A MODELLING PROCESS OF SHORT-TERM INTEREST RATE RISK MANAGEMENT FOR THE SOUTH AFRICAN COMMERCIAL BANKING SECTOR

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Abstract

This study focuses on banking book interest rate risk (IRR) management, more specifically short-term IRR management (SIRR). This type of risk is partly induced by the inflation targeting policy of the South African Reserve Bank (SARB). As a result, inflation leads to an uncertain interest rate cycle and a period of uncertain interest rate levels as it relates to lending and borrowing activities in the South African commercial banking sector. This study highlights what causes short-term interest rate risk and how the banks may forecast and manage the SIRR with reference to the inflation targeting policy. The banking industry manages a high volume of fund transactions and portfolios of investments. The banks are intricately involved in the financial markets and are therefore exposed to a large number of risk factors. A sound banking system is an important prerequisite for a country's future economic development. One key empirical finding of this research is that 50 per cent of the South African banks agree that loans that cannot undergo immediate rate adjustments are exposed to the repo-rate adjustment after the Monetary Policy Committee (MPC) meeting. Banks surveyed see the need for the development of a short-term interest rate risk (SIRR) management process to better control such repo-rate risk. The next key empirical finding is that interest rate risk is still managed via traditional repricing gap and sensitivity analysis which is not ideal for risk management due to inherent weaknesses (such as not quantifying capital risk exposure). This agrees with the Pricewaterhousecoopers Balance Sheet Management benchmark survey

Keywords: Short-term Interest Rate Risk, Banking Book Interest Rate Risk Management, Basel II

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Introduction

The new capital adequacy framework, commonly known as the Basel II Accord (and now Basel III), highlights the need for the implementation of risk management practices that are cutting edge. The ability to identify and mitigate risk by implementing financial risk management strategies has become imperative in the pursuit of achieving superior performance in the global business arena. New challenges related to risk measurement and mitigation is facing risk professionals in the banking industry around the world.

Generally, in the banking industry there is an interest rate exposure window which arises when the central bank adjusts the short-term interest rate termed the repo-rate. The problem is, how do banks identify, measure, mitigate, monitor and report the risk exposure and keep it within a desired risk tolerance level. Facing new risk factors, banks need to adjust their internal risk management models. The four major commercial banking groups in South Africa (Standard Bank Group Limited, ABSA Group Limited, FirstRand Group Limited and Nedbank Group Limited) have not had a model dealing with the repo-rate adjustment and the relevant short-term interest rate risk (SIRR) changes (Hochfelden, 2008) only.

Statement of the Problem

The first problem is that banks suffer interest income losses when the repo-rate increases due to the SARB inflation targeting monetary policy, since banks lend the funds at a lower fixed rate for a longer period of time based on the SARB's inflation expectation (that is, the initial repo-rate plus certain basis points to cover costs, profits and risk). The fixed-rate loan maturities are usually in the range from three-months to ten-years, which are longer than the two months till the next MPC meeting (Kershoff, 2007). The longer the repricing period of the fixed-rate loan, the greater the possibility of loss if the rising rate environment continues. Then, at the next MPC meeting, just two months later, the committee adjusts the repo-rate based on the actual inflation rate since expected inflation and actual inflation are rarely the same in the short term (Koch & MacDonald, 2000).

Assuming that there are no significant portfolio structures changes during the two month period between two MPC meetings, two situations may unfold. On the one hand, when interest rates are

rising, the income on the fixed-rate loans (if any) and loans that may not reprice immediately will not immediately earn more; the floating rate deposits will immediately adjust and will bear a higher interest cost which implies a lower Net Interest Margin (NIM) (NIM = (loan interest income - deposit interest expense)/earning assets) will result. On the other hand, the profit and loss (P&L) situation is related to the option risk when there is a declining interest rate expectation. The fixed-rate loans lose interest income since borrowers refinance at a lower rate; the floating-rate deposits reprice immediately, resulting in a lower NIM due to the lower opportunity income and higher opportunity expense. In the short term, the banks could use the funds borrowed from the repo market to generate new lending business at a lower offer rate due to the general declining rate environment, whereas the lost deposits will limit the loan extension and consequently may damage the banks' long-term profitability. To solve this liquidity risk problem, banks have to offer a higher than market rate to attract deposits. In the declining interest rate environment, if option-free loans and deposits are assumed, NIM will increase due to an increased interest income and a decreased interest expense if more loans can reprice than deposits in the short-term maturity bucket. In practice, most loans and deposits have implicit/embedded options allowing prepayment of loans and early withdrawal of deposits by clients, even though not stipulated explicitly in the contracts (Koch & MacDonald, 2000).

As mentioned above, the second and key problem is how banks may identify, measure, mitigate and monitor risk exposure and keep it within a desired risk tolerance level and still maintain the minimum capital requirement. The Basel II Accord raises new Policies, Procedures and Standards (PPS) for managing SIRR, together with the inflation targeting policy-induced short-term interest rate fluctuations in the South African context. It is therefore imperative for individual banks to review their short-term approach to risk management modelling processes and to make necessary adjustments to comply with new regulations. Basel II capital framework consists of three pillars where the first pillar represents a significant strengthening of minimum requirements as set out in the 1988 Accord while the second and third pillars represent the innovative additions to capital supervision (FirstRand Group, 2008). Basel II incorporates three new documents issued in 1996, 2004 and 2005 respectively (PRMIA, 2007: 5).

The third problem that banks face is to know how to minimize or avoid such shortcomings and risks when using the VaR technique and derivative contracts in developing the modelling process.

Objective of the Study

The main objective of the study was to carry out a survey of banks in South Africa to determine, among other important risk and banks management issues, what overall risk management techniques banks employ to manage interest rate risk and to determine whether there are grounds for the development of a SIRR management system or model. The survey was used as the primary source of information. Other factors were also surveyed. However the focus in this research is only on gaining an understanding of the current state of the overall risk management aspects currently employed in South African banks.

In addition to the main survey, preliminary research by way of informal interviews with the major four commercial banks' asset and liability risk managers and the risk management section of Pricewaterhousecoopers (PwC) in Johannesburg South Africa were conducted to develop a more complete understanding of the current risk management tendencies. In this regard, The Bureau of Economic Research (BER) at the University of Stellenbosch was also consulted regarding monetary policy implementation.

Research Methodology

Primary data for this study was gathered by way of a survey questionnaire sent to all commercial banks in South Africa. The focus of the review was on the IRR (with a focus on SIRR) management processes in banks.

A literature review of existing studies dealing with risk management focus on either statistical and mathematical analyses or theoretical development was also carried out. Only a few studies deal with the short-term interest rate risk management of IRR. As far as could be established there has been no study focusing on the risk created due to the South African Reserve Bank's monetary policy. As far as risk management model development is concerned, most studies have a broader conceptual or a corporate focus. They seldom are of a practical nature explaining in greater depth the development of such a model, and hence fall short in the application of necessary and often critical solutions. The following subsections briefly discuss the key aspects of the bank risk management process.

Enterprise-wide Risk Management (ERM)

It is often said that risk is best managed at the highest level in the enterprise. The financial risk management process in a bank cannot be considered effective if it does not function at this level. If an ERM approach is not used, some risks may not be identified and may eventually end up not being managed. Currently ERM does not distinguish between a SIRR management system and an IRR management system or even that two such systems should co-exist. No or little past research deals specifically with SIRR management as such. After the financial crisis, there seems to be a tendency to talk more about centralising the risk

management function which implies an EWRM approach (PwC, 2008).

By clearly defining and timely communicating governance policies and procedures at all management levels of the bank, the effective corporate and risk governances and internal control functions may lead to effective monitoring and controlling of SIRR. At least, effective corporate governance and ERM implementation should avoid the monetary loss caused by unexpected risk events and minimize the total monetary loss that could put the bank in danger as a going-concern. Corporate governance principles facilitate the risk management process by facilitating or requiring the effectiveness and accuracy of the output from each stage of the process. In the end, the effectiveness and accuracy of the outcome produced through the process (i.e. monitoring and reporting stage) may be maximized.

Tendencies in Bank Risk Management in South Africa and Globally

The past turmoil in the global financial markets was caused by the USA subprime crisis. This event necessitates changes that need to be put into place in the global banking sector, particularly within bank risk management. Recent market developments are not yet taken into account by risk management techniques and strategies of banks.

Major global and South African banks generally follow a risk management process as recommended by Basel II (and III) and related guidelines for market risk management consisting of the key stages of risk identification, measurement, mitigation, and monitoring and reporting. One important aspect that is evident is that the risk management process of most banks is situated centrally under the ERM framework. Banks in developed economies follow a similar risk management process as recommended by the Basel II Accord. Four key elements (risk identification, risk measurement, risk mitigation, and risk reporting and monitoring) form the major components of a bank's risk management process.

At present, there is not a general framework process being implemented for the SIRR management on the banking book in South Africa. The four major banks, and to a lesser extent the small and medium-sized banks (SMBs) in South Africa, have adopted a similar ERM and risk management process even though there are slight differences in terms of the risk definitions and the number and order of steps in the risk management process. Specifically, the ERM process starts at the board of director's level at the top of the management structure in banks flows to risk management committees and subcommittees, and reaches risk management areas at the bottom. Risk management functions apply to all management levels and major business units in banks. Finally, audit and compliance committees attempt to ensure the effective and efficient performance of the ERM framework. For the risk management process, banks adopt the feedback-loop model including key steps of risk identification, measurement, mitigation, and monitoring and reporting. Risk management techniques employed in each step of the process are very similar. For instance, they commonly use historical simulation VaR to measure the market risks and for monitoring. Interest rate swaps and Forward Rate Agreements (FRA's) are major hedging instruments against unexpected banking-book IRR. Moreover, in market risk management, the simplified method is suited to banks with "vanilla-type" trading[20] books and a few systems supporting their trades. The building block method is suited to banks with significant exposures which manage risks internally with relatively manual processes and systems.

The Internal Model Approach (IMA) adopted by individual banks allows them to use sophisticated risk management systems to manage and report risks, as well as calculate and optimise capital adequacy (SARB, 2006).

Bank Interest Rate Risk Management

As financial intermediaries, banks are exposed to various kinds of risks such as credit, interest rate, foreign exchange rate, liquidity and operational risk. The three main broad risk categories in banking are IRR, market risk and credit risk. The pure market risk - generated by changes of market parameters such as interest rates, equity indexes, and exchange rates - differs from market liquidity risk (Bessis, 2001).

Risk exposures are interrelated to each other as one risk event may affect one risk type that in turn triggers the sources of the other types of risks. Senior management and the board of directors in banks should pay close attention in order to improve risk management systems, frameworks and processes. Through the risk management process, the overall level of risk is identified, measured, mitigated, and monitored and reported.

One of the most important documents that any bank must have is the policy guidelines relating to risk management. In the policy document the different types of financial risks should be described. Apart from this, the policy should deal with the bank's risk appetite. This is a very important aspect as no two banks will effectively have the same approach to risk taking. This is firstly affected by the each bank's core business and generally the management's preparedness to be exposed to financial risk. Banks should decide which risks it is prepared to be exposed to, which risks can be avoided and which risks should be actively managed.

There is no universal definition of risk management and the process in the banking sector. Van Deventer at al. (2005) defines risk management

[20] It could also apply to the banking book.

as a discipline that clearly shows the management of the risks and returns of every major strategic decision at both the institutional/divisional level and the transaction level. In this study, two definitions are chosen to describe the banking risk management process. Hallikas, Karvonen, Pulkkinen, Virolainen, & Tuominen (2004: 52) state that a typical risk management process of an enterprise consists of risk identification, risk assessment, decision and implementation of risk management actions, and risk monitoring. The Basel Committee on Banking Supervision (1994 : 1) states that an adequate risk management process integrates prudent risk limits, sound measurement procedures and information systems, continuous risk monitoring and frequent management reporting.

In both classical and modern risk management practices, the goal of the financial risk management process remains to be the enhancement of the risk-return profile of transactions and that of the bank's portfolios. Nevertheless, new best practices are more risk sensitive through the development of advanced risk measurement techniques (Bessis, 2001).

The bank risk management framework, structure and process are key areas involved in bank IRR management. Through theoretical and empirical findings from both global and South African contexts, risk identification, risk measurement, risk mitigation and risk monitoring and reporting are the four critical stages in the IRR management process. Risk aggregation and capital allocation become increasingly important areas in bank risk management but this topic does not fall within the scope of this study. The banking book IRR management concerns the risk management structure, policies, procedures and internal control issues. Areas for improving the creation of links between stages of the risk management process reinforce the need for the development of a feedback loop.

Empirical Findings

The aim of the empirical survey was to gather new information about current risk management practices in the South African commercial banking sector. The questionnaire was sent to fourteen locally registered banks. Ten (71 per cent) of these banks responded with satisfactory results.

The survey questionnaire was used to identify potential gaps in risk management practices in the sector. The empirical findings will testify to the research problems addressed in the study that portfolio losses result from changes in the repo-rate.

In addition to the survey, the results of current discussions with banks on balance sheet management will also be referred to where applicable.

Survey Results

Some South African banks have developed their own risk management policies, procedures and standards based on international principles, practices and standards or internally developed polices and benchmarks. Large banks tend to have a more complex risk management process than smaller banks, coupled with more advanced risk management techniques.

Large banks have aligned their risk management policies and strategies with international principles and standards such as Basel II (now III) and the "Principles for the Management and Supervision of Interest Rate Risk". Alternatively, small banks rely on internal controls and a risk management manual, as they cannot afford expensive risk management models (such as Quantitative Risk Management or QRM and Sendero) similar to those of large banks.

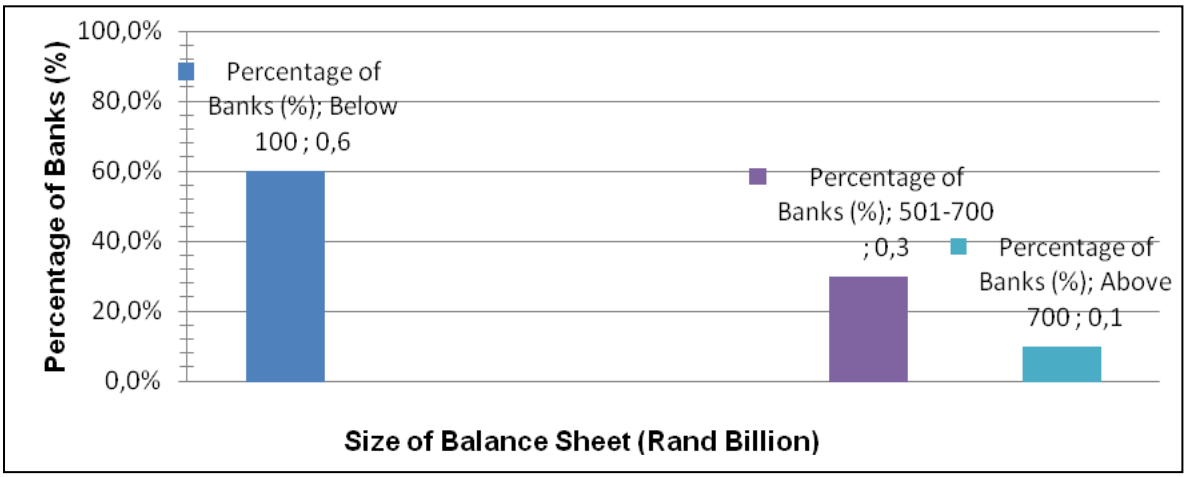
Most local banks follow a procedure based on a top-down and bottom-up decision-making process and/or a procedure based on corporate or risk governance principles. However, it seems that few (if any) of them have had a process in place that has strong links between key risk management elements (risk identification, risk measurement, risk mitigation and risk monitoring and reporting) forming a feedback loop process within the banking book and/or general IRR management unit.

In general, IRR is a key risk type in commercial banks, as they are mainly engaged in borrowing and lending activities. Small and medium banks have less sophisticated risk management systems than the large banks in South Africa. Their risk management is, to a large extent, based on historical risk events and managerial experience. Internal risk control measures are usually developed through strategic meetings and implemented throughout the bank. This is due to their smaller asset size and limited range of asset and liability products (compared to global banks) which leads to less exposure to IRR.

In this section, most of the questions asked in the survey relating to the risk management as such, are briefly discussed. Although a number of other questions dealing with other aspects of bank management were also asked, this article focuses on the risk management aspects only.

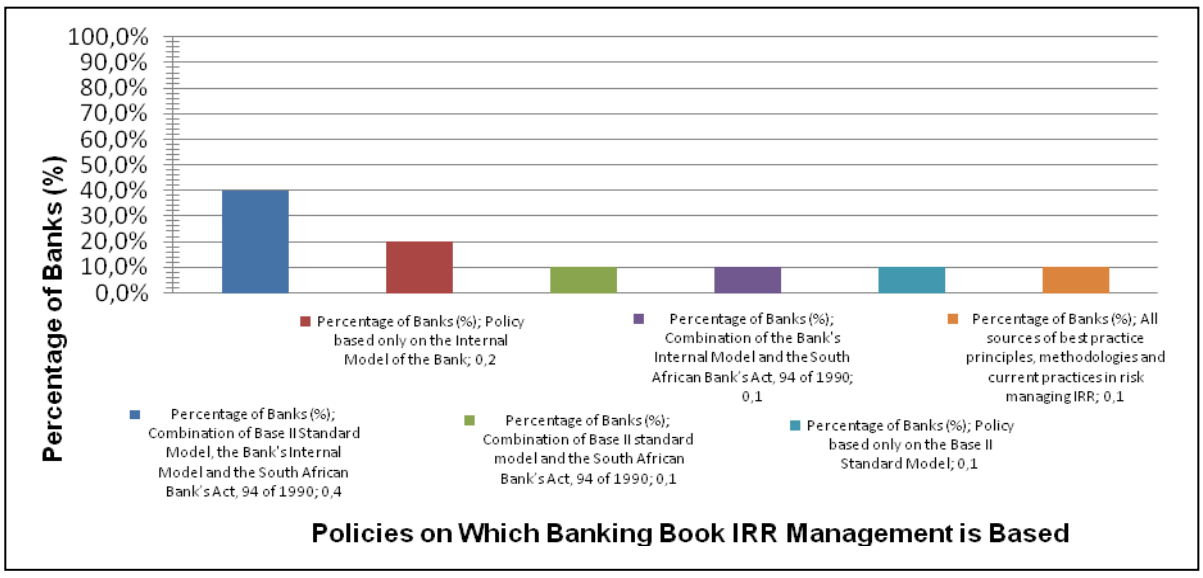
As shown in Figure 1, respondents were asked to indicate the size of their balance sheets. In 2009, ten per cent of them had total assets of over R700 billion, thirty per cent had assets between R501 and 700 billion, while the remaining sixty per cent were below R100 billion.

Figure 1. Size of the Balance Sheet



In a multiple-choice question, respondents were asked to indicate the sources on which their banking book IRR management policy is based. As illustrated in Figure 2, forty per cent of banks base their policies on a combination of Base II standard model (which will of course be adjusted for Basel III), the bank's internal model and the South African Bank's Act, 94 of 1990.

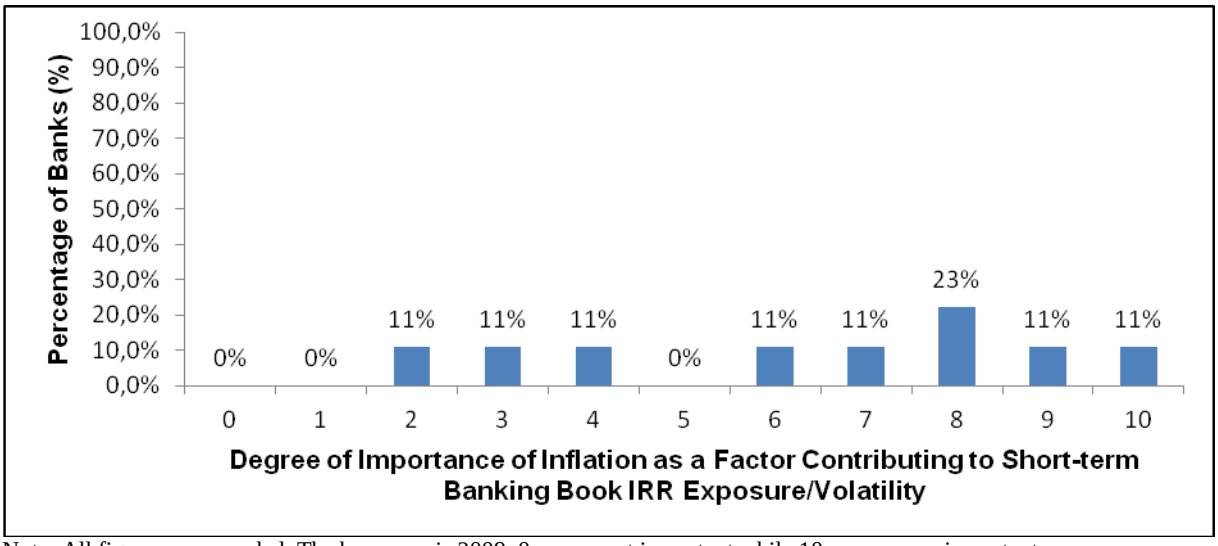
Figure 2. Policy Formation



Twenty per cent of banks base their policies solely on the banks' internal risk management model. Ten per cent of banks manage banking book IRR through a policy based on a combination of the bank internal risk management model and the South African Bank's Act, 94 of 1990. Ten per cent of banks take into account all sources of principles, methodologies and best practices to formulate policies to form the foundation to manage banking book IRR. Small banks base their policies on internal models. Other banks' policies rely on either the bank internal risk management model or Basel II standard model.

The majority of banks believe that the inflation rate is one of the main factors contributing to IRR or SIRR (See Figure 3) in South Africa. Sources of SIRR such as uncertain and frequent repo-rate adjustments by the MPC may cause financial loss (or narrowing of the NIM) in the portfolio consisting of fixed-rate loans/advances and floating-rate deposits.

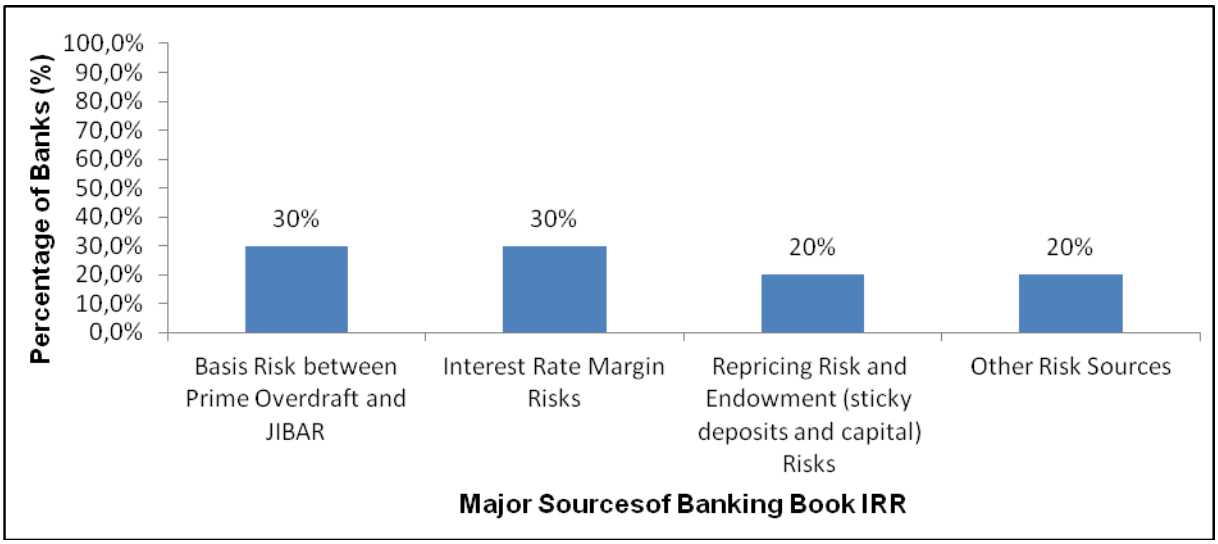
Figure 3. Inflation as Factor Causing Banking SIRR Exposure/Volatility



Note: All figures are rounded. The base year is 2009. 0 means not important while 10 means very important.

Declining interest rates will result in downside risk because of repo- and prime overdraft-linked assets repricing as well as the risk between assets linked to the prime overdraft rate versus deposits that reprice due to call-rate and three-month JIBAR (either adjustable term deposits, fixed deposits or NCDs) rate adjustments. Other major sources of banking book IRR surveyed include interest rate margin risks, repricing risk and endowment risks as illustrated in Figure 4.

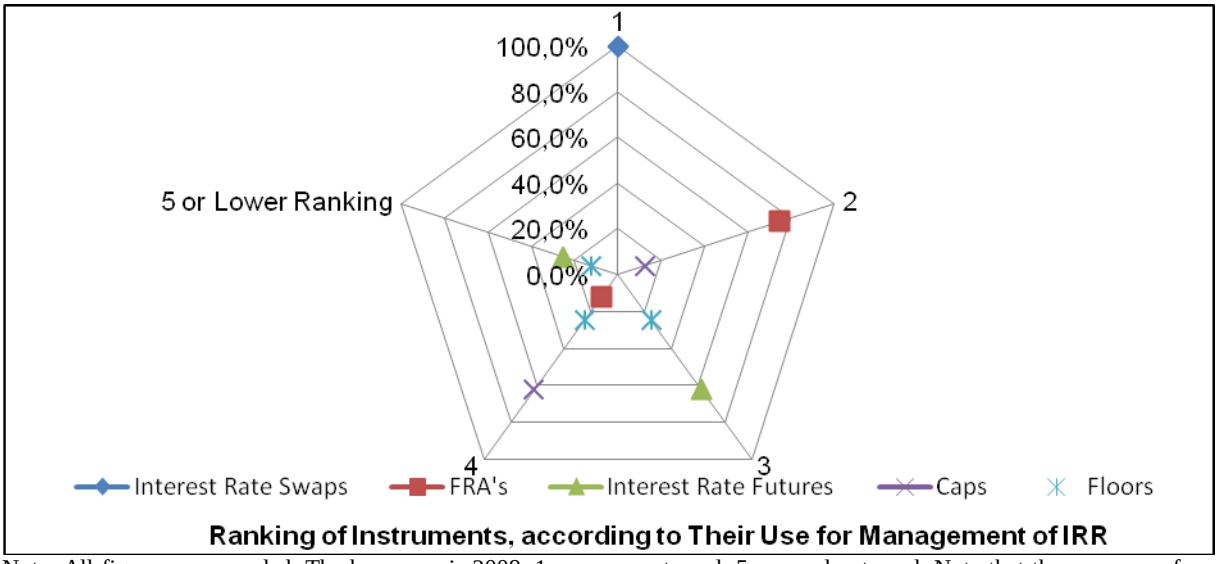
Figure 4. Major Sources of Banking Book IRR



Note: All figures are rounded. The base year is 2009. Other risk sources include duration, call basis risk, fixed versus JIBAR risk, duration risk, credit management, and asset-liability management.

Figure 5 illustrates how respondents felt about the use of tools to mitigate banking book IRR. For large and medium banks, interest rate swaps, FRA's and interest rate futures are common instruments used to hedge against IRR. In terms of SIRR relating to the banking book, risks can be mitigated through repricing based on the three-month JIBAR via a liquid swap market. Moreover, 50 per cent of respondents were positive towards the use of derivatives to reduce risk.

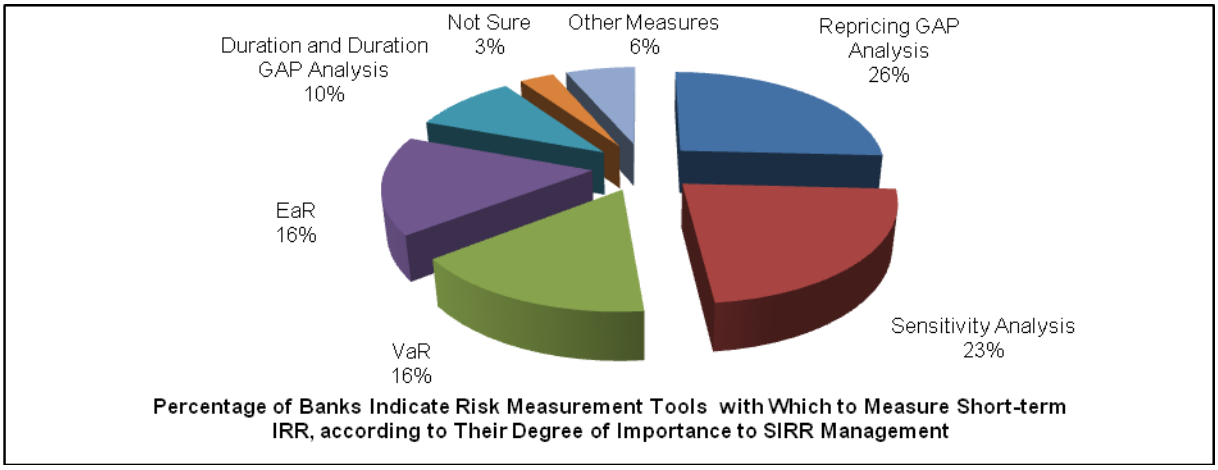
Figure 5. Tools used to Mitigate Banking Book IRR



Note: All figures are rounded. The base year is 2009. 1 means most used; 5 means least used. Note that the response of an individual bank may be included in more than one category.

As illustrated in Figure 6, risk measurement tools such as repricing GAP analysis, sensitivity analysis, VaR and EaR are often deployed to evaluate banking book IRR. However, small banks are not involved in derivative transactions but rely on the effect of portfolio offsetting and tying their interest rates to those of large banks. Small banks do not have sophisticated risk measurement tools such as VaR and GAP analysis systems in place, but rather rely on managerial experience and brainstorming, where decisions are made by reviewing historical events and forecasting future interest rate cycles. In addition, it seems the majority of banks have not had tools in place to measure embedded-option risks.

Figure 6. Risk Measurement Tools

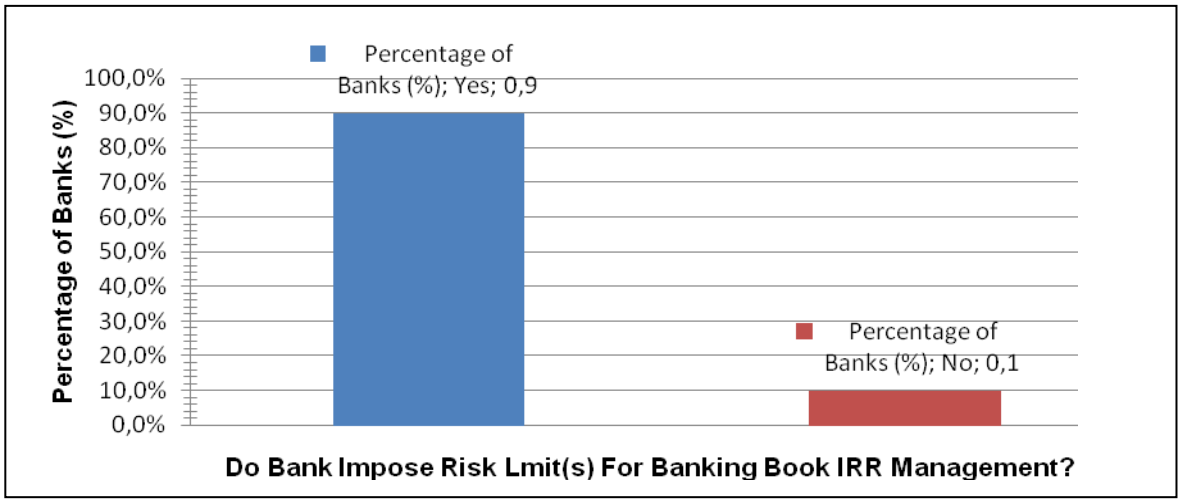


Note: All figures are rounded. The base year is 2009. Other measures include eVaR and fair value.

Most local banks have deployed stress-testing and back-testing procedures to improve the quality and accuracy of risk measurement, whereas testing procedures vary due to banks' different risk policies, measurement tools, models and risk limits. The ALM unit of banks report to the Bank Risk Management Committee, senior management and/or the board of directors, depending on an individual banks' corporate governance structure and policy statement.

In another question respondents were asked in a close-ended question to indicate whether the management of the bank has adopted risk exposure limit(s) for the banking book IRR management. As illustrated in Figure 7, eighty nine per cent of banks have adopted limits for banking book IRR management. Banks that do not set risk limits do, however, closely monitor the banking book IRR. However, the risk-limit setting is a rather subjective decision, which takes profitability targets, strategic objectives, risk tolerance levels and other factors into account.

Figure 7. Risk Limits



Those respondents that have adopted risk limits were asked in an open-ended question to indicate how the risk limits are set. Seven out of nine respondents have adopted different procedures for setting their risk limit(s), as shown in Table 1.

The risk limit in one bank is set according to the Basel II capital accord. Basel II requires that the economic capital in support of banking book IRR should not exceed a percentage of the sum of Tier I and Tier II capital. The specific percentage is discretionary, as banks may choose a capital reserve level that is higher than the required eight per cent (now 9.5 per cent) of the total risk-weighted assets. Banking book IRR as part of the total risk capital is allocated a certain percentage, which varies from one bank to another.

One large bank deploys three methods to define risk limits, corresponding to the three methods of risk identification:

- EaR sensitivity analysis is done through a one per cent parallel reduction in interest rates. The resulting change in NII as a percentage of the bank's total equity is compared with an approved risk limit.
- Interest rate sensitivity analysis is supported by credit impairment sensitivity and is benchmarked regularly against a peer group as a risk limit.
- Economic value of equity is measured for a one per cent parallel decrease in interest rates. The resulting change in equity value is then compared with a predetermined risk limit.

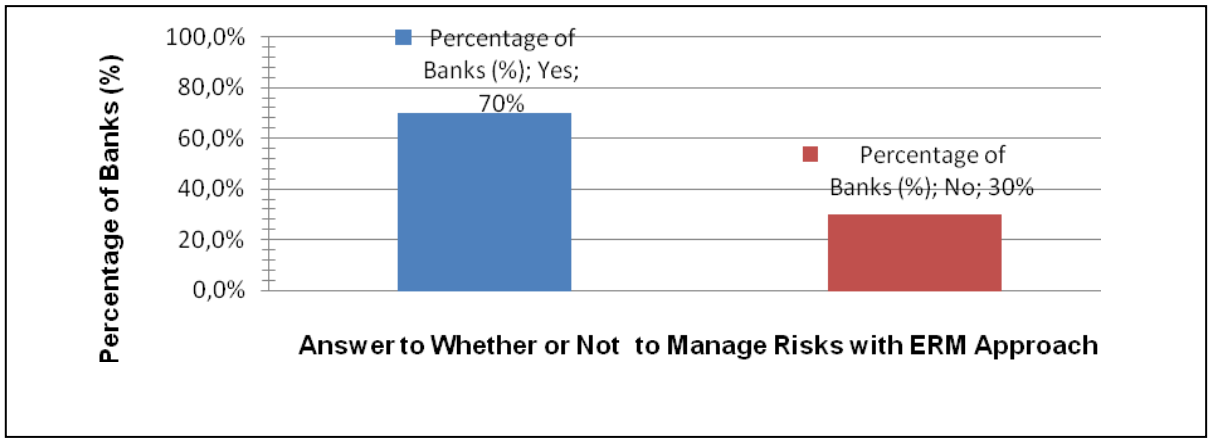
Table 1. Procedure for Setting Risk Limit(s)

Respondent Banks (bank names are not mentioned for confidentiality reasons)	Procedure for Setting Risk Limit(s)
Bank One	Based on the Basel II capital accord, economic capital (or risk limits) in support of banking book IRR should not exceed a percentage of the sum of Tier I and Tier II capital
Bank Two	Risk limits are related to EaR sensitivity, interest rate sensitivity, and economic value of equity
Bank Three	Risk limits are based on risk tolerance levels and perceived scenario likelihoods
Bank Four	Risk limits are based on the potential effect of IRR on headline earnings per share
Bank Five	Risk limits are based on the repricing gap analysis
Bank Six	Risk tolerance and prudential limit are approved by the board of directors
Bank Seven	Board approves risk limits by continually monitoring both sides of the balance sheet in a changing interest rate scenario

Most local banks reserve a higher amount of economic capital than required by Basel II, from which a certain, although low, proportion of their capital reserve is allocated for IRR. In discussion with banks in South Africa, some indicated that they will be capitalising the bank up to 15% in the next number of years.

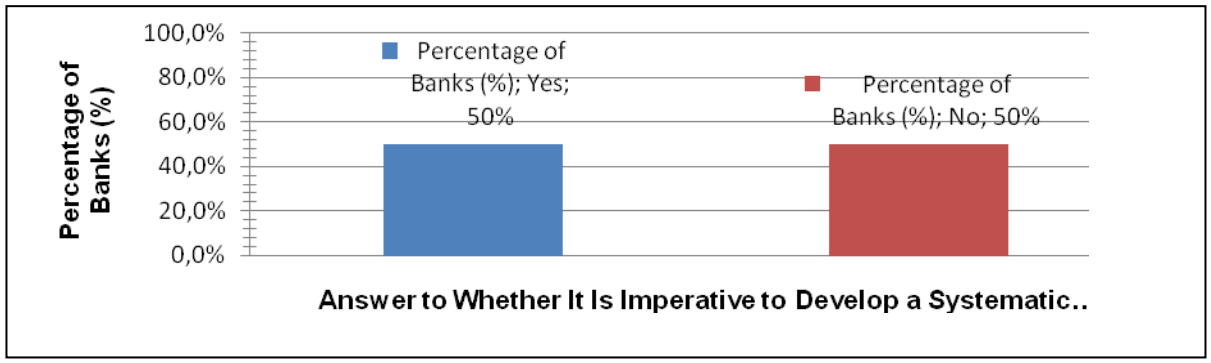
Respondents were asked in a close-ended question to indicate whether the bank follows an ERM approach to manage risks. As illustrated in Figure 8, seventy per cent of banks are of the opinion that they have implemented an ERM framework to guide bank risk management.

Figure 8. Risk Management Framework



Respondents were asked in a close-ended question to indicate whether it is imperative to also develop a systematic process to manage new SIRR exposures. Even though all banks have a general risk management process that is aligned to the strategic objectives of the bank as a whole, Figure 9 shows that fifty per cent of banks believe that it is imperative to develop a process specifically to manage SIRR. This underlines that a significant number of banks see the merit of such a system.

Figure 9. Imperative to Develop SIRR Management Process



Subprime risk occurred in the second half of 2007 onwards mostly during 2008 in the USA, which contributed to the financial crisis and then economic crisis internationally. Compared to other countries, the South African banking sector has been sheltered from such crisis due to its stringent foreign exchange control, conservative banking regulation and the new National Credit Act implemented in 2006. Even though IRR was the least affected type of risk during the crisis, banks have taken this opportunity to further strengthen their risk management through measures such as tight liquidity management and credit control, as well as wide-reaching prudential management to help prevent future financial losses.

The survey results have confirmed that there are other research problems which should receive attention. Examples are uncertain repo-rate movements and embedded-option risks giving rise to NIM loss (particularly in a declining interest rate environment) specifically as it relates to a portfolio consisting of fixed-rate loans and floating-rate deposits.

It is clear from recent discussions with banks that an aspect that will receive more attention in the next number of years is modelling capital risk more efficiently. Banks will have to increase their capital buffers by either issuing additional capital, changing their core business to accept less risk or finding

alternative ways to increase the return on assets and therefore return on capital.

Conclusions and Suggestions for Future Research

In South Africa, the SARB as bank regulator has implemented several guidelines, policies such as the King II on corporate governance, and the South African Bank's Act and Credit Act, which govern the operation of commercial banks in South Africa. Related policies include foreign exchange control, inflation targeting and other monetary policies, which also have an impact on the risk management of banks. These regulations sheltered the country from the recent financial and economic crisis.

In line with international best practices, South African banks implemented the Basel Accord in January 2008 and II and now are in the process of implementing aspects of Basel III. Large banks have put in place the ERM framework, corporate governance, risk management policies and sophisticated risk management tools to control various risks. Examples of risk include: credit risk, market risk, operational risk and other unquantifiable risks such as reputational risk.

Since 2008, the banking sector in South Africa has maintained a higher capital ratio than the eight per cent proposed by Basel II. However, there has been a continuous declining volume of loans and advances since the second half of 2009. The contraction of the lending business seen by South African banks is attributed to the risk aversion of residential customers. Moreover the lending standards have also become stricter after the financial crisis in 2007 (West, 2010a).

A major finding of this study is that 50 per cent of respondents indicated that they do agree that fixed-rate loans are unduly exposed to interest rate risk due to the repo-rate adjustment after the MPC meeting. This indicates that banks in South Africa have not yet realised the potential financial loss exposure due to the uncertain repo-rate cycle in the short term.

Another finding is that risk measurement tools remain on the traditional repricing GAP and sensitivity analysis such as simulation modelling. Greater market volatility gives rise to greater measurement errors. For instance both sensitivity analysis and VaR are limited to a small change of the interest rate when testing such a change's impact on the value of the subject portfolio.

To determine to what extent banks have adjusted their risk management systems and activities due to lessons learnt from the sub-prime crisis and the further proposals contained in Basel III, this research may be repeated in the near future. Another aspect that may be considered for future research is the development of a SIRR management model.

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