink a bank very quickly. For this reason it is monitored thoroughly and actively and taken into consideration in the setting of limits for trading and asset creation.

The general opinion among respondents to the questionnaire was that liquidity risk is not perceived to be a threat as such, but that banks are well aware of the devastating effects that a

liquidity crisis could have. For this reason, liquidity risk is perceived to be extremely well managed and monitored on a daily basis.

6.6.3.2 What economic factors (external factors) and operational factors (internal factors) can trigger a liquidity crisis at your bank/a bank?

External and internal factors that could trigger liquidity crises at banks are plentiful. Examples of each are listed below.

External factors that may trigger liquidity crises at banks include the following factors:

i. ***The market's perception of the bank.*** The market may see a bank in a negative light, whether based on factual evidence or not, and may overcharge the bank for liabilities or it may lead to the bank having to undercharge on assets, or both.

ii. ***Systemic factors.*** Liquidity problems experienced by banks may spread unexpectedly to other banks that may not necessarily have had liquidity problems.

iii. ***Management of liquidity shortage.*** The way in which the SARB manages the liquidity shortage as a result of possible large government flows may cause banks to experience liquidity crunches. Included in this, because the liquidity shortage created by the SARB is central to the effectiveness of monetary policy, is the way in which the SARB signals its monetary policy intentions to banks. Another factor may be the miscalculation of market flows, and hence, the liquidity shortage by the SARB. Central bank mechanisms for managing money are very important because the liquidity shortage in South Africa is determined by four factors, namely: foreign exchange flows, government flows, cash reserve requirements on certification, and notes and coins. In order for the regulator to stay abreast of liquidity risk, it should wait for signs of these flows and keep a close eye on the markets. Benchmark rates are also very important in terms of signals of liquidity in the markets (Joachim, 2007).

iv. ***Political environment and perception of South Africa.*** These two are really two separate factors, but they are interrelated. If there are negative (or perceived negative) political developments, the country may be seen in a negative light, which may lead to unexpected and large outflows of funds.

v. ***Changes in the regulatory environment.*** Changes to the regulatory environment may have significant consequences for banks. For example, a sudden increase in prudential requirements, such as cash reserve requirements, and liquid asset reserve requirements may lead to banks suddenly experiencing liquidity problems.

On the other hand, internal factors that may trigger liquidity crises at banks include the following:

i. ***Poor management.*** Poor management in terms of maturities of assets and liabilities may result in a liquidity crisis and time-bucket monitoring and management should be conducted on a daily basis. Poor management may also include bad strategic decisions. This was evident from the discussion on banking failures in South Africa in section 6.2.3 where it was seen that poor management caused banks to fail more often than not.

ii. ***Fraud.*** Fraud was mentioned in section 6.2.3 as being one of the largest contributors to banking failures. When a bank or some of its employees are involved in fraudulent activities, the bank's reputation may be damaged in the market to the extent that it faces a liquidity crisis.

iii. ***Systems.*** Systems problems may have dire consequences on the management and measurement of liquidity risk, which may as a result lead to a liquidity crisis. The importance of having reliable systems cannot be overstated, as the management and measurement of liquidity risk and the production of management reports rely heavily on reliable systems. The importance of systems was discussed in section 5.2.5. Systems are also used extensively in real-time settlements between banks and mis-timing of flows between paying and receiving banks may cause a bank to experience liquidity strain. Liquidity crises are not always triggered by depositors that withdraw their funds, but could also be as a result of deals that are in the pipeline that settle a day late, for example. This will cause mismatches in payment flows and could trigger a liquidity crisis. Therefore it is important to be able to stop such deals that are in the pipeline.

iv. ***Lack of skills within the organisation.*** A lack of understanding within the bank in relation to asset growth versus liability growth. In other words, a poorly thought-out growth strategy. Sometime it is necessary for banks to consider the liabilities side of the balance sheet and to make a decision to not grow assets any more. A lack of understanding of the markets also has an indirect impact on liquidity, an inexperienced trader in the market may be "ripped off" by more experienced ones.

v. ***Insufficient number of clients.*** It is important for banks to keep attracting new clients in order for them to diversify their funding sources and also to avoid large concentrations in certain sectors, geographies, etc. The importance of having diversified funding sources was discussed in section 2.3.4. Banks should have a wide variety of funding products in order for banks to have the ability to continue to attract new clients on a continuous basis.

In summary, a liquidity crisis may be caused by a wide variety of factors. Factors inside the organisation pose as big a threat as factors external to the organisation. The importance of having proper management and of managing a bank's reputation were responses that were emphasised.

6.6.3.3 Do you perceive liquidity risk to pose a threat to the banking system as a whole in South Africa? I.e. does it pose a systemic threat?

This question received responses largely based on two distinctly opposite views. The first was that liquidity risk is not considered a threat in the South African banking system. A systemic liquidity crisis is often considered as being a distinct possibility rather than a threat. Both regulators and banks are well aware of liquidity risk and it is considered to be managed actively, therefore it is considered a risk instead of a threat.

The other view supported the *concentration fragility* view that was described in section 6.2.2 where the system is considered to be too concentrated. As mentioned previously, the big four banks in South Africa own more than three quarters of all banking assets in South Africa. For this reason, a liquidity crisis may spread quite quickly from big banks to smaller banks if one of the big banks experienced liquidity problems.

6.6.3.4 What kind of contingency plan does your bank have in place?

Banks' contingency plans varied from bank to bank, of which the main features will be highlighted. Some contingency plans consist of various components and include building up liquid assets and reserves, managing the composition of the bank's book, and ensuring that the bank has credit lines in place which can be drawn upon when needed.

In addition to these, banks can run excess liquidity by having the surplus funds invested on call at other banks. Banks could also hold additional liquid assets with the purpose of accumulating a monthly cumulative surplus on the prudential liquid asset reserve requirements, which could then serve as a buffer against liquidity. This would work as long as the liquid asset reserve requirements are averaged out over the reporting period.

The general feeling among respondents was that banks have contingency funding plans in place. The details of such plans, however, differ greatly between banks. The importance of banks having contingency funding plans was discussed in section 5.2.10.

6.6.3.5 Normally a liquidity crisis spreads from big banks to smaller ones. It is often said that South Africa is a special case and that a liquidity crisis will spread from the smaller banks upwards to the bigger banks after the Saambou (7th largest at the time) and BoE (6th largest at the time) crises. Do you agree with this view and why?

Again, respondents had two distinctly opposing views. Some respondents agreed with the statement above because South Africa is considered a special banking market in that it is not a pure cash market because the market is kept short to ensure that monetary policy remains effective (liquidity shortage). South Africa also has a very low savings rate, meaning that the big money aggregators (pension funds, asset managers, etc.) are the largest depositors, which automatically make South African banks prone to being exposed to concentration risk. Banks may get into trouble when two or three of these large depositors withdraw large amounts unexpectedly.

Other respondents agreed with the above statement specifically regarding the above crises, but felt that a liquidity crisis may spread to smaller banks from big banks as well. It is assumed that if big banks face liquidity problems, it may spread to smaller banks and get them into trouble.

In summary, a liquidity crisis in South Africa will not necessarily spread from smaller banks to bigger ones, but it may spread to smaller banks if big banks are experiencing liquidity problems.

6.6.3.6 What event(s) could trigger a systemic liquidity crisis? How will it spread?

Systemic liquidity crises may be caused by liquidity build-ups over extended periods of time instead of single events. Events that may trigger such crises may include worldwide crises (such as the emerging-market crises in the 1990s), a settlement systems crisis (such as a break-down in continuous linked settlements (CLS)), political events in South Africa that may result in a run on the rand and one of the big four banks in South Africa taking a sizeable hit on its balance sheet. Another factor that may cause systemic liquidity crises includes securitisation paper that may cause problems when liabilities roll over and cannot be placed because investors require high returns on their investments. Significant changes to the regulatory and political environments were considered by some respondents to pose a significant liquidity risk to the South African banking sector. The fact that the South African banking system is heavily concentrated may in itself also pose a significant systemic liquidity threat, because a liquidity crisis may spread from the large banks to the smaller banks. This heavy concentration could, however, also be viewed as a mitigant, as money cannot really be taken out of the South African system – it can theoretically only be moved from one bank to the next.

A systemic liquidity crisis may be caused by a build-up over an extended period of time, and not necessarily by a single event. There are, however, a wide variety of single events that are considered as being able to cause a systemic liquidity crisis in South Africa.

6.6.3.7 What liquidity risk mitigating factors/instruments does your bank have in place?

Responses to this question varied. The following were considered to be liquidity risk mitigating factors:

i. ***Contingency funding plans.*** Some respondents considered their banks' contingency funding plans as liquidity risk mitigating factors.

ii. ***Active liquidity management.*** The best way to mitigate liquidity risk is often considered to be to actively manage the liquidity profile of the bank. In doing this, it is important to attempt to attract longer-term liabilities, for example liabilities with maturities of between 80 and 150 days. The most important liquidity risk mitigants may be considered the mix between liquid assets and sellable assets and the way in which assets can be securitised at short notice. For this, it would be advisable that banks structure their assets portfolios in such a way that they can determine with relative certainty how much it could expect to receive for a bundle of assets at short notice.

iii. ***Surplus liquidity.*** Banks could run surplus liquidity that is invested in NCDs, liquid assets or on call at other banks. As mentioned in section 6.6.3.4, banks could also hold additional liquid assets with the purpose of accumulating a monthly surplus on the prudential liquid asset reserve requirements, which could then serve as a buffer against liquidity. This would work as long as the liquid asset reserve requirements are averaged out over the reporting period.

iv. ***Mechanism to limit asset growth.*** Banks could employ a mechanism under which asset growth can be slowed down and even have the ability to contract the asset base during times of liquidity problems. The time horizon for this should be taken into account to ensure that such a contraction does not lead to panic.

v. ***Managing the perception of an institution.*** Another very important way in which to manage liquidity is by managing the perception of an institution. Banks should manage "loose tongues". The perception should be managed with directors and executive committee members being available for comment during times of liquidity problems and a mechanism that can determine who can say what should be instituted. During a liquidity crisis banks can set up a call centre as a central point where the situation is managed in such a way where similar stories are told.

vi. ***Committed facilities.*** Committed facilities may be considered as liquidity risk mitigants, but they are very expensive. It may be a better idea to pay a premium to have a discount facility on a variety of different assets.

vii. ***Credit derivatives.*** Some banks are of the opinion that credit default swaps can be used as liquidity risk mitigating instruments. If a bank has a credit default swap in place against a certain counterparty and that counterparty defaults, the protection seller would compensate the bank for this event occurring and would in all probability alleviate the bank's potential liquidity problems. Another example maybe that when a bank has a call option on a credit default swap, it means that it has the right but not the obligation to buy the underlying credit default swap, or the right to buy protection. Therefore, if this bank experiences liquidity problems because of a credit event occurring, such as a counterparty defaulting, it may exercise the option and buy protection for this event. The option writer then becomes the protection seller and compensates the bank for this event occurring, and once again, may alleviate the bank's liquidity problems. Although only a credit default swap was described, it is noteworthy that other credit derivatives such as total return swaps and market value swaps may also be used for liquidity risk mitigation. It is, however, important to mention that there are very limited credit markets in South Africa.

viii. ***Diversified funding base.*** As already mentioned in section 6.6.3.4, it is important for banks to have a diversified funding base and a variety of funding products to enable them to attract new clients on a continuous basis.

In summary, banks can make use of a wide variety of instruments and strategies that can be considered liquidity risk mitigants. Respondents to the questionnaire emphasised the fact that active and effective management and monitoring of liquidity risk are considered to be the most important liquidity risk mitigants.

6.6.3.8 What do you perceive as liquidity risk mitigating factors in the South African banking system?

The South African banking system is largely a closed system where money cannot to a large extent be completely withdrawn from the system. In addition, the fact that the South African system is considered to be a relatively large and stable system that is well capitalised is also seen as a liquidity risk mitigant. The South African banking system is also considered to be well regulated. Cash reserve requirements and liquid asset reserve requirements are not considered to be liquidity risk mitigants as such, because these are very small. Instead they help to protect the system of over-gearing.

Respondents to the questionnaire felt that the South African banking system is large and stable, well regulated and also adequately capitalised. These three factors are considered among respondents to be the main liquidity risk mitigants in the South African banking system.

6.6.3.9 What would prevent the same kind of crises as the Saambou and BoE crises from happening again?

The general feeling among respondents was that banks are now more aware of liquidity risk and that poor management may lead to liquidity crises, meaning that banks are better prepared than before. Another factor that may prevent such crises from happening again is that legislation in banking specifically has tightened significantly since 2002, meaning that banks operate in a better-regulated and more stable environment. In addition, major changes have taken place in the South African banking system since these crises: there are less small banks than before, when liquidity risk typically originated from these smaller banks. These crises have, however, widened the gap between large banks and small banks.

Although major structural changes have taken place in the South African banking system since these crises, it is important to note that a liquidity crisis cannot really be prevented because it typically hits without any warning.

6.6.3.10 Considering these mitigating factors, do you think it is necessary for a capital charge for liquidity risk in South Africa? If so, what should the basis of its calculation be? How large should such a requirement be to prevent liquidity crises from happening?

Most respondents responded to this question with a loud and clear "no" because capital is considered to be expensive and restrictive. By doing this the South African banking system runs the risk of being over-regulated because cash reserve requirements and liquid asset reserve requirements which fulfil this role, and already constitute about 7,5% of banks' balance sheets. In addition to these factors, it would practically be impossible to calculate the size of such a requirement with any accuracy.

One respondent pointed out that, intuitively, it makes sense to require banks to hold capital for liquidity risk. Such calculations should not be too complex, and may start off as simple liquidity ratios on which capital requirements are based. The regulation of liquidity risk may evolve over time in the same way as the regulation of market risk.

All respondents agreed that a Pillar 2(b) capital charge under Basel II would make sense. The objective of such a capital charge would not be to cover liquidity risk per se, but rather to impose a "fine" on banks that do not manage and measure liquidity risk properly in the regulator's opinion.

6.6.3.11 Would capital be an effective mitigant for liquidity risk?

Respondents felt that capital would not be an effective mitigant for liquidity risk, because capital is expensive and restrictive. It would, however, be extremely effective from a regulatory point of view, because it would raise the cost of doing business and would serve as a penalty on banks for not managing liquidity risk properly. Cash is considered to be king, although capital is there and may be used in the short-term if needed. In other words, capital is generally considered to be good for absorbing losses, but may not be as effective for covering liquidity risk because it is not a liquid asset. In order to cope with liquidity problems, banks should preferably have a stock of liquid assets or cash.

It was suggested that perhaps the regulation of liquidity risk could take place in terms of the composition of capital, but this would mean that banks would have to make substantial changes to the composition of their balance sheets. Respondents to the questionnaire felt that the best way to regulate liquidity risk is by regulators ensuring that banks apply common sense and that liquidity risk is managed properly.

6.6.4 Conclusion: Liquidity risk in South Africa

Respondents to the questionnaire did not perceive liquidity risk as a threat in South Africa, but banks and regulators are well aware of the potential danger that it holds for individual banks and the banking system as a whole. For this reason, liquidity risk is monitored and managed actively. Liquidity crises at the individual bank level as well as on a systemic level could be triggered by a wide variety of internal and external events and practices to banks.

The general feeling among respondents was that banks have contingency funding plans in place. The details of such plans, however, differ greatly between banks. In response to the question posed on whether a liquidity crisis will spread from smaller banks to larger banks because this was the way that the Saambou and BoE crises spread, respondents felt that a liquidity crisis in South Africa will not necessarily spread from smaller banks to bigger ones, but it may spread to smaller banks if big banks are experiencing liquidity problems. A systemic liquidity crisis may be caused by a build-up over an extended period of time, and not necessarily by a single event. There are, however, a wide variety of events that are considered able to cause a systemic liquidity crisis in South Africa.

Respondents to the questionnaire felt that liquidity risk is well mitigated by banks and that they make use of a wide variety of instruments and strategies to mitigate liquidity risk. Emphasis was placed on the fact that active and effective management and monitoring of liquidity risk are considered to be the most important liquidity risk mitigants. The South African banking system is large and stable, well regulated and also adequately capitalised. These three factors are considered to be the main liquidity risk mitigants in the South African banking system.

Although major structural changes have taken place in the South African banking system since the crises in 2001/02, a liquidity crisis cannot really be prevented because it typically hits without warning.

The general feeling among respondents was that it would not make sense to hold capital for liquidity risk because capital is seen as being expensive and restrictive and not an effective mitigant for liquidity risk. By requiring banks to hold capital for liquidity risk, the South African banking system also runs the risk of being over-regulated. Further difficulty regarding such a capital charge includes the way in which it should be calculated. Respondents felt that it would be extremely difficult to calculate such a capital charge in a sensible manner. For these reasons, a Pillar 2(b) capital charge under Basel II would be more sensible to regulate liquidity risk. The objective of such a capital charge would not be to cover liquidity risk per se, but rather to impose a "fine" on banks that do not manage and measure liquidity risk prudently in the regulator's opinion until such a time that it is deemed to be managing and measuring liquidity risk prudently.

6.7 Conclusion

The structure of the South African banking system was described before causes of major banking failures in the past 17 years in South Africa were identified. From this it was taken that internal factors such as fraud and poor management were responsible for banking failures more often than liquidity risk, although most banks experienced liquidity risk before failure. The SARB system of accommodation was discussed in order to gain an understanding of the environment in which South African banks operate. Banks can finance their liquidity requirements through the main weekly repo auctions, supplementary auctions, standing facility repos or the SAMOS penalty facility. This description of the SARB accommodation system was followed by a discussion of prudential requirements including cash reserve requirements, liquid asset reserve requirements and capital adequacy. It was concluded that banks hold a significant portion of their balance sheets for prudential requirement purposes.

After conducting an analysis on banks' aggregated balance sheets and liquidity risk returns in South Africa, it was concluded that the South African banking sector is extremely short-funded. This means that short-term liabilities are used to fund long-term assets, leading to the conclusion

that there are elements of significant liquidity risk in the South African banking sector. It was, however, expected that short-term liabilities are used to fund long-term assets simply because of the business of banking. It is unlikely that banks will receive thirty-year deposits which they can use to fund thirty-year mortgage loans, for example. Although this may be argued, the extent to which short-term liabilities are used to fund long-term assets indicates the presence of elements of significant liquidity risk in the South African banking sector.

The problem with analysing aggregated data for the South African banking sector is that the origins of this liquidity risk is not clear. For this reason, an analysis was conducted on individual banks by calculating various liquidity ratios for the selected banks. The conclusion from calculating liquidity ratios for individual banks was that the South African banking sector relies quite heavily on demand and short-term deposits, which tied in with the analysis conducted on banks' aggregated figures, i.e. that the South African banking sector is extremely short-funded.

Respondents to a liquidity risk questionnaire felt that liquidity risk does not pose a serious threat to South Africa, but rather that banks and regulators are well aware of the potential danger that it holds for individual banks and the banking system as a whole. For this reason, liquidity risk is monitored and managed actively. Liquidity crises at the individual bank level as well as on a systemic level could be triggered by a wide variety of internal and external events and practices to banks. It would be difficult to ensure that liquidity crises do not occur again in future, and a capital charge for liquidity risk in South Africa would not make sense according to respondents to a liquidity risk questionnaire, since capital is considered to be expensive and restrictive and not a good mitigant for liquidity risk. Respondents felt that the best way to deal with liquidity risk is to have a stock of liquid assets or cash available.

Respondents to a liquidity risk questionnaire agreed that regulators could, however, impose a capital charge for liquidity risk under Pillar 2(b) of Basel II. Although such a capital requirement would not serve the purpose of covering losses arising from liquidity risk, it would serve as a "fine" on banks that do not prudently manage and measure liquidity risk. This notion is explored further in Chapter 7.

Now that liquidity risk has been discussed and analysed in detail, Chapter 7 will make recommendations and proposals on how liquidity risk could be regulated in South Africa.

Chapter 7
Regulation of liquidity risk in South Africa

7.1 Introduction

The previous five chapters of this study have laid the foundation for proposals on how liquidity risk could be regulated from a South African perspective. This chapter starts by providing a general discussion of banking regulation and supervision in South Africa along with the objectives and principles of banking regulation and supervision.

With the objectives of banking regulation and supervision in mind, this chapter concludes the study by proposing a broad framework for the regulation of liquidity risk in South Africa.

7.2 Banking regulation and supervision

7.2.1 Introduction

Before proposals on the regulation of liquidity risk in South Africa are discussed, it is important to gain a general understanding of banking regulation and supervision and the major objectives and principles thereof. For this reason, this section provides a brief background of banking regulation and supervision as a function in South Africa after which the objectives and principles of banking regulation are described briefly.

7.2.2 Description of banking regulation and supervision

The most important role played by the financial system in any country is to provide the infrastructure for surplus resources to be allocated to those individuals and companies with deficits – this is often described as intermediation. Another major function of financial markets is to identify, allocate and price risk. The positive impact of a well-functioning financial system on economic growth of any country is well documented (Ngaujake, 2003:5). For these reasons, the importance of banking regulation and supervision cannot be over-emphasised.

According to SARB (2007g:2), banking regulation refers to the creation and maintenance of a legal framework within which institutions are licensed to operate as banks and are subject to prudential rules and practices, or a legal infrastructure within which banks can operate. Banking supervision usually refers to the process of monitoring banks' control systems, activities and the financial conditions of banks to ensure that these are always within the limits of prudent banking practice, as set out in the prudential regulations referred to in section 6.2.5.

As mentioned before, the BSD of the SARB is the banking regulator in South Africa. Other financial services are regulated and supervised by the exchanges, namely the JSE Limited (JSE), the Bond Exchange of South Africa (BESA), and also by the Financial Services Board. This is why only banks are included in the mission statement of the BSD, which states (SARB, 2002a:1):

> *"To promote the soundness of banks through the effective application of international regulatory and supervisory standards."*

Section 7.2.3 explores this mission statement by describing the main objectives of banking regulation and supervision.

7.2.3 Main objectives of banking regulation and supervision

According to the SARB (2007g:2), as in other fairly well-developed financial markets, banking regulation and supervision in South Africa are focused on achieving three primary objectives, namely:

i. ***Ensuring systemic stability.*** Stability is important as a policy objective because it is the base on which financial markets is built. Confidence in the continuity and robustness of financial markets is extremely important to any country's financial system and economy. Therefore the first objective of banking regulation is to ensure financial stability and to prevent financial crises from occurring as far as possible (Ngaujake, 2003:13). Systemic stability is ensured, to a large extent, by prudential requirements which were discussed in section 6.2.5

ii. ***Enhancing market efficiency by correcting market imperfections.*** Financial markets are imperfect and, because of this, failures occur within financial markets from time to time. Failures in financial markets occur as a result of a variety of factors, including information asymmetries and anti-competitive behaviour. Although the big four banks in South Africa own more than three quarters of all banking assets in the country, the level of competition in the banking sector is relatively low (although high between the big four banks). Information asymmetries are a major stumbling block in South Africa, because many people in South Africa are not financially literate. For these reasons, entry and exit into the banking sector are regulated, banks are subject to capital adequacy requirements and other prudential requirements and banks undertake customer support and education programmes (Bamber et al., 2001:2).

iii. ***Protecting investors and depositors.*** Investors and depositors should be protected against fraudulent activities and their exploitation by banks (GA, 2004:12).

Two "new generation" objectives of banking regulation and supervision can be added to this list, namely (GA, 2004:7-13):

iv. ***Facilitating the development of financial markets.*** This is done by creating greater access to a larger number of people to financial markets and products, facilitating the development of new markets and/or exchanges, building the capacity of a wide range of regulators to discipline the emerging areas of the markets and by liberalising increasing connectivity between regional and international financial markets (GA, 2004:10-12).

v. ***Contributing to public safety.*** Most of the regulation and supervision aimed at contributing to public safety have been focusing on combating money laundering and the financing of terrorism in the recent past.

From the above, it becomes clear that the main objectives of banking regulation and supervision relate to ensuring the safety and soundness of the financial system while also protecting depositors and investors against malpractice and exploitation.

7.2.4 Principles of banking regulation and supervision

Banking regulation and supervision are, to a large extent, principles-based. Principles followed in banking regulation and supervision were identified by Bamber et al. (2001:3-9) and include efficiency-related principles, stability-related principles, conflict-conciliatory principles, principles relating to regulatory structure and general principles. Each of these is described briefly:

i. ***Efficiency-related principles.*** Principles classified in this category are designed to contribute to the promotion of a high level of efficiency in the provision of financial services. Two such principles can be identified, namely:

- Promoting the maximum level of competition among market participants.
- Securing competitive neutrality between actual and potential suppliers of financial services. This would, when achieved, contribute to a high level of efficiency.

ii. ***Stability-related principles.*** These principles contribute to overall financial system stability by ensuring a large degree of safety and soundness in individual financial institutions. These principles are as follows:

- Incentives for the proper assessment and management of risks. These may include penalties for poor risk management, for example.
- The use of regulatory requirements (prudential requirements) based on market values instead of historical values.
- The willingness of regulators to take timely action to address adverse developments that may threaten the stability of financial institutions and the financial system.

iii. ***Conflict-conciliatory principles.*** These principles are designed to avoid regulatory and supervisory principles from conflicting with other such principles. These principles include following an integrated approach, striving to simultaneously achieve:
   - Regulatory objectives.
   - Ensuring that instruments used for regulation would at all times facilitate such an integrated approach.

iv. ***Principles relating to regulatory structure.*** Principles determining the regulatory structure are a contentious issue around the world, and South Africa is no exception. These principles relate to whether multiple regulators should regulate based on different expertise, or whether regulation should be carried out by a single regulator. Principles regarding the regulatory structure of regulators include the following:
   - Following a functional as well as institutional approach to financial regulation.
   - The co-operation between different regulatory agencies to achieve consistency.
   - A presumption in favour of a small number of regulators.

v. ***General principles.*** General principles are plentiful and include all principles that may affect the regulatory process. General principles of regulation include the following:
   - Every regulatory arrangement should be related explicitly to one or more of the objectives identified.
   - All regulatory arrangements should be justified with respect to their cost-efficiency.
   - The costs of regulatory arrangements should be distributed equitably.
   - All regulatory arrangements should be sufficient.
   - Regulatory arrangements should be practitioner-based.
   - The regulatory agency recovers its costs from the institutions which it supervises.
   - The costs are borne by a government or parastatal agency and hence by taxpayers in general.

The main principles on which financial regulation and supervision are based were described briefly, but each of the principles could be discussed in more detail. Bamber et al. (2001:3-9) described each of these regulatory principles in more detail. For the purpose of this study it is important to take note of the existence and crux of these principles which point to the sufficiency and efficiency of regulation and supervision.

7.2.5 Conclusion

Banking regulation and supervision are crucial to the soundness and stability of financial markets across the world because markets are imperfect and failures occur from time to time. The main objectives of banking regulation and supervision relate to ensuring the safety and soundness of the financial system while also protecting depositors and investors against malpractice and

exploitation. Banking regulation and supervision are principle-based and the crux of these principles points to the sufficiency and efficiency of regulation and supervision.

7.3 Proposals for regulating liquidity risk in South Africa

7.3.1 Introduction

Chapter 6 proved that there are elements of significant liquidity risk in South Africa because of the extent to which long-term assets are funded with short-term liabilities. It was clear from the questionnaire used in Chapter 6 that respondents felt that banks and regulators are aware of the threat of liquidity risk in South Africa and it is perceived to be managed and monitored well. Chapter 4 discussed the major elements of Basel II and highlighted that guidelines on the regulation of liquidity risk are a major omission from Basel II. Because of a lack of substance regarding the regulation of liquidity risk, sound principles of the management and measurement of liquidity risk were discussed in Chapter 5. With the objectives and principles of banking regulation and supervision that were discussed in section 7.2 in mind, along with the sound principles to manage and measure liquidity risk and the Basel Core Principles, this section aims to conclude this study by proposing ways in which liquidity risk could be regulated in South Africa under Basel II.

7.3.2 Process for reviewing liquidity risk

It was pointed out in section 4.4.3.6, that even though liquidity risk is included under Pillar 2 according to Basel II, it does not prescribe how it should be treated under banks' ICAAPs or how regulators should assess its inclusion under Pillar 2 when carrying out an SREP. For this reason it is proposed that the liquidity risk part of SREP reviews is conducted on the basis of a questionnaire used to determine possible gaps between banks' practices and prescribed criteria regarding the management and measurement of liquidity risk. According to this, banks would have to provide responses to a standard exhaustive questionnaire on liquidity risk after which the BSD evaluates banks' responses to the questionnaire in order to determine possible gaps between banks' practices and prescribed criteria. These gaps would then be addressed by means of an on-site visit to the bank by a BSD team. A shortened example of the suggested format of such a questionnaire is described in section 7.4.

It is important to note that such an approach has a constraint in terms of the substantial amount of work that would have to be done on the regulation of liquidity risk by both regulators and banks. Therefore resource constraints and the cost versus the benefit of such an approach would have to be considered carefully.

7.3.3 Regulatory capital for liquidity risk

Chapter 6 indicated that capital is not considered an effective instrument for regulating liquidity risk, because when a bank experiences liquidity problems, the best way to cope is to have a stock of liquid assets or cash. Therefore, the all-encompassing conclusion to this study is that capital would not be an effective mitigant for liquidity risk for a number of reasons. The major reason is that capital is often considered too expensive and restrictive to effectively deal with liquidity risk, when a bank experiences liquidity problems, it should have access to cash to be in the best position to deal with such a crisis.

Liquidity risk differs from bank to bank and a general capital charge for all banks may not be sensible, therefore liquidity risk should be analysed on a bank-by-bank basis. In other words, capital could be charged for liquidity risk under Pillar 2(b) of Basel II, as set out in section 4.4.3.5. Such a capital charge would not serve the purpose of covering losses resulting from liquidity risk, but would instead impose a penalty on banks that are deemed to manage and measure liquidity risk imprudently. Such a penalty would typically be quite small but would serve as an incentive for banks to improve their management and measurement techniques to the desired level as set out in prescribed criteria.

The criteria that should be used for determining whether banks measure and manage liquidity risk prudently should be of such a nature that the BSD complies with Revised Basel Core Principle 14: Liquidity Risk in regulating liquidity risk. In addition, it should align the criteria used to the 14 Principles for the sound management of liquidity as prescribed in Chapter 5. The criteria for sound liquidity risk management could be incorporated into the questionnaire that may be used to assess liquidity risk under Pillar 2(b) of Basel II as part of the SREP process conducted by the BSD, as proposed in section 7.3.2. A shortened example of the suggested format of such a questionnaire is described section in 7.4.

A simple approach of giving a score for the responses to each question (3 = satisfactory and 1 = unsatisfactory) could be helpful in assessing the quality of liquidity risk management and measurement and for identifying possible gaps between banks' practices and prescribed guidelines that should be addressed by a bank. The basis for determining a capital charge may be based on average scores obtained by banks answering the SREP section of the questionnaire. For example, a certain increment of capital could be charged for each 0,05 under the perfect score, which would be three. This may not be a scientific way in determining a Pillar 2(b) capital charge, but would make sense if applied consistently. When the BSD has completed enough assessments, a benchmark score could be determined that could then be used as the basis for the capital add-on.

7.3.4 An internal models approach for liquidity risk

It is accepted that it would not be preferable for the BSD to prescribe to banks which measurement and management techniques to use for managing and measuring liquidity risk internally. The reason for this is that all banks in South Africa are not equivalent in terms of size and levels of sophistication and that banks use different methods to measure and manage their liquidity risk. This is an important point, as banks are currently required to report their liquidity risk to the SARB according to prescribed methods contained in the regulatory returns.

Instead, it is proposed that banks could be allowed to use an *internal models approach for liquidity risk.* This *internal models approach for liquidity risk* is similar to the approach followed in Germany by the Bundesbank. The Bundesbank (2006:14) allows banks to use their own internal liquidity measurement and management techniques subject to regulatory approval after certain criteria have been met. Again, the approval criteria for banks to use an *internal models approach for liquidity risk* should be aligned with Revised Basel Core Principle 14: Liquidity Risk and also with the 14 Principles for the sound management of liquidity as prescribed by the BIS (2000b) and the IIF (2007).

Banks wishing to use the *models approach for liquidity risk* should be required to apply, in writing, to the Registrar of Banks. The BSD would then respond by sending a standard questionnaire specifically aimed at assessing banks' approaches to the measurement and management of liquidity risk to the applicant bank. An applicant bank would then be required to respond to such a questionnaire, after which the BSD conducts an off-site evaluation of the applicant bank's responses to the questionnaire. An on-site visit should then be conducted by the BSD to address gaps with prescribed criteria and concerns that became apparent from responses to the questionnaire. More detail of what such a questionnaire could possibly look like is described in section 7.4. The aim of such a questionnaire would be to assure the BSD that banks measure and manage liquidity risk prudently. Should the responses to the questionnaire along with an on-site visit to a bank yield satisfactory results, the BSD would approve a bank's internal models approach for liquidity risk. If, however, the responses to the questionnaire along with an on-site visit to a bank yield undesirable results, the BSD would decline a bank's internal models approach for liquidity risk. Approval or rejection of banks to use an *internal models approach for liquidity risk* should be confirmed in writing by the Registrar of Banks to the individual banks.

It would not be sensible to grant approval to banks for the use of an internal models approach for liquidity risk based on average scores obtained in responses to the questionnaire, as with the determination of capital described in section 7.3.3. The questionnaire should be used as a method to determine qualitative gaps in banks' liquidity risk management and measurement approaches. Banks should be awarded approval for the internal models approach for liquidity

risk when such gaps have been addressed sufficiently in the opinion of the BSD. In other words, the approval for banks to use an *internal models approach for liquidity risk* should be more qualitatively than quantitatively based.

7.3.5 Additional proposals on regulating liquidity risk in South Africa

7.3.5.1 Introduction

This section sets out additional proposals regarding the regulatory treatment of liquidity risk in South Africa, namely, the need for a regulatory liquidity risk policy framework and additional liquidity risk mitigants.

7.3.5.2 Regulatory liquidity risk policy framework

From the above proposals for the regulatory treatment of liquidity risk, it becomes apparent that it is important for the regulator to publish guidelines for banks on liquidity risk. These guidelines should take into account undrawn commitments and other off-balance sheet liabilities, as well as existing on-balance sheet liabilities of the bank. By publishing such a document, the BSD would comply with essential criterion one of Basel Core Principle Fourteen: Liquidity Risk as discussed in section 5.3.3.

Therefore, a further conclusion to this study is that the BSD should publish a framework in which its approach to regulating liquidity risk is described in detail. Some aspects that should be included in such a document include a widely-accepted definition for liquidity risk and guidelines/minimum standards for measurement and management techniques for liquidity risk and the process that will be followed under Pillar 2 of Basel II.

7.3.5.3 Liquidity risk mitigants

If the BSD is concerned about the level of potential liquidity risk in the South African banking system, as indicated in Chapter 6, it could consider having the additional instruments that are eligible as collateral as described in 6.2.4 included as instruments eligible for liquid assets reserve requirements, which are described in section 6.2.5.3. The exact impact of doing this is uncertain, but will probably lead to banks holding a larger amount of liquid assets over and above the 5 percent requirement. This would mean that the South African banking sector will be better protected against and better equipped to deal with liquidity problems. The process for including these instruments as liquid assets will be a tedious one, because it will mean that the South African Banks Act will have to be amended to include these instruments.

An additional mitigant for liquidity risk may be that the BSD requires banks to report their liquidity risk on a more frequent basis than the current monthly reporting. Market risk is currently reported on a daily basis simply because of the ever-changing environment. Liquidity risk can also be considered to be an ever-changing risk, which will warrant more frequent reporting.

7.3.5.4 Conclusion: Additional proposals for regulating liquidity risk in South Africa

This section described additional proposals regarding the regulatory treatment of liquidity risk. It is proposed that the BSD should publish a framework in which its approach to regulating liquidity risk is described in detail. Some aspects that should be included in such a document include a widely-accepted definition for liquidity risk and guidelines/minimum standards for measurement and management techniques for liquidity risk and the process that will be followed under Pillar 2 of Basel II.

If the BSD is concerned about the level of liquidity risk in South Africa, it is also proposed that the BSD could include the additional instruments that are eligible as collateral as described in 6.2.4 included as instruments eligible for liquid assets reserve requirements, which are described in section 6.2.5.3, although the exact impact of doing this is uncertain and that the process for doing this would be a tedious one. An additional measure that could be considered by the BSD if it is concerned about the level of liquidity risk in South Africa is to require banks to report their liquidity risk to the BSD on a more frequent basis than the current monthly reporting.

7.3.6 Conclusion: Proposals for regulating liquidity risk in South Africa

This section described a broad framework that is proposed for the regulation of liquidity risk in South Africa, which would be largely questionnaire-based. It was assumed that a capital charge would not be an effective way to regulate liquidity risk, but that liquidity risk should rather be included under Pillar 2(b) of Basel II. In addition, banks should, subject to regulatory approval, be allowed to use an internal models approach for liquidity risk.

A simple approach of giving a score for each question (3 = satisfactory and 1 = unsatisfactory) could be helpful in assessing the quality of liquidity risk management and measurement and for identifying possible gaps that should be addressed by a bank. A Pillar 2(b) capital charge could be applied to banks based on average scores obtained for answers to questions in the questionnaire, whereas approval for an internal models approach for liquidity risk could be more qualitatively based. This means that the questionnaire would be used to identify gaps between banks' practices and prescribed criteria that banks would have to address before approval for such an approach can be granted.

Additional proposals regarding the regulation of liquidity risk in South Africa include that the BSD should publish a regulatory liquidity risk policy framework in which it sets out requirements for banks and in which it describes the process for regulating liquidity risk in Pillar 2 of Basel II. It is also important that this framework includes a widely-accepted definition for liquidity risk. A further proposal was that the BSD should include the additional instruments that are eligible as collateral as described in 6.2.4 as instruments eligible for liquid assets reserve requirements, which are described in section 6.2.5.3, if it is concerned about the level of liquidity risk in South Africa. The BSD could also require banks to report their liquidity risk on a more frequent basis than the current monthly reporting if it concerned about the level of liquidity risk in South Africa.

It was mentioned that liquidity risk regulation could be largely questionnaire-based and that such a questionnaire should be aligned with the 14 Principles for the sound management of liquidity as prescribed in Chapter 5 as well as to Basel Core Principle 14: Liquidity Risk. The next section sets out examples of questions that could be included in the questionnaire to ensure that it complies with the above criteria.

7.4 Possible format of a liquidity risk questionnaire

7.4.1 Introduction

As mentioned in sections 7.3.2, 7.3.3 and 7.3.4, a liquidity risk questionnaire could be drafted according to which banks' liquidity risk management and measurement are assessed in terms of the sound Principles for managing liquidity risk and Basel Core Principle 14: Liquidity Risk that were discussed in Chapter 5. Such a questionnaire could be used for the purpose of assessing the quality of banks' liquidity risk management and measurement for the determination of a Pillar 2(b) capital charge as well as for banks applying for approval of an internal models approach for liquidity risk. In other words, the same questionnaire could be used for both purposes, or the questionnaire could be divided into two clear sections whereby all banks are required to answer the SREP or Pillar 2(b) section, and only banks applying for the use of an *internal models approach for liquidity risk* are required to complete the other section.

Once again, it is important to mention that it is critical that such a questionnaire is aligned with Revised Basel Core Principle 14: Liquidity Risk and also with the 14 Principles for the sound management of liquidity as prescribed by the BIS (2000b) and the IIF (2007). Each of the sound Principles that were discussed in section 5.2 are revisited and described briefly before a question is proposed that could be included in the liquidity risk questionnaire to ensure alignment with the specific sound Principle, along with a suggestions for the BSD as to what to be aware of in order to award scores to banks. A discussion on the alignment of the liquidity risk questionnaire follows in section 7.4.2.

The criteria which regulators are expected to comply with in order for them to comply with Basel Core Principle 14: Liquidity Risk are also revisited and described briefly along with suggestions on how these criteria could be included in the liquidity risk questionnaire. This discussion takes place in sections 7.4.2 and 7.4.3.

7.4.2 Alignment of liquidity risk questionnaire with sound principles for managing liquidity risk

7.4.2.1 Principle one: Liquidity management strategy

The first Principle states that banks *should have an agreed strategy that is communicated throughout the bank for the daily management of its liquidity* (CIMA, 2003:1).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

> *Does your bank have a Board-approved strategy for the day-to-day management of liquidity risk? If so, please provide a copy of the Board-approved policy.*

If the bank has one and provides the Board-approved policy, the BSD should ensure that the policy document has been approved by the bank's Board and that it is a current document. It is important for the BSD to then also ensure, as the review progresses, that what is written in policy is also applied in practice.

If all of the above are provided, the bank should be awarded a score of three.

7.4.2.2 Principle two: Liquidity management strategy must be Board-approved

The second Principle states that *a bank's Board of Directors should approve the strategy and all significant policies that a bank wishes to implement for its liquidity risk management. It is also the Board's responsibility to ensure that senior management take the necessary steps to monitor and control liquidity risk. Furthermore, the bank's liquidity position should be communicated to the bank's Board on a regular basis and immediately if there are any significant changes in the bank's current or future liquidity position* (NBRM, 2004:7).

The question addressing sound Principle one also addresses this sound Principle, but the following additional question could be asked in the liquidity risk questionnaire to ensure that this Principle is included:

> *Provide a copy of the latest liquidity risk report that is distributed to the Board. What is the frequency of its distribution and who are the recipients?*

Because the sound principles require that the Board should be held responsible for liquidity risk and that it should receive timely reports, this report should be distributed monthly to the Board and daily to all other parties in order to keep the Board and all other parties well-informed. The report should also be distributed to important role players in the specific bank's liquidity risk management process. It is also important that the report contains all relevant information, but also that it is not too long and cumbersome.

If the report is distributed on a daily basis it also constitutes the on-going monitoring of liquidity risk. If a bank complies with all of the above, it should be awarded a score of three.

7.4.2.3 Principle three: Effective management structure

Principle three states that *all banks should have a management structure in place to effectively execute the bank's liquidity strategy. The management structure should include the ongoing involvement of members of senior management, who must ensure that liquidity is effectively managed and that appropriate policies and procedures are established to control and limit liquidity risk. Banks should set and regularly review limits on the size of their liquidity positions over particular time horizons* (CIMA, 2003:1).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

> *Is there a structure in place to ensure co-operation and/or close links between individuals responsible for liquidity, individuals responsible to monitor market conditions and individuals with access to critical information such as credit risk managers? Provide organograms indicating where everyone involved in the management of liquidity risk fits in. In addition, is there a specific identified group within the bank that is responsible for managing the overall liquidity risk of the bank?*

It is often said that a picture speaks a thousand words, and when scrutinising an organogram, possible deficiencies in reporting lines and structures could be identified. The efficiency of reporting lines should also be assessed as the review progresses. The structure should be logical and operate efficiently. Banks are also expected to have an ALCO. It is important for the regulator to determine the frequency of ALCO meetings as well as details on the composition of the committee.

Any concerns or deficiencies in this regard would mean that the bank does not receive a score of three for these questions.

7.4.2.4 Principle four: Information systems

Principle four prescribes that *banks should have sufficient information systems for measuring, monitoring, controlling and reporting of liquid assets and funding requirements. And in addition, reports should be provided on a timely basis to the bank's Board of Directors, senior management and other appropriate personnel* (CBB, 2005:4-5).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

> *Which system(s) do your bank currently use for the management, measurement and reporting of liquidity risk? Are there any plans to change the system(s) in the near future?*

This information should provide the BSD with a relatively good idea of what the "best of breed" systems are for liquidity risk and which ones are widely used in the South African banking industry. It may pose significant operational and liquidity risks if the bank plans to migrate from current systems to new ones, meaning that the situation should be monitored closely by the BSD. Systems should also have the capability of real-time monitoring of positions and exposures to ensure the ongoing monitoring of liquidity risk.

If the bank uses systems that are considered to be good and stable for the bank in question and if there are no plans of migrating to a different system(s), the bank should be awarded a score of three.

7.4.2.5 Principle five: Ongoing measurement and monitoring of net funding requirements

According to the fifth Principle, *all banks should establish a process for the ongoing monitoring and measurement of its net funding requirements* (IFSRA, 2006a:7).

To address this sound Principle, the same question asked under section 7.4.2.2 could be asked to ensue that there is a process for the ongoing monitoring and measurement of liquidity risk.

If the BSD is satisfied with a bank's process and quality of ongoing monitoring and measurement of liquidity risk, the bank should be awarded a score of three.

7.4.2.6 Principle six: Analysing liquidity risk using "what if" scenarios

Principle six prescribes that *banks should analyse liquidity using a variety of "what if" scenarios* (BIS, 2000b:8).

Sound Principles six and seven can be addressed by including one question. The question is formulated in section 7.4.2.7 below.

7.4.2.7 Principle seven: Frequent review of assumptions

Principle seven prescribes that *banks should frequently review the assumptions used for managing liquidity to ensure the continued validity of such assumptions* (RBA, 1998:3).

It was mentioned in section 7.4.2.6 that sound Principles six and seven could be addressed by one question in the liquidity risk questionnaire. The question that could be included may read as follows:

> *Does your bank perform liquidity stress testing based on a variety of "what if" scenarios? Please provide a copy of the assumptions for such scenarios.*

Banks are required to do liquidity analyses based on a variety of "what if" scenarios. It is important for the BSD to ensure that scenarios are plentiful, plausible and not static. It is also important that the bank discloses its asset, liability, off-balance sheet and other assumptions which were described in section 5.2.8.

If the BSD is satisfied with the number of scenarios and the underlying assumptions of such scenarios the bank should be awarded a score of three.

7.4.2.8 Principle eight: Capacity to sell assets and market access

Principle eight prescribes that *a bank should frequently review its efforts to establish and maintain relationships with liability holders in order for it to maintain its diversification of liabilities and to ensure its capability of selling assets if needed* (CIMA, 2003:8).

This sound Principle could be included in the liquidity risk questionnaire by asking the following two questions:

> *How does the bank assess its market accessibility in order to understand how much funding it can expect to receive from the market, both under normal and adverse*

circumstances? Are there any specific funding sources (i.e. individual level, instrument type, nature of provider of funds, geographic market) the bank places high reliance on?

The evaluation of answers to the first question would be quite difficult and subjective, highlighting the importance that the BSD "keeps its ear to the ground" and "listen to noises" coming from the market, because the perception of a bank is what determines its relationships and ability to obtain funding. The second question ties in with the first one and the answers would indicate if there are unrealistic assumptions regarding the availability of funding and an over-reliance on certain funding sources. In other words, it should point out concentration risk in the bank's funding sources.

As mentioned, the evaluation of answers to these questions would be subjective, but if the BSD is satisfied with the responses, the bank should be awarded scores of three.

7.4.2.9 Principle nine: Contingency planning

Principle nine deals with the importance of *banks having contingency plans in place to address the strategy for handling liquidity crises and should include a procedure for making up cash-flow shortfalls in emergency situations* (IFSRA, 2006a:11-12).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

Does your bank have a contingency funding plan in place? Provide more details regarding such contingency funding plan.

It is extremely important that banks have CFPs in place. It is, however, necessary for the BSD to request and analyse details of such funding plans, because it became apparent from section 6.6.3.4 that banks' contingency plans differ greatly from bank to bank. It is preferable that banks do not include central bank accommodation as part of their contingency funding plans.

The evaluation of answers to this question should be based on the guidelines of a good CFP, as described in section 5.2.10. If a bank's CFP consists of all the elements that are considered to be a proper CFP, it should be awarded a score of three.

7.4.2.10 Principle ten: Foreign currency liquidity management

Principle ten prescribes that *banks should have measurement, monitoring and control systems for the major currencies in which it is active. In addition to analysing its aggregate foreign currency needs in combination with its domestic currency needs, banks should do analyses of its strategy for each currency individually* (RBA, 1998:7).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

> *Does the information system have the ability to calculate liquidity positions in all major currencies in which the bank deals, both individually and on an aggregate basis?*

It is of critical importance that a bank can calculate and manage liquidity positions in all major currencies in which the bank deals on an individual as well as aggregated basis. If the bank is able to do so, it should be awarded a score of three.

7.4.2.11 Principle eleven: Review of size of cash-flow mismatches in foreign currencies

Principle eleven prescribes that *banks should set and regularly review limits on the size of its cash-flow mismatches over certain time horizons for foreign currencies on an aggregate basis as well as on a currency-by-currency basis for significant currencies in which the bank deals* (CIMA, 2003:10).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

> *Please provide the latest liquidity risk limits. When were these limits last reviewed?*

Limits should be analysed in terms of size and also in terms of which counterparties are allocated limits. It is important that limit documents are up-to-date and that they are reviewed at least annually, or as required on an ad hoc basis. Banks should review cash-flow mismatches in foreign currencies, and set and regularly review limits on the size of its cash-flow mismatches over certain time horizons for foreign currencies on an aggregate basis as well as on a currency-by-currency basis.

If the BSD is satisfied with the size of limits, counterparties, the validity and frequency at which limit documents are updated, the bank should be awarded a score of three.

7.4.2.12 Principle twelve: Adequate system of internal controls

According to the twelfth Principle, *each bank should have an adequate system of internal controls over its liquidity risk management process. An essential component of the internal control system involves regular independent reviews and evaluations of the effectiveness of the system and, where necessary, ensuring that appropriate enhancements or revisions to internal controls are made. The results of such reviews should also be made available to regulators* (IFSRA, 2006a:9).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

> *When last were the liquidity risk management process, systems and controls subjected to an internal and/or external audit? Please provide the latest results.*

Part of this Principle is a requirement of independent reviews that should be made available to the regulator. Because the BSD cannot evaluate the control environment and systems of control during the course of an on-site review, it should rely on findings by internal and external audits conducted on the bank.

The score awarded for this question should therefore depend on the findings of such audits.

7.4.2.13 Principle thirteen: Mechanism for disclosure of information

According to the thirteenth principle, *banks should have a mechanism in place that ensures that there is an adequate level of disclosure of information about the bank in order for the bank to able to manage the public perception of the bank and its soundness* (BIS, 2000b:19).

A question that could be asked in the liquidity risk questionnaire to ensure that this Principle is included may read as follows:

> *Does the bank have a mechanism for public disclosure to communicate to the public the state of the bank?*

This is an important question, because liquidity risk is largely driven by perception. This was mentioned in section 6.6.3.7 where it was stated that banks should manage "loose tongues". The perception should be managed with directors and executive committee members being available for comment during times of liquidity problems, and a mechanism that can determine who can say what should be instituted. During a liquidity crisis banks can set up a call centre as

a central point where the situation is managed in such a way that all the stories that are told concur.

Scores should be awarded on the extent to which banks have such a communication mechanism in place.

7.4.2.14 Principle fourteen: Independent evaluations by supervisors

Principle fourteen prescribes that *regulators should conduct independent evaluations of banks' strategies, policies, procedures and practices. In addition, regulators should also require banks to have effective systems to identify, monitor and measure liquidity risk. Banks should also be required to submit sufficient and timely information to the regulator to enable regulators to evaluate banks' liquidity risk. Regulators should also ensure that banks have sufficient contingency plans (BIS, 2000b:19-20).*

By including all the above questions, the BSD will comply with sound Principle fourteen of the sound Principles, which prescribes independent evaluations by supervisors.

7.4.3 Alignment of liquidity risk questionnaire with criteria of Basel Core Principle 14: Liquidity Risk

Basel Core Principle 14: Liquidity Risk was discussed in section 5.3.3 and states:

> *Regulators must be satisfied that banks have a proper liquidity management strategy that considers the risk profile of the bank, with prudent policies and processes to identify, measure, monitor and control liquidity risk and to manage liquidity on a daily basis. Regulators call for banks to have contingency plans for handling unexpected liquidity problems.*

Core Principle Fourteen prescribes six essential criteria and two additional criteria with which regulators should comply in order for them to be compliant with this Principle. Each of the criteria is discussed briefly along with proposals on how they could be incorporated into the liquidity risk questionnaire. Questions that were proposed in section 7.4.2 will not be repeated, but reference is made to the questions that would ensure BSD compliance with Basel Core Principle 14: Liquidity Risk. The BIS (2006a:23-24) identified the following criteria:

i. ***Essential criterion one.*** Regulators must set liquidity guidelines for banks. These guidelines should take into account undrawn commitments and other off-balance sheet liabilities, as well as existing on-balance sheet liabilities of the bank.

The proposed question in section 7.4.2.11 on liquidity risk limits would ensure BSD compliance with essential criterion one of Basel Core Principle 14: Liquidity Risk.

ii. ***Essential criterion two.*** Regulators must confirm that banks have a well-defined liquidity management strategy, along with policies and processes for managing liquidity risk which have been approved by the Board. Regulators must also confirm that the Board plays an oversight role in ensuring that policies and processes for risk-taking are developed to monitor, control and manage liquidity risk and that policies and processes are effectively implemented by the bank's management.

The proposed questions in sections 7.4.2.1 and 7.4.2.2 would ensure BSD compliance with essential criterion two of Basel Core Principle 14: Liquidity Risk.

iii. ***Essential criterion three.*** Regulators must determine whether a bank's senior management has defined or established appropriate policies and processes to monitor, control and manage liquidity risk; that it effectively implements policies and processes; and that it understands the nature and level of liquidity risk being taken by the bank.

Again the proposed questions in sections 7.4.2.1 and 7.4.2.2 would ensure BSD compliance with essential criterion three of Basel Core Principle 14: Liquidity Risk.

iv. ***Essential criterion four.*** Regulators must require a bank to establish policies and processes for the ongoing measurement and monitoring of its net funding requirements. The policies and processes must take into account how other risks such as credit, market and operational risk might impact on the bank's overall liquidity strategy. Furthermore, policies and processes must require an analysis of the bank's funding requirements under alternative scenarios, the diversification of its funding sources, a review of concentration limits, stress testing and a frequent review of underlying assumptions to determine that they continue to be valid.

The proposed question in section 7.4.2.1 would ensure BSD compliance with essential criterion four of Basel Core Principle 14: Liquidity Risk.

v. ***Essential criterion five.*** Regulators must acquire adequate information to identify banks that carry out significant foreign currency liquidity transformation. Where a bank or banking group's foreign currency business directly or indirectly, through lending in foreign currencies to domestic borrowers, is deemed to be significant, or where a

specific currency in which the bank has a material exposure is experiencing problems, regulators must require the bank to carry out a separate analysis of its strategy for each currency individually and, where appropriate, set and regularly review limits on the size of its cash-flow mismatches for foreign currencies for each currency individually and on an aggregated basis.

The proposed question in section 7.4.2.10 would ensure BSD compliance with essential criterion five of Basel Core Principle 14: Liquidity Risk.

vi. ***Essential criterion six.*** Regulators must determine whether banks have contingency plans in place for managing liquidity problems, including informing the regulator.

The proposed question in section 7.4.2.9 would ensure BSD compliance with essential criterion six of Basel Core Principle 14: Liquidity Risk.

vii. ***Additional criterion one.*** Regulators must determine that where a bank conducts business in multiple currencies, the bank's foreign currency liquidity strategy is stress tested separately and that the results of stress tests are taken into account in determining the appropriateness of mismatches.

The proposed question in section 7.4.2.6 would ensure BSD compliance with additional criterion one of Basel Core Principle 14: Liquidity Risk.

viii. ***Additional criterion two.*** Regulators must confirm that a bank from time to time reviews its efforts to establish and preserve relationships with liability holders, maintains the diversification of its liabilities and aims to ensure its capacity to sell assets.

The proposed questions in section 7.4.2.8 would ensure BSD compliance with additional criterion two of Basel Core Principle 14: Liquidity Risk.

7.4.4 Summary of liquidity risk questionnaire

From sections 7.4.2 and 7.4.3 it became apparent that more than one sound Principle along with some of the criteria of Basel Core Principle 14: Liquidity Risk could be addressed by a single question and that each of the sound Principles and Core Principle criteria does not necessarily have to be included in the liquidity risk questionnaire by means of separate questions. For this reason, a table was drafted in which all the proposed questions are linked to the sound Principles and/or Basel Core Principle criteria that it addresses. Table 7.1 provides a summary of the

questions that were proposed to be included in a liquidity risk questionnaire in sections 7.4.2 and 7.4.3 to ensure that the questionnaire is aligned with the sound Principles for the management and measurement of liquidity risk and Basel Core Principle 14: Liquidity Risk.

Table 7.1: Summary of liquidity risk questionnaire

Examples of questions that could be included in a liquidity risk questionnaire			
	Question	Sound Principle	Basel Core Principle 14: Liquidity Risk
1	Does your bank have a Board-approved strategy for the day-to-day management of liquidity risk? If so, please provide a copy of the Board-approved policy.	SP* 1, SP 2, SP 12	EC** 2, EC 3, EC 4
2	Is there a structure in place to ensure co-operation and/or close links between individuals responsible for liquidity, individuals responsible to monitor market conditions and individuals with access to critical information such as credit risk managers? Provide organograms indicating where everyone involved in the management of liquidity risk fits in.	SP 3, SP 12	EC 2, EC 3, EC 5
3	Is there a specific identified group within the bank that is responsible for managing the overall liquidity of the bank?	SP 3	N/A
4	Please provide the latest liquidity risk limits. When were these limits last reviewed?	SP 3, SP 11	EC 1
5	Which system(s) do your bank currently use for the management, measurement and reporting of liquidity risk? Are there any plans to change the system(s) in the near future?	SP 4	N/A
6	Does the information system have the ability to calculate liquidity positions in all major currencies in which the bank deals, both individually and on an aggregate basis?	SP 4, SP 10	EC 5
7	Provide a copy of the latest liquidity risk report that was distributed to the Board. What is the frequency of its distribution and who are the recipients?	SP 2, SP 5	N/A
8	Does your bank perform liquidity stress testing based on a variety of "what if" scenarios? Please provide a copy of the assumptions for such scenarios.	SP 6, SP 7	AC*** 1
9	How does the bank assess its market accessibility in order to understand how much funding it can expect to receive from the market, both under normal and adverse circumstances?	SP 8	AC 2
10	Are there any specific funding sources (i.e. individual level, instrument type, nature of provider of funds, geographic market) the bank places high reliance on?	SP 8	AC 2
11	Does your bank have a contingency funding plan in place? Provide more details regarding such contingency funding plan.	SP 9	EC 6
12	When last were the liquidity risk management process, systems and controls subjected to an internal and/or external audit? Please provide the latest results.	SP 12	N/A
13	Does the bank have a mechanism for public disclosure to communicate to the public the state of the bank?	SP 13	N/A

* SP = Sound Principle

** EC = Essential criterion

*** AC = Additional criterion

It becomes clear from Table 7.1 that some of the proposed questions address more than one sound Principle and/or Core Principle criteria. It is important to note that the thirteen questions that were proposed to be included in the liquidity risk questionnaire do not constitute the entire liquidity risk questionnaire, but that these questions were used as examples on how the sound Principles and Core Principle criteria could be aligned with a liquidity risk questionnaire. The full questionnaire could be expected to be more detailed and exhaustive.

7.4.5 Conclusion: Possible format of a liquidity risk questionnaire

This section described a questionnaire that could be compiled according to which banks' liquidity risk management and measurement are assessed in terms of the sound Principles for managing liquidity risk and the Basel Core Principles that were discussed in Chapter 5. One questionnaire could be used for the purpose of assessing the quality of banks' liquidity risk management and measurement in terms of an SREP as well as for banks applying for approval of an internal models approach for liquidity risk. The same questionnaire could be used for both purposes, or the questionnaire could be divided into two clear sections whereby all banks are required to answer the SREP or Pillar 2(b) section, and only banks applying for the use of an internal models approach for liquidity risk are required to complete this section. The example of such a questionnaire included possible questions that could be asked of banks to ensure alignment with the sound Principles for the management and measurement of liquidity risk and the Basel Core Principles.

The sound Principles for the management and measurement of liquidity risk were discussed briefly along with possible questions that could be included in a liquidity risk questionnaire to ensure the alignment of the sound Principles with the questionnaire. Suggested answers to each of the proposed questions were also included. Basel Core Principle 14: Liquidity Risk was discussed briefly, after which reference was made to proposed questions that would ensure BSD compliance with the prescribed criteria. A summary was drafted in the form of a table to provide clarity on the proposed questions and which sound Principles and/or Core Principle criteria each of them addresses. A full version of a liquidity risk questionnaire could be expected to be much more exhaustive and detailed, but the questions were used to indicate how the liquidity risk questionnaire could be aligned to the sound Principles and Basel Core Principle criteria.

7.5 Conclusion

Banking regulation and supervision are crucial to the soundness and stability of financial markets across the world because markets are imperfect and failures occur from time to time. The main objectives of banking regulation and supervision relate to ensuring the safety and soundness of the financial system while also protecting depositors and investors against malpractice and

exploitation. Banking regulation and supervision is principle-based and the crux of these principles points to the sufficiency and efficiency of regulation and supervision.

This section described a broadly proposed framework for the regulation of liquidity risk in South Africa. It was assumed that a capital charge would not be an effective way to regulate liquidity risk, but that liquidity risk should rather be included under Pillar 2 of Basel II. In addition, banks should, subject to regulatory approval, be allowed to use an *internal models approach for liquidity risk.*

The assessment of both the adequacy of banks' liquidity risk management and measurement under the SREP process, as well as for banks applying for the use of an internal models approach for liquidity risk, could take place based on a questionnaire divided into a section of questions for SREP assessments and a section of questions for banks applying for the use of an internal models approach for liquidity risk. Banks not yet applying for the use of an internal models approach for liquidity risk would not be required to answer the questions in the second section. A simple approach of giving a score for each question (3 = satisfactory and 1 = unsatisfactory) could be helpful in assessing the quality of liquidity risk management and measurement and for identifying possible gaps between banks' practices and prescribed guidelines that should be addressed by a bank.

A Pillar 2(b) capital charge could be applied to banks based on average scores obtained for answers to questions in the questionnaire, whereas approval for an internal models approach for liquidity risk could be more qualitatively-based. This means that the questionnaire would be used to identify gaps between banks' practices and prescribed criteria that banks would have to address before approval for such an approach can be granted.

Additional proposals regarding the regulatory treatment of liquidity risk include that the BSD should publish a framework in which its approach to regulating liquidity risk is described in detail and which contains a widely-accepted definition of funding liquidity risk. An additional measure that could be considered by the BSD should it be concerned about the level of liquidity risk in South Africa, is to require banks to report their liquidity risk to the BSD on a more frequent basis than the current monthly reporting.

A liquidity risk questionnaire could be used for the purpose of assessing the quality of banks' liquidity risk management and measurement in terms of an SREP as well as for banks applying for approval of an internal models approach for liquidity risk. The same questionnaire could be used for both purposes, or the questionnaire could be divided into two clear sections whereby all banks are required to answer the SREP or Pillar 2(b) section, and only banks applying for the use of an internal models approach for liquidity risk are required to complete this section. The example of

such a questionnaire included possible questions that could be asked of banks to ensure alignment with the sound Principles for the management and measurement of liquidity risk and the Basel Core Principles.

The sound Principles for the management and measurement of liquidity risk were discussed briefly along with possible questions that could be included in a liquidity risk questionnaire to ensure the alignment of the sound Principles with the questionnaire. Suggested answers to each of the proposed questions were also included. Basel Core Principle 14: Liquidity Risk was discussed briefly, after which reference was made to proposed questions that would ensure BSD compliance with the prescribed criteria. A summary was drafted in the form of a table to provide clarity on the proposed questions and which sound Principles and/or Core Principle criteria each of them addresses. A full version of a liquidity risk questionnaire could be expected to be much more exhaustive and detailed, but the questions were used to indicate how the liquidity risk questionnaire could be aligned to the sound Principles and Basel Core Principle criteria.

Chapter 8
Conclusion

8.1 Introduction

This dissertation encompasses a literature study on the regulatory treatment of liquidity risk. A significant amount of research has been published regarding the regulation of credit risk, market risk and operational risk. However, little has been done regarding the regulatory treatment of liquidity risk.

Liquidity risk is an extremely large and complicated field. Liquidity risk is defined in a variety of ways and there is an even wider variety of sources and techniques that can be used to mitigate liquidity risk. Banks use different measures to quantify liquidity risk, based on the size and sophistication of different banks.

South Africa will implement Basel II on 1 January 2008, when it will adopt capital requirements for credit risk, market risk and operational risk. Liquidity risk in the South African banking sector was proven to be significant, but generally not considered to be a distinct threat. Clearly articulated principles on liquidity risk supervision are a glaring omission from Basel II in the light of the obvious dangers of liquidity risk and the importance of correctly measuring and managing liquidity risk. This is emphasised by the fact that the term "liquidity risk" appears only three times in the Basel II document that is almost 350 pages long. Against this backdrop, the critical question is the way in which the South African banking regulators could treat liquidity risk under the Basel II framework. The BIS and IIF prescribed means for both banks and regulators to ensure the sound management of liquidity risk, which could serve as theoretical guidelines for the regulatory treatment of liquidity risk.

Therefore, the aim of this study was explore current practices of the management and measurement of liquidity risk and to propose guidelines for effective liquidity risk regulation in South Africa. This study provides conclusions and recommendations on the regulatory treatment of liquidity risk in South Africa under Basel II.

8.2 Summary of the research

8.2.1 Chapter 2

Chapter 2 derived an all-encompassing definition for liquidity risk for the purposes of this study before it reviewed the sources and characteristics of liquidity risk. The aim of this chapter was to gain a thorough understanding of liquidity risk, its origins and how it can be mitigated.

8.2.2 Chapter 3

Chapter 3 continued where Chapter 2 left off and discussed ways in which to manage and measure liquidity risk.

A typical ALCO and its responsibilities were discussed before different methods to measure liquidity risk were discussed, including liquidity ratios, the cash capital methodology, maturity mismatch analysis and newer methods such as liquidity-at-risk. All five these measures for liquidity risk were discussed.

8.2.3 Chapter 4

Chapter 2 and Chapter 3 served as a theoretical overview of liquidity risk and its related concepts. With these chapters serving as background, this study explored Basel II, including a discussion on economic and regulatory capital.

Basel II is discussed in general terms with the focus on the determination of how liquidity risk is expected to be treated under Basel II. After a complete overview of Basel II, this chapter discussed liquidity risk in relation to Basel II and whether and where it fits into the Basel II picture.

Basel II expects liquidity risk to be assessed under Pillar 2 and specific reference is made to liquidity risk under Principle two of the Supervisory Review Process, where it is required of banks to do a comprehensive assessment of the risks that it faces. More specifically, banks are expected to have adequate systems for measuring, monitoring and controlling liquidity risk. In addition, banks are expected to evaluate the adequacy of their capital given their own liquidity profile and the liquidity of the markets in which they operate. After the liquidity crunch experienced in markets across the world and the subsequent run on Northern Rock, the Basel Committee for Banking Supervision emphasised the need for strengthening the regulation of risks such as liquidity risk.

8.2.4 Chapter 5

Because it was assumed that liquidity risk should be treated under Pillar 2 of Basel, Chapter 5 explored sound principles for the management of liquidity risk. This chapter investigated sound

principles for the management and measurement of liquidity risk by reviewing published literature from a variety of sources. It was set out as fourteen principles, each of which was discussed in detail to gain an understanding of the complications and expectations that banks and regulators both should have regarding the management and measurement of liquidity risk. Chapter 5 proceeded to briefly discuss the Basel Core Principles in general, after which specific attention was given to Revised Core Principle Fourteen: Liquidity risk. In other words, Chapter 5 discussed the theoretical side of the regulation of liquidity risk.

8.2.5 Chapter 6

Chapter 6 described practical aspects of the South African banking system and major banking failures since 1990. The SARB system of accommodation and prudential requirements in South Africa were also discussed to provide a background to the South African banking system and the environment in which banks operate.

This was followed by an analysis on the aggregated banks' balance sheet and liquidity risk returns in South Africa, and concluded that the South African banking sector was extremely short-funded. The difficulty in analysing aggregated data for the South African banking sector is that the origins of this liquidity risk is not clear. For this reason, an analysis was conducted on individual banks by calculating various liquidity ratios for the selected banks.

Chapter 6 continued by describing liquidity risk in South Africa. This was done through the interpretation of answers to a questionnaire that was compiled and sent to various respondents. It was clear from the questionnaire used in Chapter 6 that respondents felt that banks and regulators are aware of the threat of liquidity risk in South Africa and it is perceived to be managed and monitored well.

8.2.6 Chapter 7

With the theoretical background provided on the regulation of liquidity risk that was provided by Chapter 5, and the current situation regarding liquidity risk in South Africa that was discussed in Chapter 6, Chapter 7 made recommendations and proposals on how liquidity risk could be regulated in South Africa.

8.3 Conclusions and implications

8.3.1 Process for reviewing liquidity risk

Although Pillar 2 reviews a variety of other risks and not only liquidity risk, it is proposed that the liquidity risk part of such reviews is conducted on the basis of a questionnaire used to determine possible gaps between banks' practices and prescribed criteria regarding the management and

measurement of liquidity risk. According to this, banks would have to provide responses to a standard exhaustive questionnaire on liquidity risk after which the BSD evaluates banks' responses to the questionnaire in order to determine possible gaps between banks' practices and prescribed criteria. These gaps would then be addressed by means of an on-site visit to the bank by a BSD team.

It is important to note that such an approach has a constraint in terms of the substantial amount of work that would have to be done on the regulation of liquidity risk by both regulators and banks. Therefore resource constraints and the cost versus the benefit of such an approach would have to be considered carefully.

8.3.2 Regulatory capital for liquidity risk

Chapter 6 indicated that capital is not considered an effective instrument for regulating liquidity risk, because when a bank experiences liquidity problems, the best way to cope is to have a stock of liquid assets or cash. Therefore, the all-encompassing conclusion to this study is that capital would not be an effective mitigant for liquidity risk for a number of reasons. The major reason is that capital is often considered too expensive and restrictive to effectively deal with liquidity risk, when a bank experiences liquidity problems, it should have access to cash to be in the best position to deal with such a crisis.

Liquidity risk differs from bank to bank and a general capital charge for all banks may not be sensible, therefore liquidity risk should be analysed on a bank-by-bank basis. In other words, capital could be charged for liquidity risk under Pillar 2(b) of Basel II. Such a capital charge would not serve the purpose of covering losses resulting from liquidity risk, but would instead impose a penalty on banks that are deemed to manage and measure liquidity risk imprudently. Such a penalty would typically be quite small but would serve as an incentive for banks to improve their management and measurement techniques to the desired level as set out by prescribed criteria.

The criteria that should be used for determining whether banks measure and manage liquidity risk prudently should be of such a nature that the BSD complies with Revised Basel Core Principle 14: Liquidity Risk in regulating liquidity risk. In addition, it should align the criteria used to the 14 Principles for the sound management of liquidity as prescribed in Chapter 5. The criteria for sound liquidity risk management could be incorporated into the questionnaire that may be used to assess liquidity risk under Pillar 2(b) of Basel II as part of the SREP process conducted by the BSD.

A simple approach of giving a score for each question (3 = satisfactory and 1 = unsatisfactory) could be helpful in assessing the quality of liquidity risk management and measurement and for identifying possible gaps between banks' practices and prescribed guidelines that should be addressed by a bank. The basis for determining a capital charge may be based on average scores obtained by banks answering the SREP section of the questionnaire. For example, a certain increment of capital could be charged for each 0,05 under the perfect score, which would be three. This may not be a scientific way in determining a Pillar 2(b) capital charge, but would make sense if applied consistently. When the BSD has completed enough assessments, a benchmark score could be determined that could then be used as the basis for the capital add-on.

8.3.3 An internal models approach for liquidity risk

The BSD should not prescribe to banks which methods to use to report their liquidity risk, because all banks are not the same in terms of size and sophistication. For this reason, banks should be allowed to follow an *internal models approach for liquidity risk* whereby banks are, subject to regulatory approval, allowed to use their own internal liquidity risk measures to report liquidity risk to the BSD. This approach is similar to the approach followed by the Bundesbank in Germany.

8.3.4 A liquidity risk questionnaire

A liquidity risk questionnaire could be drafted according to which banks' liquidity risk management and measurement is assessed in terms of the sound Principles for managing liquidity risk and the Basel Core Principles that were discussed in Chapter 5. One questionnaire could be used for the purposes of assessing the quality of banks' liquidity risk management and measurement in terms of an SREP as well as for banks applying for approval of an *internal models approach for liquidity risk*. The same questionnaire could be used for both purposes, or the questionnaire could be divided into two clear sections whereby all banks are required to answer the SREP or Pillar 2(b) section, and only banks applying for the use of an *internal models approach for liquidity risk* are required to complete this section.

8.3.5 Regulatory liquidity risk policy framework

A further conclusion to this study is that the South African banking regulator should publish a framework in which its approach to regulating liquidity risk is described in detail. Some aspects that should be included in such a document include a widely-accepted definition for liquidity risk and guidelines/minimum standards for measurement and management techniques for liquidity risk and the process that will be followed under Pillar 2 of Basel II.

8.3.6 Liquidity risk mitigants

If the BSD is concerned about the level of potential liquidity risk in the South African banking system, as indicated in Chapter 6, it could consider having the additional instruments that are eligible as collateral as described in 6.2.5.3 included as instruments eligible for liquid assets reserve requirements. The exact impact of doing this is uncertain, but will probably lead to banks holding a larger amount of liquid assets over and above the 5 percent requirement. This would mean that the South African banking sector will be better protected against and better equipped to deal with liquidity problems. The process for including these instruments as liquid assets will be a tedious one, because it will mean that the South African Banks Act will have to be amended to include these instruments.

An additional mitigant for liquidity risk may be that the BSD requires banks to report their liquidity risk on a more frequent basis than the current monthly reporting. Market risk is currently reported on a daily basis simply because of the ever-changing environment. Liquidity risk can also be considered to be an ever-changing risk, which will warrant more frequent reporting.

8.4 Future research

The study opened three research opportunities. Firstly, the analysis of funding liquidity risk in South Africa can be compared with the situation in other countries. Although the South African banking sector can be seen as a unique one as a result of the large inherent concentration of risk in the big four banks which own more than three quarters of all banking assets, it may still compare favourably with the situation in other countries.

Secondly, a study could ensue on the extent to which other countries mitigate liquidity risk through prudential requirements such as liquid asset reserve requirements and minimum reserve balances. A study on this may yield interesting results when compared with the prudential requirements in South Africa.

Finally, what is proposed by this dissertation does not necessarily reflect proposals made by all banking regulators in other countries. This is an important consideration because one of the major aims of Basel II was to level the playing field for all banks. For this reason, it is important that the South African approach to regulate liquidity risk under Basel II remains in line with the approaches proposed by other countries' regulators in future. In other words, research could be conducted on how regulators in other countries propose to treat liquidity risk under Basel II.

Appendix A Conversion to percentages of total balance sheet size

Table A.1: Data converted to percentages of total balance sheet size

	Balance sheet size	Total capital allocated	Capital adequacy percentage	Capital requirement as percentage of balance sheet	Cash reserve requirements (CRR)	CRR percentage size of total balance sheet	Liquid asset reserve requirements (LARR)	LARR percentage size of total balance sheet
May-02	1,055,555,813	83,626,176	12.12%	7.92%	19,055,851	1.81%	42,272,579	4.00%
Jun-02	1,064,568,476	85,309,960	12.41%	8.01%	19,162,636	1.80%	42,680,348	4.01%
Jul-02	1,061,001,846	89,244,670	12.99%	8.41%	19,253,325	1.81%	43,000,522	4.05%
Aug-02	1,058,578,008	89,724,516	13.03%	8.48%	19,798,578	1.87%	42,980,834	4.06%
Sep-02	1,069,999,438	86,450,557	12.65%	8.08%	19,556,851	1.83%	42,761,493	4.00%
Oct-02	1,066,112,830	86,630,250	12.65%	8.13%	19,668,628	1.84%	43,237,283	4.06%
Nov-02	1,086,510,253	87,639,808	12.54%	8.07%	19,667,046	1.81%	43,403,154	3.99%
Dec-02	1,099,978,824	89,726,739	12.62%	8.16%	19,753,062	1.80%	44,218,014	4.02%
Jan-03	1,227,966,260	85,504,039	11.78%	6.96%	18,722,838	1.52%	48,316,031	3.93%
Feb-03	1,230,851,618	86,356,372	11.83%	7.02%	19,100,071	1.55%	49,392,645	4.01%
Mar-03	1,230,437,506	89,302,448	12.25%	7.26%	19,580,169	1.59%	49,947,533	4.06%
Apr-03	1,294,740,925	90,903,025	12.15%	7.02%	19,251,672	1.49%	51,772,195	4.00%
May-03	1,288,599,902	95,342,935	12.70%	7.40%	19,190,745	1.49%	51,679,445	4.01%
Jun-03	1,344,906,107	96,089,577	12.74%	7.14%	18,956,570	1.41%	53,525,005	3.98%
Jul-03	1,328,670,051	96,185,747	12.78%	7.24%	18,688,584	1.41%	53,434,535	4.02%
Aug-03	1,310,159,107	96,473,162	12.80%	7.36%	18,978,996	1.45%	53,393,982	4.08%
Sep-03	1,364,448,373	100,759,016	13.28%	7.38%	18,992,275	1.39%	53,693,654	3.94%
Oct-03	1,369,344,103	97,754,341	12.69%	7.14%	19,176,026	1.40%	55,418,772	4.05%
Nov-03	1,404,754,380	101,802,924	12.93%	7.25%	19,328,346	1.38%	56,366,290	4.01%
Dec-03	1,379,823,224	97,792,846	12.44%	7.09%	19,517,544	1.41%	56,103,420	4.07%
Jan-04	1,375,498,010	99,067,731	12.59%	7.20%	19,241,842	1.40%	55,984,341	4.07%
Feb-04	1,369,130,616	101,262,099	12.60%	7.40%	19,662,421	1.44%	56,113,449	4.10%
Mar-04	1,359,082,214	103,815,490	12.83%	7.64%	19,433,066	1.43%	54,547,040	4.01%

Apr-04	1,342,558,310	102,553,355	12.77%	7.64%	20,113,456	1.50%	55,261,056	4.12%
May-04	1,320,447,609	104,101,692	13.21%	7.88%	19,978,118	1.51%	54,502,805	4.13%
Jun-04	1,350,508,811	106,513,406	13.61%	7.89%	20,082,831	1.49%	54,510,703	4.04%
Jul-04	1,351,515,120	107,461,112	13.50%	7.95%	20,683,434	1.53%	55,953,923	4.14%
Aug-04	1,395,254,314	106,978,531	13.37%	7.67%	20,486,323	1.47%	56,210,837	4.03%
Sep-04	1,406,361,187	108,982,359	13.48%	7.75%	20,635,686	1.47%	56,978,384	4.05%
Oct-04	1,436,294,185	110,428,704	13.34%	7.69%	21,402,935	1.49%	58,658,494	4.08%
Nov-04	1,484,815,500	115,092,748	13.71%	7.75%	22,045,505	1.48%	60,507,486	4.08%
Dec-04	1,498,434,227	118,422,205	13.99%	7.90%	22,437,244	1.50%	61,965,467	4.14%
Jan-05	1,529,212,575	121,105,680	14.13%	7.92%	22,234,013	1.45%	61,970,600	4.05%
Feb-05	1,544,070,825	118,084,340	13.63%	7.65%	22,586,005	1.46%	63,460,481	4.11%
Mar-05	1,513,317,325	115,624,436	13.25%	7.64%	22,750,037	1.50%	63,077,478	4.17%
Apr-05	1,527,448,672	120,544,510	13.56%	7.89%	23,343,626	1.53%	63,342,927	4.15%
May-05	1,541,626,540	123,727,332	13.76%	8.03%	23,860,015	1.55%	63,842,457	4.14%
Jun-05	1,564,077,956	120,277,339	13.22%	7.69%	24,049,947	1.54%	64,937,157	4.15%
Jul-05	1,617,925,861	120,403,863	13.04%	7.44%	24,477,547	1.51%	66,198,376	4.09%
Aug-05	1,611,645,919	120,672,242	12.93%	7.49%	24,808,951	1.54%	66,904,205	4.15%
Sep-05	1,620,821,492	123,897,975	13.05%	7.64%	25,173,677	1.55%	67,416,092	4.16%
Oct-05	1,628,041,569	125,875,191	12.99%	7.73%	25,490,203	1.57%	67,469,997	4.14%
Nov-05	1,659,572,524	128,975,795	13.15%	7.77%	25,968,338	1.56%	67,825,907	4.09%
Dec-05	1,677,541,308	127,399,373	12.72%	7.59%	26,843,100	1.60%	68,877,763	4.11%
Jan-06	1,722,247,061	131,331,744	12.95%	7.63%	27,246,837	1.58%	70,869,082	4.11%
Feb-06	1,771,978,177	132,593,470	13.00%	7.48%	27,375,702	1.54%	72,738,714	4.10%
Mar-06	1,803,916,581	137,525,344	13.21%	7.62%	28,192,265	1.56%	74,474,246	4.13%
Apr-06	1,812,611,605	146,822,602	13.83%	8.10%	28,503,819	1.57%	74,952,507	4.14%
May-06	1,869,591,320	142,041,500	13.18%	7.60%	28,646,875	1.53%	76,645,393	4.10%
Jun-06	1,960,184,204	139,910,915	12.78%	7.14%	28,902,812	1.47%	79,498,097	4.06%
Jul-06	1,939,307,359	143,744,725	12.85%	7.41%	29,659,309	1.53%	81,798,514	4.22%
Aug-06	1,967,977,046	144,459,877	12.51%	7.34%	30,206,070	1.53%	80,795,718	4.11%
Sep-06	2,064,311,846	147,699,683	12.55%	7.15%	30,760,295	1.49%	84,130,893	4.08%
Oct-06	2,049,937,754	153,358,929	12.74%	7.48%	31,852,249	1.55%	86,148,848	4.20%

Nov-06	2,062,302,334	154,379,278	12.63%	7.49%	32,686,258	1.58%	86,642,361	4.20%
Dec-06	2,075,305,693	153,453,390	12.29%	7.39%	33,522,523	1.62%	87,671,076	4.22%
Jan-07	2,097,272,580	154,401,469	12.25%	7.36%	33,845,610	1.61%	87,595,812	4.18%
Feb-07	2,160,354,777	157,862,048	12.25%	7.31%	34,470,211	1.60%	89,692,071	4.15%
Mar-07	2,176,477,311	167,740,300	12.72%	7.71%	35,073,571	1.61%	91,133,389	4.19%
Apr-07	2,205,557,539	168,683,439	12.54%	7.65%	35,927,252	1.63%	92,103,298	4.18%
Average	**1,530,025,715**	**115,998,255**	**12.90%**	**7.60%**	**23,667,663**	**1.55%**	**62,683,420**	**4.09%**

Source: SARB (2007a)

Appendix B Data used from the liabilities side of the balance sheet

Table B.1: Data used from the liabilities side of the balance sheet

Apr-07					
	Line No.	1	2	3	4
		Liabilities			
Liabilities	LINE NO	Liabilities at month-end* - Short-term	Liabilities at month-end* - Medium-term	Liabilities at month-end* - Long-term	Liabilities at month-end* - Total
Funding-related liabilities to the public (total of items 2; 16 and 19)	1	1,105,743,528	350,607,658	354,620,184	1,810,971,372
Acknowledgements of debt endorsed and rediscounted; but still outstanding on behalf of clients per contra; (refer item 77 : (total of items 21 to 24)	20	386,283	5,450	250	391,983
Other liabilities and trade creditors, including tax liabilities (total of items 26 and 27)	25	144,397,420	20,743,556	50,354,009	215,494,986
Capital and reserves (total of items 39, 40 and 41)	28				178,699,198
Total capital and liabilities (total of items 1,20,25 and 28)	42				2,205,557,539
		1,250,527,231	371,356,664	404,974,443	2,026,858,338
	Short-term	Medium-term	Long-term	Total	Liabilities and capital - Total
Funding-related liabilities to the public (total of items 2; 16 and 19)	61.058%	19.360%	19.582%	100.000%	
Acknowledgements of debt endorsed and rediscounted; but still outstanding on behalf of clients per contra; (refer item 77 : (total of items 21 to 24)	98.546%	1.390%	0.064%	100.000%	
Other liabilities and trade creditors, including tax liabilities (total of items 26 and 27)	67.007%	9.626%	23.367%	100.000%	
Total liabilities	61.698%	18.322%	19.980%	100.000%	
Total liabilities and capital	56.699%	16.837%	18.362%	8.102%	100.000%

Source: SARB (2007a)

Appendix C Data used from the assets side of the balance sheet

Table C.1: Data used from the assets side of the balance sheet

Apr-07				
	Line No.	1	2	3
Assets		Month-end balances * Total	Month-end balances - Banking	Month-end balances - Trading
Money (total of items 44 to 46)	43	46,142,248	45,950,947	191301
Loans and advances (item 62 less item 63)	47	1,854,607,967	1,803,557,837	51,050,130
Investment and trading positions after mark-to-market adjustments where applicable (total of items 65 to 69 less item 70)	64	251,187,451	120,181,674	131,005,777
Non-financial assets (total of items 72 to 76)	71	14,680,316	14,668,845	11,471
Clients' liabilities for acknowledgements of debt outstanding; per contract; refer item 20 (total of items 78 to 81)	77	391,983	391,983	0
Deferred tax	82	2,209,407	2,209,407	0
Assets repossessed or bought in to protect an advance or investment	83	1,125,083	1,125,083	0
Other assets (including remittances in transit)	84	35,172,322	25,310,747	9,861,575
Total assets (total of items 43; 47; 64; 71; 77; 82; 83 and 84)	85	**2,205,516,777**	**2,013,396,523**	**192,120,254**
Assets		Month-end balances * Total	Month-end balances - Banking	Month-end balances - Trading
Money	43	100.000%	99.585%	0.415%
Loans and advances	47	100.000%	97.247%	2.753%
Investment and trading positions after mark-to-market adjustments where applicable	64	100.000%	47.845%	52.155%
Non-financial assets	71	100.000%	99.922%	0.078%
Clients' liabilities for acknowledgements of debt outstanding	77	100.000%	100.000%	0.000%
Deferred tax	82	100.000%	100.000%	0.000%
Assets repossessed or bought in to protect an advance or investment	83	100.000%	100.000%	0.000%
Other assets (including remittances in transit)	84	100.000%	71.962%	28.038%
Total assets	85	100.000%	91.289%	8.711%

Source: SARB (2007a)

Appendix D Data used for assets from DI 300

Table D.1: Data used for assets from DI 300

Total banks DI 300 Assets	0-31 days	32-60 days	61-91 days	92-181 days	Total assets
May-02	315,825,551	38,121,943	35,401,532	39,166,012	428,515,038
Jun-02	351,919,249	35,861,433	35,912,064	39,090,953	462,783,699
Jul-02	316,170,235	41,205,538	43,063,415	43,942,710	444,381,898
Aug-02	288,733,399	45,550,784	40,574,376	48,000,585	422,859,144
Sep-02	321,345,665	35,731,051	34,435,936	54,448,467	445,961,119
Oct-02	327,086,390	46,430,747	49,228,116	63,237,518	485,982,771
Nov-02	311,832,528	50,995,642	34,754,109	48,770,279	446,352,558
Dec-02	355,589,760	34,581,118	45,039,326	37,960,914	473,171,118
Jan-03	400,343,876	61,174,233	43,778,212	45,369,519	550,665,840
Feb-03	432,078,443	35,922,001	40,167,896	42,289,649	550,457,989
Mar-03	415,003,013	38,136,030	43,805,831	51,095,769	548,040,643
Apr-03	463,333,700	48,357,493	37,990,406	37,778,515	587,460,114
May-03	487,725,070	46,823,478	32,164,353	45,476,433	612,189,334
Jun-03	516,226,036	45,425,040	31,689,912	48,318,330	641,659,318
Jul-03	504,699,280	39,342,929	42,626,611	42,117,578	628,788,398
Aug-03	491,292,511	53,278,745	38,960,071	42,264,321	625,795,648
Sep-03	532,038,299	36,889,275	38,626,944	50,183,735	657,738,253
Oct-03	510,043,609	47,552,481	38,868,524	47,739,336	644,203,950
Nov-03	519,465,491	55,533,956	40,417,094	48,408,790	663,825,331
Dec-03	504,976,807	44,647,666	44,439,732	44,359,212	638,423,417
Jan-04	497,755,428	52,559,178	50,860,482	47,282,431	648,457,519
Feb-04	499,035,412	52,688,433	40,271,604	49,595,468	641,590,917
Mar-04	486,483,254	44,354,588	41,514,242	48,583,738	620,935,822
Apr-04	476,309,542	45,361,717	37,884,498	49,112,815	608,668,572
May-04	461,727,057	42,143,454	35,584,391	43,936,873	583,391,775
Jun-04	472,394,193	44,017,891	33,717,642	43,161,996	593,291,722
Jul-04	463,679,334	41,633,949	34,960,055	44,802,630	585,075,968
Aug-04	478,944,443	40,221,327	44,350,767	58,313,617	621,830,154
Sep-04	492,195,153	42,936,953	40,949,644	64,895,418	640,977,168
Oct-04	499,199,630	45,159,879	43,653,482	61,618,072	649,631,063
Nov-04	525,017,506	42,737,311	44,263,225	55,245,557	667,263,599
Dec-04	534,875,887	45,315,482	40,311,545	54,275,794	674,778,708
Jan-05	564,364,822	43,145,810	35,049,873	50,942,411	693,502,916
Feb-05	565,681,078	49,204,420	33,455,070	56,905,403	705,245,971
Mar-05	543,166,269	44,385,244	38,420,917	57,467,827	683,440,257
Apr-05	544,867,903	45,964,310	42,318,289	57,386,008	690,536,510
May-05	542,595,268	47,183,729	38,226,470	56,794,935	684,800,402
Jun-05	548,081,002	48,355,255	39,055,953	60,353,650	695,845,860
Jul-05	595,135,530	50,505,330	34,628,991	63,949,556	744,219,407
Aug-05	560,446,980	54,220,373	43,996,826	74,441,282	733,105,461
Sep-05	560,623,381	50,830,413	50,181,719	61,611,758	723,247,271
Oct-05	560,431,841	62,199,301	41,513,096	59,078,740	723,222,978
Nov-05	580,473,385	50,764,481	48,234,036	51,654,707	731,126,609
Dec-05	591,871,698	53,613,806	31,697,697	63,738,966	740,922,167
Jan-06	604,656,483	46,045,646	50,528,022	72,941,981	774,172,132
Feb-06	631,965,840	56,637,664	38,865,542	80,838,198	808,307,244
Mar-06	638,928,768	43,909,911	54,229,258	75,712,477	812,780,414

Apr-06	631,227,422	59,173,703	54,401,913	71,946,058	816,749,096
May-06	667,321,762	64,282,571	61,960,988	75,137,835	868,703,156
Jun-06	717,371,890	70,686,418	57,475,472	88,010,452	933,544,232
Jul-06	703,273,670	67,004,564	51,089,362	80,750,121	902,117,717
Aug-06	706,013,935	69,332,377	56,363,806	81,455,507	913,165,625
Sep-06	761,444,393	66,408,695	66,842,865	87,573,559	982,269,512
Oct-06	732,541,089	69,439,482	65,629,085	81,550,818	949,160,474
Nov-06	713,311,502	89,693,592	58,281,920	81,266,849	942,553,863
Dec-06	671,299,059	72,148,942	56,290,843	78,897,177	878,636,021
Jan-07	677,148,468	72,797,999	60,804,671	91,934,344	902,685,482
Feb-07	724,295,439	65,757,860	62,405,451	95,646,087	948,104,837
Mar-07	706,945,995	66,475,732	74,630,712	82,430,640	930,483,079
Apr-07	694,816,659	84,649,363	64,794,444	83,717,037	927,977,503
Average	533,227,455	51,425,146	44,860,689	59,416,290	688,929,579

Source: SARB (2007a)

Appendix E Liquidity ratios for selected South African banks

Table E.1: General liquidity ratios for selected South African banks

	Loan-to-deposit ratios					Loan-to-liability ratios					Liquid-assets-to-liability ratios					Volatile dependency				
	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07
Total banks	0.87	0.87	0.88	0.89	0.90	0.69	0.68	0.69	0.71	0.72	0.15	0.15	0.15	0.15	0.15	-0.20	-0.16	-0.17	-0.19	-0.23
Bank 1	1.03	1.06	1.07	1.07	1.03	0.86	0.86	0.85	0.86	0.88	0.11	0.11	0.12	0.12	0.10	-0.33	-0.29	-0.32	-0.34	-0.39
Bank 2	0.90	0.91	0.91	0.94	0.95	0.79	0.77	0.78	0.81	0.82	0.20	0.19	0.19	0.19	0.19	-0.24	-0.19	-0.20	-0.24	-0.26
Bank 3	0.85	0.87	0.88	0.87	0.89	0.60	0.60	0.61	0.63	0.65	0.11	0.11	0.10	0.11	0.10	-0.15	-0.14	-0.14	-0.12	-0.17
Bank 4	0.25	0.22	0.24	0.28	0.28	0.22	0.18	0.19	0.23	0.23	0.23	0.28	0.32	0.23	0.32	0.44	0.40	0.44	0.44	0.36
Bank 5	5.05	4.57	5.01	3.61	2.72	1.27	1.32	1.21	1.22	1.20	0.26	0.24	0.28	0.20	0.24	-0.88	-0.91	-0.88	-0.95	-0.90
Bank 6	0.84	0.84	0.80	1.06	1.11	0.67	0.67	0.64	0.83	0.87	0.83	0.80	0.86	0.69	0.71	-0.21	-0.19	-0.11	-0.27	-0.24
Bank 7	0.13	0.14	0.15	0.20	0.20	0.12	0.13	0.14	0.19	0.19	1.00	1.01	0.99	0.99	0.96	0.60	0.60	0.60	0.54	0.54
Bank 8	0.69	0.69	0.73	0.72	0.78	0.65	0.65	0.69	0.71	0.76	0.45	0.43	0.40	0.43	0.36	-0.21	-0.21	-0.24	-0.22	-0.30
Bank 9	1.01	1.02	1.02	1.02	1.03	0.99	1.01	1.01	1.01	1.02	0.08	0.06	0.06	0.06	0.07	-0.91	-0.93	-0.94	-0.94	-0.94
Bank 10	1.60	1.38	1.22	1.04	1.64	0.91	0.83	0.80	0.72	0.97	0.61	0.86	0.80	0.82	0.40	-0.27	-0.19	-0.14	-0.08	-0.19

Table E.2: Liability liquidity ratios for selected South African banks – Part 1

	Total-deposit-to-total-liability ratio					Equity-to-total-asset ratio				
	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07
Total banks	4.46	4.53	4.59	4.35	4.11	0.080	0.077	0.076	0.079	0.081
Bank 1	6.97	6.63	4.58	4.22	4.41	0.085	0.082	0.081	0.082	0.086
Bank 2	5.21	5.57	6.22	4.87	5.11	0.095	0.091	0.082	0.088	0.089
Bank 3	3.64	3.66	4.39	4.19	3.65	0.069	0.066	0.066	0.069	0.068
Bank 4	13.72	24.59	21.92	20.73	6.37	0.050	0.035	0.038	0.047	0.058
Bank 5	0.43	0.50	0.33	0.56	0.76	0.291	0.293	0.281	0.217	0.228
Bank 6	2.15	2.38	2.64	2.73	2.90	0.388	0.371	0.415	0.406	0.483
Bank 7	27.25	24.74	21.83	26.46	25.75	0.204	0.207	0.209	0.222	0.221
Bank 8	3.23	3.43	3.62	3.70	3.33	0.072	0.071	0.071	0.111	0.108
Bank 9	1.03	1.03	1.02	1.02	1.02	0.110	0.102	0.098	0.097	0.102
Bank 10	8.48	5.94	5.71	13.53	19.63	0.564	0.633	0.619	0.600	0.644

Table E.3: Liability liquidity ratios for selected South African banks – Part 2

	Percentage demand deposits					Percentage short-term deposits					Percentage medium-term deposits					Percentage long-term deposits				
	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07	Apr-06	Jul-06	Oct-06	Jan-07	Apr-07
Total banks	41.61%	44.63%	43.68%	43.20%	41.93%	19.11%	20.62%	20.94%	21.88%	18.34%	22.11%	17.50%	18.93%	17.43%	20.30%	17.18%	17.24%	16.45%	17.49%	19.43%
Bank 1	41.12%	42.89%	40.32%	38.85%	35.30%	20.76%	26.04%	24.78%	23.88%	20.03%	27.20%	18.87%	19.02%	19.31%	23.90%	10.92%	12.20%	15.88%	17.97%	20.77%
Bank 2	42.68%	46.29%	46.98%	47.38%	47.03%	18.92%	21.14%	19.63%	18.29%	16.00%	25.20%	19.68%	21.40%	19.28%	21.68%	13.20%	12.89%	11.99%	15.05%	15.29%
Bank 3	46.25%	50.18%	49.23%	48.42%	48.70%	16.18%	16.33%	17.51%	21.67%	15.80%	16.39%	13.54%	17.47%	12.78%	14.74%	21.18%	19.95%	15.79%	17.13%	20.76%
Bank 4	62.20%	56.25%	60.92%	57.95%	53.48%	13.61%	15.53%	18.48%	24.71%	20.41%	16.90%	24.15%	16.04%	12.52%	22.22%	7.29%	4.07%	4.56%	4.82%	3.89%
Bank 5	25.83%	22.04%	10.25%	11.43%	12.49%	6.56%	9.03%	3.83%	6.24%	9.74%	27.94%	23.43%	41.57%	26.48%	21.18%	39.67%	45.49%	44.36%	55.85%	56.60%
Bank 6	1.12%	1.01%	0.91%	0.88%	0.93%	50.99%	55.21%	60.73%	61.72%	64.29%	1.35%	1.68%	0.55%	0.71%	0.30%	46.55%	42.10%	37.81%	36.69%	34.47%
Bank 7	0.00%	0.13%	0.01%	0.17%	0.12%	88.24%	87.41%	87.80%	87.08%	87.09%	9.63%	9.99%	9.45%	9.79%	9.75%	2.14%	2.47%	2.74%	2.95%	3.04%
Bank 8	0.00%	0.00%	0.00%	0.00%	0.00%	44.91%	46.65%	46.03%	48.01%	44.40%	27.50%	27.42%	29.47%	25.11%	25.85%	27.59%	25.93%	24.50%	26.88%	29.75%
Bank 9	2.51%	2.50%	2.23%	2.16%	2.18%	0.08%	0.07%	0.01%	0.04%	0.01%	0.09%	0.09%	0.13%	0.07%	0.10%	97.31%	97.34%	97.64%	97.73%	97.71%
Bank 10	39.60%	49.24%	65.02%	71.50%	63.05%	30.90%	18.05%	6.66%	8.17%	20.07%	17.75%	15.91%	12.33%	12.94%	11.79%	11.76%	16.80%	16.00%	7.39%	5.09%

Appendix F Liquidity risk questionnaire

1. Do you perceive liquidity risk to pose a threat to your bank?

2. What economic factors (external factors) and operational factors (internal factors) could trigger a liquidity crisis at your bank/a bank?

3. Do you perceive liquidity risk to pose a threat to the banking system as a whole in South Africa? I.e. does it pose a systemic threat?

4. What kind of contingency funding plan does your bank have in place?

5. Normally a liquidity crisis spreads from big banks to smaller ones. It is often said that South Africa is a special case and that a liquidity crisis will spread from the smaller banks upwards to the bigger banks after the Saambou (7^{th} largest at the time) and BoE (6^{th} largest at the time) crises. Do you agree with this view and why?

6. What event(s) could trigger a systemic liquidity crisis? How will it spread?

7. What liquidity risk mitigating factors/instruments does your bank have in place?

8. What do you perceive as liquidity risk mitigating factors in the South African banking system?

9. What would prevent the same kind of crises as the Saambou and BoE crises from happening again?

10. Considering these mitigating factors, do you think it is necessary for a capital charge for liquidity risk in South Africa? If so, what should the basis of its calculation be? And how large should such a requirement be to prevent liquidity crises from happening?

11. Would capital be an effective mitigant for liquidity risk?

List of References

AAA *see* AMERICAN ACADEMY OF ACTUARIES.

ABSA GROUP LIMITED. 2007. *ABSA Group Limited Shareholder Report 2006.* April. Johannesburg, South Africa.

ACTS *see* SOUTH AFRICA.

ALGORITHMICS. 1999. Making a Scene, *Research Quarterly, Volume Z No. 3.* September. Toronto, Canada. [Internet] http://www.algorithmics.com/research/sep99/arq-makingascene.pdf [Date of use: 12 February 2007].

AMERICAN ACADEMY OF ACTUARIES. 2000. *Report of the Life Liquidity Work Group of the American Academy of Actuaries to the NAIC's Life Liquidity Working Group.* 2 December. Boston, United States of America. [Internet] https://www.actuary.org/pdf/naic/lifeliq_1200.pdf [Date of use: 25 July 2007].

ANON. 2005. *South Africa: Tackling the Legacy of Apartheid.* January. South-Western, a Division of Thomson Learning. [Internet] http://www.swlearning.com/economics/kennett/kennett2e/Kennett_SouthAfrica.pdf [Date of use: 27 November 2007].

APRA *see* AUSTRALIAN PRUDENTIAL REGULATORY AUTHORITY.

ASIAN DEVELOPMENT BANK. 2001. *Strengthening the Banking Supervision and Liquidity Risk Management System of the People's Bank of China, Final Report.* 15 June. Manila, Philippines. [Internet] http://www.adb.org/Documents/Reports/TAR3098/TA3098_Main_Report.pdf [Date of use: 15 February 2007].

ASPACHS, O., NIER, E. and TIESSET, M. 2005. *Liquidity, Banking Regulation, and the Macroeconomy: Evidence on Bank Liquidity Holdings from a Panel of UK-Resident Banks.* February. London, England. [Internet] http://www.bis.org/bcbs/events/rtf05AspachsNierTiesset.pdf [Date of use: 6 March 2007].

AUSTRALIAN PRUDENTIAL REGULATORY AUTHORITY. 2000a. *Guidance Note on Liquidity Management Strategy.* September. Sydney, Australia. [Internet] http://www.apra.gov.au/policy/final_adi_standards/AGN210.1.pdf [Date of use: 19 March 2007].

AUSTRALIAN PRUDENTIAL REGULATORY AUTHORITY. 2000b. *Guidance Note on Minimum Liquidity Holdings.* August. Sydney, Australia. [Internet] http://www.apra.gov.au/policy/final_adi_standards/AGN210.3.pdf [Date of use: 19 March 2007].

AUSTRALIAN PRUDENTIAL REGULATORY AUTHORITY. 2000c. *Guidance Note on Scenario Analysis.* September. Sydney, Australia. [Internet] http://www.apra.gov.au/policy/final_adi_standards/AGN210.2.pdf [Date of use: 19 march 2007].

AZIAKPONO, M., DE ANGELIS, C. and FAURE, P. 2005. *The Transmission of Monetary Policy under the repo System in South Africa: An Empirical Analysis, A Paper Presented at the Biennial Conference of the Economic Society of South Africa.* 7-9 September. Durban, South Africa. [Internet] http://www.essa.org.za/download/2005Conference/De%20Angelis.pdf [Date of use: 12 November 2007].

BAMBER, R., FALKENA, H., LLEWELLYN, D. and STORE, T. 2001. *Financial Regulation in South Africa.* South African Financial Sector Forum. Johannesburg, South Africa.

BANCO DE PORTUGAL. 2006. *Financial Stability Report 2005.* July. Lisbon, Portugal. [Internet] http://www.bportugal.pt/publish/REF/cap5_05_e.pdf [Date of use: 6 March 2007].

BANGIA, A., DIEBOLD, F. X., SCHUERMAN, T. and STROUGHAIR, J. D. 1999. Modeling Liquidity Risk, With Implications for Traditional Market Risk Measurement and Management, *Working Paper No. 99-06.* Wharton Financial Institutions Center, University of Pennsylvania. November. Philadelphia, United States of America.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1988. *International Convergence of Capital Measurement and Capital Standards.* July. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1992. *A Framework for Measuring and Managing Liquidity.* September. Basel, Switzerland. [Internet] http://www.bis.org/publ/bcbs10b.pdf [Date of use: 6 March 2007].

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1996. *Amendment to the Capital Accord to Incorporate Market Risks.* January. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1997a. *Core Principles for Effective Banking Supervision.* September. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1997b. *Consultative Document – Pillar II (Supervisory Review Process).* September. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1998. *Amendment to the Capital Accord to Incorporate Market Risks.* April. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1999a. A New Capital Adequacy Framework, *Consultative Paper Issued by the Basel Committee on Banking Supervision.* June. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 1999b. *Capital Requirements and Bank Behaviour: The Impact of Basel II, Working Paper Number 1.* April. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2000a. *Principles for the Management of Credit Risk.* September. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2000b. *Sound Practices for Managing Liquidity in Banking Organisations.* February. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2001a. *Conducting a Supervisory Self-Assessment – Practical Application.* April. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2001b. *Consultative Document – Pillar II (Supervisory Review Process).* January. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2001c. *The Joint Forum: Risk Management Practices and Regulatory Capital, Cross-Sectoral Comparison.* November. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2002. *Sound Practices for the Management and Supervision of Operational Risk.* July. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2004a. *Bank Failures in Mature Economies, Working Paper Number 13.* April. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2004b. *International Convergence of Capital Measurement and Capital Standards, A Revised Framework.* June. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2004c. *Principles for the Management and Supervision of Interest Rate Risk.* July. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2005a. *Amendment to the Capital Accord to Incorporate Market Risks.* November. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2005b. *International Convergence of Capital Measurement and Capital Standards, A Revised Framework.* June. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2006a. *Core Principles Methodology.* October. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2006b. *International Convergence of Capital Measurement and Capital Standards, A Revised Framework.* July. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2006c. *Report on International Developments in Banking Supervision, Report No. 15.* September. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2006d. Risk and Liquidity in a System Context, *BIS Working Paper Number 212.* August. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2006e. The Banking System in Emerging Economies: How Much Progress has been made? *BIS Paper Number 28.* August. Basel, Switzerland.

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2006f. *The Joint Forum: The Management of Liquidity Risk in Financial Groups.* May. Basel, Switzerland. [Internet] http://www.bis.org/publ/joint16.pdf

[Date of use: 12 February 2007].

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2007a. Financial Market Developments and the Work of the Basel Committee, *Press Release issued on the BIS Website.* 9 October. Basel, Switzerland. [Internet] http://www.bis.org/press/p071009.htm [Date of use: 22 October 2007].

BANK FOR INTERNATIONAL SETTLEMENTS, Basel Committee on Banking Supervision (BCBS). 2007b. *History of the Basel Committee and its Membership.* January. Basel, Switzerland. [Internet] http://www.bis.org/bcbs/history.pdf [Date of use: 16 May 2007].

BANK OF AMERICA. 2005. *Portrait of a Bank, Annual Report – 2004.* March. Charlotte, United States of America. [Internet] http://www.bankofamerica.com/annualreport/2004/backmatter/mda/mda_liquidityrisk.cfm [Date of use: 6 March 2007].

BANK OF THAILAND. 2003. *Audit Manual for Liquidity Risk.* December. Risk Assessment and Technology Department, Financial Institutions Supervision, Bank of Thailand. Bangkok, Thailand.

BARITSCH, V. 2006. Liquidity Risk – Regulatory Framework, *Presentation Given in London.* Financial Services Authority. 8 August. London, England. [Internet] http://www.isda.org/c_and_a/ppt/VB-LiquidityRiskpresentation08-08-06.ppt [Date of use: 12 February 2007].

BCS *see* BUSINESS CONTROL SOULTIONS.

BELOUSOV, S., and BOBYSHEV, A. 2005. Handling Liquidity Risk in Market Risk Modelling: Practical Experience, *PRMIA Risk Management Conference.* 20 September. Moscow, Russia. [Internet] http://www.gloriamundi.org/picsresources/absb.pdf [Date of use: 13 February 2007].

BERGER, A. N. and BOUWMAN, C. H. S. 2006. *The Measurement of Bank Liquidity Creation and the Effect of Capital.* September. Washington DC, United States of America. [Internet] http://fic.wharton.upenn.edu/fic/papers/07/0702.pdf [Date of use: 13 February 2007].

BERKOWITZ, J. 2000. *Incorporating Liquidity Risk into VaR Models.* Graduate School of Management, University of California, Irvine. 12 September. Irvine, United States of America. [Internet] http://www.uh.edu/~jberkowi/liqrisk.pdf [Date of use: 13 February 2007].

BESSIS, J. 2002. *Risk Management in Banking, 2nd Edition.* John Wiley and Sons Limited. Chichester, England.

BHARATHIDASAN INSTITUTE OF MANAGEMENT. 2006. *Basel II – Integrated Risk Management Solution.* 1 November. Tamil Nadu, India. [Internet] http://www.bim.edu/pdf/Aspeak/Intergrated%20Risk%20Management.pdf [Date of use: 21 May 2007].

BIS *see* BANK FOR INTERNATIONAL SETTLEMENTS.

BLANCO, C. 2003. Financial Liquidity Adequacy for Energy and Commodity Trading Firms, Article in the *Risk Desk, Volume IV Number 6, Special Reprint.* Scudder Publishing. Crownsville, United States of America. [Internet] http://www.blackswanrisk.com/pdf/June04RiskDesk.pdf [Date of use: 2 August 2007].

BONELLI, S. 2005. Early Warning Signals, *Presentation Given by Fitch Rating at the NARUC Accounting/Finance Conference.* 21 September. Salt Lake City, United States of America. [Internet] http://www.puc.idaho.gov/RELATEDSITES/ACCT/2005/21AM%20Bonelli%20Early%20Warning%20Signals%20Fitch%20NARUC%209%2021%2005.ppt [Date of use: 22 February 2007].

BOT *see* BANK OF THAILAND.

BOTHA, Z. 2005. *Introduction to the South African Money market, Manual for South African Institute of Financial Markets RPE Exam.* September. South African Institute of Financial Markets. Johannesburg, South Africa.

BOTHMA, F. 2000. Nine Steps to ALCO Enlightenment, *Article in ALCO Update Volume 12 Number 1.* February. Riskflow Technologies (Pty) Ltd, Johannesburg, South Africa. [Internet] http://www.riskflow.com/DOWNLOAD/VOL12NO1.pdf [Date of use: 14 February 2007].

BRAR, R. 2005. *Liquidity Risk and Impact on Treasury.* 18 April. [Internet] http://www.gtnews.com/article/5886.cfm [Date of use: 31 May 2007].

BRUNNERMEIER, M. K. and PEDERSEN, L. H. 2006. *Market Liquidity and Funding Liquidity.* August. New York, United States of America. [Internet] http://www.rhsmith.umd.edu/finance/pdfs_docs/seminarfall06/Brunnermeier.pdf [Date of use: 21 February 2007].

BUNDESBANK *see* DEUTSCHE BUNDESBANK.

BUSINESS CONTROL SOLUTIONS. 2005. *Basel II Capital Accord: Regulation, Risk and Control.* September. London, England. [Internet] http://www.bcsplc.com/_system/MediaFiles/121.pdf [Date of use: 31 July 2007].

CARRE, S. 2007. Liquidity Management Practices, *Presentation given at APRA Liquidity Risk Management Conference.* 3-4 May. [Internet] http://www.apra.gov.au/Policy/upload/5d-Steve-Carre-Liquidity-management-practices.pdf [Date of use: 25 June 2007].

CASSIDY, C., CHANDRA, V. and YEUNG, K. 2007. Issues for Regulators in Regulating Liquidity Risk, *Presentation given at APRA Liquidity Risk Management Conference.* 2-4 May. [Internet] http://www.apra.gov.au/Policy/upload/2a-Colleen-Cassidy-Issues-for-regulators-in-supervising-liquidity-risk-Australia-s-perspective.pdf [Date of use: 7 June 2007].

CAVALCANTI, R. O., EROSA, A. and TEMZELIDES, T. 2004. Liquidity, Money Creation and Destruction, and the Returns to Banking, *Working Paper Series Number 394.* September. European Central Bank. Frankfurt, Germany. [Internet] http://www.ecb.int/pub/pdf/scpwps/ecbwp394.pdf [Date of use: 23 February 2007].

CAYMAN ISLANDS MONETRAY AUTHORITY. 2003. *Statement of Guidance – Liquidity Risk Management.* October. [Internet] http://www.cimoney.com.ky/uploadedFiles/Regulatory_Framework/Policy_and_Development/Rules,_Statements_of_Guidance_and_Principles/Banking/SOGLiquidityRiskManagement.pdf [Date of use: 24 July 2007].

CBB *see* CENTRAL BANK OF THE BAHAMAS.

CEBS *see* COMMITTEE OF EUROPEAN BANKING SUPERVISORS.

CENTRAL BANK OF EAST TIMOR (BANCO CENTRAL TIMOR-LESTE). 2000. *Instruction CPO/B-2000/2 on Regulatory Capital.* February. Dili, East Timor. [Internet] http://www.bancocentral.tl/Download/Regulations/CPO-B-2000-2.pdf [Date of use: 15 August 2007].

CENTRAL BANK OF THE BAHAMAS. 2005. *Supervisory and Regulatory Guidelines: Guidelines for the Management of Liquidity Risk.* May. Nassau, N.P., Bahamas. [Internet] http://www.centralbankbahamas.com/public/LiqRiskG30.03.05.pdf [Date of use: 7 March 2007].

CHAMP, B. 2003. *Open and Operating: Providing Liquidity to Avoid a Crisis.* Federal Reserve Bank of Cleveland. 15 February. Cleveland, United States of America. [Internet] http://www.clevelandfed.org/research/com2003/0215.pdf [Date of use: 13 February 2007].

CHORAFAS, D. N. 2004. *Economic Capital Allocation under Basel II: Cost, Benefit and Implementation Procedures.* Butterworth-Heinemann. Oxford, England.

CHUNG, B. Y. 2000. Managing Foreign Debt and Liquidity Risks, *Policy Paper Number 8.* September. Bank for International Settlements. Basel, Switzerland. [Internet] http://www.bis.org/publ/plcy08f.pdf [Date of use: 13 February 2007].

CHURCHILL, R. 2006. *The ICAAP Process by HBOS.* October. [Internet] http://www.cml.org.uk/cml/filegrab/RachelChurchill.pdf?ref=5004 [Date of use: 8 March 2007].

CIFUENTES, R., FERRUCCI, G. and SONG SHIN, H. 2004. *Discussion of Liquidity Risk and Contagion.* May. [Internet] http://www.bis.org/bcbs/events/rtf04thakor.pdf [Date of use: 12 February 2007].

CIMA *see* CAYMAN ISLANDS MONETARY AUTHORITY.

CLARKE, J. 2007. Liquidity Risk, *Presentation to the South African Reserve Bank: Bank Supervision Department by CitiGroup.* 28 February. Pretoria, South Africa.

COGNOS. 2003. *Basel II.* June. United States of America. [Internet] http://www.cognos.com/solutions/thankyou/basel2.pdf [Date of use: 30 July 2007].

COMMITTEE OF EUROPEAN BANKING SUPERVISORS. 2004a. *Review of Consultation Paper 03: The Application of the Supervisory Review Process under Pillar 2.* 31 August. Brussels, Belgium. [Internet] http://www.c-ebs.org/documents/8985EACBonCEBSCP03.pdf [Date of use: 8 March 2007].

COMMITTEE OF EUROPEAN BANKING SUPERVISORS. 2004b. *The Application of the Supervisory Review Process under Pillar 2.* May. [Internet] http://www.bundesbank.de/download/bankenaufsicht/pdf/cebs/cebs_srp.pdf [Date of use: 21 May 2007].

COMMITTEE OF EUROPEAN BANKING SUPERVISORS. 2005. *Review of Consultation Paper 03: The Application of the Supervisory Review Process under Pillar 2.* June. Brussels, Belgium. [Internet] http://www.c-ebs.org/Consultation_papers/CP03-second.pdf [Date of use: 21 May 2007].

COMMITTEE OF EUROPEAN BANKING SUPERVISORS. 2006. *Guidelines on the Application of the Supervisory Review Process under Pillar 2 (CP03 Revised).* 25 January. [Internet] http://www.c-ebs.org/pdfs/GL03.pdf [Date of use: 7 June 2007].

DANIELSON, J., EMBRECHTS, P., GOODHART, C., KEATING, C., MUENNICH, F., RENAULT, O. and SHIN, H. S. 2001. An Academic Response to Basel II, *Special Paper No. 130, LSE Financial Markets Group and ESRC Research Centre, Special Papers Series.* May. [Internet] risk.lse.ac.uk/rr/files/JD-01-6-19-992957996-8.pdf [Date of use: 26 June 2007].

DANMARKS NATIONALBANK. 2006. *Financial Stability 2006.* 30 May. Copenhagen, Denmark. [Internet] http://www.nationalbanken.dk/C1256BE9004F6416/side/Financial_Stability_2006/$file/kap07.htm [Date of use: 6 March 2007].

DAVIS, E. P. 2003. Liquidity Management in Banking Crises – *Lecture given at Brunel University, West London.* London, England. [Internet] http://www.zen13767.zen.co.uk/imf%202003-4.pdf [Date of use: 13 February 2007].

DECKER, P. A. 2000. The Changing Character of Liquidity and Liquidity Risk Management: A Regulator's Perspective, *Emerging Issues Series.* Supervision and Regulation Department, Federal Reserve Bank of Chicago. April. Chicago, United States of America. [Internet] http://www.chicagofed.org/publications/publicpolicystudies/emergingissues/pdf/SandR-2000-5.pdf [Date of use: 28 January 2007].

DELLFINER, M., LIPPI, C. and PAILHÉ, C. 2006. Liquidity Risk Management in Banks, International Best Practice and Cases, *MPRA Paper No. 1668.* October. Central Bank of Argentina. Buenos Aires, Argentina.

[Internet] http://mpra.ub.uni-muenchen.de/1168/01/MPRA_paper_1168.pdf

[Date of use: 12 February 2007].

DELOITTE. 2004. International Standards: Implications for Banking Regulation in Developing Countries' Financial Markets, *Southern African Workshop on Financial Regulation and Tiered Banking.* 24 November. Johannesburg, South Africa. [Internet] http://www.finmarktrust.org.za/documents/2004/NOVEMBER/Deloitte_tiered.pdf

[Date of use: 22 February 2007].

DELOITTE and TOUCHE. 2003. Securitisation Schemes, *Presentation given at Auditor's College.* 15 September. Johannesburg, South Africa. [Internet] http://www.reservebank.co.za/internet/Publication.nsf/LADV/147BF3C295FDD83E42256E36004C8BE0/$File/FIST+Regulatory.pdf [Date of use: 14 November 2007].

DERVIZ, A. and KADLČÁKOVÁ, N. 2005. Business Cycle, Credit Risk and Economic Capital Determination by Commercial Banks, *BIS Papers Number 22.* Bank for International Settlements. April. Basel, Switzerland. [Internet] http://www.bis.org/publ/bppdf/bispap22q.pdf [Date of use: 28 February 2007].

DEUTSCHE BANK. 2005. *Annual Report 2004.* 6 April. Frankfurt, Germany. [Internet] http://annualreport.deutsche-bank.com/2004/ar/riskreport/liquidityrisk.php [Date of use:] 6 March 2007.

DEUTSCHE BUNDESBANK. 2006. *Regulation of the Liquidity of Institutions (Liquidity Regulation).* 14 December. Frankfurt, Germany. [Internet] http://www.bundesbank.de/download/bankenaufsicht/pdf/liqv_en.pdf [Date of use: 26 February 2007].

DEUTSCHE BUNDESBANK. 2007a. *Explanatory Memorandum on the Regulation of the Liquidity of Institutions (Liquidity Regulation; Liquiditätsverordnung).* 23 February. Frankfurt, Germany. [Internet] http://www.bundesbank.de/download/bankenaufsicht/pdf/liqbegruendung_en.pdf [Date of use: 26 June 2007].

DEUTSCHE BUNDESBANK. 2007b. *Liquidity – Regulation of the Liquidity of Institutions (Liquidity Regulation; Liquiditätsverordnung).* July. Frankfurt, Germany. [Internet] http://www.bundesbank.de/bankenaufsicht/bankenaufsicht_liquiditaet.en.php [Date of use: 26 July 2007].

DIAMOND, D. W. and DYBVIG, P. H. 1983. Bank Runs, Deposit Insurance and Liquidity, *The Journal of Political Economy, Volume 91, No. 3,* pp 401-419. June. The University of Chicago Press. Chicago, United States of America. [Internet] http://links.jstor.org/sici?sici=0022-3808%28198306%2991%3A3%3C401%3ABRDIAL%3E2.0.CO%3B2-Z [Date of use: 13 February 2007].

DIAMOND, D. W. and LEA, M. J. 1992. Fannie Mae Foundation, *Journal of Housing Research, Volume 3 Issue 1,* Chapter 7: Quantitative Analysis of Efficiency. Office of Housing Policy Research, Washington DC, United States of America. [Internet] http://www.fanniemaefoundation.org/programs/jhr/v3i1-index.shtml [Date of use: 14 February 2007].

DIAMOND, D. W. and RAJAN, R. G. 2000. *Liquidity Risk, Liquidity Creation and Financial Fragility – A Theory of Banking, University of Chicago.* September. The University of Chicago Press. Chicago, United States of America. [Internet] http://faculty.chicagogsb.edu/raghuram.rajan/research/doug1.pdf [Date of use: 13 February 2007].

DICK, K. E., JOHNSON, J. and ROBINSON, J. F. 2001. The Challenges of Sound Liquidity Risk Management: OCC Expectations and Policy for Community Banks, *OCC Telephone Seminar.* 15-16 May. Washington DC, United States of America. [Internet] http://www.occ.treas.gov/LiqRiskMgt%20handouts.pdf [Date of use: 7 March 2007].

DRZIK, J., NAKADA, P. and SCHUERMANN, T. 1998. Risk Capital Measures in Financial Institutions: Part 1 – The Debt Holder's Perspective, Article in *Erisk Magazine.* 30 July. [Internet] http://www.erisk.com/Learning/Research/063_rskcapval.pdf [Date of use: 31 May 2007].

DUSIC, S. and RIEGGERT, P. 2005. Financial Risk Management Framework – Cash Flow at Risk, *Presentation given at the Annual Conference of the Croatian Association of Corporate Treasurers.* September. Zagreb, Croatia. [Internet] http://www.treasury.hr/docs/HukrHR/DokumentiTekst/32/0.0/Original.ppt [Date of use: 16 August 2007].

DU TOIT, D. 2005. *Introduction to the Forex Market – A South African Perspective, Manual for South African Institute of Financial Markets RPE Exam.* November. South African Institute of Financial Markets. Johannesburg, South Africa.

EBIC *see* EUROPEAN BANKING INDUSTRY COMMITTEE.

ECB *see* EUROPEAN CENTRAL BANK.

ECKBO, B. E. and NORLI, Ø. 2002. *Pervasive Liquidity Risk.* November. University of Toronto. Toronto, Canada. [Internet] http://mba.tuck.dartmouth.edu/pages/faculty/espen.eckbo/PDFs/Pre-Pub/EckbNorlLIQ1102.pdf [Date of use: 15 February 2007].

ELIZALDE, A. and REPULLO, R. 2004. Economic and Regulatory Capital: What is the Difference? *CEMFI Working Paper Number 0422.* December. CEMFI, Madrid, Spain. [Internet] ftp://ftp.cemfi.es/wp/04/0422.pdf [Date of use: 28 February 2007].

ENGLER, P., JOKIPII, T., MERKL, C., KALTWASSER, P. R. and VINHAS DE SOUZA, L. 2005. The Effect of Capital Requirement Regulation on the Transmission of Monetary Policy: Evidence from Austria, *Working Paper 99.* 23 May. Oesterreichische Nationalbank, Vienna, Austria. [Internet] http://www.oenb.at/de/img/wp99_tcm14-28885.pdf [Date of use: 15 February 2007].

ESTRADA, D. and OSORIO, D. R. 2006. *A Market Risk Approach to Liquidity Risk and Financial Contagion.* Banco de la Republica. February. Bogotá, Colombia. [Internet] http://www.banrep.gov.co/docum/ftp/borra384.pdf [Date of use: 14 February 2007].

ESTRELLA, A. 2000. Regulatory Capital and the Supervision of Financial Institutions: Some Basic Distinctions and Policy Choices, *Sveriges Riksbank Workshop on Challenges for Central Banking.* 14-15 January. Stockholm, Sweden. [Internet] http://www.newyorkfed.org/research/economists/estrella/s2000.pdf [Date of use: 14 August 2007].

EUROPEAN BANKING INDUSTRY COMMITTEE. 2005. *EBIC Position Paper on the Proposed Capital Requirements Directive.* 24 March. Brussels, Belgium. [Internet] http://www.leaseurope.org/pages/Studies_and_Statements/Statements/z_EBIC%20PP%20on%20CRD%20Final.pdf [Date of use: 2 August 2007].

EUROPEAN CENTRAL BANK. 2002. *Developments in Banks' Liquidity Profile and Management.* May. Frankfurt, Germany. [Internet] http://www.ecb.int/pub/pdf/other/banksliquidityprofile02en.pdf [Date of use: 15 July 2007].

FALKENSTEIN, E. 1997. Accounting for Economic AND Regulatory Capital in RAROC Analysis, Article in *Bank Accounting and Finance Journal, Volume 11, Number 11, Fall.* November. [Internet] http://www.efalken.com/rarocreg.PDF [Date of use: 28 February 2007].

FARIN, T. A. 2004. *Implementing Best Practices in Asset/Liability Management – Part 1: Establishing a Solid Decision-making Framework.* June. Fitchburg, United States of America. [Internet] http://www.cyfi.com/media/documents/pdf/best_practices_pt1.pdf [Date of use: 19 March 2007].

FAURE, A. P. 2002. *Getting to grips with the Money market.* The Financial Markets College (Pty) Ltd. Cape Town, South Africa.

FAURE, A. P. 2006. *The Derivatives Market, Manual for South African Institute of Financial Markets Derivatives RPE Exam.* February. South African Institute of Financial Markets. Johannesburg, South Africa.

FAYMAN, J. 2004. *Extended Time Horizon VaR: A Comparison of Measurement Methods.* Honours Project: School of Computational and Applied Mathematics, University of the Witwatersrand. 8 December. Johannesburg, South Africa.

FEDERAL RESERVE BANK. 2006. *Federal Reserve Statistical Release: Money Stock Measures – Discontinuance of M3.* 9 March. [Internet] http://www.federalreserve.gov/releases/h6/discm3.htm [Date of use: 26 June 2007].

FEDERATION BANCAIRE FRANCAISE. 2006. *Response to Consultation Paper CP 12 (CP 12) on Stress Testing Under the Supervisory Review Process,* Letter. 27 September. Paris, France. [Internet] http://www.c-ebs.org/documents/FBF_CP12.pdf [Date of use: 21 February 2007].

FERNANDEZ, F. A. 1999. *Liquidity* Risk – New Approaches to Measurement and Monitoring, *Securities Industry Association Working Paper.* December. New York, United States of America. [Internet] http://www.sia.com/research/pdf/workingpaper.pdf [Date of use: 21 February 2007].

FILENET. 2007. Basel II: From Compliance to Competitive Advantage, *Whitepaper for Banking and Financial Markets.* January. Costa Mesa, United States of America. [Internet] http://www.filenet.com/English/Industry_Solutions/Financial_Services/BaselCompliance.pdf [Date of use: 21 May 2007].

FINANCIAL SERVICES AGENCY. 2002. *Liquidity Risk Management Systems Checklist, Inspection Manual for Deposit-Taking Institutions.* June. The Japanese Government. Japan. [Internet] http://www.fsa.go.jp/en/refer/manual/yokin_e/y07.pdf [Date of use: 12 February 2007].

FINANCIAL SERVICES AUTHORITY. 2002. Liquidity Risk in the Integrated Prudential Sourcebook: Systems and Controls Chapter, *Consultation Paper 128.* March. London, England. [Internet] http://www.fsa.gov.uk/pubs/cp/cp128.pdf [Date of use: 16 February 2007].

FINANCIAL SERVICES AUTHORITY. 2003. *Overview of the SREP Framework Proposed for use by the FSA.* March. [Internet] http://www.fsa.gov.uk/pages/About/What/International/pdf/SREP_overview.pdf [Date of use: 8 March 2007].

FINANCIAL SERVICES AUTHORITY. 2004. *Report on Pillar 2 Thematic Visits.* April. London, England. [Internet] http://www.fsa.gov.uk/pubs/international/basel_p2thematic.pdf [Date of use: 8 March 2007].

FINANCIAL SERVICES AUTHORITY. 2006a. *ICAAP Submission Suggested Format.* November. London, England. [Internet] http://www.fsa.gov.uk/pages/About/What/International/pdf/ICAAP_sub.pdf [Date of use: 19 March 2007].

FINANCIAL SERVICES AUTHORITY. 2006b. *Pillar II: Issues Under Discussion, Insurance Standing Group.* September. London, England. [Internet] http://www.fsa.gov.uk/pubs/international/isg_pil2.pdf [Date of use: 13 February 2007].

FINANCIAL SERVICES AUTHORITY. 2006c. *Overview of the SREP Framework Proposed for use by the FSA.* March. [Internet] http://www.fsa.gov.uk/pages/About/What/International/pdf/SREP_overview.pdf [Date of use: 8 March 2007].

FINANCIAL SERVICES ROUNDTABLE. 1999. Guiding Principles in Risk management for US Commercial Banks, *Report of the Subcommittee and Working Group on Risk Management Principles.* June. United States of America. [Internet] http://www.fsround.org/media/pdfs/riskmgmt.pdf [Date of use: 3 August 2007].

FINANCIAL SUPERVISION COMMISSION. 2005. *A Consultative Paper on Liquidity Risk Management Policies for Banks.* Isle of Man Government. 31 January. [Internet] http://www.gov.im/lib/docs/fsc/Consultative/Banking/s4liquidity.pdf [Date of use: 15 February 2007].

FINANSINSPEKTIONEN. 2005. Institutions' Internal Capital Adequacy Assessment Process – Assessment of Capital Adequacy under Basel II, *Journal No. 05-5939-350.* 26 September. Stockholm, Sweden. [Internet] http://www.fi.se/upload/90_English/20_Publications/10_Reports/Report2005_8.pdf [Date of use: 21 May 2007].

FINKELSTEIN, G., HOSHINO, T., INO, R. and MORGAN, E. 2006. *Economic Capital Modelling: Practical Considerations.* 14 December. Milliman Inc. New York, United States of America. [Internet] http://latinamerica.milliman.com/research_resources/Economic-Capital-Modeling-Practical-Considerations-12-14-06.pdf [Date of use: 6 March 2007].

FIRSTRAND BANK LIMITED. 2006. *2006 Annual Report.* November. Johannesburg, South Africa.

FOX, I. 2007. HBOS Approach to Liquidity Risk, *Presentation given at APRA Liquidity Risk Management Conference.* 3-4 May. [Internet] http://www.apra.gov.au/Policy/upload/5b-Ian-Fox-HBOS-approach-to-liquidity-risk.pdf [Date of use: 25 June 2007].

FRESE, T. 2005. Liquidity Risk in the Focus of Banking Supervision, Article in *X-News – The FlexFinance News Magazine, Edition 3.* October. {Internet] http://www.flexfinanceloan.com/inc/download.php?file=Xnews_Edition_3_E.pdfandpath=media/pdf/ [Date of use: 24 July 2007].

FSA *see* FINANCIAL SERIVES AUTHORITY.

FSC *see* FINANCIAL SUPERVISION COMMISSION.

GA *see* GENESIS ANALYTICS.

GATEV, E., SCHUERMAN, T. and STRAHAN, P. E. 2004. How do banks Manage Liquidity Risk? Evidence From Equity and Deposit markets in the Fall of 1998, *NBER Working Paper Number 10982.* December. Cambridge, United States of America. [Internet] http://www.nber.org/papers/w10982 [Date of use: 15 February 2007].

GENESIS ANALYTICS. 2004. *A Policy Lens to view Financial Regulation, Prepared for FinMark Trust.* December. [Internet] http://www.finmarktrust.org.za/documents/2005/JANUARY/Fin_regulation.pdf [Date of use: 26 November 2007].

GOODSPEED, I. 2002. ALCO Terms of Reference, Article in *ALCO Update Volume 14 Number 1.* May. Riskflow Ltd, Johannesburg, South Africa. [Internet] http://www.riskflow.com/DOWNLOAD/VOL14NO1.pdf [Date of use: 14 February 2007].

GOVERNMENT HOUSING BANK, THAILAND. 2005. *Annual Report 2005 - Risk Management.* December. Bangkok, Thailand. [Internet] http://www.ghb.co.th/eng/aboutus/ar/48/13.pdf [Date of use: 13 February 2007]. p49-53.

GREENSPAN, A. 1999. Currency Reserves and Debt, *Remarks made by the Chairman before the World Bank Conference on Recent Trends in Reserves Management.* 29 April. Washington, United States of America. [Internet] http://www.federalreserve.gov/boardDocs/speeches/1999/19990429.htm [Date of use: 23 July 2007].

GUIDOTTI, P. E. 1999. Remarks to the G-33 Seminar. 11 March. Bonn, Germany.

GUIDOTTI, P. E. 2002. *Toward a Liquidity Risk Management Strategy for Emerging Market Economies, Revised.* March. Buenos Aires, Argentina. [Internet] 200.32.4.58/~pguidotti/global.finance.pdf [Date of use: 2 August 2007].

GUNNION, S. 2007. Bank Reserve Hike 'Not the Best way to cut Debt', Article in *Business Day.* 13 February. Johannesburg, South Africa. [Internet] http://www.businessday.co.za/articles/article.aspx?ID=BD4A383897 [Date of use: 13 February 2007].

HALL, C. 2006. *ICAAP: What Would be useful to Management and the Regulator?* February. London, England. [Internet] http://www.garp.com/library/Meets/GARPICAAP.PDF [Date of use: 8 March 2007].

HAWKINS, P. and BERTOLDI, A. 2005. The Impact of the Dedicated Banks Bill on Access to Financial Services – *A Report Prepared for FinMark Trust.* July. South Africa. [Internet] http://www.finmarktrust.org.za/documents/2005/JULY/DBB_report.pdf [Date of use: 25 June 2007].

HEATH, D. and KU, H. 2005. *Liquidity Risk with Coherent Risk Measures.* February. Pittsburg, United States of America. [Internet] http://www.gloriamundi.org/ShowTracking.asp?ResourceID=453057782 [Date of use: 25 January 2007].

HKMA *see* HONG KONG MONETARY AUTHORITY.

HOGGARTH, G., REIDHILL, J. and SINCLAIR, P. 2003. Resolution of Banking Crises: An Overview, Article in *Financial Stability Review 2003.* Bank of England. December. London, England. [Internet] http://www.bankofengland.co.uk-publications-fsr-2003-fsr15art6 [Date of use: 25 February 2007].

HOLTON, G. A. 2004. *Capital Calculations – Has the CCRO Missed the Point?* January. [Internet] http://www.riskexpertise.com/papers/Capital.PDF [Date of use: 16 August 2007].

HONG KONG MONETARY AUTHORITY. 2004. *Supervisory Policy Manual – Liquidity Risk Management, Version 1.* 20 August. Hong Kong. [Internet] http://www.info.gov.hk/hkma/eng/bank/spma/attach/LM-1.pdf [Date of use: 16 February 2007].

HONG KONG MONETARY AUTHORITY. 2006. *Supervisory Policy Manual – Supervisory Review Process, Version 1.* 10 November. Hong Kong. [Internet] http://www.info.gov.hk/hkma/eng/bank/spma/attach/CA-G-5.pdf [Date of use: 10 May 2007].

IFSRA *see* IRISH FINANCIAL SERVICES REGULATORY AUTHORITY.

IIF *see* INSTITUTE OF INTERNATIONAL FINANCE.

IMF see INTERNATIONAL MONETARY FUND.

INSTITUTE OF INTERNATIONAL FINANCE. 2007. *Principles of Liquidity Risk Management.* March. Washington DC, United States of America.

INTERNATIONAL MONETARY FUND. 2006. *Financial Sector Assessment Programme – Australia, Supporting Materials for Assessment against the Basel Core Principles.* October. Washington DC, United States of America. [Internet] http://www.apra.gov.au/AboutAPRA/upload/IMF-Financial-System-Stability-Assessment.pdf [Date of use: 7 June 2007].

INVESTEC PLC AND INVESTEC LIMITED. 2006. *2006 Annual Report.* June. Johannesburg, South Africa.

IRISH FINANCIAL SERVICES REGULATORY AUTHORITY. 2006a. *Requirements for the Management of Liquidity Risk, Regulatory Document for Credit Institutions.* 28 June. Dublin, Ireland. [Internet] http://www.ifsra.ie/data/in_bci_files/Requirements%20for%20the%20Management%20of%20Liquidity%20Risk%20FINAL%20June%2006.pdf [Date of use: 8 March 2007].

IRISH FINANCIAL SERVICES REGULATORY AUTHORITY. 2006b. *Review and Evaluation of ICAAP/Dialogue with Institutions – Supervisory Disclosure.* 31 December. Dublin, Ireland. [Internet] http://www.ifsra.ie/data/in_sdi/Review%20and%20Evaluation%20of%20ICAAP%20-%20Dialogue%20with%20Institutions.pdf [Date of use: 8 March 2007].

JARROW, R. A. and PROTTER, P. 2005. *Liquidity Risk and Risk Measure Computation.* 27 February. New York, United States of America. [Internet] http://www.gloriamundi.org/picsresources/rajpep.pdf [Date of use: 14 February 2007].

JOACHIM, G. 2007. *Personal Interview with Gunter Joachim: Managing Director, MGP (Pty) Ltd.* 21 November. Pretoria, South Africa.

JOBST, A. 2005. *Asset Securitisation as a Risk Management and Funding Tool: What does it hold in store for SMEs?* December. Germany. [Internet] http://www.securitization.net/publications/pdfs/Jobst_AssetSec_Apr05.pdf [Date of use: 14 November 2007].

JOSHI, M. S. 2005. *Basel II: Three Steps of Governance.* Risk Management Group, KPIT Summins. Bangalore, India. January. [Internet] http://www.indiaforensic.com/basel-ii.pdf [Date of use: 10 May 2007].

KAPSTEIN, E. B. 2006. Architects of Stability? International Co-operation among Financial Supervisors, *BIS Working Papers, Number 199.* Monetary and Economic Department, Bank for International Settlements. February. Basel, Switzerland.

KAROLY, V. 2006. *A Case Study of South African Commercial Mortgage Back Securitisation.* November. Pretoria: University of South Africa. (Dissertation – M.Com).

KAUFMAN, G. G. 1999. *Do Lender of Last Resort Operations Require Supervision?* Loyola University Chicago and Federal Reserve Bank of Chicago. 19 November. Chicago, United States of America. [Internet] http://www.sba.luc.edu/centers/finpol/LLR.pdf [Date of use: 16 February 2007].

KOCH, T. W. and MacDONALD, S. S. 2006. *Management of Banking, Sixth Edition – International Student Edition.* Thomson South-Western, a part of the Thomson Corporation. Mason, United States of America.

KPMG INTERNATIONAL. 2004. Basel II: A Closer Look – Managing Economic Capital, *Financial Advisory Services, Publication Number 209-772.* October. KPMG International. [Internet] http://www.greta.it/credit/credit2006/talk/Tuesday_26/1_Acharya.pdf [Date of use: 28 February 2007].

KPMG INTERNATIONAL. 2005a. Spotlight on Economic Capital, *Financial Advisory Services, Publication Number 211486.* April. KPMG International. [Internet] http://www.kpmg.com/Industries/FS/Other/PDFEconomicCapital.htm [Date of use: 28 February 2007].

KPMG INTERNATIONAL. 2005b. Spotlight on Liquidity Risk Management, *Financial Advisory Services, Publication Number 211940.* April. KPMG International. Internet] http://www.kpmg.com/Industries/FS/Other/PDFLiquidityRisk.htm [Date of use: 12 February 2007].

KRONSEDER, C. 2003a. *Liquidity Risk Management: An Introduction.* 13 May. Credit Suisse First Boston. Boston, United Sates of America. [Internet] http://www.gtnews.com/article/4988.cfm [Date of use: 21 February 2007].

KRONSEDER, C. 2003b. *Measuring Liquidity Risk.* 25 May. Credit Suisse First Boston. Boston, United Sates of America. [Internet] http://www.gtnews.com/article/5044.cfm [Date of use: 21 February 2007].

KRONSEDER, C. 2003c. *Managing Liquidity Risk.* 20 August. Credit Suisse First Boston. Boston, United Sates of America. [Internet] http://www.gtnews.com/article/5125.cfm [Date of use: 21 February 2007].

KRONSEDER, C. 2004. *Best Practices for Liquidity Risk Management.* 27 January. Credit Suisse First Boston. Boston, United Sates of America. [Internet] http://www.gtnews.com/article/5327.cfm [Date of use: 21 February 2007].

KRONSEDER, C. and KUBLI, H. R. 2003. *Managing Liquidity Risk.* 20 August. Credit Suisse First Boston. Boston, United Sates of America. [Internet] http://www.sensalis.com/Publikationen/Managing%20Liquidity%20Risk.pdf [Date of use: 15 February 2007].

KU, H. 2005. *Liquidity Risk with Coherent Risk Measures.* November. Toronto, Canada. [Internet] http://www.math.yorku.ca/~hku/liquidity.pdf [Date of use: 25 January 2007].

LACHAPELLE, E. and LENORMAND, T. 2007. *A Whitepaper on Basel II.* Veridion Inc. Montreal, Canada. [Internet] http://www.veridion.net/Page-Level1/Basel2/BaselII_En_WP.pdf [Date of use: 31 July 2007].

LARGE, A. 2005. Financial Stability – Managing Liquidity Risk in a Global System, *Speech by Sir Andrew Large – Deputy Governor of the Bank of England at the Fourteenth City of London Central Banking and Regulatory Conference.* 28 November. London, England. [Internet] http://www.bankofengland.co.uk/publications/speeches/2005/speech261.pdf [Date of use: 5 February 2007].

LUÜS, C. 2007. *ABSA Econotrends, Cash Reserve Requirements: The use of Cash Reserve Requirements to Curtail Credit Demand.* 13 February. Johannesburg, South Africa.

MAHADEVAN, A. 2001. *Incorporating Liquidity Risk in VaR Estimation.* August. ICICI Bank, Research Centre. Chennai, India. [Internet] http://www.gloriamundi.org/picsresources/mlr.pdf [Date of use: 14 February 2007].

MAKOFF, G. 1999. Liquidity Risk Management for Emerging Market Borrowers, *Presentation by Salomon Smith Barney – A Member of CitiGroup.* 2 November. Salomon Smith Barney. [Internet] http://treasury.worldbank.org/web/pdf/makoff.pdf [Date of use: 23 January 2007].

MARCHBANKS, C. F. 2007. Supervision of Liquidity Risk Management – US Regulatory Issues, *Presentation given at APRA Liquidity Risk Management Conference.* 3-4 May. [Internet] http://www.apra.gov.au/Policy/upload/2b-Craig-Marchbanks-Supervision-of-liquidity-risk-management-US-regulatory-issues.pdf [Date of use: 7 June 2007].

MARCUS, G. 2000. Issues for Consideration in Mergers and Take-overs, from a Regulatory Perspective – *Statement Issued by Ms G. Marcus, Deputy Governor of the South African Reserve Bank.* 18 July. Pretoria, South Africa. [Internet] http://www.reservebank.co.za/internet/Publication.nsf/WCEV/78995483DB3859E542256B4100329FB2/?opendocument [Date of use: 7 September 2007].

MARTIN, A. 2007. Liquidity Risk Stress Testing – Scenario Modelling in a Globally Active Bank, *Presentation given at APRA Liquidity Risk Management Conference.* 3-4 May. [Internet] http://www.apra.gov.au/Policy/upload/7b-Andrew-Martin-Scenario-modelling-in-a-globally-operating-bank.pdf [Date of use: 7 June 2007].

MAS *see* MONETARY AUTHORITY OF SINGAPORE.

MATZ, L. and NEU, P. 2007. *Liquidity Risk Measurement and Management: A Practitioner's Guide to Global Best Practices.* John Wiley and Sons (Asia) Pte Ltd. Singapore.

MBOWENI, T. T. 2004. The South African Banking Sector: An Overview of the past ten years, *Address by Mr TT Mboweni, Governor of the South African Reserve Bank, at the year-end media cocktail function.* 14 December. [Internet] http://www.reservebank.co.za/internet/publication.nsf/0/4C59EEA3FBC055C342256F6A00448757?opendocument [Date of use: 26 November 2007].

McLAUGHIN, M. and SEGAL, S. 2006. *Unlocking the Value of Economic Capital, Deloitte Financial Services.* June. Deloitte Touche Tohmatsu. London, England. [Internet] http://www.deloitte.com/dtt/cda/doc/content/dtt_fsi_UnlockingtheValuein%20EC_2006-07-17.pdf [Date of use: 28 February 2007].

MEH, C. and MORAN, K. 2003. *Bank Capital, Agency Costs, and Monetary Policy.* 22 October. Bank of Canada. Ontario, Canada. [Internet] http://economics.uwo.ca/centres/epri/monetaryconference/papers/Meh.pdf [Date of use: 21 February 2007].

MEISTER, E. 2005. Pillar 2 in Basel II – Supervisory Implications and Implementation in Germany, *Presentation given at a Seminar at the Bank of Russia: "The Supervisory Implications of Basel II".* 20 April. Moscow, Russia. [Internet] http://www.bis.org/review/r050426i.pdf [Date of use: 21 May 2007].

MENDOZA, J.C. AND STEPHANOU, C. 2005. Credit Risk Measurement under Basel II: An Overview and Implementation Issues for Developing Countries, *World Bank Policy Research Working Paper No. 3556.* April. World Bank. Washington DC, United States of America. [Internet] http://www.ifc.org/ifcext/rbcgp.nsf/AttachmentsByTitle/CreditRiskBasel2.pdf/$FILE/CreditRiskBasel2.pdf [Date of use: 26 July 2007].

MIERZEJEWSKI, F. 2006. *Economic Capital Allocation Under Liquidity Constraints.* April. Faculty of Economy and Applied Economy, Katholieke Universiteit, Leuven. Brussels, Belgium. [Internet] http://www.econ.kuleuven.be/insurance/pdfs/fmeca2.pdf [Date of use: 28 February 2007].

MISHKIN, F. S. 2003. *The Economics of Money, Banking, and Financial Markets, 7th Edition –.* 11 July. Addison Wesley Economics Series. Indianapolis, United States of America.

MITCHELL-INNES, H. A. 2006. *The Relationship between Interest Rates and Inflation in South Africa: Revisiting Fisher's Hypothesis.* May. Grahamstown: Rhodes University. (Dissertation - M.Com).

MONETARY AUTHORITY OF SINGAPORE. 2005. Proposals for the Implementation of Basel II in Singapore – Phase 1, *Consultation Paper P008-2005.* August. Singapore. [Internet] http://www.mas.gov.sg/resource/publications/consult_papers/2005/Basel%202-Phase%201.pdf [Date of use: 14 August 2007].

MONETARY AUTHORITY OF SINGAPORE. 2006. Liquidity Risk Supervision – A Revised Minimum Liquid Asset Framework, *Consultation Paper P004-2006.* May. Singapore. [Internet] http://www.mas.gov.sg/resource/publications/consult_papers/2006/ConsultationPaperMAS613.pdf [Date of use: 15 February 2007].

MOOLMAN, H. C. 2004. *The South African Stock Market and the Economic Environment.* University of Pretoria. Pretoria, South Africa. (Thesis – P.hD) [Internet] upetd.up.ac.za/thesis/available/etd-04192004-153516/unrestricted/00front.pdf [Date of use: 15 October 2007].

MURANGA, J. and OHSAWA, M. 1997. *Measurement of Liquidity Risk in the Context of Market Risk Calculation.* Institute for Monetary and Economic Studies - Bank of Japan. Tokyo, Japan. December. [Internet] http://www.bis.org/publ/ecsc07j.pdf [Date of use: 25 January 2007].

NATIONAL BANK OF THE REPUBLIC OF MACEDONIA. 2004. *Supervisory Circular No. 6: Liquidity Risk Management.* June. Banking Regulation Department. Skopje, Republic of Macedonia. [Internet] http://www.nbrm.gov.mk/WBStorage/Files/SUP_Circular-likvidnost0.pdf [Date of use: 14 August 2007].

NATTER, R. 2006. *The Basel II Standardized Approach.* September. American Bar Association. Chicago, United States of America. [Internet] http://www.abanet.org/buslaw/committees/CL130000pub/newsletter/200609/natter.pdf [Date of use: 2 August 2007].

NBRM *see* NATIONAL BANK OF THE REPUBLIC OF MACEDONIA.

NEDBANK GROUP. 2007. *Nedbank Group 2006 Annual Report.* April. Johannesburg, South Africa.

NEL, H. F. 2000. Minimum Reserve Requirements, Article in the *South African Reserve Bank Quarterly Bulletin.* December. Pretoria, South Africa.

NGAUJAKE, U. 2003. *Protecting Depositors and Promoting Financial Stability in South Africa: Is there a case for the Introduction of Deposit Insurance?* November. Grahamstown: Rhodes University. (Dissertation – M.Com). [Internet] eprints.ru.ac.za/90/02/NGAUJAKE_Thesis.pdf [Date of use: 26 November 2007].

NOUY, D. 2000. *The* Basel Committee Core Principles for Effective Supervision, *Presentation given at the Global Workshop on Implementing Emerging Financial Sector Standards: A Public/Private Sector Challenge.* 18-20 December. Paris, France. [Internet] http://www1.worldbank.org/finance/assets/images/dl03_nouy.pdf [Date of use: 3 August 2007].

NOVARE. 2006. *Liquidity in Abundance – Market Overview: December 2006.* December. Johannesburg, South Africa. [Internet] http://www.novare.co.za/PDF/NovareNews-Liquidityinabundance-December2006.pdf [Date of use: 16 February 2007].

O'BRIEN, Y. C. 2007. Measurement of Monetary Aggregates Across Countries, *Finance and Economics Discussion Series, Division of Research and Statistics and Monetary Affairs, Federal Reserve Board.* February. Washington DC, United States of America. [Internet] http://www.federalreserve.gov/Pubs/feds/2007/200702/200702pap.pdf [Date of use: 26 June 2007].

OCC *see* OFFICE OF THE COMPTROLLER OF THE CURRENCY.

OESTERREICHISCHE NATIONALBANK. 2006. *Guidelines on Bank-Wide Risk Management Internal Capital Assessment Process.* February. Vienna, Austria. [Internet] http://www.oenb.at/de/img/lf_icaap_englisch_gesamt__tcm14-39190.pdf?bcsi_scan_249132DF56A09290=1 [Date of use: 21 Mays 2007].

OESTERREICHISCHE NATIONALBANK. 2007. *Basel II History.* July. Vienna, Austria. [Internet] http://www.oenb.at/en/finanzm_stab/basel_II/basisinfo/entstehungsgeschichte/basel_ii_history.jsp [Date of use: 31 July 2007].

OFFICE OF THE COMPTROLLER OF THE CURRENCY. 1997. *Comptroller's Handbook – Asset Securitization.* November. Comptroller of the Currency, Administrator of National Banks. Washington DC, United States of America. [Internet] http://www.occ.gov/handbook/assetsec.pdf [Date of use: 14 November 2007].

OFFICE OF THE COMPTROLLER OF THE CURRENCY. 2001. *Comptroller's Handbook – Liquidity: Liquidity and Funds Management.* February. Comptroller of the Currency, Administrator of National Banks. Washington DC, United States of America. [Internet] http://www.occ.treas.gov/handbook/liquidity.pdf [Date of use: 16 August 2007].

OKEAHALAM, C. C. 1998. The Political Economy of Bank Failure and Supervision in the Republic of South Africa, Article in the African Journal of Political Science, Volume 3, Number 2, pp 28-49. [Internet] archive.lib.msu.edu/DMC/African%20Journals/pdfs/political%20science/volume3n2/ajps003002004.pdf [Date of use: 26 November 2007].

OLSON RESEARCH. 2000. *A/L Benchmarks Industry Report – Standard for Asset/Liability Management.* 4th Quarter. Columbia, United States of America. [Internet] http://www.olsonresearch.com/IndustryRpt/PDF/2000Q4-IndustryReport.pdf [Date of use: 22 October 2007].

OR *see* OLSON RESEARCH.

PALMER, J. 2004. Basel II and Beyond, *Opening address by Mr John Palmer, Deputy Managing Director of the Monetary Authority of Singapore, at the MAS Risk Conference.* 12 July. Singapore. [Internet] http://www.bis.org/review/r040720f.pdf [Date of use: 7 February 2007].

PIQUEIRA, N. S. 2006. *Marketwide Liquidity and another Look at Liquidity Risk.* Department of Finance, University of Houston. January. Houston, United States of America. [Internet] http://www.fma.org/SLC/Papers/marketwide_liquidity_and_another_look_at_liquidity_risk.pdf [Date of use: 7 March 2007].

PITERMAN, S. 2000. Stabilisation, Vulnerability and Liquidity as a Safety Net: Some Thoughts Evoked by the Israeli Experience, *BIS Policy Paper No. 8.* October. Bank for International Settlements. Basel, Switzerland. [Internet] http://www.bis.org/publ/plcy08.pdf [Date of use: 27 July 2007].

PORTEOUS, B., McCULLOCH, L. and TAPADAR, R. 2003. An Approach to Economic Capital for Financial Services Firms, Article in *Risk Magazine.* April. [Internet] http://www.actuaries.org.uk/files/pdf/finance_invest/porteous_article_0403.pdf [Date of use: 28 February 2007].

PRICE-WATERHOUSE-COOPERS. 2003. Liquidity Risk – New Requirements get Closer and Clearer, Article in *PWC Financial Services Bulletin.* December. London, England. [Internet] http://www.pwc.com/images/gx/eng/fs/dp24.pdf [Date of use: 25 January 2007].

PRICE-WATERHOUSE-COOPERS. 2005. Effective Capital Management: Economic Capital as an Industry Standard? PricewaterhouseCoopers Global Financial Services Briefing Programme Article in *PWC Financial Services Bulletin – A Joint Project with the Economist Intelligence Unit.* December. London, England. [Internet] http://www.pwc.com/extweb/pwcpublications.nsf/docid/758FFEB46B7082D3852570D200149DEE/$File/1205eiusurvey.pdf [Date of use: 28 February 2007].

PROTTER, P. 2006. *Liquidity Risk, School of Operations Research, Cornell University – SAMSI Transition Workshop on Financial Mathematics.* 28 February. New York, United States of America. [Internet] http://www.samsi.info/200506/fmse/transition/p.protter.pdf [Date of use: 7 February 2007].

QUIGLEY, P. 2005. *Modelling and Managing Bank Capital Post Basel I.* October. Society for Actuaries in Ireland. Dublin, Ireland. [Internet] http://www.actuaries.ie/Events%20and%20Papers/Events%202005/051027%20Paul%20Quigley.pdf [Date of use: 21 May 2007].

RBA *see* RESERVE BANK OF AUSTRALIA.

RBF *see* RESERVE BANK OF FIJI.

RBNZ *see* RESERVE BANK OF NEW ZEALAND.

REIF, F. 2006. Economic Capital vs. Regulatory Capital Planning, *Presentation given at ERSTE Bank.* February. Copenhagen, Denmark. [Internet] http://www.sparkasse.at/erstebank/ [Date of use: 26 June 2007].

REPULLO, R. 2005. Liquidity Risk, Risk Taking and Lender of Last Resort, *International Journal of Central Banking.* September. Madrid, Spain. [Internet] http://www.ijcb.org/journal/ijcb05q3a2.pdf [Date of use: 6 February 2007].

RESERVE BANK OF AUSTRALIA. 1998. *Liquidity Risk Management, Prudential Statement 1.* April. Sydney, Australia. [Internet] http://www.rba.gov.au/MediaReleases/1998/prudential_statement_d1 [Date of use: 12 February 2007].

RESERVE BANK OF AUSTRALIA. 2003. *Financial Stability Standard for Central Counterparties.* May. [Internet] http://www.rba.gov.au/PaymentsSystem/StdClearingSettlement/central_counterparties_standard.html#terminology [Date of use: 26 June 2007].

RESERVE BANK OF AUSTRALIA. 2007. *Notes to Tables Contained in the Statistical Bulletin.* April. [Internet] http://www.rba.gov.au/Statistics/Bulletin/NotesToTables.rtf [Date of use: 26 June 2007].

RESERVE BANK OF FIJI. 2006a. Liquidity Risk Management Requirements for Banks, *Banking Supervision Policy Statement No. 9A, Notice to Banks Licensed under the Banking Act 1995.* March. Suva, Fiji. [Internet] http://www.rbf.gov.fj/docs/Liquidity%20Policy%20Banks.pdf [Date of use: 25 July 2007].

RESERVE BANK OF FIJI. 2006b. Liquidity Risk Management Requirements for Credit Institutions, *Banking Supervision Policy Statement No. 9B, Notice to Credit Institutions Licensed under the Banking Act 1995.* March. Suva, Fiji. [Internet] http://www.rbf.gov.fj/docs/Liquidity%20Policy%20CIs.pdf [Date of use: 25 July 2007].

RESERVE BANK OF NEW ZEALAND. 2007. *Descriptions of Tables Contained in the Statistical Bulletin.* April. Wellington, New Zealand. [Internet] http://www.rbnz.govt.nz/statistics/monfin/C3/description.html [Date of use: 26 June 2007].

RICHARDSON, J. and STEPHENSON, M. 2000. Some Aspects of Regulatory Capital, *Occasional Papers Series 7.* March. Financial Services Authority. London, England. [Internet] http://www.fsa.gov.uk/pubs/occpapers/OP07.pdf [Date of use: 14 August 2007].

ROSEN, D. 2004. Reconciling Economic and Regulatory Credit Capital in a Basel II Framework, Algorithmics Inc. *Speech Given at ICBI Geneva.* 7 December. Geneva, Switzerland. [Internet] http://www.fields.utoronto.ca/~drosen/Presentations/ICBI%20-%20Reconciling%20Basel.pdf [Date of use: 7 March 2007].

ROYAL BANK OF CANADA. 2003. *2003 Annual Report.* December. Montreal, Canada. [Internet] http://www.rbc.com/investorrelations/pdf/ar_2003_e.pdf [Date of use: 2 August 2007].

SA *see* SOUTH AFRICA.

SAAYMAN, A. 2003. *Securitisation and Bank Liquidity in South Africa.* School of Economics, Risk Management, and International Trade, Potchefstroom University for CHE. November. Potchefstroom, South Africa. [Internet] http://www.essa.org.za/download/2003Conference/SaaymanA_Securitisation%20And%20Bank%20Liquidity%20In%20South%20Africa.pdf [Date of use: 13 February 2007].

SARB *see* SOUTH AFRICAN RESERVE BANK.

SASFIN HOLDINGS LIMITED. 2002. *Annual Report.* October. South Africa. [Internet] http://www.sasfinbank.co.za/siteimgs/Annual%20Report%202002.pdf [Date of use: 27 November 2007].

SBP *see* STATE BANK OF PAKISTAN.

SCHMIDT BIES, S. 2007. An Update of the Basel II Implementation in the United States, *Remarks made at the Global Association of Risk Professionals Basel II Summit in New York.* 26 February. New York, United Stated of America. [Internet] http://www.bis.org/review/r070228e.pdf [Date of use: 8 March 2007].

SEATER, J. J. 2001. *Optimal Bank Regulation and Monetary Policy.* Economics Department, North Carolina State University. January. Raleigh, United States of America. [Internet] http://www4.ncsu.edu/~jjseater/PDF/PublishedPapers/RegulationAndMoney.pdf [Date of use: 28 February 2007].

SFRC *see* SHADOW FINANCIAL REGULATORY COMMITTEES.

SHADOW FINANCIAL REGULATORY COMMITTEES. 1999. Improving the Basle Committee's New Capital Adequacy Framework, *Joint Statement by the Shadow Financial Regulatory Committees of Europe, Japan and the US.* 14 June. New York, United States of America. [Internet] http://www.econ.keio.ac.jp/staff/masaya//shadow/article/jointstate_1.doc [Date of use: 14 August 2007].

SHARMA, P. 2004. *Speech on Liquidity Risk.* 8 October. Financial Services Authority. London. England. [Internet] http://www.fsa.gov.uk/Pages/Library/Communication/Speeches/2004/SP201.shtml [Date of use: 27 January 2007].

SHIN, H. S. 2005. Financial System Liquidity, Asset Prices and Monetary Policy, Article in the *Changing Nature of the Business Cycle.* September. Reserve Bank of Australia. Sydney, Australia. [Internet] http://www.rba.gov.au/PublicationsAndResearch/Conferences/2005/Conference_Volume_2005.pdf [Date of use: 16 February 2007]. p312-335.

SIBILKOV, V. 2007. *Asset Liquidity and Capital Structure.* June. University of Wisconsin. Milwaukee, United States of America. [Internet] http://www.uwm.edu/People/sibilkov/liquidity.pdf [Date of use: 2 August 2007].

SKERRITT, P. 2003. *Derivatives.* Peter Skerritt and Associates. Johannesburg, South Africa.

SOUTH AFRICA. 1989. *South African Reserve Bank Act 90 of 1989.* Government Printer. Pretoria, South Africa.

SOUTH AFRICA. 1998. Regulations Relating to Capital-Adequacy Requirements ("CAR") for Banks' Trading Activities in Financial Instruments. (Proclamation No. R 1058, 1998) *Government Gazette, 6268,* 21 August. (Regulation Gazette No. 19165).

SOUTH AFRICA. 2000. Regulations Relating to Banks. (Proclamation No. R 1112, 2000) *Government Gazette, 6917*, 8 November. (Regulation Gazette No. 21726).

SOUTH AFRICA. 2001. Amendment of Regulations. (Proclamation No. R 1004, 2001) *Government Gazette, 7180,* 5 October. (Regulation Gazette No. 22737).

SOUTH AFRICA. 2002. Amendment of Regulations. (Proclamation No. R 1464, 2002) *Government Gazette, 7521*, 5 October. (Regulation Gazette No. 24088).

SOUTH AFRICA. 2003. *Banks Act 94 of 1989, as Amended 2003.* Government Printer. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 1998. Monetary Policy and Reserve Bank Accommodation Procedures, *Statement issued by Dr C.L. Stals, Governor of the South African Reserve Bank.* 7 March. [Internet] http://www.reservebank.co.za/internet/Publication.nsf/LADV/8674487562D693DA42256B530048CBF5/$File/07Mar98.pdf [Date of use: 7 February 2007].

SOUTH AFRICAN RESERVE BANK. 1999. *Banks Act Circular 10/99: Liquid Assets Held in Compliance with Section 72 of the Banks Act, 1990, and Section 50 of the Mutual Banks Act, 1993.* 20 September. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2002a. Annual Report, *Bank Supervision Department.* Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2002b. *Banks Act Circular 10/2002: Disclosure of Repurchase and Resale Agreements and Similar Transactions.* 20 September. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2003. *Proposals to Improve the Functioning of the South African Reserve Bank's Refinancing System and the Interbank Market.* April. [Internet] http://www2.resbank.co.za/internet/Publication.nsf/LADV/CB046D1D7EC2765542256CFB003060B4/$File/Refinancing+system.pdf [Date of use: 10 February 2007].

SOUTH AFRICAN RESERVE BANK. 2004a. *A Consultative Paper on Modifications to the Money Market Operations of the South African Reserve Bank.* Financial Markets Department. December. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2004b. Financial Stability Review, *Financial Stability Department.* September. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2004c. *Introduction to Central Banking.* July. South African Reserve Bank College. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2005a. *Introduction to Derivatives.* May. South African Reserve Bank College. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2005b. *Monetary Policy.* February. South African Reserve Bank College. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2006a. Financial Stability Review, *Financial Stability Department.* March. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2006b. *Monetary Policy Review.* November. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2006c. *The Market Risk Internal Models Circular, Revision 1.0.* January. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2007a. *Electronic DI Returns and other Information Available to the Public: DI 100, DI 300, DI 310, DI 400, DI 900.* June. [Internet] http://www.resbank.co.za/sarbdata/ifdata/default.asp [Date of use: 10 June 2007].

SOUTH AFRICAN RESERVE BANK. 2007b. Framework for Setting Individual Capital Requirements and the Inclusion of Hybrid Debt Instruments as Qualifying Primary Capital, *Accord Implementation Forum: Steering Committee, Position Paper 162v4.* March. Bank Supervision Department. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2007c. *List of Eligible Collateral.* 23 May. Financial Markets Department. Pretoria, South Africa. [Internet] http://www.reservebank.co.za/internet/Publication.nsf/LADV/631936992C6C037F422572DB00494266/$File/Eligible+Collateral+23+May+2007.pdf [Date of use: 11 September 2007].

SOUTH AFRICAN RESERVE BANK. 2007d. *Operational Notice Pertaining to the Money market Operations Conducted by the Financial Markets Department of the South African Reserve Bank.* May. Financial Markets Department. Pretoria, South Africa. [Internet] http://www.reservebank.co.za/internet/Publication.nsf/LADV/1D0C1AF499F20C20422572DB00489191/$File/Ops+Notice+May+2007.pdf [Date of use: 11 September 2007].

SOUTH AFRICAN RESERVE BANK. 2007e. *Proposed Amended Regulations Relating to Banks, Draft Document Issued for Public Comment.* April. Bank Supervision Department. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2007f. Proposed Treatment of Pillar 2, *Accord Implementation Forum: Risk Management Sub-Committee, Position Paper 146v1.* March. Bank Supervision Department. Pretoria, South Africa.

SOUTH AFRICAN RESERVE BANK. 2007g. *The Bank Supervision Department.* July. Pretoria, South Africa. [Internet] http://www.reservebank.co.za/internet/Publication.nsf/LADV/524BC78D03BA24ED4225733A0031EEE8/$File/Fact+sheet+10.pdf [Date of use: 11 November 2007].

SOUTH AFRICAN RESERVE BANK. 2007h. *The South African Reserve Bank's System of Accommodation.* July. Pretoria, South Africa. [Internet] http://www.reservebank.co.za/internet/Publication.nsf/LADV/524BC78D03BA24ED4225733A0031EEE8/$File/Fact+sheet+9.pdf [Date of use: 11 November 2007].

STANDARD BANK. 2003. Commentary of Results: Overview of Financial Results. April. Johannesburg, South Africa. [Internet] http://standardbank.co.za/site/investor/Ann2003_Performed.html

[Date of use: 20 February 2008].

STANDARD BANK. 2007. *Economic Profile: South Africa 2007.* June. Johannesburg, South Africa. [Internet] ws9.standardbank.co.za/sbrp/DocumentDownloader?docId=1187 [Date of use: 12 November 2007].

STANDARD BANK GROUP. 2007. *Standard Bank Group Annual Report 2006.* April. Johannesburg, South Africa.

STATE BANK OF PAKISTAN (SBP). 2003. *Risk Management: Guidelines for Commercial Banks and DFIs.* 25 August. Karachi, Pakistan. [Internet] http://www.sbp.org.pk/about/riskmgm.pdf [Date of use: 13 February 2007].

STATE BANK OF PAKISTAN. 2006. *Minimum Capital Requirements for Banks and DFIs, Revised Regulatory Capital Framework under Basel II.* 27 June. Karachi, Pakistan. [Internet] http://www.sbp.org.pk/bsd/2006/Annex_C8.pdf [Date of use: 14 August 2007].

STATISTICS NORWAY. 2007. *Composition of Money Supply.* April. Oslo, Norway. [Internet] http://www.ssb.no/en/m2/tab-02-en.html [Date of use: 26 June 2007].

STOLZ, S. and WEDOW, M. 2005. Banks' Regulatory Capital Buffer and the Business Cycle: Evidence for German Savings and Cooperative Banks, *Discussion Paper Series 2: Banking and Financial Studies, No. 07/2005.* July. Deutsche Bundesbank. Frankfurt, Germany.

STYGER, P. and VOSLOO, P. G. 2005. *The Banker's Guide to the Basel II Framework.* December. Johannesburg, South Africa. [Internet] http://www.banking.org.za/documents/2005/DECEMBER/InfoDoc_29781.pdf [Date of use: 19 March 2007].

SYED A. S. 2004. Islamic Modes of Finance and Associated Liquidity Risks, *Paper Prepared for Conference on Monetary Sector in Iran: Structure, Performance and Challenging Issues.* February. Tehran, Iran. [Internet] http://www.sbp.org.pk/departments/ibd/Lecture_6_Islamic_Modes_Finance_Liquidity.pdf [Date of use: 7 March 2007].

THORAVAL, P. 2006. The Basel II Framework: The Role and Implementation of Pillar II, Article in *Banque de France Financial Stability Review Number 9.* December. Banque de France. Paris, France. [Internet] http://www.banque-france.fr/gb/publications/telechar/rsf/2006/etud6_1206.pdf [Date of use: 2 February 2007].

TOWERS PERRIN. 2006. *Economic Capital.* August. Stamford, United States of America. [Internet] http://www.towersperrin.com/tp/getwebcachedoc?webc=TILL/USA/2006/200608/fasttrack_ec_08_21_06.pdf [Date of use: 7 June 2007].

TSAI, K. T. 2004. Risk Management via VAR – Article in *ICSA Bulletin.* January. [Internet] http://www.gloriamundi.org/ShowTracking.asp?ResourceID=453055562 [Date of use: 22 November 2006].

URRY, R. H. 2007. *Personal Interview with Rob Urry, Senior Manager: Market Risk, Bank Supervision Department, South African Reserve Bank.* 10 October. Pretoria, South Africa.

VAN DER WALT, E. J. 2006. *Quoting Sources, 4th Edition.* December. North-West University. Potchefstroom, South Africa.

VAN ROY, P. 2005. Credit-ratings and the Standardised Approach to Credit Risk in Basel II, *European Central Bank Working Paper Series No. 517.* August. European Central Bank. Frankfurt, Germany. [Internet] http://www.ecb.int/pub/pdf/scpwps/ecbwp517.pdf [Date of use: 27 July 2007].

VINOGRADOV, D. V. 2006. Financial Markets, Financial Intermediation, and Bailout Policy – *PhD Dissertation at Heidelberg University.* November. Heidelberg, Germany. [Internet] deposit.ddb.de/cgi-bin/dokserv?idn=981884555anddok_var=d1anddok_ext=pdfandfilename=981884555.pdf [Date of use: 25 July 2007].

WANG, A. W. 2003. Institutional Equity Flows, Liquidity Risk and Asset Pricing, *Job Market Paper.* University of California. January. Los Angeles, United States of America. [Internet] http://web.gsm.uci.edu/~ashwang/papers/Liquidity.pdf [Date of use: 14 February 2007].

WEINBERG, M. 2007a. Bank Liquidity Management Practices, *Presentation given at APRA Liquidity Risk Management Conference.* 3-4 May. [Internet] http://www.apra.gov.au/Policy/upload/5c-Marc-Weinberg-Bank-liquidity-management-practices.pdf [Date of use: 7 June 2007].

WEINBERG, M. 2007b. IIF Report – Principles of Liquidity Risk Management: Considerations for Regulators, *Presentation given at APRA Liquidity Risk Management Conference.* 3-4 May. [Internet] http://www.apra.gov.au/Policy/upload/2c-Mark-Weinberg-IIF-Report-Principles-of-liquidity-risk-management-Considerations-for-regulators.pdf [Date of use: 7 June 2007].

WEST, G. 2004. *Risk Measurement for Financial Institutions.* Financial Modelling Agency, CAM Department, University of the Witwatersrand. 25 November. Johannesburg, South Africa. [Internet] http://www.cam.wits.ac.za/mfinance/MPT2004/rm.pdf [Date of use: 20 February 2007].

WOCCU *see* WORLD COUNCIL OF CREDIT UNIONS.

WOLF, M. 2007. From a Bank run to Nationalising Deposits, Article in *Financial Times.* 18 September. [Internet] http://www.ft.com/cms/s/02658970-65ec-11dc-9fbb-0000779fd2ac,s01=1.html [Date of use: 19 September 2007].

WORLD COUNCIL OF CREDIT UNIONS. 2002. *Examination Process – Asset Liability Management Process, Development Best Practices in Credit Union Supervision.* 30 October. Madison, United States of America. [Internet] http://www.woccu.org/best_practices/bp_files/1068675279asset_liability.pdf [Date of use: 19 March 2007].