

MARKET INTEREST RATE FLUCTUATIONS: IMPACT ON THE PROFITABILITY OF COMMERCIAL BANKS

by

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Thesis submitted in fulfilment of the requirements for the degree of
Master of Management in Finance & Investment

in the

FACULTY OF COMMERCE LAW AND MANAGEMENT
WITS BUSINESS SCHOOL

at the

UNIVERSITY OF THE WITWATERSRAND

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DECLARATION

I, ***Euphemia Ifeoma Godspower-Akpomiemie***, declare that the research work reported in this dissertation is my own, except where otherwise indicated and acknowledged. It is submitted for the degree of Master of Management in Finance and Investment in the University of the Witwatersrand, Johannesburg. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other universities.

Euphemia Ifeoma Godspower-Akpomiemie

Signed at-----

On the----- Day of-----2012

ABSTRACT

There are many functions of the financial system, with the basic function of transferring loanable funds from lender to borrowers (Rose et al, 1995). This financial transaction can be carried out directly or semi directly between lenders and borrowers. The shortcomings of direct and semi direct financing have opened doors for a third method—financial intermediation, which is done by financial intermediaries.

Commercial bank is the classic example of financial intermediary at work. To achieve the goal of owners' wealth maximization, banks should manage their assets, liabilities, and capital efficiently. In doing this, the bank should be conscious of the *gap* or spread between the interest income and the interest expenses paid, which is called net interest income (NII). Net interest income is a major part of banks' profit, this is basically why the financial intermediaries try to offer lowest returns to savers and lend funds to borrowers at the highest possible interest rates. It is measured as net interest margin (NIM), which is NII divided by the average earning assets.

This study examines the interest rate sensitivity of commercial banks' interest profitability (Net Interest Margin) and net worth at the theoretical level and attempt to measure empirically the extent to which the interest profitability and net worth of commercial banks have been affected during the period of changing interest rates between 2001 and 2010. It as well measures the extent to which the factors that determine interest rate movement affect interest rate and which of the factors has more effect on interest rate.

The measure of profitability captures the essence of lend-long borrow-short without directly including other determinants of bank income, such as loan loss and loan volume, which may be correlated with interest rates. It is also important to note that NIM is not a measure of total banks' profits since it does not include non-interest income and expenses.

A software package stata 10.0 was used to conduct the hypothesis testing, trend, and correlation analysis. The sampled banks are fourteen commercial banks and one investment bank in South Africa. The sampled banks were later divided into two groups (big and small), based on their assets size as at the year-end 2010. There are five (5) big banks with asset size of more than R100 billion and ten (10) small banks with asset size of less than R100 billion

as at the year-end 2010. Analysis was further carried out separately on both the big and small banks to see the effect of interest rate fluctuations on them. Data required by the model was obtained from annual financial statements of the sampled banks for the period of ten years.

It was found that fluctuations on interest rate (repo rate) affect the profit of commercial banks, but this effect is huge on small banks than the big banks. As the repo rate increases, the profit of commercial banks increases. Such effect of repo rate on profit of commercial banks was found to be statistically significant. It was also found that interest rate changes as well affect the net worth of commercial banks. The macroeconomic factors that determine the interest rates do not have direct effect on the banks' profit, but have significant effect on the banks' net worth, especially that of the small banks. As the rate of inflation, the rate of money supply, and uncertainty increase, the net worth of the small commercial banks in South Africa also increase.

It could be advised that to maximize owners' equity, South African commercial banks (big and small) should concentrate more on forecasting and controlling the determinants of the interest rates, rather than the interest rates themselves. It was also found that among the internal factors affecting profit and net worth of commercial banks, the liquidity ratio is most significant relative to capital ratio, competition, and non-performing loan.

DEDICATION

This research report is dedicated to

God Almighty,

My husband: Mr Godspower Akpomiemie,

and

My children: Ejiro, and Yoma Godspower-Akpomiemie.

ACKNOWLEDGEMENTS

I would like to record my thanks and gratitude to everyone who assisted and encouraged me during my master's program and in the completion of this research. All their help and understanding contributed to the successful completion of this difficult task. Particularly, I would like to thank the following people

Prof. Kalu Ojah: My supervisor, whose extreme support and constant guidance provided me with the inspiration to complete the research. His professional and expert knowledge was critical in making this research possible.

My Family: Thanks to my hubby; GP, and my children; Ejiro and Yoma, for believing in me and stuck with me throughout the entire program. Especially my hubby for his sacrifices to ensure the program was a success. To my parents; for bringing me into this world and giving me a career path.

My friends: Thanks to all my friends, who helped me in one way or the other; assistance, advice, encouragement, for the success of this program.

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CHAPTER 1

INTRODUCTION

1.1 CONTEXT OF THE STUDY

The financial system is composed of a network of financial markets, institutions, businesses, households, and governments. There are many functions of the financial system, with the basic function of transferring loanable funds (credits) from lenders (savings surplus units) to borrowers (savings deficit units) (Rose et al, 1995). Lenders being those whose current income receipts exceed their current expenditure, giving them extra funds to lend to borrowers. This financial transaction can be carried out directly between lenders and borrowers or semi-directly, where a third party is involved. The shortcomings of direct and semi-direct financing have opened doors for a third method—financial intermediation, which is done by financial intermediaries.

Commercial bank is a classic example of financial intermediary at work; meeting the ultimate needs of both borrowers and lenders. Early banks lent mainly to two classes of borrowers: merchants and governments (Kohn, 2004). Lending to merchants usually took the form of discounting commercial bills. It was a standard IOU used by merchants. Governments on the other hand were always in need of credits. They borrow from early merchants in exchange of trading rights.

The menu of banks' assets has grown steadily over the years. The list of borrowers has expanded from merchants and governments to include landowners, other banks, industrial firms, and consumers. Banks have faced demand for credits from these new classes of borrowers. Satisfying their demands has led to higher yields but typically increased risk and reduced liquidity, especially mortgage lending, because of its long term maturity.

By almost any measure, the commercial bank is the most important financial intermediary serving the public today. They offer more services than the majority of other financial institutions, which include expanding the money supply by granting credits (loans) to borrowers. They accept deposits from saving surplus units (lenders), and grant it as credits

(loans) to saving deficit units (borrowers). Loans and deposits are the major components of the bank's balance sheet—Assets and Liabilities.

1.2 PROBLEM STATEMENT

To achieve the goal of owners' wealth maximization, banks should manage their assets, liabilities, and capital efficiently. In doing this, the bank should be conscious of the *gap* or spread between the interest income earned on their assets and the interest expenses paid on their liabilities, which is called net interest income (NII). Net interest income is a major part of banks' profit, this is basically why the financial intermediaries try to offer lowest returns to savers and lend funds to borrowers at the highest possible interest rates. It is measured as net interest margin (NIM), which is NII divided by the average earning asset. Lopez-Espinosa et al (2011) revealed that the volatility in interest rate in the 2000s explains much of the net interest margin (NIM) differences across countries, as well as NIM reduction in developed countries.

As many other studies on interest rate have shown (Delis et al, 2011; Kasman et al, 2011; Hanweck and Kilcollin, 1984), maturity mismatch of banks assets and liabilities (while performing asset transformation function), and unexpected change in interest rate, potentially expose the banks to interest rate risk. This exposure will result to refinancing or reinvestment risk, depending on the direction and level of interest rate change (Saunders and Cornett, 2003).

The net interest income (NII) of the bank is highly exposed to this interest rate risk, as it is based on the "GAP" between Rate Sensitive Assets (RSA) and Rate Sensitive Liabilities (RSL). Basically, change in the net interest income is the function of change in interest rate and the GAP. It is a major concern for banks that hold a large proportion of their portfolio in long-term fixed-rate loans (Hanweck and Kilcollin, 1984).

Interest rate risk among other risks (credit, liquidity, insolvency, market etc.) is a major concern for financial institutions. It can cause harm, if not failure, to a financial institution, by interacting with other risks. For instance, as interest rate rises, credit risk increases (corporations and consumers will likely default in repayment), which can lead to liquidity risk (as banks may depend on loan repayment for liquidity management purposes), this leads to solvency risk, thereby affecting the profit and equity or capital positions of financial services firms.

The commercial banks face market value risk in addition to refinancing and reinvestment risk that occur when interest rates change, whereby the market value of the banks' assets is reduced due to rising interest rates. The interest rate shock that results in losses in the market value of assets directly affect the net worth (owners' equity) because debt holders are senior claimants on a firm's assets, while equity holders are junior claimants (Saunders and Cornett, 2003). Moreover, many factors determine the changes or movement of interest rates, which include, demand and supply of loanable funds, Central Bank's monetary policy implementation, inflation, investors' expectations, competition among financial institutions, etc.

This study is aimed at assessing the effect of interest rate sensitivity on the profitability (the net interest margin) and net worth of commercial banks in South Africa. It will as well assess which of the determinants of interest rate has more effect on interest rate and thus on profits and net worth of commercial banks. I believe that upon the completion of this study, policy makers such as, the Reserve Bank and commercial bank managers will find it useful when making macroeconomic and managerial decisions; while investors, non-financial firms, and even consumers will find it useful as a guide towards opportunities as to when to invest or save.

1.3 RESEARCH OBJECTIVES

The main objective of this study is to investigate the impact of market interest rates fluctuations on both the profitability and net worth of commercial banks. The research carried out on this study should contribute to a better understanding of market interest rates; the determinants of market interest rate; and which of the determinants has more effect on interest rate changes. It will as well make an empirical contribution to the discussion of banks' profitability, overall wealth performances, and eventual contributions to the economic development.

If banks, non-bank businesses, and individuals should have improved understanding, assessment, and evaluation of market interest rates, they would be better equipped to make investment decisions that will be beneficial to them and to the economy in general. Such understanding, assessment, and evaluation, will enable:

- Individuals to decide either to save (make deposits) in banks, or to focus on other types of non-depository investments.
- Non-bank businesses to decide on the ratio of debt to equity to employ in financing their businesses.
- Banks to decide when to facilitate greater lending activity for profit maximization.
- May provide another “granular” avenue for hedging/managing/forecasting interest rate risk.

The decision taken by the above three groups, based on the understanding, assessment, and evaluation of interest rate, boils down to commercial banks’ profitability. Therefore, hopefully this study will bring some important conclusions about the effect of interest rates on banks’ profits, and how such effects affect their net worth.

1.4 RESEARCH QUESTIONS

- What is the impact of market interest rates fluctuations on commercial banks’ profit and / net worth in South Africa?
- Which of the determinants of interest rate has a more impacting effect on interest rate and profits/ net worth of commercial banks in South Africa?
- What interest rate risk management lesson derives from the preceding two relationships, if any?

1.5 DEFINITION OF TERMS AND ABBREVIATIONS

For better understanding of this research, definitions of terms and abbreviations that are extensively used in this study are provided as follows.

- GAP: The difference between rate sensitive assets and rate sensitive liabilities.
- Rate sensitive Assets: An asset that is repriced at or near current market interest rates.

- Rate sensitive Liabilities: A liability that is repriced at or near current market interest rates.
- NII: Net Interest Income
- NIM: Net Interest Margin
- Fixed-rate: The rate of interest set at the beginning of the contract period, which remains in force over the contract period no matter what happens to market rates.
- Floating-rate: The rate of interest periodically adjusted to some underlying index, also called Adjustable Rate of Mortgage (ARM).
- CPI: Consumer Price Index, measured as the percentage change in inflation rate.
- MPC: Monetary Policy Committee.
- CD: Certificate of Deposit.

1.6 LIMITATIONS

The aim of this study is to analyze the impact of market interest rate fluctuations on commercial banks' profitability and net worth in South Africa. Depending on availability of data, fifteen banks are selected for the research. The result derived from the analysis of these banks will be considered indicative of impact of market interest rate fluctuation on profitability of commercial banks. It is important to note that:

- The measure of profitability captures the essence of lend-long borrow-short without directly including other determinants of bank income, such as loan loss and loan volume, which may be correlated with interest rates.
- The net interest margin (NIM) is not a measure of total banks' profits since it does not include non-interest income and expenses.

- Other determinants of banks profit such as, ownership structure, taxation and regulations, financial structure, legal and institutional indices were also not included.
- Reduction in net interest margin can be as a result of high loan default.
- The variation on net interest margin may reflect differences in the net interest income (numerator) or differences in the average earning assets (denominator).
- There are many possible short term interest rates to be used for this study, but to avoid multicollinearity only the repurchase (repo) rate is used to represent the market interest rate. Multicollinearity is a statistical problem where the explanatory variables are highly correlated with one another. If it occurs, the regression model has difficulty telling which explanatory variable is influencing the dependent variable. (Wooldridge, 2006).

1.7 ASSUMPTIONS

- The financial data downloaded for this research is accurate and reliable.
- All banks prepare financial statements in accordance with International Financial Reporting Standard (IFRS), and understand IFRS in the same way, thus the data is comparable.
- Given that sampled fifteen banks account for more than ninety per cent (90%) of South African banking industry's assets, its representative of the national banking industry.
- This study uses panel data and assumes that the effect of interest rate changes varies across the observations and over time.

1.8 OUTLINE OF THE STUDY

The remainder of this study is structured as follows: Section two contains the literature review of my study, detailing the roles and functions of commercial banks, factors that affect their profitability, with special attention on market interest rate. It also details the factors that determine and cause changes in interest rates, how interest rates can be forecasted and hedged.

Section three presents the methodology used in this study. The data is analyzed using regression analysis. It also contains the time series analysis where the relationship between market interest rate and banks' profits over time are identified. Section four addresses the questions proposed for the study, and how the interpreted results address and answer the proposed questions. Finally, section five draws conclusions about the study in relation with the research questions.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Financial institutions have become essential to modern living. Credit cards, checking accounts, life, auto, and home insurance policies are all basic services supplied by the current multitude of world-wide financial institutions.

A financial institution is a business firm whose principal assets are financial assets or claims, such as stocks, bonds, and loans; instead of real assets, such as buildings, equipment, and raw materials (Rose et al, 1995). Financial institutions make loans to customers or purchase investment securities in the financial marketplace. They also offer a wide variety of other financial services, ranging from insurance protection and sale of retirement plans, to safekeeping of valuable and provision of mechanisms for making payments, transferring funds, and storing financial information. Financial institutions are divided into two groups; financial intermediaries and other financial institutions.

Financial intermediaries acquire the IOUs issued by borrowers (primary securities), and at the same time sell their own IOUs (secondary securities) to savers. Financial intermediaries are further divided into two; depository and non-depository institutions. Depository institutions are financial intermediaries whose significant proportion of their funds comes from customer deposits (Saunders and Cornett, 2003). They include; commercial banks, savings associations and banks, and credit unions. For the purpose of this study, our focus is in commercial banks and how interest rate risk affects their profitability and net worth.

2.2 COMMERCIAL BANKS

Commercial banks comprise the largest group of depository institutions in size. They perform functions similar to those of savings institutions and credit unions, that is, they accept deposits (liabilities) and make loans (Saunders and Cornett, 2003). But they differ in their composition of assets and liabilities. Commercial banks liabilities usually include non-deposit

sources of funds, while their loans are broader in range, including consumer, commercial, and real estate loans.

Commercial banks are among the most regulated firms in the economy. They can be chartered either by the state (state-chartered banks) or by the federal government (national banks). All the national banks must be members of Federal Reserve System and must be insured by the Bank Insurance Fund (BIF), which is administered by the Federal Deposit Insurance Corporation (FDIC) (Fabozzi and Modigliani, 2003). Because of the inherent special nature of banking and banking contracts, regulators have imposed numerous restrictions on their product and geographic activities (Saunders and Cornett, 2003).

Within the banking industry, banks' activities, the structure and composition of assets and liabilities vary significantly across banks of different sizes. The smaller or community banks tend to specialize in retail or consumer banking, such as providing residential mortgages and consumer loans and accessing the local deposit base. Recently this group of banks is decreasing in both number and importance. The next are the regional and super-regional banks. They engage in more complete array of commercial banking activities, such as consumer and residential lending as well as commercial and industrial lending, both regionally and nationally. The majority of banks fall into this group. The third group is the interbank or federal funds market. The banks in this group engage in interbank market for short-term borrowing and lending of bank reserves. Some of the very biggest banks belong to the fourth group called money center banks. They rely heavily on non-deposit or borrowed sources of funds.

2.3 COMMERCIAL BANKS' SERVICES

Commercial banks now offer more services than the majority of other financial institutions, such services ranging from regular checking accounts, through consumer and mortgage lending, to underwriting of new securities issues by corporations and governments (Rose et al, 1995). The services can be broadly classified into three; individual banking, institutional banking, and global banking (Fabozzi and Modigliani, 2003). Different banks generate more activities in certain areas than others. For example, money center banks are more active in global banking.

2.3.1 Individual Banking

This encompasses consumer lending, residential mortgage lending, consumer installment loans, credit card financing, automobile financing, brokerage services, student loans, and individual-oriented financial investment services such as personal trust. Mortgage lending and credit card financing generate both interest and fee income, while brokerage and financial investment services generate fee income. Bank loans are one of the most important sources of credit in the economy, providing financial resources so that consumers, businesses, and governments can acquire goods and services even when their income and savings are inadequate (Rose et al, 1995).

2.3.2 Institutional Banking

This category is made up of loans to nonfinancial corporations, financial corporations (such as life insurance companies), and government entities (states, local, and foreign governments). Also included are commercial real estate financing, leasing activities, and factoring¹. Loans and leasing generate interest income; while other services banks offer institutional customers generate fee income (Fabozzi and Modigliani, 2003). These services include assets management services, custodial services, and cash management services such as account maintenance, check clearing, and electronic transfers.

2.3.3 Global Banking

In this category, banks compete head-to head with another type of financial institution—investment banking firms. Global banking activities involve corporate financing, capital market and foreign exchange products and services. Corporate financing involves procuring funds for customer beyond traditional bank loan but through underwriting of securities (though there is a limit in this area). It also involves advice to corporate customers in such areas of strategies for obtaining funds, corporate restructuring, diversifications, and acquisitions. Most global banking activities generate fee income rather than interest income. Capital market and foreign exchange products and services involve transactions where the

¹ Banks purchase of account receivables.

banks may act as brokers or dealers in a service. These services generate both interest and fee income for the banks.

Moreover, the financial products developed by banks to manage risk also yield income. The products include interest rate swap, interest rate agreements, interest rate options, currency swaps, and forward contracts. Banks generate either commission income or spread income from selling such products (Fabozzi and Modigliani, 2003).

Finally, the most important service by the commercial banks is expanding the money supply (transmission of monetary policy), through the making of loans and investments. They attract funds (deposits) from savings-surplus units by issuing attractive financial assets (secondary securities) and lend these funds to borrowers or savings-deficit units, accepting IOUs (primary securities) in return (Rose et al, 1995). Because the liabilities (deposits) of depository institutions are significant component of the money supply (M1, M2, and M3)² that impacts the rate of inflation, they play a key role in the **transformation of monetary policy** from central bank to the rest of the economy (Saunders and Cornett, 2003). That is, commercial banks are one of the conduits through which monetary policy actions³ impact the rest of the financial sector and the economy in general.

2.4 COMMERCIAL BANKS' FUNDING

Commercial banks are highly leveraged organizations, relying mainly on debt (principal deposits) to support their assets. There are three main sources of funds for commercial banks; (1) deposits, (2) non-deposit borrowing, and (3) equity capital or net worth (stocks and retained earnings (Fabozzi and Modigliani, 2003).

² M1: currency under circulation, plus demand deposits at all commercial banks (less cash items in the process of collection, plus other checkable deposits.

M2: M1, plus savings accounts and small time deposits (CDs, T. Bills less than \$100,000), plus other non-deposit obligations of depository institutions.

M3: M2, plus large time deposits (Negotiable CDs

³ Monetary policy actions include open market operations (the purchase and sale of securities in the securities market), setting the discount rate (the rate charged on "lender of last resort" borrowing from the Federal Reserve), and setting reserve requirements (the minimum amount of reserve assets depository institutions must hold to back deposits held as liabilities on their balance sheet).

2.4.1 Deposits

Historically, most of the funds raised by banks come from deposits. Several types of deposit accounts are available in commercial banks, which include demand deposits and other transaction accounts (time deposits, and savings deposits).

Demand deposits is payable on demand to the deposit holder or to someone designated by the holder on presentation of a signed draft to the bank. The best-known demand deposit is the regular checking account, which does not bear interest but permits the customer to write any number of checks desired (subject to some type of service charge) (Rose et al, 1995). However, there are other transaction accounts similar to regular checking accounts but pay interest; examples are the Negotiable Order of Withdrawal (NOW), which carries a fixed rate of interest and is accessible by writing a check and the Money Market Deposit Account (MMDAs), which permit limited check writing but generally pay a higher and more flexible rate of interest than NOWs. Its interest payment is based on short-term interest rates.

Time deposits also called certificates of deposit set a fixed maturity date and pay either a fixed or floating interest rate. Some certificates of deposits can be sold in the open market prior to their maturity while others cannot be sold. If a depositor elects to withdraw the funds prior to maturity, the bank imposes early withdrawal penalty (Fabozzi and Modigliani, 2003).

Savings deposits pay interest (typically below market interest rate), but do not have specific maturity and usually can be withdrawn on demand. The savings and time deposits are usually referred to as nontransactions deposits.

The composition of bank's deposit is of considerable importance to its growth and earnings. The greater the proportion of demand deposits relative to time and savings deposits at an individual bank, the larger that bank's liquidity needs tend to be and the more concern it is about cash withdrawals and unexpected demand for loans. While the greater proportion of time deposits to demand and savings deposits exposes the bank to highest interest rates payments, which has the effect of driving up bank costs and placing a downward pressure on bank's earning (Rose et al, 1995). Therefore commercial banks should be conscious of a trade-off between liquidity needs and high interest expenses.

2.4.2 Non-deposit Borrowings

Usually banks supplement deposits with non-deposit borrowings to actively manage their assets. Such non-deposit sources of funds include short-term borrowings of reserves in the federal funds, borrowing through the use of security repurchase agreements, or through credit obtained from discount windows of the Federal Reserve banks. Banks also use long-term borrowing of funds, including mortgages and subordinated notes, and debentures. In recent years, supplements of banks deposits and other borrowings have been sales of bank loans and securitization⁴ of assets.

2.4.3 Equity Capital or Net Worth

Like any corporation, banks also draw upon their owners (the stockholders) for funds. Equity capital is relatively small proportion of total assets in the commercial banks' balance sheet, as banks are highly leveraged, relying mainly on debt. Owner's equity capital provides less than 10 percent of all the funds needed to run the modern bank, while more than 90 percent of bank's assets are supported by borrowings. The principal components of equity capital are retained earnings, capital reserves, par value of common and preferred stock, and surplus⁵ (Rose et al, 1995).

2.5 COMMERCIAL BANKS' PRODUCTS

Loans represent three-fifth of the assets of all US insured banks (Rose et al, 1995). Banks make a bewildering array of loans for thousands of different purposes. There are three main categories of loans made by commercial banks.

2.5.1 Real Estate Loans

These are the largest component of loans made by commercial banks. They represent extension of credit to buy or build on real property (land), and loans to support the construction or purchase of homes, factories, apartments, shopping centers, warehouses etc.

⁴ Securitization is the packaging and selling of loans and other assets backed by securities.

⁵ The excess value of any stock issued above the stock's par value.

Real estate loans are very long-term loans with an average maturity of approximately 28 years (Rose et al, 1995).

2.5.2 Commercial and Industrial (C&I) Loans

These are commonly referred to as business loans, that help fund purchase of equipment, new venture start-up costs, and inventories for privately owned firms. C&I loans can be made for periods as short as a few weeks to as long as eight years or more.

2.5.3 Individual (consumer) Loans

These represent personal and auto loans made by banks to individual consumers. It can be in the form of revolving loans such as credit card debt or in the form of non-revolving loans such as new and used automobile loans, mobile home loans, and fixed term consumer loans (24 months personal loans) (Saunders and Cornett, 2003).

Both real estate and commercial and industrial loans can be made at either fixed rates of interest or floating rate. A fixed-rate loan has the rate of interest set at the beginning of the contract period. The rate remains in force over the loan contract period no matter what happens to market rates. A floating rate loan (also called Adjustable Rate Mortgage) has the rate of interest periodically adjusted to some underlying index. In low interest period, borrowers prefer fixed-rate to floating rate.

2.5.4 Other Loans

These represent loans to farmers, other banks, nonbank financial institutions, brokers and dealers, state and local governments, foreign banks, and sovereign governments.

2.5.5 Some Non-debt products

Apart from loans, banks engage in some non-debt products and services, which can be on or off the balance sheet of the banks. Off balance sheet activities are becoming increasingly important, in terms of the amount involved and income they generate for banks, especially as

the ability of the banks to attract high quality loan applicants and depositors becomes ever more difficult. An item or activity is off balance sheet if, when a contingent event occurs, such item or activity moves onto the asset or liability side of the balance sheet (Saunders and Cornett, 2003). Some of the non-debt products and services are as follows.

Securitization: This is the process of packaging and selling loans and other assets backed by securities. Along with derivatives instruments (futures, forwards, swaps, and options), financial institutions use securitization to hedge interest rate risk. It also makes financial institutions' assets more liquid, by increasing the availability of fund to the mortgage market and reducing interest cost of borrower. In effect the efficiency of the borrowing and lending process has been improved (Livingston, 1993). Securitization is also an important source of fee income, with financial institutions acting as servicing agents for the assets sold. It also helps reduce the effect of regulatory taxes, such as capital requirements, reserve requirements, and deposit insurance premiums (Saunders and Cornett, 2003).

Derivatives: Financial products developed by banks such as futures, forwards, swaps, and options can be used either for hedging interest rate risk and other purposes or become dealers of those products and act as counterparties in trades with customers. Banks generate both fees income and commission income from these products.

Letters of credit: They are contingent guarantees sold by financial institutions to underwrite the trade or commercial performance of the buyer of the guarantee (such as corporation) (Saunders and Cornett, 2003). They are widely used in both domestic and international trade. Banks engage in selling both Commercial and standby letters of credits. Standby letters of credit cover mostly contingencies that are potentially severe, less predictable, or frequent, and not necessarily trade related.

Loan commitments: This is a contractual commitment made by a bank to make a loan up to a stated amount at a given interest rate in future. Apart from the interest income generated from this contract, the bank also charges up-front fee for making fund available throughout the agreed period, and back-end fee for any unused component of a loan commitment (Saunders and Cornett, 2003).

Investment in interest earning assets: (treasury bills, treasury bonds, sovereign bonds). Commercial banks hold treasury securities as secondary reserves that can readily be turned into cash as the need arises (Livingston, 1993). The Government uses this avenue for

monetary policy implementation, through the open market operation, thereby the banks serving as Government agents.

Credit allocation: Banks are major and sometimes the only source of finance for particular sectors of the economy pre identified as being in special need of finance. Government has identified residential real estate and farming sectors as the sectors in need of special subsidies, as they are especially important sectors of the economy in terms of the overall social welfare of the population. The government has directly encouraged financial institutions to specialize in financing these areas through the creation of mortgage banks, agricultural banks etc.

Intergenerational Wealth transfer: Commercial banks help savers to transfer wealth between youth and old age across generations. This they do by engaging in trust funds and life insurance policies,

Trust services: The trust departments of commercial banks hold and manage assets for individuals or corporations. These trusts include estate assets and assets delegated to bank trust departments by less sophisticated investors. Pension funds are also being managed by trust departments. The banks manage the pension funds; act as trustees for any bond held by the pension funds, and act as transfer and disbursement agents for the pension funds.

Correspondent banking: This is the provision of banking services to other banks that do not have the staff resources to perform the services themselves. Such services include check clearing and collection, foreign exchange trading, hedging services, and participation in large loan and security issuance (Saunders and Cornett, 2003). Payment for the services is generally in the form of non-interest bearing deposits held at the bank offering the corresponding services.

2.6 SOUTH AFRICAN BANKING SECTOR

Falkena et al (2004) asserts that the South African banking industry is oligopoly in nature, being dominated by four large commercial banks controlling the majority of the market shares. According to country ratings as at the year 2010, the four banks are Standard Bank, ABSA, NEDBank, and FirstRand Bank.

Many studies on South African banks, Hawkins (2002), Basson and Ojah (2007) assert that South African banking industry is not realizing the objective that banks should when acting as efficient financial intermediary. Demand for loanable funds for small businesses are often pushed into fringe and are left with no avenue for funding besides other micro lending institutions, which charge exorbitant rates for funds. Basson and Ojah (2007) pointed that despite the fact that all banks in South Africa are privately owned, the ownership of banking institutions remains highly concentrated. The top South African banks have significant common shareholders as well as material interest in each other's' banking operations. Note too that the four listed are the only ones with widely spread accessible branch network.

According to South African Reserve Bank (2010), as at the end of 2009, the market share of the top four banks was 84.58%, and no significant changes were recorded during the past few years. As at the end of Dec 2010, average net interest margin for the top four banks was 2.78%, average return on assets was 0.895, and return on equity was 15.07 compared to that of 2009 of 2.96%, 0.94, and 15.84 respectively.

2.7 MARKET INTEREST RATE

Interest rates measure the price paid by a borrower or debtor to a lender or creditor for the use of resources during some time intervals (Fabozzi and Modigliani, 2003). Goedhuys (1982), defined interest rate as the general level in financial assets and claims of all types whether call loans or debentures, company shares or government bonds, bank overdraft or bill of exchange. There are nominal and real interest rates. Nominal interest rate is the rate not corrected for inflation. Nominal interest rate on loan relates the amount of interest on the loan to the amount of money lent, while real interest rate is that which incorporates the effect of inflation. It is measured in terms of purchasing power. The two rates are connected by a simple relation called Fisher Effect, which says that real interest rate is measured as nominal interest rate minus expected inflation rate, because an expectation about future inflations definitely affects market interest rate (Kaufman, 1986).

The market interest rate is the interest rate offered most commonly on deposits in banks, other interest bearing accounts, as well as loan, it is determined by the supply and demand for credit (Farlex, 2009). Market interest rate largely depends on the supply and demand for credit, competition in the loanable market, and other economic factors, such as inflation rate,

expectation of investors, monetary policy of the government etc. The question of practical importance is whether the rate may be expected to move above or below today's level, how far it may go, and how long the movement may take. There are many different market interest rates in a given currency.

Treasury rate: The rate an investor earns on the instruments (Treasury bills and Treasury bonds) used by the Government to borrow from its own currency.

Interbank borrowing and lending rate (SABOR for South Africa, LIBOR for London): The rate at which banks lend and borrow from each other.

Mortgage rate: The rate charge on mortgages, it can be fixed or floating rate.

Deposit rate: The rate at which depositors are compensated for saving money with the bank. It is also called funding rate.

Prime rate: The rate at which banks lend to their customers. It is also called the lending rate.

Federal fund rate: The rate on reserves traded among commercial banks for overnight use.

Repo rate: This is the discount rate at which central bank repurchase government securities from the commercial banks. The central bank uses it to maintain the level of money supply it wants in the country's monetary system. It is a benchmark for variable deposits and lending rates in South Africa. The deposit and lending rates fluctuate along with changes in the repurchase rate; lending rate at a margin above, and the deposit rate at a margin below the repurchase rate, depending on maturity, risk, liquidity, and prevailing economic conditions (SARB monetary policy review 2009).

2.8 NET INTEREST INCOME (NII) AND NET INTEREST MARGIN (NIM)

Net Interest Income (NII) is the different (GAP) between the interest received from loans and investments and the interest paid on deposits and other liabilities, as Allen (1988) assumed in his theoretical model that there is interdependence between loans and deposits in banks. In other words, net interest income (NII) is the different between interest income and interest expense. While, the net interest margin (NIM) is the net interest income measured as a percentage of earning assets. Total net interest income is obviously not comparable between

institutions of substantially different sizes, but the net interest margin (expressed as a percentage) may be meaningfully compared among institutions. Angbazo (1997) stipulated that factors such as credit risk and interest rate risk, as well as the interaction between these two types of risks are among the variables that affect net interest margin.

The management of financial institutions manages assets and liabilities so as to control the size of the net interest margin. This control may be defensive or aggressive. The defensive asset/liability management prevents the interest rate changes from decreasing or increasing the net interest margin. In contrast, aggressive asset/liability management focuses on increasing the net interest margin by altering the portfolio of the institution. The success and failure of both strategies depends on the movement of interest rates (Rose et al, 1995).

In some countries where banks are the main sources of funds, the level of net interest margin is one of the important policy variables to measure how efficient is the bank in performing its function as an intermediary institution, to collect deposits and distribute loanable funds (Sidabalok and , Viverita, 2011).

2.9 INTEREST RATE RISK

Management of financial institutions faces different types of risk when managing loan portfolios or individual securities. The risk encompasses credit or default risk, liquidity risk, repayment risk, and interest rate risk (Rose et al, 1995). The major concern throughout the financial system is the interest rate risk.

Interest rate risk refers to the effect of interest rate volatility on rate earning assets and rate paying liabilities. For a given change (1%), interest rate risk also includes the effect of shift in volume and composition of assets and liabilities (Saha et al, 2009). As many other studies on interest rate have shown (Delis et al, 2011; Kasman et al, 2011; Hanweck and Kilcollin, 1984), maturity mismatch of banks assets and liabilities (while performing asset transformation function), and unexpected change in interest rate, potentially expose the banks to interest rate risk. This exposure will result to refinancing or reinvestment risk, depending on the direction and level of interest rate change (Saunders and Cornett, 2003).

In periods of high interest rates, institutions having heavy commitments to long term securities face a large risk of depreciation in the value of their portfolios (Hanweck and

Kilcollin, 1984). Therefore the cost of rolling over or borrowing funds could be more than the return earned on such investment (refinancing risk). On the other hand, if institutions rely heavily on short term assets than liabilities, in the event of low interest rate, excess borrowed fund will be reinvested at low interest rate (reinvestment risk) (Saunders and Cornett, 2003). Since banks have been increasing their securities holding relative to loan in recent years, interest rate risk has been increasing in the banking industry. It reduces the liquidity of the banks and increases the risk of insolvency (Rose et al, 1995). Interest rate risk is a more serious threat to intermediaries than default risk (Kohn, 2004). There are different ways (models) a financial institution can measure the exposure it faces in running a mismatched maturity book (gap between rate sensitive asset and rate sensitive liability). They include repricing model, maturity model, duration model, convexity, the term structure of interest rate.

2.9.1 Repricing (Funding Gap) Model

This approach analyses the gap (repricing gap) between the interest revenue earned on assets and interest expense paid on liabilities. It calculates the rate sensitivity of each asset and each liability. Rate sensitivity means that the assets or liability is repriced at or near current market interest rate within a certain time horizon (Saunders and Cornett, 2003).

2.9.2 Maturity Model

This model analyses the gap just like repricing model, but uses market value accounting instead of book value as done in repricing model. The market value accounting reflects economic reality or the true values of assets and liabilities.

2.9.3 Duration Model

Like the maturity model, this approach considers the market value of the assets and liabilities, but it takes into account the time of payment of all cash flows as well as the asset's or liability's maturity. The duration model through duration gap (the measure of overall interest rate exposure for a financial institution), also measures the change in the net worth due to the changes in interest rate (Saunders and Cornett, 2003).

2.9.4 Convexity

While the duration model measures the effect of changes in interest rates, convexity gives more accurate result for a larger change in the interest rate (Hull, 2003).

2.10 EFFECT OF INTEREST RATE RISK ON BANKS' PROFITABILITY

Interest rate movement is a major concern to all financial institutions and markets. It affects decision making, performance, and growth of any particular financial institution, (Madura, 1989). Changes in interest rate and interest rates expectations affect the income and expenditure of financial institutions. Under normal circumstances, the intermediary's average yield on asset (loan) will exceed the rate it pays to savers in order to attract funds. In fact, a positive net interest margin must exist over a long term for a financial institution to remain in the business of borrowing and lending money. But the maintenance of a positive net interest margin over time has been a special problem for a number of financial institutions in the recent years, due to volatile interest rates as well as other factors like restrictive regulations, reckless management etc.

According to Hanweck and Kilcollin, (1984), four factors determine the effect of a change in the general level of interest rate on banks' net interest margin (NIM). First, there is proportion of assets and liabilities. The higher the liability proportion relative to assets, the lower the NIM will be if interest rate increases. Second, there is a response of new asset and liability rates to changing general level of interest rate. Interest rate spreads between assets and liabilities may widen or narrow as interest rate rise, thereby increasing or decreasing NIM. Third, asset and liability portfolios may shift with changes in interest rate. For example, deposits and loans made at low interest rates may be renegotiated at current rate. Fourth, the size of a bank's portfolio may change with changing interest rates, and so may affect NIM.

The total effect of interest rate changes on profitability (Net Interest Income) can be summarized by its "*gap*". GAP is the difference between the interest rate-sensitive assets (loans) and interest rate sensitive liabilities (deposits) (Rose et al, 1995). Under aggressive management strategy, if interest rates are expected to rise, financial institutions with positive gap will experience rise in interest margin. Net income will increase because revenue from interest rate-sensitive assets will increase more than their cost. Financial institution with negative gap has to adjust its portfolio if it expects interest rate to rise, example, shortening the maturity of its assets, by selling long term securities and purchasing short term securities. Expectations of falling interest rate will produce the opposite adjustment of portfolio.

Management will want to shift to negative gap position to benefit from falling interest rate (Rose et al, 1995).

Falling interest rate may be accompanied by recession which can cause slower growth in loans and increase in loan losses. For all banks, profitability tends to be reduced (Hanweck and Kilcollin, 1984).

2.11 EFFECT OF INTEREST RATE RISK ON NET WORTH

The commercial banks face market value risk in addition to refinancing and reinvestment risk that occur when interest rates change, whereby the market value of the banks' assets is reduced due to rising interest rates. The interest rate shock that results in losses in the market value of assets directly affect the net worth (owners' equity), because debt holders are senior claimants on a firm's assets, while equity holders are junior claimants (Saunders and Cornett, 2003). Molyneux and Thorton (1992) examined the determinants of banks profitability in several countries; the result indicated a positive association between return on equity and the level of interest rates.

When interest rates rise, the market value of both assets and liabilities fall. If the maturity of the assets is longer than the maturity of the liabilities, for any given change in interest rate, the market value of assets (A) falls more than the market value of liabilities (L). This definitely affects the net worth [equity (E)], as the balance sheet identity is $E = A - L$ (Saunders and Cornett, 2003). Saha et al, (2009) confirmed this, that danger lurks in the banking books because interest rate hike reduces the present value of asset much more than that of liabilities, thereby depleting a bank's net worth. This takes us to Pillar 2 of Basel II, which states that interest rate risk in the banking book should also attract capital charges, if the losses in the Economic Value of Equity (EVE) is severe enough. EVE equals present value of assets minus present value of liabilities.

2.12 FACTORS THAT DETERMINE THE LEVEL OF INTEREST RATE

Changes in interest rate are determined by many factors which include the supply and demand for credit, competition in the loanable market, and other economic factors, such as inflation rate, expectation of investors, monetary policy of the government etc.

2.12.1 Demand and Supply of Loanable Funds

In a free-market, system like the economy of the United states , interest rate is determined in the market place by the interaction of borrowers and lenders (demand and supply of funds) (Shetty et al, 1995). Such interaction results in an equilibrium interest rate, when preference of borrowers and lenders are successfully matched. An equilibrium interest rate is acceptable to both parties to the transaction, and it is the rate at which the loan transaction is completed (Rose et al 1995).

The supply of funds depends on the preference of society for current versus future consumption, the lower the preference for current consumption, the stronger the incentive to accumulate funds. The demand for fund depends on the opportunities available for using borrowed funds efficiently and profitably, the more profitable the usage of funds the greater the demand for funds. If demand for funds increases/or the supply of funds declines, the price of funds (interest rate) will rise vice verse.

2.12.2 Inflation

Inflation affects interest rate because it affects the value of money promised in future, (Kohn, 2004). The rate of interest quoted in the financial market is sometimes contrasted with the real rate of interest, which is the observed market rate, corrected for price changes (inflation), (Goedhuys, 1982). According to Fisher effect, expectations of high inflation causes savers to require higher nominal (market) interest rate, as it is the only way they can maintain the existing real rate of interest. Real interest rate is measured as nominal interest rate minus expected inflation rate, because an expectation about future inflations definitely affects market interest rate (Kaufman, 1986).

Many studies have provided research on the relationship between expected inflation and interest rate; Booth and Ciner, (2001), and Laatsch and Klein (2003) stipulated that there is one-for one relationship between expected inflation and nominal interest rate in the long run. Laatsch and Klein (2003) went further to clarify that nominal interest rate adjust one-for-one with the change in expected inflation supporting Fisher's hypothesis, but changes in nominal interest rate does not lead or lag changes in expected inflation.

Lenders may certainly anticipate inflation just as borrowers may do, expectations of inflation then should tend to drive up interest rate as;

- a. Borrowers seek to obtain funds to purchase goods before their prices rise.
- b. Lenders seek to protect the purchasing power of their funds.
- c. Federal Reserve tightens credit in an effort to retard inflationary pressure.

If banks' management were able to fully anticipate inflation rate, it implies that banks can appropriately adjust interest rates in order to increase their revenues faster than their costs, and thus acquire higher profits. On the contrary, unanticipated inflation can lead to improper adjustment of interest rate, and hence to the possibility that costs will increase faster than revenues. (Anthanasoghou et al, 2006).

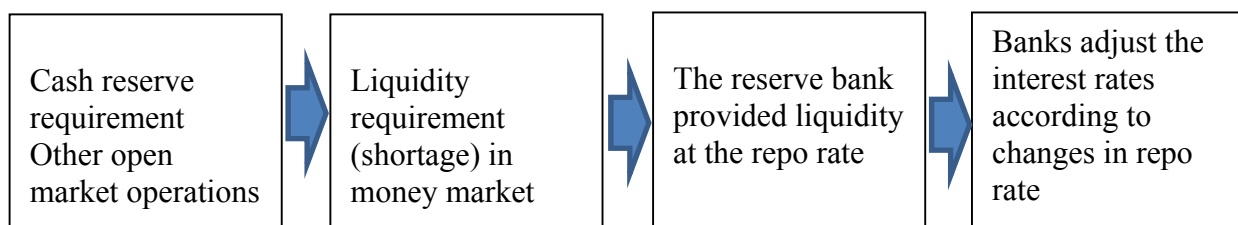
2.12.3 Monetary Policy

One of the purposes of the Federal Reserve of the Central Bank of every country is to control the supply of money and credit in the country through the monetary policy. The implication of monetary policy is when money supply is targeted, the resultant interest rate has to be accepted, or vice versa. The increase in money supply by the Central Bank leads to decrease in interest rate, this decrease in interest rate thereby increases demand for money (Blanchard, 2007). On the other hand, if monetary policy is used to fight inflation, the Federal Reserve sells securities (open market operations), raise reserve requirement of banks, and raises the discount rate. These actions reduce the supply of money, reduce banks' excess reserve, and increase the cost of credit (interest rates) (Mayo, 1989). Also if the central bank wants to restrict banks' lending to the private sector because of one reason or the other, it increases the bank rate [discount rate (what it charges to banks)], this induces an increase in the rate of interest charge on bank loans (Page, 1993).

In pursuing the objective of protecting the value of Rand, the South African Reserve Bank (SARB) conducts monetary policy under the inflation targeting framework. This framework is characterized by an announcement of numerical target point or range for inflation rate that is intended to be achieved over a period of time. When setting monetary policy the reserve bank decides on the level of short-term interest rate necessary to meet inflation target. The Monetary Policy Committee (MPC) decisions influence the overall lending policies of the banks and also the demand for money and credit in the economy (South African Reserve bank, July 2007).

The MPC of South Africa adopted an easier monetary policy stance in 2010, thereby supporting the recovery in the domestic economic activity. The repurchase rate was subsequently reduced three times during the year by a cumulative one-and half percentage (1 ½ %) point to 5.5 % in November 2010. On 20 January 2011, the MPC decided to keep the repurchase unchanged, against the backdrop of the improving growth outlook (South African Reserve bank, March 2011).

The South African Reserve Bank plays an important role in determining the level of short-term interest rates as these rates are closely related to the rate (Repo Rate) at which the central bank lends money to the private sector banks. The Reserve Bank's repo rate influences the interest rates charged by banks, the general level of interest rates in the economy and, consequently, the economic aggregates such as money supply, bank credit extension and, ultimately, the rate of inflation. The MPC implementation frame work of the reserve bank can be simplified as follows:



Money-market interest rates are determined by a combination of market forces and the repo rate. But it is important to note that market interest rates may not always change by exactly the same margin as a change in the repo rate, depending on factors such as the extent to

which change in repo rate has been anticipated and priced in (South African Reserve bank, March 2011). For this reason, uncertainty is one of the determinants of interest rate movements.

2.12.4 Investors' Expectation

The expectation theory argues that interest rates are functions of investors' expectations (Rose et al, 1995). If the investors' expectation is that the money supply will be increased by the Federal Reserve over the next period, the level of interest rate will increase. This is because the increase in money supply has not actually been implemented, while investors already reacted towards it.

2.12.5 Competition

Competition in the loanable market also affects the interest rate. Lowering the cost of deposit and raising the interest on loan by commercial banks will increase profit. But the ability to do so depend on how much competition faced in the industry. Even if there are few commercial banks to compete with, the non-bank substitute may be a problem, this leads to disintermediation. (Rose et al, 1995)

2.12.6 Uncertainty

Uncertainty about the future also plays a predominant part in the process of interest rate determination. Among more predominant types of uncertainty include

- a. The term period over which funds are made available. The longer the term of the loan, the greater the uncertainty that circumstances may change, therefore the higher compensation demanded by the lenders of funds. Thus the longer the term of the loan the higher the interest rate charged.
- b. The lender of funds will also be concerned about the ability of the borrower of funds to repay the loan. The higher the risk of default by the user or lower his/her credit rating, the higher the interest rate charged by the supplier of funds.

- c. During the period of low economic growth (measured by the GDP), banks narrow the spread between the deposit rate and repo rate, probably an attempt to attract deposits. This occurred between 2006 and 2008 when there was decelerating real economic growth (SARB monetary policy review 2009).

2.13 HEDGING THE INTEREST RATE RISK

The effective management of risks determines the success or failure of a modern financial institution (Saunders and Cornett, 2003). Interest rate risk is more difficult to manage compared to other risks facing the financial institutions. One complication is that there are many different interest rates in a given currency. Another complication is that to describe interest rate, more than a single number is needed. A function describing the variation of the rate with maturity is needed. This is called term structure of interest rate or yield curve (Hull, 2003)

Interest rate risk used to be an inhibiting and constraining element in the financing process. Rising interest rates would increase the cost of financial intermediaries, since they would pay more to acquire funds, but their fixed-rate fixed assets would be yielding old interest rates agreed upon. Consequently, rising interest rates no longer impede the institutional lender from increasing asset size and potential profit opportunities. This is due to the introduction of “variable interest rate financing” (Kaufman, 1986). Variable rate which is called Adjustable Rate Mortgage (ARM) or floating rate reduces the interest rate risk of the lender. When interest rates go up, and deposits from savers are to be paid for, the interest rate to be charged on outstanding loan can also be raised. By doing this, the net interest income remains roughly the same. Of course, the interest rate risk had not disappeared, but has been shifted from lender to borrower (Kohn, 2004). The following interest rate derivatives can also be used to hedge interest rate risk.

Interest Rate Futures

This can be used to hedge against adverse interest rate movements by locking in either a price or an interest rate. When an interest rate futures contract is purchased, the investor is locking in a set interest rate regardless of which direction interest rates will move in the future. A

thrift or commercial bank can hedge its cost of funds by locking in a rate using CD futures contract.

Interest Rate Options

Interest rate options can be written on cash instruments or futures. It can be used to hedge against adverse interest rate movement by setting a floor or ceiling to the rate. An investor can *buy a call* option if expects interest rate to fall, or alternatively *sell or write* a put option. While an investor who expects interest rate to rise will *buy a put* option or *sell a call* option. Suppose a thrift or commercial bank wants to make sure that its cost of fund does not exceed certain level. It can do so by buying a put option on CD futures (Fabozzi and Modigliani, 2003).

Forward Rate Agreement (FRA)

This is an agreement between two parties (one of whom is a dealer firm – a commercial bank or investment firm) who agreed at a specified future date to exchange an amount of money based on a reference interest rate and a notional principal amount (Fabozzi and Modigliani, 2003).

Interest Rate Swaps

This is an agreement whereby two parties agree to exchange periodic interest payments. The amount of interest exchanged is based on the notional amount.

2.14 FORECASTING THE INTEREST RATE

Interest rate forecast is essential to financial institutions and other firms. This they do in an attempt to capitalize on interest rate expectations. While the focus of defensive asset/liability management is to insulate the portfolio from interest rate changes, the success of aggressive asset/liability management depends on ability to forecast future interest rates (Rose et al, 1995). A variety of approaches are used in forecasting interest rate movements.

One of the most widely used approaches makes use of the flow of funds concept with loanable funds framework. With this concept, financial analysts project the supply and demand for loanable funds. While the supply of loanable funds includes funds provide by

major financial institutions as well as by other sources (excluding individuals), the demand for loanable includes credit demand from businesses, consumers, and government. It is important to note that the quantity of loanable funds supplied is presumed to increase with rise in the interest rate (Rose et al, 1995).

Expected future equilibrium interest rate can also be revealed in the prices and yields attached to contracts calling for future deliveries of interest bearing financial assets in the financial future markets (Rose et al, 1995). However, the record of professional forecasters has been so bad in anticipating interest rate changes. So it has been said that “the most important role for a forecaster is to forecast often with as much ambiguity as possible (Rose et al, 1995).

More so, interest rate may be forecasted indirectly by forecasting the future rate of inflation, provided the analyst has confidence in the Fisher effects. So since there is a sizeable error rate in inflation forecast by the market in general, better forecast of inflation rate, which is indirectly forecast of interest rate, can be profitable to the financial institutions (Rose et al, 1995).

2.15 CONCLUSION OF LITERATURE REVIEW

This section introduces the commercial banks and their services of intermediation between the savings surplus units and saving deficit units. Due to the intermediation role of commercial banks, the major part of their profit depends on the *gap* or spread between the interest income earned on their assets(loans to savings deficit unit) and the interest expenses paid on their liabilities(deposits from savings surplus unit), which is called net interest income (NII). Net interest income is a major part of banks’ profit, this is basically why the financial intermediaries try to offer lowest returns to savers and lend funds to borrowers at the highest possible interest rates.

The literature infers that the interest rate risk affects the profit as well as the net worth of commercial banks, because net interest income is a major part of commercial banks’ profit. This argument is tested in the research methodology and the results of this research report.

CHAPTER 3

RESEARCH METHODOLOGY

This section deals with the design, population and sampling methods used in the study. The method of data collection used for the study is detailed, followed by the tools and methods used in analysing the data.

3.1 RESEARCH DESIGN

This study is quantitative in nature, and involves mathematical modelling in order to determine the effect of changes in interest rates on profit and net worth of the sampled banks. This study uses panel data and assumes that the effect of interest rate changes vary across the observations and over time, therefore the use of stochastic econometric (panel regression analysis) process is appropriate.

Regression analysis is a statistical tool used for investigating the relationship between variables, it is an important tool for financial researchers (Koop, 2006), as has been used by many other researchers like Delis et al (2011), Kasman et al (2011), Hanweck and Kilcollin (1984), Demirguc-Kunt and Harry (1999), Saha et al (2009) on related studies. The deployment of regression technique is usually preceded by the formation of a mathematical model, which indicates a priori relations between the variables. For the purpose of this study, the variables of interest include profit (net interest margin) and net worth of commercial banks, market interest rates (for this study repo rate is used), factors that determine the interest rate movements, and some banks-specific factors. For the purpose of this study, there are five (5) models to be interpreted individually.

1. The determinant(s) of interest rate movement that affects interest rate the most.
2. The effect of interest rate fluctuations on commercial banks' profit.
3. The effect of interest rate fluctuations on commercial banks' net worth.
4. How such dominant(s) from model one determinants affect commercial banks' profit.

5. How such dominant(s) from model one determinants affect commercial banks net worth.

The models, which are designed to sum the theoretical (empirical) relationship between the study variables, are as follows:

$$1. MI_{it} = \alpha + \beta_1 CPI_t + \beta_2 Ms_t + \beta_3 Unc_t + \varepsilon_t \quad (3.1)$$

$$2. P_{it} = \alpha + \beta_1 MI_{it} + \beta_2 LqR_{it} + \beta_3 CapR_{it} + \beta_4 Comp_{it} + \beta_5 Npl_{it} + \varepsilon_t \quad (3.2)$$

$$3. NW_{it} = \alpha + \beta_1 MI_{it} + \beta_2 LqR_{it} + \beta_3 CapR_{it} + \beta_4 Comp_{it} + \beta_5 Npl_{it} + \varepsilon_t \quad (3.3)$$

$$4. P_{it} = \alpha + \beta_1 DomD + \varepsilon_t \quad (3.4)$$

$$5. NW_{it} = \alpha + \beta_1 DomD + \varepsilon_t \quad (3.5)$$

MI_{it} is the market interest rate at time t ; for the purpose of the study the South African repo rate is used, measured as the average repo rate. This is used because it is the benchmark for variable deposits and lending rates in South Africa.

CPI_t is the percentage changes in consumer price index of South Africa used to measure the inflation rate.

Ms_t is the money supply rate. For the purpose of the study M_3 is used to measure the money supply rate in the country (South Africa).

Unc_t is uncertainty in the economy. It is measured as the standard deviation of gross domestic product (GDP) for the current year and two previous years.

P_{it} is the profit (net interest margin) of bank i at time t . It is measured as

$$NIM = \text{Interest Income} - \text{Interest Expenses} \div \text{Average Earning Assets}.$$

LqR_{it} is the liquidity ratio of bank i at time t .

$CapR_{it}$ is the capital ratio of bank i at time t .

$Comp_{it}$ is the level of completion among banks; it is measured as the average total asset of three big banks (in terms of asset size as at the year 2010) divided by the assets bank i at time t .

Npl_{it} is the non-performing loan of bank i at time t ; it is measured as the loan loss provision divided by the total loan.

NW_{it} is the net worth of bank i at time t .

DomD is the determinant of interest rate movement that affects interest rate the most. It is the dominant determinant which will emerge available after regressing equation 3.1.

α and β_i ($i = 1, 2, \dots, N$) are the coefficients; α is the intercept while β is the slope, which measures the influence of MI, CPI, M_3 , and Repo (the explanatory or independent variables) on P, MI, NW (the dependent variable) as the case may be (Koop, 2006). The liquidity ratio (LqtyR), capital ratio (CapR), completion (Comp), and non-performing loan (Npl) are considered as a set of bank specific factors that affect profit and/or net worth.

3.2 POPULATION AND SAMPLE

3.2.1 Population

The research population is all operational commercial banks in South Africa.

3.2.2 Sample Size and Selection

From the practical point of view, this study needed to balance the need for representative data sample with availability of data. As such, the data sample used for the study is fourteen commercial banks and one investment bank (total of fifteen banks) in South Africa for the period of ten years (from 2001 to 2010). The reason for including an investment bank is due to its deals with customers' deposits, loans, and advances (i.e. its significant commercial banking activity), which definitely are affected by interest rate fluctuations.

The sampled banks are of two sets, the big and the small banks, based on their total assets as at the year-end 2010. The big banks are the banks with assets size of over R100 billion, they include Standard bank, ABSA, Nedbank, and FirstRand bank, while the remaining ten banks are ranked as small with assets size of below R100 billion. Table 3.1 below lists the sampled

banks, their specialization, their asset size, percentage of their asset size to the banking industry's total assets, and the their country ranks as at the year 2010.

Table 3.1: Sampled banks, specialization, total asset, percentage of total asset to the banking industry's total asset, and country ranks as at 2010.

Bank Name	Specialization	Total Asset as at 2010	% of Total Asset	Country Rank
STANDARD BANK	Commercial Bank	824 600.00	26.40	1
ABSA	“	680 923.00	21.80	2
NEDBANK	“	576 490.00	18.46	3
FIRSTRAND BANK	“	576 386.00	18.45	4
INVESTEC BANK	Investment Bank	197 879.00	6.34	5
IMPERIAL BANK	Commercial Bank	55 660.00	1.78	6
AFRCAN BANK	“	34 435.00	1.10	8
PSG GROUP	“	14 686.00	0.47	9
MERCANTILE BANK	“	6 236.00	0.20	10
ALBRAKA BANK	“	2 825.00	0.09	15
GRINDROD BANK	“	2 440.00	0.08	19
SASFIN BANK	“	1538.00	0.05	20
S A BANK OF ATHENS	“	1 245.00	0.04	24
HABIB OVERSEA BANK	“	798.00	0.03	25
GSB MUTUAL BANK	“	776.00	0.02	26

NOTE: The total asset is reported in millions of rand. The total asset of South African banking industry is **R3 123 349 million** as at year-end, December 2010, and there were 38 operational banks in South Africa as at the year 2010 (source, Bank Scope data base).

3.3 DATA COLLECTION

The data for the study largely come from the income statement and balance sheet of the sampled banks from Bank Scope database. A ten-year data from financial year-end 2001 to financial year-end 2010 was collected from the banks' annual reports. The interest rates (prime, repo, and deposit), consumer price index, rate of money supply, and gross domestic product were obtained from the South African Reserve Bank (SARB) database.

The following pieces of financial information required for the study, obtained from both the annual reports of the sampled banks and the SARB database are as follows:

- Net interest margin (NIM) of the sample banks on yearly basis from 2001 to 2010.
- The net worth or owners' equity of the sampled banks from 2001 to 2010.
- The provision for loan loss of the sampled banks from 2001 to 2010.
- The total capital ratios of the sampled banks from 2001 to 2010.
- The liquidity ratios of the sampled banks from 2001 to 2010.
- The total assets of the sampled banks from 2001 to 2010.
- The gross loan of the sampled banks from 2001 to 2010.
- The Gross Domestic Product (GDP) from 1999 to 2010.
- The Consumer Price Index (CPI) from 2001 to 2010.
- The repurchase rate (repo rate) from 2001 to 2010.
- The money supply rate (M3) from 2001 to 2010.
- The prime lending rate from 2001 to 2010.
- The deposit rate from 2001 to 2010.

A dataset was created in excel for the sampled banks and the variables for the study, and a panel data became available. The dataset include five big banks with total assets of over R100 billion each, while the other ten banks have below R100 billion worth of total assets each (see table 3.1). All financial data were downloaded, and there are ten years' data available for all the sampled banks. Any bank with incomplete ten years consecutive financial report was excluded from the study.

The data set was checked for completeness and accuracy before fitting it to the model. For the purpose of modelling, all bank names were replaced with a bank identification number, but are used interchangeably with the bank names. Table 3.2 below lists each bank's identification number, and number of years of financial information obtained.

Table 3.2: Bank names, identification numbers, and number of years of financial data extracted.

Bank Name	Bank Number	Number of Years
STANDARD BANK	1	10
ABSA	2	10
FIRSTRAND BANK	3	10
NEDBANK	4	10
INVESTEC BANK	5	10
IMPERIAL BANK	6	10
AFRCAN BANK	7	10
PSG GROUP	8	10
MERCANTILE BANK	9	10
ALBRAKA BANK	10	10
GRINDROD BANK	11	10
SASFIN BANK	12	10
S A BANK OF ATHENS	13	10
HABIB OVERSEA BANK	14	10
GSB MUTUAL BANK	15	10

3.4 THE RESEARCH INSTRUMENT

Being an important tool for financial researchers (Koop, 2006), and having been used by many international researchers like Delis et al (2011), Kasman et al (2011), Hanweck and Kilcollin (1984), Demirguc-Kunt and Harry (1999), Saha et al (2009) on related studies, regression analysis is applied in this study by using simple panel data method to estimate equations 3.1 to 3.5. The dataset formed was transferred to stata 10.0 to assess the effect of interest rate fluctuations on commercial banks' profitability, as well as on net worth. The factors that determine interest rate movements were assessed, to determine which of the factors has more impact on interest rate. The number of samples (fifteen banks) and time period (ten years) are well defined.

The following preliminary tests were carried out to ensure the validity and accuracy of the results from the analysis.

Stationarity Test

All the variables were tested for stationarity, using unit root test by Hadri (2000). Nonstationarity was corrected using differencing order before the data is fitted to the model.

Autocorrelation Test

Because serial correlation (autocorrelation) in linear panel-data models biases the standard errors and causes the results to be less efficient, a new test discussed by Wooldridge (2002) is very attractive because it can be applied under general conditions and is easy to implement (Drukker, 2003). For this study, autocorrelation was tested in all the models using Wooldridge test, all the autocorrelation problems noticed in the models were corrected using Prais-Winsten AR (1) model.

Hausman Test

Ordinary least square (OLS) model is not appropriate for linear panel-data (Wooldridge, 2006). The opportunity to use either fixed effect model or random effect model has been tested using Hausman test. This test helps one to evaluate if a statistical model corresponds to the data.

3.5 DATA ANALYSIS

Hypothesis testing, trend, and correlation analyses are conducted using stata 10.0 to determine the effects of the explanatory variables on the dependent variables, and the relationships that exist among them.

3.5.1 Hypothesis Testing

Hypothesis testing is carried out on equations 3.1 to 3.5, with the hypothesis formally stated as follows:

Hypothesis 1

H₀: Fluctuations in macroeconomic factors (consumer price, percentage in money supply, and uncertainty) do not determine fluctuation in the interest rates.

H₁: Fluctuations in macroeconomic factors (consumer price, percentage in money supply, and uncertainty) determine fluctuations in the interest rates.

Hypothesis 2

H₀: Changes in interest rates (repo) do not affect commercial banks' profit.

H₁: Changes in interest rates (repo) affect commercial banks' profit.

Hypothesis 3

H₀: Changes in interest rates (repo) do not affect commercial banks' net worth.

H₁: Changes in interest rates (repo) affect commercial banks' net worth.

Hypothesis 4

H₀: Dominant determinants of interest rates (repo) do not affect commercial banks' profits.

H₁: Dominant determinants of interest rates (repo) affect commercial banks' profits.

Hypothesis 5

H₀: Dominant determinants of interest rates do not affect commercial banks' net worth.

H₁: Dominant determinants of interest rates (repo) affect commercial banks' net worth.

3.5.2 Trend Analysis

A graph plotted using time series data can be used to examine trend behavior. In this study, the following graphs are plotted.

The market interest rate (repo rate) and the profit of the sampled banks are plotted over time to determine the possible relationship between them. The plot was divided into big banks (with total assets of over R100 billion), and small banks (with total assets of less than R100 billion). The mean profit is used in this plot.

Repo rate verse net worth of the big and small banks: The logged mean net worth is used, due to high values of net worth relative to the repo rates. This is done to see the effect of repo rate changes on big and small banks' profit during the observed period.

The repo rate and its determinants sampled in the study: This is to see the trend of repo rate, inflation (consumer price index), money supply, and uncertainty during the period of observation.

The prime, the repo, and deposit rates: These rates were plotted over time to determine their trend behavior, to see the effect of repo rate in pricing the prime rate and deposit rate by the commercial banks.

3.5.3 Correlation Analysis

Regression is the most appropriate tool for use if the analysis contains more than two variables. Yet it is also not unusual when working with several variables to calculate the correlation between each pair. Therefore a pair wise correlation analysis is conducted on the test variables. This particular test is useful in flagging any potential multicollinearity problem that might crop up in the regression tests.

CHAPTER 4

PRESENTATION AND DISCUSSION OF RESULT

4.1 PRESENTATION OF RESULT

The empirical analysis and results are based on financial data from the sampled banks and the South African Reserve Bank (SARB) for the period of ten consecutive years (2001 to 2010). The banks have different financial year-ends, but with 12 months complete data for each year-end. The financial data extracted from the annual reports of the sampled banks and SARB are as tabulated in Appendix A and B, respectively.

ABSA and Mercantile banks changed their financial year-end from March 31 to December 31 in 2003 and 2006, respectively, while Grindrod changed its own from June 30 to December 31 in 2007.

PSG group has its financial year end of February (28 or 29) throughout the period.

Investec bank and GSB mutual bank have their financial year-end in March 31, and have been consistent during the observed period.

FirstRand and Sasfin banks have their financial year end in June 30, consistent during the observed period.

African bank has its own in September 30 during the observed period.

Finally, Standard bank, NedBank, Imperial bank, Habib oversea bank and South African bank of Athens use the calendar year end of December 31 as their financial year-end.

The financial data was corrected of nonstationarity, autocorrelation, and multicollinearity before fitting it to the model. In descriptive analysis, the net worth was logged due to its higher values compared to other variables.

4.1.1 Descriptive Analysis

Table 4.1 shows the correlation between the test variables. The repo, prime, and deposit rates are highly correlated with one another, mainly because repo rate is the benchmark with which prime and deposit rates are determined. This makes it difficult for the regression model to actually tell which of the independent variables is influencing the dependent variable (multicollinearity problem). Therefore, the repo rate is chosen among the three rates for the regression.

Table 4.1: Correlations among the test variables.

	Repo	Prime	Depo	CPI	Mnys	Uncert
Repo	1.0000					
Prime	0.9864	1.0000				
Depo	0.9712	0.9686	1.0000			
CPI	0.4824	0.4957	0.5312	1.0000		
Mnys	0.2017	0.1694	0.1207	0.0429	1.0000	
Uncert	-0.5275	-0.5120	-0.3929	-0.1659	-0.8500	1.0000

Table 4.2 below shows the correlation between the banks' profits (net interest margin) and the repo rate along with the bank-specific variables (internal factors). It reveals that both the internal factors and the repo rate are positively correlated with profit, but the internal factors have stronger positive correlation with profit than repo rate (an external factor). It also shows that the bank-specific variables are negatively correlated with the repo rate, with the exception of the non-performing loan, which may be due to the fact that repo rate is used as the benchmark for loan pricing by financial institutions. Among the internal factors, only non-performing loan displayed a stronger positive correlation (with liquidity ratio), but has an inverse relationship (negative correlation) with competition.

Table 4.2: Correlations among profit, repo rate, liquidity ratio, capital ratio, completion, and non-performing loans.

	Pft	Repo	Lqdy	CapR	Comp	Npl
Pft	1.0000					
Repo	0.0025	1.0000				
Lqdy	0.5761	-0.1063	1.0000			
CapR	0.6255	-0.0905	0.4914	1.0000		
Comp	0.0156	-0.0521	0.0253	0.0502	1.0000	
Npl	0.7033	0.0237	0.6220	0.3516	-0.2079	1.0000

Table 4.3 shows the correlations among the banks' net worth, repo rate, and the bank-specific factors. Both the repo rate and the internal factors have negative correlation with the banks' net worth, with the exception of the non-performing loan.

Table 4.3: Correlations among net worth, repo rate, liquidity ratio, capital ratio, completion, and non-performing loans.

	Netw	Repo	Lqdy	CapR	Comp	Npl
Netw	1.0000					
Repo	-0.1176	1.0000				
Lqdy	-0.1791	-0.1063	1.0000			
CapR	-0.2769	-0.0905	0.4914	1.0000		
Comp	-0.5085	-0.0521	0.0253	0.0502	1.0000	
Npl	0.0184	0.0237	0.6220	0.3516	-0.2079	1.0000

Table 4.4 lists the mean profits of both big and small banks. It reveals that the small banks have higher profit (net interest margin) than the big banks. The small banks have the highest mean net interest margin of 9.068 in 2006 and the lowest of 6.271 in 2010. The big banks have the highest profit figure of 3.406 in 2001 and lowest of 2.674 in 2004. This shows that small banks make more net interest margin, but with higher standard deviation than the big banks of South Africa. This means that the profits of the small banks spread over a large range of values, especially in the year 2006 and 2007.

Table 4.4: The mean profit for big and small banks by year.

Profit	5 Big Banks		10 Small Banks	
Year	Mean	Standard Dev.	Mean	Standard Dev.
2001	3.406	1.110531	6.833	5.301857
2002	3.116	0.8849181	7.454	5.235386
2003	2.848	0.8459137	8.262	6.928262
2004	2.674	0.8450326	8.658	9.237866
2005	2.774	0.5854742	7.266	9.24514
2006	2.848	0.5510173	9.068	10.26932
2007	3.010	0.5857901	9.011	10.4357
2008	2.830	0.4440158	7.627	6.695183
2009	2.906	0.6593027	7.281	5.399816
2010	2.678	0.4846854	6.271	4.327153

Table 4.5 lists the mean logged net worth of the banks (big and small). It shows that the net worth of the banks increases by year, with low standard deviation, which entails low variation or dispersion of the actual values from the average (mean) values.

Table 4.5: The mean logged net worth for big and small banks by year.

Net Worth(Log)	5 Big Banks		10 Small Banks	
	Mean	Standard Dev.	Mean	Standard Dev.
2001	9.091466	0.2835458	4.925833	1.666067
2002	9.205576	0.2194793	4.842237	1.810445
2003	9.34199	0.3932556	5.063939	1.6446
2004	9.553506	0.3806042	5.219495	1.433272
2005	9.731119	0.4320756	5.386761	1.408148
2006	9.925853	0.4955337	5.534618	1.558076
2007	10.12193	0.523865	5.837977	1.658672
2008	10.3149	0.4970133	6.103205	1.639281
2009	10.39465	0.4874655	6.229705	1.650765
2010	10.47737	0.4579093	6.404803	1.805841

Figure 4.1 below shows the mean profit (net interest margin) for all sampled banks during the observed period. It is shown that small banks have higher net interest margin than the big banks. African bank with total asset of R34 435 million (a small bank) has the highest mean net interest margin of 25.76%. The big banks have relatively low net interest margin, ABSA has 3.58%, which is the highest among the big banks. Investec bank (a big bank with total asset of R197 879) is the least profitable among the whole sampled banks with mean of 1.98%.

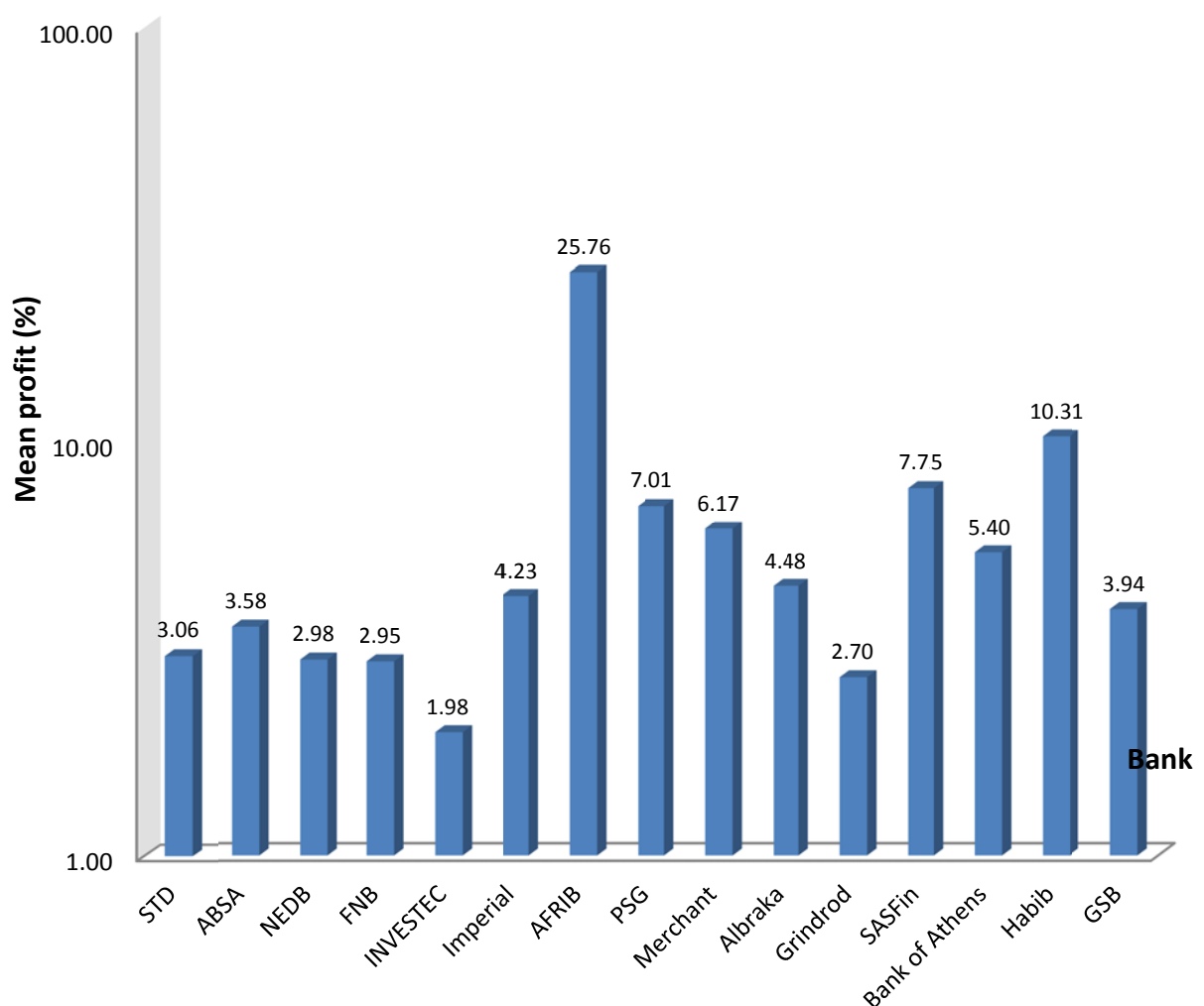


Figure 4.1 Mean percentage profit of sampled banks during the period 2001 - 2010

Figure 4.2 graphically plots the mean logged net worth of the sampled banks during the observed period (2001 to 2010). NedBank has the highest value of 10.08, followed by ABSA and Standard banks with 10.06 each. Habib bank has the least value of 3.33. This shows that the big banks have more net worth compared to the small banks. Given that big banks recorded low level of profitability (net interest margin), one can infer/summarise that big banks enjoy high net worth due to their access to significant pool of non-interest earning (mainly via service fees).

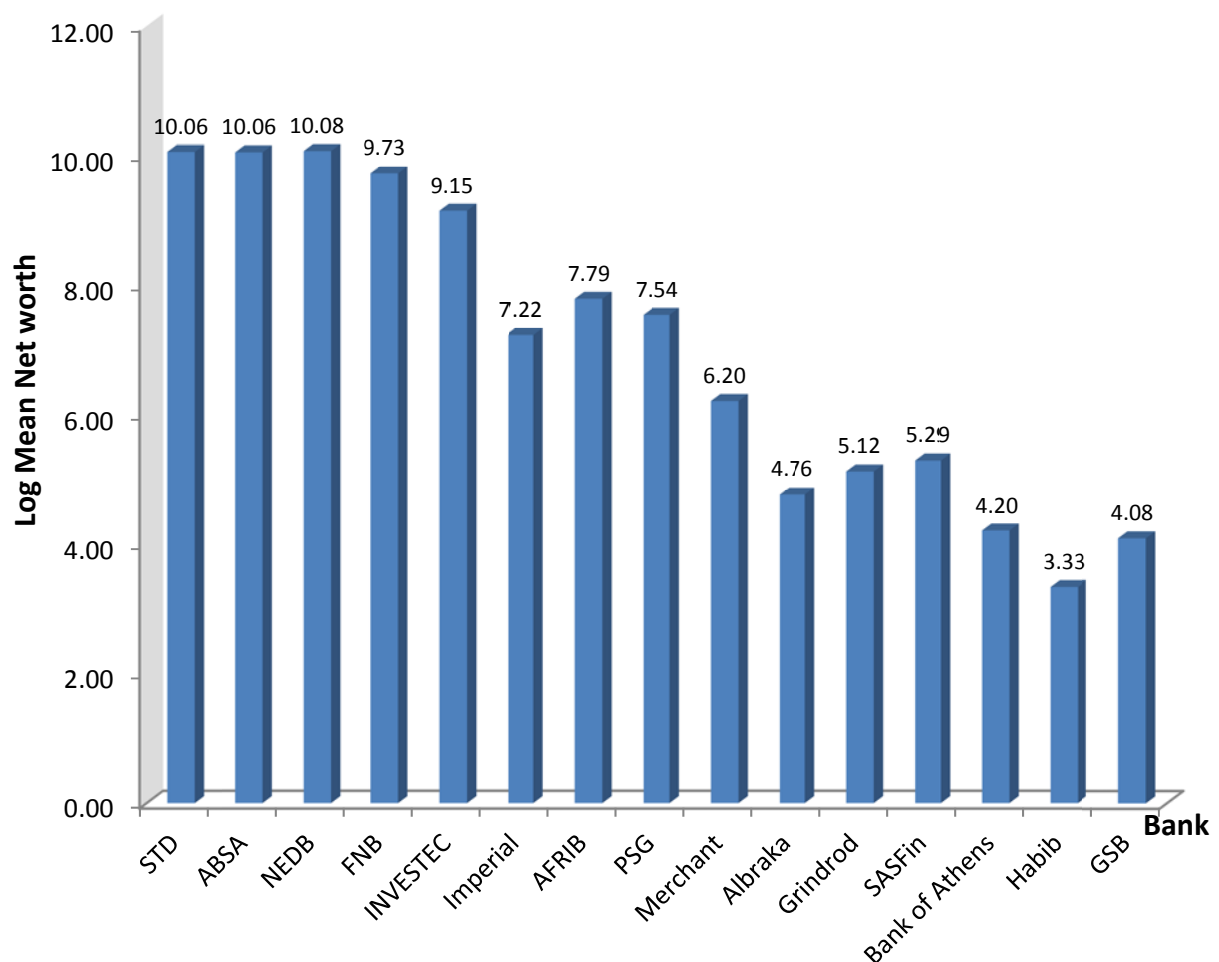


Figure 4.2 The mean logged net worth of sampled banks during the period 2001 - 2010

Figure 4.3 graphically indicates the trend of interest rate (repo) fluctuations and its cursory effect on profits of both big and small banks. It appears that the effect of repo rate is more on the profitability of small banks than those of the big banks. In addition, one can deduce from the plot that interest rate fluctuations are more beneficial to small banks which may contribute to their higher net interest margin relative to big banks. This confirms Hanweck and Kilcollin's (1984) finding that small commercial banks as a group have experienced increase in profitability (net interest margin) both absolutely and relatively than large banks during periods of rising interest rates.

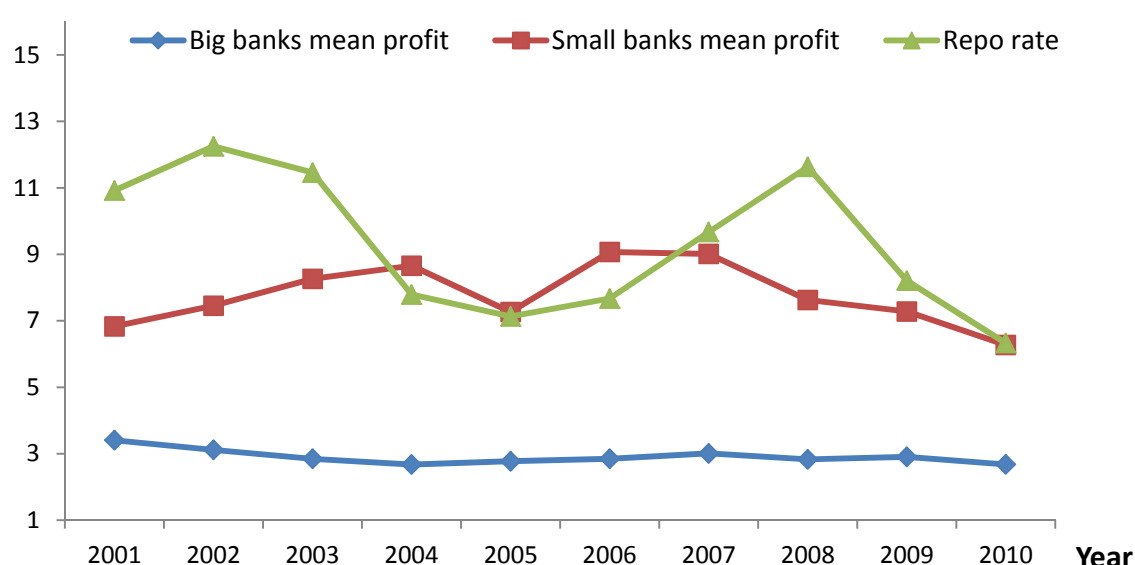


Figure 4.3 Comparison of repo rate with mean profit of big and small banks respectively

Figure 4.4 below, plots the trend of interest rate, and net worth of the sampled big and small banks. It shows that interest rate fluctuations appear not have affected the banks' net worth during the observed period (2001 to 2010). There is a slight decrease in net worth of the small banks in 2002, as interest rate (repo) increased, which partially reflects the finding in figure 4.3, where small banks' profitability appear to be strongly associated with interest rates.

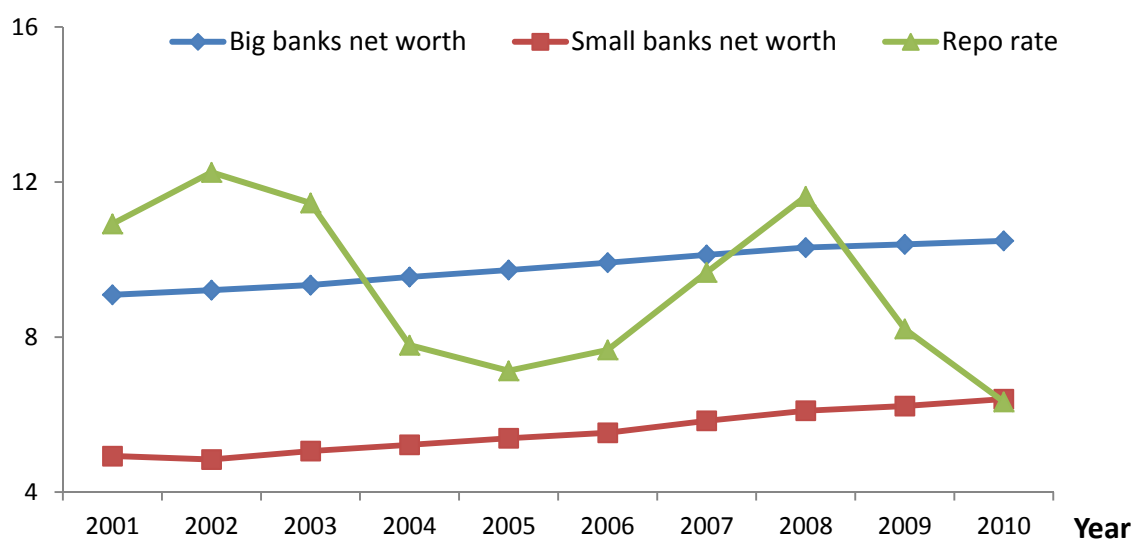


Figure 4.4 Comparison of repo rate with net worth of big and small banks respectively

Figure 4.5 plots the trend of the repo rate and theoretical determinants of interest rates. It shows that repo rate and consumer price index move in the same direction, while uncertainty measured as standard deviation of GDP, and money supply appear less correlated with repo rate.

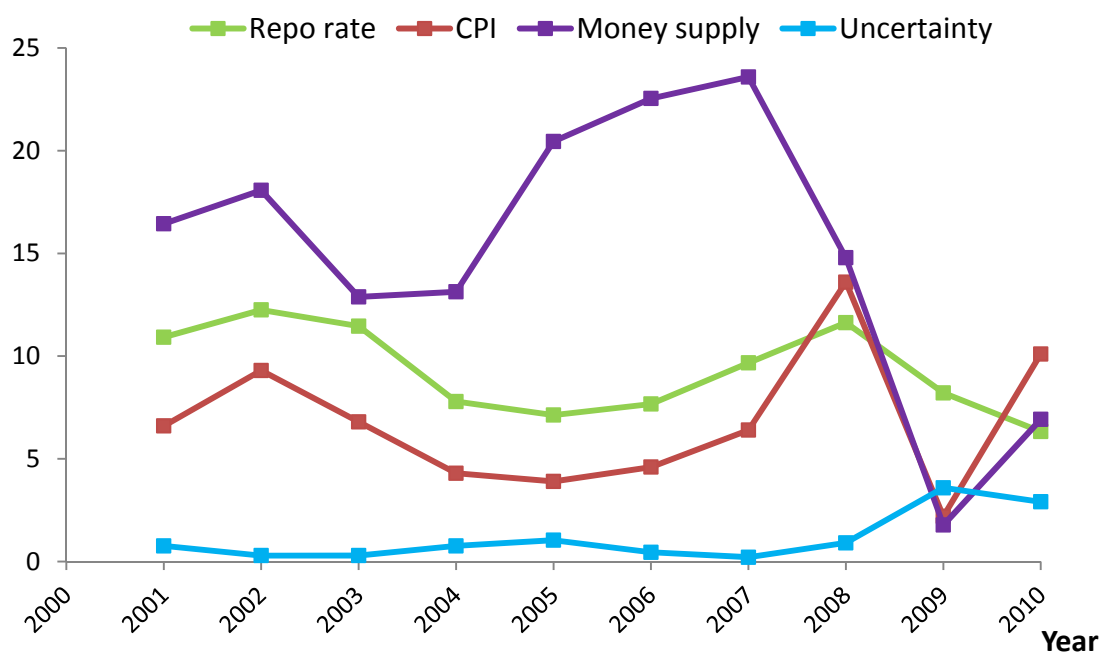


Figure 4.5 Trend of Repo rate, CPI, Money supply and Uncertainty

Figure 4.6 plots the trend of prime, repo, and deposit rates (all of which are proxies of interest rate). The deposit rate trend shows that depositors received a relatively smaller interest benefit during the monetary policy tightening phases of 2002, and from 2006 to early 2009, but received a relatively larger interest benefit during monetary policy easing cycles in 2003 and 2009. A much narrower spread between banks' deposit rates and repo rate was maintained between 2006 and 2008 as banks probably attempted to attract deposits during the period of decelerating economic growth (see uncertainty trend in figure 4.5).

The prime (lending) rate, which generally uses repo rate as a benchmark, was found to fluctuate at around 240 basis points above the repo rate from 2001 to 2010 (South African Reserve bank, November 2009). Some little narrowing occurred during 2002 and from 2006 to 2008 during the tightening phases of monetary policy. Similarly the gap between prime rate and repo rate widened when policy eased in 2003 and 2009.

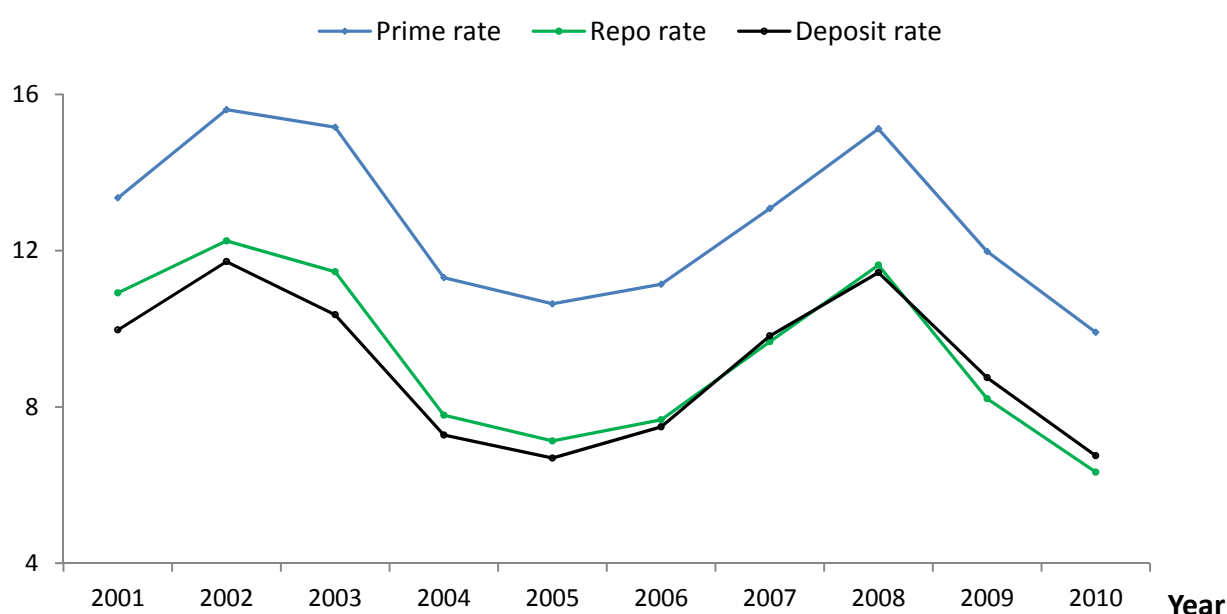


Figure 4. 6 Comparison of prime rate, repo rate and deposit rate 2001 - 2010

4.1.2 Result of Hypothesis Testing

The hypothesis for the study is limited to the South African economy and commercial banks. The hypothesis tests are summarized in Table 4.6 below.

Table 4.6 *Summary of hypothesis testing*

	Null hypothesis	Alternative hypothesis
Hypothesis 1	Fluctuations in macroeconomic factors do not determine the fluctuations in interest rate (repo rate) in South Africa during the observed period (2001 to 2010).	Fluctuations in macroeconomic factors determine the fluctuation in interest rate (repo rate) in South Africa during the observed period.
Hypothesis 2	Changes in interest rates (repo rate) do not affect commercial banks' profit (net interest margin) during the observed period.	Changes in interest rates (repo) affect commercial banks' profit (net interest margin) during the observed period.
Hypothesis 3	Changes in interest rates (repo rate) do not affect commercial banks' net worth.	Changes in interest rates (repo rate) affect commercial banks' net worth.
Hypothesis 4	The dominant determinants of interest rates (repo), among the macroeconomic factors, do not affect commercial banks' profits (net interest margin).	The dominant determinants of interest rates (repo), among the macroeconomic factors, affect commercial banks' profits (net interest margin).
Hypothesis 5	. The dominant determinants of interest rates (repo), among the macroeconomic factors, do not affect commercial banks' net worth.	The dominant determinants of interest rates (repo), among the macroeconomic factors, affect commercial banks' net worth.

4.1.3 **Summary of the Result**

The models used for the study perform reasonably well with most variables staying stable across the various regressions tested. The explanatory powers of the models are reasonably high, while the F-statistics for all models are significant at the 5% level. The Hausman fixed

random test was used to determine which model is appropriate for each hypothesis. The classification of banks as big and small is based on the asset size as at the year 2010. The big banks have asset size of over R100 billion, while the small banks are banks with asset size of below R100 billion.

Table 4.7 *Summary of the results of hypothesis testing for 15 sampled banks*

Hypothesis	Model	P-value	Coefficient	Decision	Findings
Hypothesis 1 CPI Money supply Uncertainty	Random effects	0.000 0.008 0.000	0.1878659 -0.1070841 -1.3030630	Accept H1	There is significant evidence that fluctuations in macroeconomic factors such as CPI, money supply, and uncertainty of the economy determine the changes in interest rates (repo rate).
Hypothesis 2	Random effects	0.012	0.3638664	Accept H1	The changes caused by interest rate fluctuations in profits of commercial banks are statistically significant.
Hypothesis 3	Prais-Winsten	0.007	163.9697	Accept H1	Net worth of commercial banks is significantly affected by interest rate fluctuations.
Hypothesis 4 CPI Money supply Uncertainty	Fixed effects	0.135 0.354 0.206	-0.1427175 -0.0681456 -0.6479516	Accept H0	The effect of macroeconomic factors (most predictors of repo rate) on commercial banks' profit is not statistically significant.
Hypothesis 5 CPI Money supply Uncertainty	Prais-Winsten	0.326 0.560 0.813	36.062 -18.56356 -66.5477	Accept H0	The effect of macroeconomic factors (most predictors of repo rate) on commercial banks' net worth is not statistically significant.

Table 4.8 *Summary of the results of hypothesis testing for the 5 big sampled banks*

Hypothesis	Model	P-value	Coefficient	Decision	Findings
Hypothesis test 2	Random effects	0.283	0.0371527	Accept H0	The changes caused by interest rate fluctuations in profits of big banks in South Africa are not statistically significant.
Hypothesis test 3	Prais-Winsten	0.756	-94.13676	Accept H0	The net worth of the big commercial banks is not significantly affected by interest rate fluctuations.
Hypothesis test 4 CPI Money supply Uncertainty	Fixed effects	0.729 0.617 0.952	0.0081384 -0.0091081 0.0077185	Accept H0	The effect of macroeconomic factors (most predictors of repo rate) on big commercial banks' profit is not statistically significant.
Hypothesis test 5 CPI Money supply Uncertainty	Prais-Winsten	0.147 0.316 0.926	243.4403 -169.9121 74.7295	Accept H0	The effect of economic factors (most predictors of repo rate) on big commercial banks' net worth is not statistically significant.

Table 4.9 *Summary of the results of hypothesis testing for 10 small sampled banks*

Hypothesis	Model	P-value	Coefficient	Decision	Findings
Hypothesis test 2	Random effects	0.040	0.480819	Accept H1	There is significant evidence that fluctuations in interest rate affect profit of small commercial banks during the observed period.
Hypothesis test 3	Fixed effects	0.305	-34.78151	Accept H0	No significant evidence that net worth of small commercial banks is affected by interest rate fluctuations
Hypothesis test 4 CPI Money supply Uncertainty	Fixed effects	0.173 0.392 0.267	-0.2083123 -0.0996299 -0.8991706	Accept H0	The effect of macroeconomic factors (most predictors of repo rate) on small commercial banks' profit is not statistically significant.
Hypothesis test 5 CPI Money supply Uncertainty	Fixed effects	0.009 0.213 0.048	68.35641 24.16229 269.2799	Accept H1	The effect of macroeconomic factors on small commercial banks' net worth is statistically significant.

4.1.4 Changes in Repo Rate with Macroeconomic Factors

In the random effect regression model of repo rate against the investigated macroeconomic factors (CPI, money supply and uncertainty), the coefficient of each variable represented the estimated change in repo rate predicted by a percentage change in each factor, holding all other variables constant.

Repo rate and CPI

Increase in CPI led to an increase in repo rate (coeff. = 0.188; [CI = 0.087 – 0.289]; $p < 0.001$). This means that every percentage increase in CPI would result in a 0.19% increase in repo rate, and this is statistically significant as the two tail p-value of the estimate is less than the cut-off of 0.05 within 95% confidence interval.

Repo rate and Money supply

Money supply affected repo rate in the opposite direction. A percentage increase in money supply would cause a 0.11% decrease in repo rate (coeff. = - 0.107; [CI -0.187 to – 0.027]; $p = 0.008$). This estimate was statistically significant with a p-value of 0.008 at 95% confidence interval.

Repo rate and uncertainty

Increase in uncertainty resulted in a decrease in repo rate (coeff. = -1.303; [CI –1.856 to - 0.750]; $p < 0.001$). This means repo rate decreases by 1.30% for every unit change in uncertainty. This effect of uncertainty on repo rate is statistically significant.

4.1.5 Banks' Profit Variations with Repo Rate

Using the random effect model (from Hausman test), profit of the banks was estimated with changes in repo rate over the 10 year observed period. The regression was controlled with other bank-specific variables (liquidity ratio, capital ratio, competition, and non-performing loan).

On all sampled banks

Running regression using the fifteen sampled banks, increase in repo rate led to an increase in profit (coeff. = 0.364; [CI = 0.080 to 0.648]; $p = 0.012$). This means that for every percentage change in repo rate, profit increases by 0.36%. This effect is statistically significant with p-value (0.012) less than 0.05 at 95% confidence interval. Among the controlling variables, capital ratio, competition, and non- performing loan all have positive coefficients of 0.287, 0.002, 1.019 respectively, but only capital ratio and non-performing loan are statistically

significant ($P < 0.001$) at 5% confidence level, while liquidity ratio has a negative coefficient of -0.005, and is not statistically significant ($p\text{-value} = 0.513$, greater than 0.05).

On Big banks

For a percentage change in repo rate, the profit of the five big banks increases by 0.037%, but this is not statistically significant with a $p\text{-value}$ of 0.283 at 95% confidence interval (coeff. = 0.037; [CI = -0.031 to 0.105]; $p = 0.283$). Liquidity and capital ratios have negative coefficients of -0.035 and -0.089, meaning that a percentage change in liquidity and capital ratios decreases profit of big banks by 0.035% and 0.090%, respectively. This effect is statistically significant with $p\text{-values}$ of 0.006 and 0.022 at 5% confidence level, respectively. Competition and nonperforming loan have positive coefficients of 0.006 and 0.010 with $p\text{-values}$ of 0.956 and 0.940 at 95% confidence interval respectively, which shows that they are not statistically significant.

On small banks

Running regression using only the small banks, increase in repo rate led to an increase in profit (coeff. = 0.481; [CI = 0.021 to 0.940]; $p = 0.040$). That means for every percentage change in repo rate, profit of small banks increases by 0.481%. This effect is statistically significant with a $p\text{-value}$ of 0.040 which is less than 0.05 at 95% confidence interval. This confirms the plot in figure 4.3, that the effect of interest rate fluctuations is more on small banks' profit than on big banks' profit. The control variables: capital ratio, competition, and non-performing loan have positive coefficients of 0.298, 0.01, and 2.195, respectively. This means that any percentage change in the above mentioned variables will lead to an increase in profit, but only capital ratio and non-performing loan are statistically significant ($P < 0.001$) at 95% confidence level, while liquidity ratio has a negative coefficient of -0.002, and is not statistically significant ($p\text{-value} = 0.828$, greater than 0.05).

4.1.6 Banks' Net Worth Variations with Repo Rate

As was regressed in profit variations, the sampled banks' net worth were estimated with changes in repo rate during the observed period (2001 to 2010), while controlling for the regression of banks' net worth with the same banks- specific variables (liquidity ratio, capital ratio, competition and non-performing loan).

On all sampled banks

Using the Prais-Winsten AR (1) model to correct the serial correlation problem in this model, (coeff = 163.97; [CI = 46.642 to 281.297]; $p = 0.007$). This means that a percentage change in repo rate increases the net worth by R163.97, this is statistically significant with a p-value ($P = 0.007$) less than 0.05 at 95% confidence interval. The control variables: liquidity ratio, capital ratio and competition also have positive influence on net worth with coefficient of 8.209, 20.814, and 0.644 respectively, but only liquidity has a statistical significant effect with a p-value of 0.018 which is less than 0.05 at 95% confidence interval. The non-performing loan has a negative effect on net worth with coefficient of -100.042, but not statistically significant as with a p-value of 0.373.

On big banks

Using the same Prais-Winsten AR (1) model, a percentage change in repo rate reduces the net worth of the five big banks by R94.137, but this is not statistically significant with a p-value of 0.756 at 95% confidence interval (coeff. = -94.127; [CI = -700.211 to 511.938]; $p = 0.756$). Liquidity and competition have negative coefficients, meaning that a percentage change in liquidity ratio and competition decreases net worth of big banks by R7.481 and R2509.051, respectively. This effect is not statistically significant with p values of 0.952 and 0.366 at 95% confidence level respectively. Capital ratio and nonperforming loan have positive coefficients of 587.544 and 1667.509 with p-values of 0.169 and 0.247 at 95% confidence interval respectively, which indicate that they are not statistically significant.

On small banks

Using the fixed effect model as recommended by Hausman test, a percentage change in repo rate leads to a decrease in net worth of the small banks by R34.782, (coeff. = -34.782; [CI = -101.959 to 32.395]; $p = 0.305$). This effect is not statistically significant, with a p-value (0.305) greater than 0.05 at 95% confidence interval. The control variables: liquidity ratio and competition have positive coefficients of 12.803 and 0.118, respectively. It means that any percentage change in the mentioned variable will lead to an increase in net worth, but only liquidity ratio is statistically significant ($P < 0.001$) at 5% level, while competition has a p-value of 0.847. Capital ratio and non-performing loan have negative coefficients of -10.906, and -81.394 and p-values of 0.476 and 0.34, respectively greater than 0.05 at 95% confidence level, which show that they are not statistically significant.

4.1.7 Banks' Profit Variations with the Dominant Determinants of Repo Rate

From the regression of repo rate against its determinants (CPI, money supply, and uncertainty), it was discovered that all of them are significant determinants of repo rate, but uncertainty is the most influential of repo rate. Uncertainty has coefficient of -1.303, meaning its 1% increase will decrease repo rate by 1.30%, while a percentage change in CPI and money supply will only affect repo rate by 0.19% and -0.11%, respectively. Using the fixed effect model as considered appropriate by Hausman test, banks' profit (for all sampled banks, big, and small banks) was regressed against the macroeconomic factors (CPI, money supply, and uncertainty), to determine their individual effects on profit, controlling the regression with the bank-specific variables: (liquidity ratio, capital ratio, competition, and non-performing loan).

On all sampled banks

CPI → (coeff. = -0.143; [CI = -0.3307 to 0.0453]; p = 0.135)

Money supply → (coeff. = -0.068; [CI = -0.2134 to 0.0771]; p = 0.354).

Uncertainty → (coeff. = -0.648; [CI = -1.658 to 0.362]; p = 0.206).

This means that for any percentage change in CPI (inflation rate), money supply, and uncertainty would lead to a decrease in profit by 0.143%, 0.068%, and 0.648% respectively. All these effects are not statistically significant as the p-values of 0.135, 0.354, and 0.652, respectively are greater than 0.05 at 95% confidence interval.

For the internal factors, liquidity ratio and competition have negative coefficients of -0.020 and -0.006. Meaning that a percentage change in liquidity ratio and competition decreases profit by 0.020% and 0.006%, with p-values of 0.002 and 0.048, respectively, which show that both effects are statistically significant at 95% confidence interval. Capital ratio and non-performing loan have positive coefficients of 0.036 and 0.383, but are not statistically significant with p-values of 0.585 and 0.291, respectively.

On Big banks

A percentage increase in CPI and uncertainty would lead to an increase in profit of the big banks by 0.008% each. While a percentage change in money supply leads to a decrease in profit by 0.009%. The effects of the above mentioned macroeconomic factors are not statistically significant with p-values of 0.729, 0.617, and 0.952, respectively at 95% confidence interval, as shown below.

CPI $\rightarrow$ (coeff. = 0.008; [CI = -0.0393 to 0.0556]; p = 0.729).

Money supply $\rightarrow$ (coeff. = -0.009 [CI = -0.0458 to 0.0276]; p = 0.617)

Uncertainty $\rightarrow$ (coeff. = 0.0077; [CI = -0.2526 to 0.2680]; p = 0.952).

For the bank-specific factors, liquidity ratio, capital ratio and non-performing loan at any percentage change, decreases profits of big banks by 0.022%, 0.102%, and 0.144%, respectively. The effects of liquidity ratio and non-performing loan are not statistically significant with p-values of 0.098, and 0.405 at 95% confidence interval, respectively, while the effect of capital ratio is statistically significant with a p-value of 0.011. Competition has a positive coefficient of 0.052 with a p-value of 0.867, which is not statistically significant at 95% confidence interval.

On small banks

Running regression using the small banks alone, a percentage change in CPI, money supply, and uncertainty decreases the profit by 0.208%, 0.100%, and 0.899%, respectively. These effects are not statistically significant with p-values of 0.173, 0.392, and 0.267, respectively at 95% confidence interval. The summary is as follows:

CPI $\rightarrow$ (coeff. = -0.208; [CI = -0.5107 to 0.0941]; p = 0.173).

Money supply $\rightarrow$ (coeff. = -0.0996; [CI = -0.3304 to 0.1312]; p = 0.392).

Uncertainty $\rightarrow$ (coeff. = -0.899; [CI = -2.5024 to 0.7041]; p = 0.267).

The control variables: liquidity ratio and competition have inverse relationships with profits of small banks, with coefficients of -0.020 and -0.006, respectively. It means that any percentage change in the mentioned variables will lead to a decrease in profit, but only the

effect of liquidity ratio is statistically significant ($P=0.014$) at 95% confidence interval, while the effect of competition is not, with a p-value of 0.097, which is greater than 0.05. Capital ratio and non-performing loan have positive relationships with profit with coefficients of 0.044 and 0.448 but are not statistically significant with p-values of 0.614 and 0.364, respectively.

4.1.8 Banks' Net Worth Variations with the Dominant Determinants of Repo Rate.

The banks' net worth (for all sampled banks, big, and small banks) were also regressed against the macroeconomic factors that are statistical determinants of repo rate. The regression was as well controlled with the bank-specific variables (liquidity ratio, capital ratio, competition and non-performing loan).

On all sampled banks

Serial correlation problem was corrected using the Prais-Winsten AR (1) model, as net worth of the sampled banks is regressed against the dominant determinants of repo rate (CPI, money supply, and uncertainty).

CPI $\rightarrow$ (coeff. = 36.062; [CI = -36.290 to 108.415]; $p = 0.326$).

Money supply $\rightarrow$ (coeff. = -18.564; [CI = -81.428 to 44.301]; $p = 0.560$).

Uncertainty $\rightarrow$ (coeff. = -66.548; [CI = -622.510 to 489.415]; $p = 0.813$).

This means that a percentage change in CPI increases banks' net worth by R36.062, with a p-value of 0.326. While any percentage change in money supply and uncertainty would lead to decrease in net worth by R18.564 and R66.548, with p-values of 0.561 and 0.813, respectively. These effects are not statistically significant at 95% confidence level as their p-values are greater than 0.05.

The control variables: liquidity ratio, capital ratio and competition also have positive influence on net worth with coefficients of 7.670, 8.799, and 0.616, respectively, but only liquidity ratio has a statistical significant effect with a p-value of 0.031, which is less than 0.05 at 95% confidence interval. The non-performing loan has a negative effect on net worth with coefficient of -74.196, but not statistically significant with a p-value of 0.524.

On big banks

Using the same Prais-Winsten AR (1) model on only big banks, any percentage change in CPI and uncertainty increases the banks' net worth by R243.440 and R74.730, with p-values of 0.147 and 0.926, respectively. Whereas, a percentage change in money supply would reduce the net worth by R169.912, with a p-value of 0.316. None of the effects is statistically significant, as the p-values are greater than 0.05 at 95% confidence level. The result is summarized as follows:

CPI $\rightarrow$ (coeff. = 243.440; [CI = -89.586 to 576.467]; p = 0.147).

Money supply $\rightarrow$ (coeff. = -169.912; [CI = -508.866 to 169.06]; p = 0.316).

Uncertainty $\rightarrow$ (coeff. = 74.730; [CI = -1151.563 to 1701.022]; p = 0.926).

For the control variables: liquidity ratio, capital ratio, and non-performing loan have positive coefficients. Which show that a percentage change in liquidity ratio, capital ratio and non-performing loan increases the net worth of the big banks by R49.439, R471.040, and R226.875, with p-values of 0.739, 0.380, and 0.917 at 95% confidence interval, respectively, which indicate that they are not statistically significant. While competition has a negative coefficient, showing that a percentage change in competition decreases the net worth of big banks by R2480.254, with a p-value of 0.427. The effects are not statistically significant as p-values are greater than 0.05 at 95% confidence interval.

On small banks

The fixed effect model as stipulated by Hausman test is used to run the same regression on the small banks.

CPI $\rightarrow$ (coeff. = 68.356; [CI = 18.033 to 118.680]; p = 0.009).

Money supply $\rightarrow$ (coeff. = 24.162; [CI = -14.258 to 62.583]; p = 0.213).

Uncertainty $\rightarrow$ (coeff. = 269.280; [CI = 2.458 to 536.102]; p = 0.048).

This means that a percentage in CPI, money supply, and uncertainty increases the net worth of the small banks by R68.356, R24.162, and R269.280, with p-values of 0.009, 0.213, and 0.048, respectively. The effects of CPI and uncertainty are statistically significant as the p-

values are less than 0.05 at 95% confidence interval, while the effect of money supply is not statistically significant.

For the internal factors, liquidity ratio and competition have positive coefficients of 13.007 and 0.566, respectively. It means that any percentage change in the mentioned variables would lead to an increase in net worth, but only liquidity ratio is statistically significant ($P < 0.001$) at 95% confidence interval, while competition has a p-value of 0.348, which is not statistically significant at 95% confidence interval. Capital ratio and non-performing loan have negative coefficients of -1.569, and -88.711, with p-values of 0.914 and 0.281 respectively, showing that they are not statistically significant at 95% confidence interval.

4.2 DISCUSSION OF RESULT

The findings on the variations of profit and net worth of commercial banks in South Africa from 2001 to 2010 due to fluctuations in interest rate (repo rate) are discussed. From the data analysis and presentation of result, the macroeconomic factors that influence the changes in repo rate were first estimated to determine which influences repo rate most.

4.2.1 Changes in Repo Rate with Macroeconomic Factors

The result of this study indicates that changes in inflation rate (CPI), money supply, and uncertainty, are strong determinants of changes in repo rate. A 1% change in CPI increases the repo rate by 0.19%, while a percentage change in money supply and uncertainty decreases the repo rate by 0.11% and 1.30%, respectively. The coefficients of these economic factors are statistically significant, which confirms the trend of these economic factors with repo rate (*as reflected figure 4.5*). This means that if inflation rate increases, the Reserve Bank increases the rate at which government securities are repurchased from the commercial banks. This finding is consistent with the results of Booth and Ciner (2001), and Laatsch and Klein (2003), that there is a one for one relationship between expected inflation and nominal interest rate. But to avoid hyperinflation, the Federal Reserve does not consistently follow the inflation rate to measure the repo rate, but has the right to use repo rate to tighten credit in order to retard inflationary pressure (South African Reserve bank, March 2011).

The result shows that money supply and uncertainty have inverse relationships with the repo rate. The implication of monetary policy is that when money supply is targeted, the resultant interest rate is adopted. If the Federal Reserve adopts expansionary monetary policy (increase in money supply), this reduces the interest rate (*repo rate, as confirmed by the result*), which in turn reduces the prime lending rate of commercial banks, thereby increasing demand for credit (Blanchard, 2007). The Reserve Bank uses this action to influence the overall lending policies of commercial banks, and demand for money and credit in the economy (South African Reserve bank, July 2007). The result also shows that uncertainty is the most influential of the repo rate with a negative coefficient of 1.30. This means that if there is high uncertainty in the economy, the government takes care of it through the Reserve Bank by reducing the interest rate by way of expansionary monetary policy. This occurred between 2004 and 2006 (*as shown, figure 4.5*).

4.2.2 Repo Rate Variations with Banks' Profit

Changes in interest rate (repo rate) affect the profit of commercial banks in South Africa, as revealed in the result of the analysis. A percentage change in repo rate increases the commercial banks' profit by 0.36%, this effect is statistically significant. This result is consistent with Demirguc-Kunt and Harry (1999), who found that interest rates are associated with higher interest margins and profitability, especially in developing countries.

This could mean that South African commercial banks, while carrying out asset transformation and intermediation functions, are conscious of maturity mismatch of their assets and liabilities and unexpected changes in interest rates (Delis et al, 2011; Kasman et al, 2011; Hanweck and Kilcollin, 1984), and/or they are using interest rate derivatives to hedge the interest rate risk. It can also be said that the banks' managers practice aggressive asset/liability management by forecasting the future interest rates and adjusting their portfolio depending on the direction and level of interest rate changes in favor of their profit (net interest margin) (Rose et al., 1995).

For further clarification, regression was separately carried out on big and small banks, to see if the effect is of the same level in two group sizes. It was revealed that the effect of interest rate changes is high in small banks relative to big banks. A percentage change in the repo rate increases the profit of the big banks by 0.037%, and this effect is not statistically significant.

While the same percentage change in repo rate significantly increases the profit of the small banks by 0.481%. This confirms the plot in figure 4.3 which shows the trend effect of repo rate and profit of small banks relative to that of big banks. This result is consistent with the findings of Hanweck and Kilcollin, (1984) that small commercial banks as a group have actually experienced increase in profitability (net interest margin) relative to large banks in periods of rising interest rates (since 1976).

4.2.3 Repo Rate Variations with Banks' Net Worth

The result shows that the net worth of the commercial banks is significantly affected by interest rate fluctuations. A percentage change in repo rate increases the net worth by R163.97. This is in agreement with Molyneux and Thorton (1992) findings, that there is a positive association between return on equity and the level of interest rates. It can be said that the banks manage the maturity of their assets and liabilities effectively to absorb the shock of interest rate risk on net worth. As stipulated by Saha et al. (2009), if there is maturity mismatch, interest rate hike reduces the present value of assets much more than that of liabilities, thereby depleting the bank's net worth.

But this result contradicts the regression separately carried out on big and small banks. It reveals that a percentage change in repo rate reduces the net worth of big and small banks by R94.14 and R34.78 respectively, although the effects are not statistically significant. This insignificant effect can also be confirmed from figure 4.4, which shows the unrelated trend of repo rate with the net worth of big and small banks. But in 2002, there was a little decrease in small banks' net worth as repo rate increased. However this contradiction between the results from all sampled banks and that of big/small banks may be attributed to the reduction in the number of sampled banks and number of observation in the analysis.

4.2.4 Banks' Profit with the Dominant Determinants of Repo Rate

All the macroeconomic variables (CPI, money supply, and uncertainty) used in the analysis are dominant determinants of repo rate, as they all have significant effect on repo rate. However, uncertainty was found to have the highest influence on repo rate from hypothesis one, as a percentage of it reduces the repo rate by 1.31%. Whereas a percentage change in

CPI and money supply increases the repo rate by 0.19% and reduces it by 0.11%, respectively. Estimating the effect of these external factors on the banks' profit, the results show that a percentage change in CPI, money supply, and uncertainty decreases the profit of all sampled banks by 0.143%, 0.068%, and 0.648%, respectively. These effects are not statistically significant.

CPI and uncertainty have contrary effects on big banks' profit, compared to their effects on all the sampled banks. They increase the big banks' profit by 0.008% each, at any percentage change. Meanwhile their effects on small banks' profit are in accordance with the effects they have on all the sampled banks. For the small banks, a percentage change on CPI and uncertainty decreases the profit by 0.208% and 0.899%, respectively. Whereas money supply still have reduction effect on both big and small banks by 0.009% and 0.10%, respectively. It could be said that the big banks must have absorbed the shock of CPI and uncertainty with the advantages they have over the small banks, which include, asset size, loan volume, deposit volume, branch networks, strategic locations etc.

However all these effects, both positive and negative are not statistically significant. This is in agreement with Sidabalok and Viverita (2011), who found that macroeconomic factors have no direct effect on net interest margin in Indonesia, but contrary to the findings of Saunders and Schumacher (2000), that the macroeconomic variables significantly influence the determination of the margin by banks.

Also, as this study revealed that inflation (CPI) increases the profit of the big banks by only 0.008%, it is in partial agreement with the Demirguc-Kunt and Harry's (1999) findings, which revealed that inflation is associated with higher realised interest margins and higher profitability. They went further to say that inflation entails higher cost, more transactions, and generally more expensive branch network, but the positive relationship between inflation and bank profitability implies that bank income increases more with inflation than bank cost. Probably, these contradictions may be due to differences in periods of studies and different economic conditions of different countries at the time of study. According to this study, there is no significant effect of macroeconomic factor (uncertainty) on South African commercial banks' profit (net interest margin) from 2001 to 2010.

4.2.5 Banks' Net Worth with the Dominant Determinants of Repo Rate

The result revealed that CPI at any percentage change increases the net worth of all sampled banks, big, and small banks by R36.062, R243.44, and R68.36, respectively. The effect on the small banks is highly significant, but effects on all sampled banks and big banks are not. A percentage change in money supply reduces the net worth of the sampled banks and that of big banks by R18.56 and R169.91, respectively, but has a contrary effect on the small bank's net worth with an increase of R24.162, all these effects are not statistically significant. While a change in uncertainty reduces the net worth of the sampled banks by R66.55, but increases that of big and small banks by R74.730 and R269.28, respectively, only the effect on small banks is statistically significant.

From the results, one can infer that commercial banks net worth benefit from changes in macroeconomic factors that determine the repo rate than changes in repo rate itself, as the results revealed that changes in repo rate reduce the net worth of both big and small banks. Whereas, changes in the macroeconomic factors increase the banks' net worth, except money supply which reduces only the big banks' net worth.

4.2.6 Banks' Profit and Net Worth with the Banks Specific Internal Factors

The analysis revealed that among the internal factors affecting profit and net worth of commercial banks, the liquidity ratio is the most significant factor relative to capital ratio, competition, and non-performing loan. The results show that high liquidity reduces the profit of commercial banks in South Africa, and the effect is statistically significant. This is in agreement with the findings of Sidabalok and Viverita (2011), Doliente (2003), Angbazo (1997), Wong (1997), that bank-specific factors also significantly affect the net interest margin of the banking sector. On the other hand, high liquidity increases the net worth of commercial banks. It was also found that this liquidity effect is highly significant with small banks' but not statistically significant with big banks' net worth.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

Banks have become increasingly aware of interest rate risk in the financial industry. Among other risks, it is a major concern for financial institutions, as it can cause harm, if not failure, to a financial institution, by interacting with other risks. The net interest income (NII) of banks is highly exposed to interest rate risk, as it is based on the “GAP” between rate sensitive assets and rate sensitive liabilities. This is a major concern to banks that hold a large proportion of their portfolio in long-term fixed-rate loans.

Therefore, the general objective of this study is to investigate the impact of interest rate risk on both the profitability and net worth of commercial banks in South Africa over a period of ten years. The research also is extended to investigate the extent to which the interest rate risk affect the profit and net worth of big and small banks separately (big and small measured in terms of asset size of the banks as at the year-end 2010).

The research is quantitative in nature and involves mathematical modelling, stochastic econometric approach (time series regression analysis) was applied, using panel data, which assumes that the effect of interest rate changes vary across the observations and over time. Hausman fixed random test was used to determine which model (between fixed effect and random effect) is appropriate for each hypothesis.

From the interest rate model, it was found that all the macroeconomic factors used in the study are important predictors of interest rate (repo rate) changes. But uncertainty, which was measured as the standard deviation of gross domestic product for the current year and two previous years, has the highest influence on interest rate during the observed period 2001 to 2010).

The estimated results from the profit models show that profit of South Africa’s commercial banks are significantly increased by the changes in repo rate, this effect is more on small banks relative to big banks. Whereas the macroeconomic factors (inflation, money supply and

uncertainty), which are the important predictors of repo rate, do not have any direct significant effect on the banks' profits, it was found that contrary to repo rate effect on profit, these macroeconomic factors reduce profits of the commercial banks, but the effect is not statistically significant.

From the net worth model, the estimated results show that repo rate significantly affects (increases) the net worth of commercial banks in South Africa during the observed period. But a non-significant reduction effect was noticed when estimation was carried out separately on big and small banks. Interestingly, it was found that inflation (CPI) and uncertainty, which are determinants of repo rate, have significant increase effect on the net worth of the small banks, contrary to the non-significant reduction effect by the repo rate. An increase in repo rate insignificantly reduces the big and small banks' net worth by R94.14 and R34.78, respectively. But increase in inflation and uncertainty (macroeconomic factors) increases the big banks' net worth by R243.44 and R74.73, respectively, as well as increases the small banks' net worth by R68.36 and R269.28, respectively.

It could be advised that to maximize owners' equity, South African commercial banks (big and small) should concentrate more on forecasting and controlling the determinants of the interest rates, rather than the interest rate itself. It was also found that among the internal factors affecting profit and net worth of commercial banks, the liquidity ratio is most significant relative to capital ratio, competition, and non-performing loan.

5.2 CONCLUSION OF THE STUDY

The result from the analysis of the data-set would lead us to conclude that: Firstly, macroeconomic factors determine the changes in repo rate, but uncertainties in the economy, at a particular point in time has the highest influence in predicting the changes in repo rate. Secondly, interest rate (repo rate) changes have a positive effect on the profit (net interest margin) of commercial banks in South Africa during the period of 2001 to 2010. Thirdly, small commercial banks actually experience increase in profitability (net interest margin) both absolutely and relative to big banks in periods of rising interest rates. This indicates that there is a positive relationship between interest rate and NIM as small banks indicate increasing profitability with rising interest rate.

Fourthly, interest rate fluctuations significantly increase the net worth of commercial banks in South Africa, but this effect was contrary and no more significant when estimation was carried out separately on big and small banks. However, macroeconomic factors (inflation, money supply, and uncertainty) individually handled do not significantly affect the profit of commercial banks. But inflation and uncertainty significantly increase the net worth of the small commercial banks in South Africa. This means that South African banks (especially the small ones) could focus on forecasting and hedging the macroeconomic factors that determine interest rates rather than the focusing on interest rates themselves. Finally, liquidity ratio has the highest effect on banks' net interest margin and net worth relative to the other bank-specific (internal) factors used in this study.

5.3 RECOMMENDATIONS FOR FURTHER RESEARCH

A number of issues were identified during this research which could be explored further in the future. These issues were highlighted as follows:

- Include other developing countries and compare the level of the effect of interest rate fluctuations on profit and net worth's of commercial banks across countries.
- Include major developed countries and compare the deciding factor of interest rate fluctuations between developed and developing countries.
- Include non-financial factors, such as ownership structure, number of customers, physical locations etc, and determine their relationship to banks' profit and net worth.

Finally, this research has fulfilled its purpose of using econometric methods to investigate the impact of interest rate fluctuations on profit and net worth of commercial banks in South Africa, and to identify the macroeconomic factor that most affects interest rate (repo rate) changes over a period of time. The later objective is meant to inform banks of alternative macroeconomic factors that could be targeted for hedging interest rate risk.

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APPENDICES

APPENDIX A FINANCIAL DATA FROM BANKS' ANNUAL REPORT

Observations	Bank	year	Profit (%)	Net worth (R mill)	Non-performing Loan (%)	Competition	Liquidity Ratio (%)	Capital Ratio (%)
1	1	2001	3.86	11062.00	1.05	0.95	15.18	10.70
2	1	2002	4.13	11744.00	0.93	1.01	17.33	11.30
3	1	2003	3.46	15237.00	0.72	0.92	11.22	12.50
4	1	2004	2.80	18197.00	0.36	0.86	9.86	13.40
5	1	2005	2.66	20376.00	0.50	0.82	19.70	12.50
6	1	2006	2.57	25885.00	0.63	0.86	17.25	12.40
7	1	2007	3.07	32300.00	1.02	0.86	12.61	12.50
8	1	2008	2.87	38288.00	2.09	0.82	14.26	12.20
9	1	2009	2.58	43207.00	2.13	0.83	17.14	14.10
10	1	2010	2.55	47614.00	1.34	0.84	15.74	14.90
11	2	2001	4.12	9682.00	0.82	0.99	6.78	10.70
12	2	2002	3.76	10616.00	1.68	0.94	7.91	10.20
13	2	2003	3.44	12610.00	0.95	1.15	8.43	11.50
14	2	2004	3.42	15849.00	0.82	1.16	8.10	12.30
15	2	2005	3.52	20622.00	0.47	1.13	6.33	11.70
16	2	2006	3.51	28726.00	0.40	1.03	11.39	12.30
17	2	2007	3.51	35528.00	0.48	0.97	21.76	12.50
18	2	2008	3.21	44994.00	1.04	0.98	16.29	14.00
19	2	2009	3.96	47418.00	1.62	1.02	13.17	14.70
20	2	2010	3.31	52630.00	1.10	1.02	10.34	14.80
21	3	2001	3.38	11796.00	1.04	1.08	11.01	11.60
22	3	2002	2.51	12470.00	0.68	1.05	10.70	15.70
23	3	2003	2.55	16048.00	0.91	0.96	8.90	12.20
24	3	2004	2.30	20127.00	0.67	1.03	10.08	12.50
25	3	2005	2.96	24354.00	0.41	1.11	14.35	13.30
26	3	2006	3.20	28057.00	0.47	1.16	17.39	11.40
27	3	2007	3.47	33132.00	0.58	1.25	9.95	11.70
28	3	2008	3.31	38281.00	1.10	1.32	7.25	13.10
29	3	2009	3.07	39759.00	1.49	1.25	7.08	15.60
30	3	2010	3.05	38400.00	1.40	1.20	6.92	14.86

Observations	Bank	year	Profit (%)	Net worth (R mill)	Non-performing Loan (%)	Competition	Liquidity Ratio (%)	Capital Ratio (%)
31	4	2001	4.17	7113.70	0.91	1.20	7.78	9.40
32	4	2002	3.21	7486.00	0.65	1.03	9.42	10.00
33	4	2003	3.30	10321.00	0.73	1.19	10.06	10.30
34	4	2004	3.43	12343.00	0.22	1.28	6.87	13.50
35	4	2005	2.83	16266.00	0.25	1.24	6.93	11.10
36	4	2006	2.87	19466.00	0.52	1.16	25.10	12.00
37	4	2007	2.94	24949.00	0.74	1.25	22.09	11.40
38	4	2008	2.32	29290.00	1.09	1.27	22.36	12.28
39	4	2009	2.24	32258.00	1.91	1.20	18.77	13.11
40	4	2010	2.21	35625.00	1.25	1.20	20.56	14.00
41	5	2001	1.50	6141.00	0.67	3.41	36.70	19.05
42	5	2002	1.97	8390.00	0.45	2.96	30.52	19.60
43	5	2003	1.49	6069.00	1.26	4.02	36.19	19.40
44	5	2004	1.42	7762.00	0.36	4.00	30.53	19.80
45	5	2005	1.90	8120.00	0.24	4.11	30.22	19.50
46	5	2006	2.09	8812.00	-0.02	4.13	32.93	16.12
47	5	2007	2.06	10056.00	0.12	4.02	34.70	14.14
48	5	2008	2.44	12960.00	0.40	4.31	31.67	14.30
49	5	2009	2.68	14195.00	0.58	3.75	27.51	14.19
50	5	2010	2.27	16454.00	0.67	3.51	34.91	15.53
51	6	2001	3.49	358.00	1.19	30.49	3.07	10.86
52	6	2002	4.72	677.70	1.97	22.94	7.60	12.10
53	6	2003	4.96	909.80	1.93	22.68	3.31	12.34
54	6	2004	3.82	1075.00	1.54	19.54	3.93	10.22
55	6	2005	3.90	1013.70	1.51	21.46	3.93	10.20
56	6	2006	4.32	1522.80	0.56	21.33	5.17	10.20
57	6	2007	4.33	1906.70	0.74	18.89	6.74	10.47
58	6	2008	4.52	2695.20	1.13	18.91	6.62	10.56
59	6	2009	4.14	3360.30	1.53	13.93	7.31	11.08
60	6	2010	4.09	3761.00	1.90	12.47	8.13	11.20

Observations	Bank	year	Profit (%)	Net worth (R mill)	Non-performing Loan (%)	Competition	Liquidity Ratio (%)	Capital Ratio (%)
61	7	2001	21.10	1213.50	-2.02	34.54	8.89	34.10
62	7	2002	20.23	1874.60	5.19	32.64	57.19	31.43
63	7	2003	24.74	2088.10	4.85	45.87	74.79	40.80
64	7	2004	31.16	1892.00	8.78	45.8	148.91	34.70
65	7	2005	32.93	2076.00	8.48	54.35	86.31	34.30
66	7	2006	36.10	2246.00	7.67	55.63	109.75	31.20
67	7	2007	36.98	2341.00	7.73	49.75	288.99	28.50
68	7	2008	21.61	2463.00	8.63	41.91	122.33	25.50
69	7	2009	17.54	3217.00	9.19	30.03	266.59	30.10
70	7	2010	15.18	8979.00	7.40	20.15	521.46	28.90
71	8	2001	5.11	1714.90	—	51.76	52.19	50.21
72	8	2002	13.06	2088.70	—	48.41	34.67	46.65
73	8	2003	16.85	1183.50	—	113.3	206.70	45.62
74	8	2004	18.68	365.20	—	138.22	—	15.32
75	8	2005	2.29	608.20	—	129.88	—	21.77
76	8	2006	2.70	1268.00	—	253.76	379.23	69.17
77	8	2007	3.63	3947.50	—	104.39	261.61	71.76
78	8	2008	2.11	5069.10	—	50.89	—	35.68
79	8	2009	2.73	4619.00	—	48.09	74.79	32.70
80	8	2010	2.91	5210.40	—	47.26	498.15	35.48
81	9	2001	4.15	507.50	3.09	47.75	17.04	—
82	9	2002	4.58	19.50	24.25	94.73	21.07	—
83	9	2003	3.54	171.90	-1.33	132.11	42.73	11.80
84	9	2004	3.86	515.60	0.28	120.72	62.75	39.20
85	9	2005	8.21	566.60	-1.34	106.06	53.38	34.50
86	9	2006	7.54	682.80	-0.47	104.18	58.18	30.10
87	9	2007	7.62	853.40	0.19	121.66	44.07	26.80
88	9	2008	8.98	1296.80	0.19	121.90	45.91	27.30
89	9	2009	6.76	1465.20	0.25	116.55	39.84	25.50
90	9	2010	6.45	1566.80	0.09	110.81	43.92	23.80

Observations	Bank	year	Profit (%)	Net worth (R mill)	Non-performing Loan (%)	Competition	Liquidity Ratio (%)	Capital Ratio (%)
91	10	2001	4.50	40.30	0.62	336.98	17.71	7.68
92	10	2002	4.65	54.80	0.20	336.07	12.38	8.50
93	10	2003	4.59	57.60	1.60	342.32	28.40	6.71
94	10	2004	3.44	74.50	0.02	325.97	9.76	10.82
95	10	2005	3.79	118.40	-0.18	307.71	14.75	13.01
96	10	2006	4.05	187.40	-0.22	316.39	42.29	16.99
97	10	2007	5.02	201.60	0.11	340.53	22.79	15.40
98	10	2008	5.55	216.90	0.17	386.45	24.09	14.39
99	10	2009	4.92	228.90	0.07	285.36	31.60	9.62
100	10	2010	4.24	233.40	0.03	245.67	29.34	8.26
101	11	2001	4.24	96.90	—	342.60	24.91	18.78
102	11	2002	3.79	118.00	—	354.83	22.61	19.32
103	11	2003	3.89	118.50	0.00	470.94	54.42	30.97
104	11	2004	2.30	123.30	0.42	483.49	65.07	26.33
105	11	2005	1.41	115.80	0.49	411.35	63.95	19.34
106	11	2006	1.76	118.50	0.24	534.49	40.27	16.67
107	11	2007	2.66	268.80	0.05	332.64	21.26	18.84
108	11	2008	2.50	276.50	-0.04	384.31	35.44	16.50
109	11	2009	2.09	292.70	0.24	322.42	25.16	14.17
110	11	2010	2.32	353.00	0.29	284.39	19.36	13.41
111	12	2001	9.69	98.70	0.24	203.26	68.33	22.80
112	12	2002	6.36	142.50	1.30	192.63	63.05	19.80
113	12	2003	6.43	153.20	-0.71	245.26	57.18	35.60
114	12	2004	9.06	172.20	-0.96	664.90	5.67	34.72
115	12	2005	4.29	209.30	0.25	491.61	33.04	28.36
116	12	2006	12.45	197.50	0.88	449.83	64.88	19.10
117	12	2007	5.04	173.00	0.59	513.16	21.76	15.46
118	12	2008	3.79	233.80	0.12	503.96	23.55	16.30
119	12	2009	11.71	385.30	1.28	495.83	17.99	24.18
120	12	2010	8.66	392.00	2.37	451.21	22.40	26.66

Observations	Bank	year	Profit (%)	Net worth (R mill)	Non-performing Loan (%)	Competition	Liquidity Ratio (%)	Capital Ratio (%)
121	13	2001	5.45	30.70	2.88	431.59	32.12	17.00
122	13	2002	6.13	25.80	1.00	462.11	26.08	15.90
123	13	2003	6.38	24.10	1.22	575.18	23.25	11.22
124	13	2004	5.62	46.00	-0.56	539.84	26.86	16.39
125	13	2005	5.04	54.07	0.02	557.38	27.86	16.14
126	13	2006	5.11	65.28	0.29	563.90	31.36	14.32
127	13	2007	5.98	85.72	0.12	503.71	7.95	12.09
128	13	2008	5.48	185.00	0.40	533.13	17.65	16.54
129	13	2009	4.35	180.28	0.42	540.01	9.42	13.20
130	13	2010	4.44	199.21	0.37	557.43	4.02	18.15
131	14	2001	6.06	11.50	0.76	866.57	69.94	—
132	14	2002	7.01	17.30	0.62	830.07	76.29	23.95
133	14	2003	5.81	17.10	3.73	1010.02	74.56	21.32
134	14	2004	4.60	20.30	0.31	962.89	75.22	21.45
135	14	2005	7.20	23.10	0.00	862.71	84.56	19.44
136	14	2006	13.13	29.70	0.00	962.79	78.29	21.01
137	14	2007	15.06	39.20	0.20	1070.52	79.67	24.09
138	14	2008	17.76	51.30	0.06	116.83	82.64	17.56
139	14	2009	14.65	53.80	0.00	904.33	82.10	16.44
140	14	2010	11.82	57.90	0.12	869.90	75.64	16.76
141	15	2001	4.54	48.00	1.47	635.90	25.81	13.90
142	15	2002	4.01	50.30	1.16	734.68	25.99	12.40
143	15	2003	5.43	59.00	1.25	979.40	20.08	13.60
144	15	2004	4.04	82.30	0.25	889.16	19.40	16.70
145	15	2005	3.60	95.40	0.24	835.30	19.14	13.20
146	15	2006	3.52	43.20	0.23	899.84	18.35	8.36
147	15	2007	3.79	47.70	0.41	934.01	20.07	7.76
148	15	2008	3.97	55.20	0.46	1097.33	16.10	8.38
149	15	2009	3.92	62.00	0.50	928.18	14.50	16.20
150	15	2010	2.60	63.70	0.42	894.34	16.57	15.70

**APPENDIX B FINANCIAL DATA FROM SOUTH AFRICAN RESERVE
BANK**

year	Repo Rate (%)	Prime Rate (%)	Deposit Rate (%)	CPI (%)	Money Supply (%)	Uncertainty (%)
2001	10.92	13.35	9.97	6.60	16.44	0.76
2002	12.25	15.60	11.72	9.30	18.07	0.29
2003	11.46	15.16	10.36	6.80	12.88	0.29
2004	7.79	11.31	7.28	4.30	13.13	0.76
2005	7.13	10.64	6.69	3.90	20.45	1.04
2006	7.67	11.14	7.49	4.60	22.54	0.45
2007	9.67	13.08	9.82	6.40	23.59	0.21
2008	11.63	15.12	11.44	13.60	14.79	0.91
2009	8.21	11.80	8.75	2.20	1.78	3.59
2010	6.33	9.91	6.75	10.10	6.92	2.91

APPENDIX C

DEFENCE PANEL STATUS (APPROVAL OF TITLE)



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PAG

Ms El Godspower-Akpomiemie
P O Box 30756
Braamfontein
Johannesburg
2017
South Africa

Dear Ms Godspower-Akpomiemie

Master of Management (Finance and Investment Management): Approval of Title

We have pleasure in advising that your proposal entitled "*Market interest rate fluctuations: impact on the profitability of commercial banks*" has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

A handwritten signature in black ink, appearing to read 'M Bosman'.

Mrs Marike Bosman
Faculty Registrar
Faculty of Commerce, Law & Management