

**AN EXAMINATION OF THE DETERMINANTS OF INTEREST RATE
SPREAD IN COMMERCIAL BANKS, EVIDENCE FROM TANZANIA
COMMERCIAL BANKS**

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SPREAD IN COMMERCIAL BANKS, EVIDENCE FROM TANZANIA
COMMERCIAL BANKS**

By

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**A Dissertation Submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Science in Accounting and Finance (Msc A&F) of Mzumbe
University**

2019

CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled: **Examination on determinants of Interest Rate Spread in Commercial banks: Evidence from Tanzania commercial banks**, in partial/fulfillment of the requirements for award of the degree of Master of Science in Accounting and Finance of Mzumbe University.

Signature

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ABBREVIATIONS AND ACRONYMS

BoT	Bank of Tanzania
SSA	Sub-Saharan Africa
IRS	Interest Rate Spread
ABT	Access Bank Tanzania Ltd
ACB	Akiba Commercial Bank Limited
AB	Amana Bank Limited
AzB	Azania Bank Ltd
BoAT	Bank of Africa Tanzania Limited
CRDB	Cooperative and Rural Development Bank Plc
DTBT	Diamond Trust Bank Tanzania Limited
ET	Ecobank Tanzania Limited
ExBT	Exim Bank Tanzania Limited
MCB	Mkombozi Commercial Bank Limited
MWCB	Mwalimu Commercial Bank
NBC	National Bank of Commerce Limited
NMB	National Microfinance Bank Plc
NICBT	NIC Bank Tanzania Ltd
TPB	Tanzania Postal Bank
BFIA	Banking and Financial Institutions Act
NPL	Non-Performing Loans

NII	Net-Interest Income
OC	Operating Cost
RoA	Return on Assets
BS	Bank Size
GDP	Gross Domestic Product
IR	Inflation Rate
RR	Reserve Requirement
ARDL	Auto-Regressive Distributed Lag
VECM	Vector Error Correlation Model
ECM	Error Correlation Model

ABSTRACT

This research examines the determinants of IRS in commercial banks in Tanzania from a period of 2000-2017. The study used Stata econometric software to analyze panel data extracted from commercial banks annual statements, Bank of Tanzania reports and World Bank indicator data. The analysis employed the Ho and Saunders (1981) pure interest spread concept where by the analysis involved two step procedures to estimate the bank specific determinants and macro-economic determinants respectively.

The Hausman test signified fixed effect model was suitable model for first step regression on determining the effects of bank specific determinants and Random effect model to be appropriate model for second step regression in accessing the power of macro-economic factors on IRS.

The results observe that banks operational costs ratio and banks size are the banks specific factors that affect IRS in Tanzanian commercial banks. The study also observe GDP growth rate and Reserve requirement ration to be the macro-economic factors which significantly influence IRS in Tanzania. However the bank specific variables appear to be more suggesting factors that determine IRS in Tanzania commercial banks in comparison with macroeconomic factors, this were identified by showing high coefficient value that significantly affect IRS in Tanzania commercial banks.

The study conclude that smaller banks are undermined by large banks with high technology and high capital base hence high cost in managing their operation but still compete with large banks by charging low lending rate and lead to their perishing.

The study recommends stabilized policies to be employed by the Government and Regulating bodies to ensure growth of small and medium banks to enable them to penetrate market and break supremacy by the large banks.

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CHAPTER ONE

1.0 Introduction

This chapter concern with background to the problem, statement of the problem, research questions, Research objectives, scope of the study, significance of the study, limitations of the research and organization of the dissertation.

1.1. Background of the study

Economic development of any country is facilitated by development of the financial sector. Banking industry plays a major role in the financial sector, particularly with respect to mobilization of savings and provision of credit. Banks interest rate spread provides information for the efficiency of intermediation process, profitability and monetary policy impacts (Bank of Tanzania, 2018).

All over the world, the government in both developed and developing countries have been injecting more effort on regulating financial sector especially the banking industry. Among the most obvious indicator of stress in the financial sector has been the unusual increase in the interest rate spreads (Cúrdia & Woodford, 2009). The kind of interest rate spread discussed in this paper is the ex post spread, is obtained from the interest rate revenue minus interest expenses that incurred by the banks. This is a more functional measure because it manage banks with high yield in which they have greater percent to face default (Demirguc-Kunt & Huizinga, 1999; Folawewo & Tennant, 2008).

Many countries in Africa, Caribbean countries and Latin America are faced with high interest rate spread (Folawewo & Tennant, 2008).Despite of taking structural modification reforms that led to the liberalization of interest rates in several countries in the Sub- Saharan Africa (SSA), they are still faced with high level of interest rate spreads (Folawewo & Tennant, 2008). In the current past years most developing countries have given extensive awareness to policy design targeted to provide for existence and development of vibrant financial institutions.

The financial industry liberalization in most of African countries including Tanzania was partly informed by the Neo-Liberal view on the financial repression hypothesis (FRH). The liberalization and reform was associated by inaction of Banking and financial institution Act by the Government in June, 1991 (Aikaeli, Mugizi, & Ndanshau, 2011; Aikoh, 2013; Manamba, 2017). Since that time number of financial institutions including commercial banks have increased, the Bank of Tanzania has permitted and registered a number of commercial banks to date as 40 registered commercial banks (Bank of Tanzania, 2018).

1.2. Statement of the problem

Economic development of a country is facilitated by the efficiency in financial sector. Banks plays a major role of intermediation to enable sustainable flow of capital from surplus unit to deficit unit, and interest rate spread helps to measure the intermediation process by the banks. The widening of the interests rate spread which is the difference between deposit rate and lending rate, is the indicator of banking sector inefficient (Aikaeli et al, 2011). Basically interest rate spread provides information on the efficiency of the financial intermediation, profitability and monetary policy impact (Were & Wambua, 2013a). A nation that has a sound financial sector is likely to have economic growth, thus it will have narrow IRS.

In Tanzania, the interest rate spread is still persistent and fluctuating since the liberalization of financial sector (Manamba, 2017). The world development indicator data show that interest rate spread in Tanzania has being declining as from 2000 it was 14.191% up to 2008 where it was recorded as 6.729%, however in 2011 the spread has jumped up to 8.185% and declined again to 5.464% in 2016. In 2017 the interest rate spread moved up to 6.438%, this situation attribute the decline to an accommodative monetary policy stance (Bank of Tanzania, 2018). Therefore to promote credit growth the Bank of Tanzania reviews its monetary and financial policies in which from 2017 the review reflects the need to encourage financial growth for supporting economic activities. However, the Bank of Tanzania monetary policy statement shows that commercial banks lending rate remained high, reflecting increased risk premium associated with the rise in non-performing loans in the

financial sector which limit effective transmission of the monetary policy signals (Bank of Tanzania, 2018).

This research examined the determinants of IRS on commercial banks in Tanzania, covering a wide range period before the reform of the provision of the Bank of Tanzania Act in 2000 up to 2017. A researcher considered both, bank specific factors and macroeconomic factors in determining the behavior of interest rate spread on commercial banks in Tanzania. The determinants will be empirically examined to ascertain their significance and impact on the determination of prevailing interest rate spreads in the banking sector.

1.3. Research objectives

1.3.1. Main objective

To study the performance and determinants of interest rate spread in commercial banks in Tanzania.

1.3.2 Specific objectives

1. To study the effect of bank specific factors on interest rate spread of commercial banks in Tanzania.
2. To study the influence of Macro-economic determinants on interest rate spread of commercial banks in Tanzania.
3. To compare the significance level between banks specific factors and the Macro-economic factors on interest rate spread in Tanzania.

1.4. Research questions

From the above general and specific objective the researcher has developed the question to answer for the above objectives. The major question is what are the factors of interest rate spread on commercial banks in Tanzania?

The specific questions for the above objectives are;

1. What are the individual banks specific determinants and behavior of interest rate spread for commercial banks in Tanzania?

2. What are the Macroeconomic determinants and behavior of interest rate spread for commercial banks in Tanzania?
3. Which factors show high level of significance in determining interest rate spread in commercial banks in Tanzania?

1.5. Scope of the study

After a thoroughly review of different literatures, the study focused on the individual banks specific factors and the Macro-economic factors that determine the interest rate spread. Therefore the parameter of these variables was operating expenses ratio, non- performing loans ratio, return on assets ratio, bank size, and bank leverage ratio. On the other hand the Macro-economic factor was real gross domestic product (GDP) growth rate, inflation rate and the reserve requirement ratio by the Bank of Tanzania. This study was based on the empirical analysis on panel data of commercial banks for the period between 2000 and 2017, using 15 commercial banks in Tanzania. The researcher used the following commercial banks, Access Bank Tanzania Ltd, Akiba Commercial Bank Ltd, Amana Bank Ltd, Azania Bank Ltd, Bank of Africa Tanzania Ltd, CRDB Bank Plc, Diamond Trust Bank Tanzania Ltd, Ecobank Tanzania Ltd, Exim Bank Tanzania Ltd, Mkombozi Commercial Bank Ltd, Mwalimu Commercial Bank, National Bank of Commerce Ltd, National Microfinance Bank Plc, NIC Bank Tanzania Ltd and Tanzania Postal Bank. The researcher used these banks because they are registered central depository participants by the BoT and they have covered a wide range of time since they are started.

1.6. Significance of the study

The study is intended to examine the factors of interest rate spread on commercial banks in Tanzania. The results therefore provide answers to possible determinants of interest rate spread in Tanzania commercial banks. These results enables the Bank of Tanzania to closely monitor movements of interest rates spread of commercial banks and enable them to set stabilizing policies that will facilitate supply of credit and ensure effective banking operations that will be conducive to the development of the national economy. This significant contribution of this study could be possible if the

implication of the obtained determinants will help to reduce the prevailing interest rate spread of commercial banks in Tanzania. The Government will benefit from the results on structuring of the monetary policy whereby it will continue to closely monitor and manage movements in banks' operations in order to introduce stability of money market interest rates and help policy makers in making informed decision pertaining interest rates prevailing in the economy (Bonga, 2016). However, the study will enable students of higher learning to obtain knowledge as literature on the learning of determinants of IRS in Tanzania.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This part reviews the argument on a range of source of information about the study which prescribes the determinants of IRS on commercial banks in Tanzania. In this chapter a researcher examined all available and necessary literatures to get equipped with the study in place.

The chapter contains four parts, the first part concern the theoretical review of the literature which explain the concept of the study and the theories applied. The second part is the empirical literatures concern the previous studies similar to the study conducted by the researcher. The third part consists of the conceptual framework and the research model which shows the structured set of ideas from which the researcher properly identify the relationship of the study(Kothari, 2004). . However it starts by the review of the evolution of commercial banks in Tanzania

2.1 Evolution of commercial banks in Tanzania

Tanzania has been implementing economic reforms which include liberalization of financial sector since 1986 (Aikaeli et al., 2011). The liberalization of the financial sector was spearheaded by the enactment of the Banking and Financial Institutions Act (BFIA) in 1991 which allowed the entrance of private sector in the Tanzanian financial sector. Although the emergence of several multinational banks with big capital base and superior technology seems to marginalize the small banks, hence makes the competition extremely stiff for some small banks. Since liberalization to 2000, four private banks and one public bank have collapsed (Manamba, 2017). The first to sail was the Meridian Biao (1994), followed by Tanzania Housing Bank (THB) in 1995, Trust Bank (1998), Greenland Bank (1999) and First Adili (2000). The collapse of these banks indicates that the banking system is faced by major problems of insolvency (Manamba, 2017).

The enactment of Bank of Tanzania Act of 1995, which legally considered price stability as the prime objective of monetary policy, brought an end to the use of direct instruments of monetary policy sub-summed by the Government under the Annual Finance and Credit Plans in 1971, and undermined the use of indirect monetary policy instruments. This Act was later reformed to the Bank of Tanzania Act (2006) which anchored the supervisory role of the central bank in order to promote financial and macroeconomic stability in the country.

In Tanzania financial system before the introduction of the financial sector reforms consisted principally of the central bank and two commercial banks, the National Bank of Commerce (NBC) and the Cooperative and Rural Development Bank (CRDB) until 1991 were Tanzania has about 14 institutions in the financial system (Manamba, 2017). Around June 1991 and August 2011 commercial banks increased to 30 from only 2 banks were 7 are regional unit banks and non-commercial banks increased from 3 to 5, insurance companies increased from 1 to 21 and 200 bureau de change established. The financial sector intermediation and efficiency have improved quite appreciably, as of December 2017 the banking supervision of the Bank of Tanzania has approved and registered 40 commercial banks in Tanzania. However the commercial banks' lending rates remained high which reflects the increase risk premium associated by non-performing loans (Bank of Tanzania, 2018).

2.2 Explanation on key concepts

This review, concern with the definition of the main concepts of the Interest rate spread, financial intermediation concept and transaction cost concept.

2.2.1 Interest rate spread concepts and its measurement

The ongoing concerns about the effectiveness of the credit channel for monetary policy transmission have brought many discussion of Interest Rate Spread. Literature distinguishes interest rate spread into ex-ante and ex-post interest rate spread (Demirguc-Kunt & Huizinga, 1999). The first is the difference between the interest rates charged on loans and rates paid on deposits that is written on the contract agreement. The later is the difference between banks real gained interest revenues and their real incurred interest expenses. These two differ from each other by the

amount of loan that has evaded. The ex-post spread is a more useful measure because it controls for the fact that banks with high yield, risk credits are likely to face more defaults.

Bank spreads measure the gap between the amounts a bank pays the providers of funds and what it receives from users of bank credit. The literature continues to distinguish among different definitions of measuring bank spreads. (Aikoh, 2013) measure IRS, as the different between the interest income gained and the interest rate paid by the customers when make deposits, borrowed funds divided by total assets or different between the ratio of interest received to all interest bearing assets and the ratio of interest paid to all interest bearing liabilities. The other comes close to the difference between typical borrowing interest and lending rate. The fourth approach is to divide net interest income as a percentage of total assets.

According to (Rebei, 2014) the most common definitions are a narrow definition, which is described as the difference between interest income over loans and the interest expense over deposits; and a broad definition, which corresponds to the bank's total interest income minus total interest expense, divided by total interest-bearing assets.

In general, the spread is measured by the difference between lending rates and deposit rates (Bonga, 2016). However banks offer a variety of financial products, with different set rates and maturity period. Such financial products may include personal loans, mortgages, housing loans, staff loans among others. Regardless of the financial products offered the landing rate may differ depending on the credit worthwhile of the client (Bonga, 2016). Therefore this study will concentrate on those rates offered to customers whose possibility of default is lowest.

The current study will apply an ex-post measurement approach that uses the rates quoted on loans and on deposits as appropriate for the credit worthiness client with lowest chance of loan default.

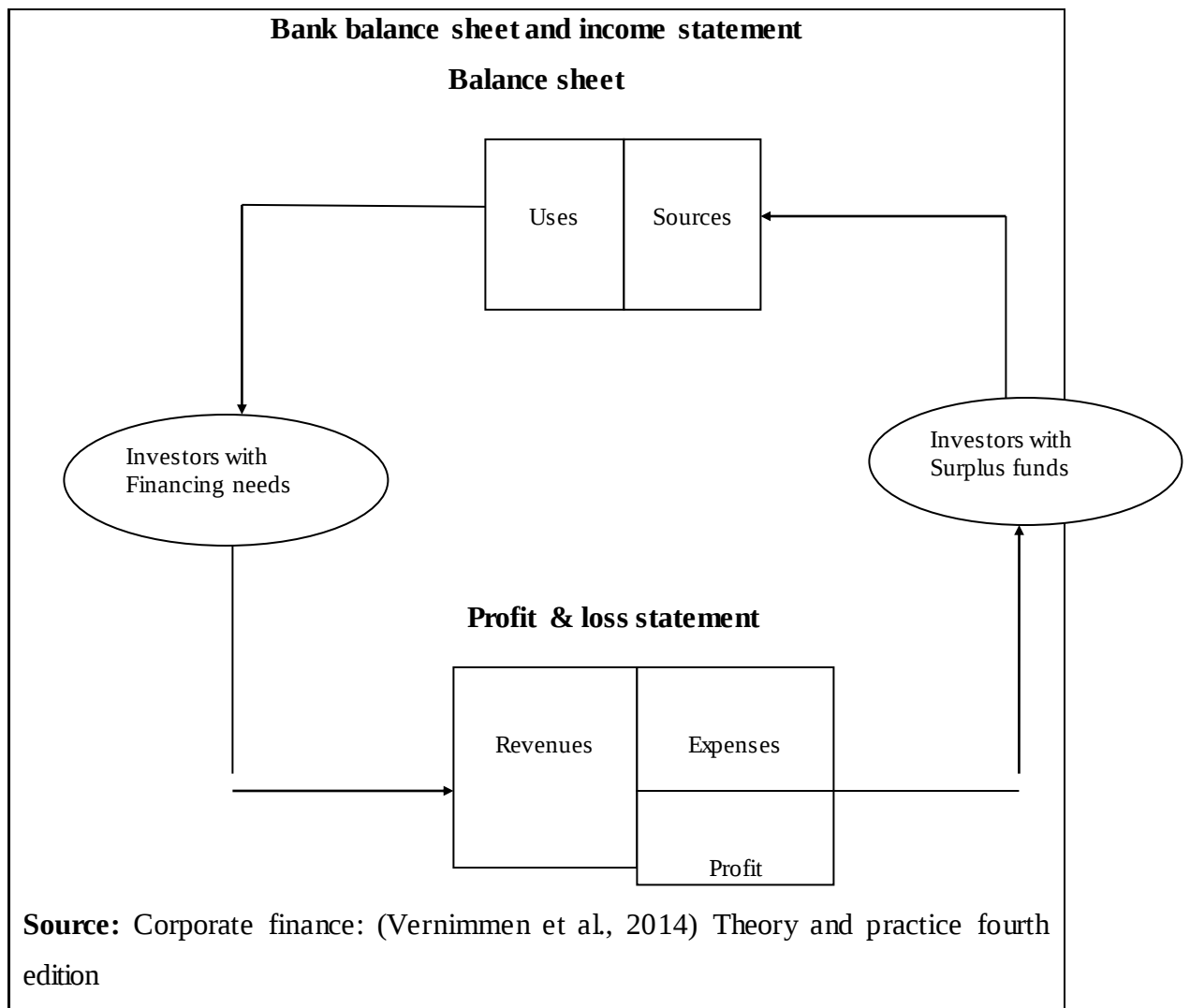
2.2.2 Financial Intermediation Concept

According to (Vernimmen, Quiry, Dallochio, Le Fur, & Salvi, 2014) the main role of a financial system is to bring together directly or indirectly financial participants with surplus financial resources, such as households, and those with net financial needs, such as companies and governments. Firstly, the financial system serves as a broker to counterpart the supply of funds with the corresponding demand. Secondly, financial intermediary such as banks buy securities to companies or provide loans to individuals. The banks in turn collect funds in the form of demand or savings deposits or issue their securities that they place with investors. Hence, the financial system serves as a gatekeeper between suppliers and users of capital and performs the function of intermediation.

Banks are financial intermediaries that collect funds from surplus units and make the funds available to deficit units. The liabilities side of its balance sheet, apart from their nature, from deposits to bonds to shareholders' equity. Capital serves as the creditors' crucial assurance. On the assets side, the intermediary shows all uses of funds, regardless of their nature, loans, investments, etc. The intermediary earns a return on the funds it employs and pays interest on the resources. These cash flows appear in its income statement in the form of revenues and expenses. The difference, or spread, between the two constitutes the intermediary's earnings¹.

¹ Explanation on Intermediation concept in detail is given in the book of Corporate finance: Theory and practice Vernimmen et al. (2014)

Figure 2.1 Financial intermediation concept



2.2.3 Transaction Cost Concept

This idea was brought about by (Coase, 1991). In sorting out a market business deal, there is a need to identify whom to deal with, need to take negotiations, to prepare the contract and to undertake the assessment needed to verify adherence of contract terms. In the world of investment, transaction costs are expenses incurred when buying or selling securities. Transaction costs include search and information costs, negotiate and decision costs, distrust costs and, policing and enforcing costs. In the population where there are no financial agents, dealings costs will be high and there is no guarantee that one could get what he wants both in terms of amount and time used. The financial institutions would act on behalf of lenders and borrowers and

utilize economies of scale and extent. The transaction costs would include monetary costs (Tobin, 1963) and search costs, monitoring and audit costs (Benston & Smith, 1976). In conclusion, financial intermediaries' existence minimize transaction costs, as deficit units visit banks for financial products and savers deposit with banks their excess funds for a return.

2.3. Theoretical Literature

The theoretical literature concerns with the review of different theories in the field of economics and finance that support this study.

2.3.1. Expectations Theory

This theory explain the effect marked by expectations of customers, banks and other businesses towards the supply and demand of financial markets (Weth, 2002). If expectations for inflation increase, there will be shifting of supply and demand of surplus fund and higher interest rates result. This theory links with our study by associating macroeconomic effect to banks IRS fluctuation due to supply and demand of credit in the financial market. Also bank's portfolio of assets and liabilities depends in part on the expected return to various assets and the expected cost of various liabilities (Cukierman & Hercowitz, 1990), expectations theory assumes that interest rates are determined by supply of surplus funds and demand for credit (Vernimmen et al., 2014). In this study the theory is relevant if people expect inflation to increase in future, they would tend to fail to deposit money in commercial banks and hence results to low supply of funds due to high borrowing rates which widening the spread.

Expectation theory also describes the effect of increase and decrease of growth domestic product of a nation can facilitate expectations among participant of financial intermediation process. Banks manager may expect increase of borrowers due to high level of investment and project execution. This may enhance lowering of borrowing rate and hence lowers spread in the commercial banks. However the expectation of increase of growth domestic product may build credit worthiness of

customers since there will be trust that fund is available in the market hence will also facilitate lowering of lending rate.

2.3.2. Asymmetric information theory

This theory explains the absence of proportionality in information among participant of financial sector. According to (Bonga, 2016) the primary reason for financial intermediation is informational asymmetries between participants of financial system. This theory provide explanation where some people may have less information about the market or other individual may have more information about the market hence some may pay more or less cost for the same products. The presence of banks will enable availability of information in the market at a more relatively symmetrical manner. Therefore financial intermediation moderates this confusion and the cost incurred. In an environment where there is asymmetric information asymmetry there is possibility to have misallocation of inadequate resource in which consumers will pay too much or too little, and firms producing too much or too little, hence may lead to market crash. Potentially, this could be a harmful scenario when one part uses the weakness of lack of information by the other part. Markets do work best when knowledge is perfect and is shared evenly by all parties involved in a transaction. Hence, asymmetric information is an economic problem because one party can exploit their greater awareness.

The function of banks as financial intermediaries helps to solve the problem of asymmetric information. Therefore banks play as intermediaries that influence awareness among participant in financial sector to access market information to facilitate the process involved in supply of credit available from surplus unit to deficit unit. The information asymmetric theory hence explain the problem that face the banking sector on the lack of information or availability of false information in the market that hinder the banks services and this may lead to inefficiency whereby banks may charge high borrowing rate with the notion that there is high credit risk or customer may fail to make deposit this a false notion that the management have poor

control and they may not obtain true statement about their transaction which may lead to loss.

Therefore, the awareness brought by the banks that has been explained by the asymmetric information theory to the financial market information play a bigger role to this study in which it regulate interest rate spread through reduction of operational cost which is the among variable in this study that determine interest rate spread.

2.4. Empirical Literature

This is the assessment on the previous studies and findings of the determinants of interest rate spread or correlated topics. However studies that examine the determinants of bank interest rate spreads similar to this study have generally used variables that can be analyzed in three broad categories. There exist bank specific variables, banking industry specific variables and the broad macroeconomic variables. The current study will examine the available literature and come up with the best way that this study will be carried out to bring about quality policy prescription related to bank interest rate spreads determination and control. Hence the study will categorize the variables into two categories that are bank specific variables and macroeconomic variables which carries the effect of industrial specific factors.

2.4.1. Banks specific determinants of interest rate spread

(Kiptui, 2014) analyze the determinants of interest rate spreads of the commercial banks in Kenya using panel data analysis for 39 commercial banks. The study used banks specific factors and suggested that operational costs have been found to be major determinants contributing to 7-10 percent. The study recommended the need for banking sector efficiency improvements. However the study by Phili L.Brock, Lilian Rojas Suares in Latin America explores the determinants of bank spreads using panel data analysis; it employs two step procedures used by Ho and Saunders (1981). The researcher consider bank specific variables and suggest that higher operating cost raise spreads as due to high levels of non-performing loans, although the size of these effects differs across the countries.

The study in Tanzania (Manamba, 2017), used quarterly time series data covering the period of 1986-2013. The study revealed that interest rate spreads are significantly determined by lack of competition among financial institutions and also it is established that as proportion of liquid assets increases, the bank liquidity risk decreases which in turn results to lower interest rate spread. Hence, this study suggests that policies should be directed at improving risk management, building a prudential level of liquid assets, strengthening supportive information and bank supervision. The study by (Aikoh, 2013) examine determinants of interest rate spread on 28 quarterly published reports of commercial banks and bank of Tanzania economic bulletin publications. This study suggested that bank individual specific factors for determination of interest rate spread are the treasury bills rate, non-interest income, provision for loan losses and non-performing loans. The policy implication for this study encourages high responsiveness of commercial banks spreads to be regulated.

Never the less the study of (Khawaja & ud Din, 2007) which determine interest rate spread in Pakistan by using panel data, the study used 29 commercial banks. The study discovered that interest rate for deposit fund in the total deposits is the significant determinant of IRS and the concentration on market has no influence on interest rate spread. The study suggested that the competitive environment may results to review by non-trust authority.

Also the review of the study by (Rusuhuzwa, Karangwa, & Nyalihama, 2016) examined the determinants o interest rate spread in commercial banks using panel data generalized method of moments estimation. The study indicated that credit risks, operating cost and inflation positively determine interest rate spread in Rwanda. The study implies that banks should adopt cost minimization policies that will help management of credit and reduce risks.

2.4.2. Macroeconomic determinants of interest rate spread

(Sheriff & Amoako, 2014) examined the macroeconomic determinants of interest rate spread for Ghana using Auto-regressive distributed lag (ARDL) methodology and VECM respectively. The study used secondary data on a monthly basis for the

period of 1999-2010. The study recommended that government borrowing, interest rate and inflation rate should be kept low and policies that maximize savings should be pursued. The study is likely to suffer from misspecification by considering macro determinants only, though there are also bank specific factors that affect the determination of spreads. (Kiptui, 2014) in Kenya and Phili L. Brock, Lilian Rojas Suarez in Latin America have also discussed about macroeconomic factors of interest rate spread. The researchers used Real Gross Domestic Product growth rate, inflation rates and market concentration as major macroeconomic variables. The study suggests efficiency in improvement and stability maintenance of the macroeconomic environment. However the study by Tarsila Segalla, Priscilla Maria and Marcio Nakane in determining banks interest rate spread in Brazil, suggest this macroeconomic variables are the most significant factors to explain the behavior of bank interest spread in Brazil. The study makes use of panel data techniques and employed a two-step approach due to Ho and Saunders (1981) to measure the relative of the micro and the macro elements to uncover the main determinants of the bank interest rate spread in Brazil.

In Tanzania several literatures have examined the macroeconomic determinants of banks interest rate spreads. The study by (Manamba, 2017) in Tanzania used the quarterly time series data study revealed that interest rate spreads are significantly determined by existence of diseconomies of scale in the financial system. The researcher suggests that policies should be directed at maintaining macroeconomic stability. According to (Aikaeli et al., 2011), in examining interest rate spreads in Tanzania using macroeconomic and regulatory factors during the period 1991-2009 discovered that the IRS in Tanzania were strongly caused by net government borrowing from commercial banks, banking sector development, minimum statutory reserve required and the rate on discount. However the results recommend the significance of lower discount rate and reduction of reserve required as a strategy in monetary policy to reduce IRS in Tanzania. The study used co-integration and Error Correlation Model (ECM) to analyze the data from commercial banks in Tanzania.

Most of the studies in Tanzania employ regression technique using time series data and cross sectional data from commercial banks financial statements but this paper is going to use a panel data regression technique to analyze the determinants of banks interest rate spread in Tanzania.

2.5 Conceptual framework and research model

A conceptual framework is the blue print which shows the researchers understanding on how the testing variables in the study connect each other. It provide an amalgamation of literature on how to explain the phenomenon, therefore it point out the objective of research (McGaghie, Bordage, & Shea, 2001).The conceptual framework point out to a large extent from the framework called theoretical framework. The framework draws support from time-tested theories that represent the findings of many researchers on why and how a particular phenomenon occurs and the relationship between them.

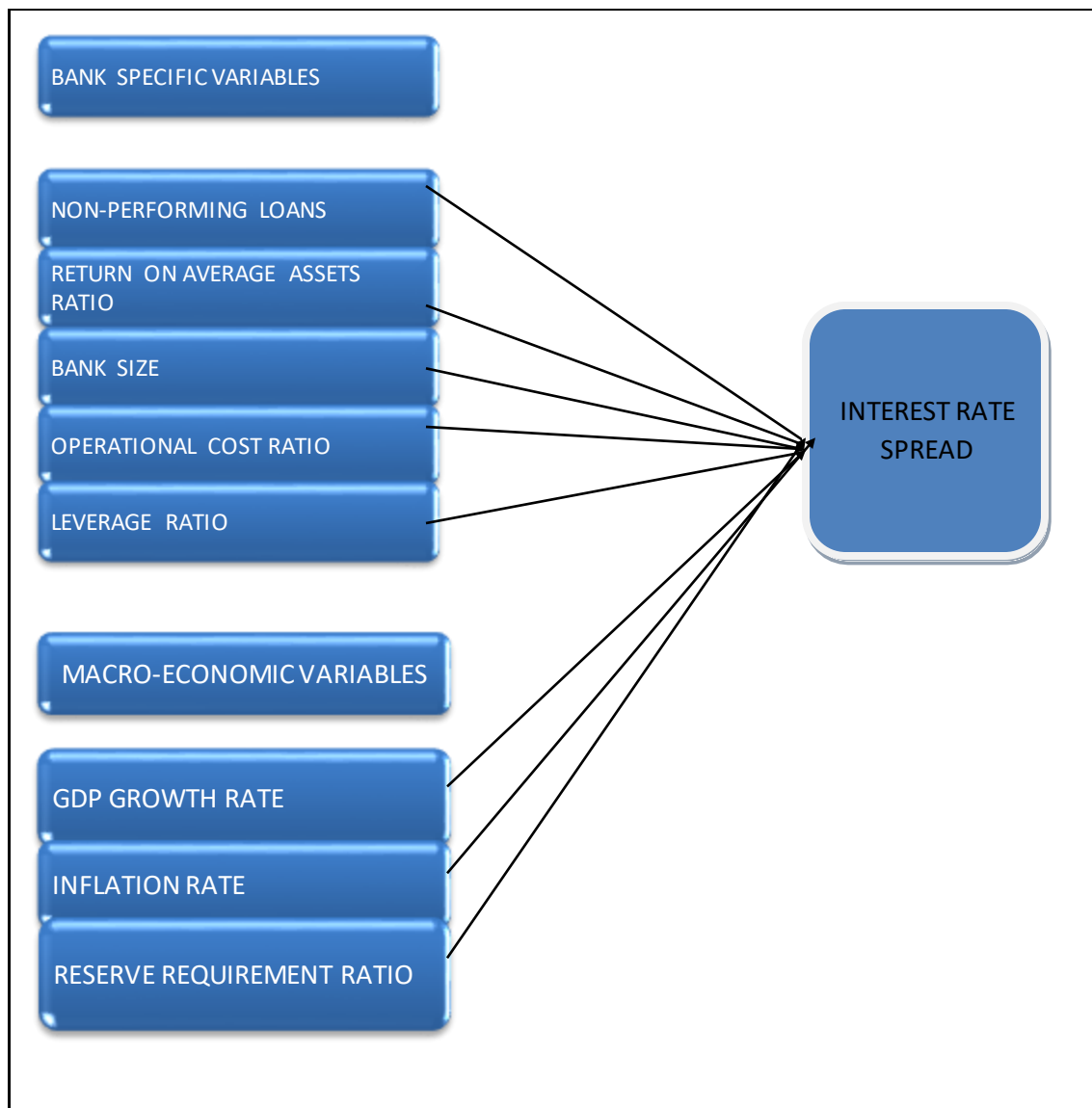
The current study looks upon the behavior and the effect of determinant of IRS on commercial banks in Tanzania. The framework contains two groups of explanatory variables in the left side that comprise of bank level variable on the top followed by macroeconomic determinants at the bottom all of them explain the behavior of IRS which is the dependent variable on the right side of the framework.

The dependent variables in the bank specific indicators include ratio in non-performing, return on assets ratio, bank size, operational cost ratio and leverage ratio. On the other side the macroeconomic variables include growth domestic product rate, inflation rate and reserve requirement ratio. The study will survey the proportion of these variables to study the spread in the Tanzanian banking sector. However the study selected these variables due to availability of information in Tanzania banks and the type of the study also required the use of secondary data hence these variables takes consideration of the ease of access.

The conceptual framework is backed up by theories that link the independent variables and dependent variable. The expectation theory describes the

macroeconomic variables which are growth domestic product growth rate, the inflation rate and the reserve requirement ratio. The theory link these macroeconomic variables with the independent variable interest rate spread. Participant of financial sector thus include commercial banks as for this study expect fluctuation in these macroeconomic conditions hence they tend to change to adapt the economic condition at a particular period of time. However the information asymmetric theory explains the relationship exist among some bank specific variables with the bank interest rate spread. The information symmetry exist among the financial market influence additional cost of intermediation by the commercial banks, this reflect the cost incurred by the individuals who acquire loans from commercial banks which may contribute to increase in nonperforming loans and thus the return on average assets of commercial banks to decrease.

Figure 2.2 Conceptual framework and research model



Source: Researchers' own design

The study will exploit these proportions to survey possible determinants of interest rate spreads with respect to the Tanzania banking sector. The selection of variables has been guided by the various existing literature, but availability of data for the banks in Tanzania is taken into consideration.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This section concerns with the methodologies that the researcher will use in examining the study on determinants of banks interest rate spread. This part concerns with the tactics and design used in carrying out this study, It includes study, area of study, population of the study, units of analysis, the variables and their measurements, and sampling techniques and sample size, types and sources of data, data collection methods, validity issues, and data analysis methods (Kothari, 2004).

3.1 Research Design

A research design refers to the framework that has been created to seek answers to research questions. According to (Creswell, Plano Clark, Gutmann, & Hanson, 2003) a research design is the plan and a strategy employed by a researcher to obtain answers to research problems and research questions. The research design is broken into sampling design, observational design, statistical design and operational design(Bonga, 2016).The current study relies in sampling aspects to attain its objectives. The sampling design deals with the method of selecting items to be observed for the given study (Kothari, 2004), this study have used this design because the researcher used judgments to select some commercial banks due to ease of access of information from those banks.

This study is designed to find out whether the selected determinants of interest rate spread are significantly affecting the interest rate spread in commercial banks in Tanzania. The study focus on the quantitative research approach, the reason behind the use of quantitative research approach was that, the quantitative research approach is useful where quantitative data are generated from large samples to test applicability of the accessible theory using numerical analysis (Aikoh, 2013). Quantitative research allows the researcher to measure and analyze data in detail relationship between dependent and independent variables, and can be used to test hypotheses because of its ability to measure data using statistics (Jones, 2016). The

main disadvantage of quantitative research is that it does not study things in a natural setting or discuss the meaning things have for different people as qualitative research does (Bonga, 2016).

3.2 Sampling technique and sample size

The research is basically to find out the interest rate spread in commercial banks in Tanzania. The study used deliberate sampling which is also known as purposive or convenience sampling. This sampling method involves purposive or deliberate selection of particular units of the population for constituting a sample which represents the population. The technique involves selection of the sample based on the ease of access of the sample. Hence this study used a total of 15 selected commercial banks out of 40 registered commercial banks in Tanzania (Bank of Tanzania, 2018). The study used annually panel data from 2000 to 2017 commercial banks financial statements, thus employed a period of 18 years to study specific determinants of interest rate spread in Tanzania. However the study will use report reviews from Bank of Tanzania (BoT) and World Bank indicators to study the macroeconomic factors of IRS in Tanzania, by using data from 2000 to 2017 which makes a period of 18 years.

In studying the specific determinants of IRS in Tanzania using annually financial statement of 15 commercial banks in a period of 18 years it makes a total of 270 observations. Nevertheless, on macroeconomic determinants using statistical data from BoT and World Bank in a period of 18 years it makes a total of 18 observations. Therefore the study had employed a total of 288 observations in studying both bank specific determinants of IRS as well as macroeconomic determinants of IRS in commercial banks in Tanzania.

3.3 Data types, sources and collection methods used

The study empirically investigated the determinants of banks IRS in Tanzania. This study mainly relies on statistical data to attain its objectives; the data used are panel data from commercial banks annual statements, the world development indicator data and the Bank of Tanzania data, these data obtained from fifteen commercial banks in Tanzania from 2000 to 2017. The data are collected through empirical survey and it employs panel data estimation methodology to analyze. Panel data models provide much more insights than time series models or cross section data models because it is theoretically possible to isolate the effects of specific effects and actions (Hsiao, 2007).

3.4 Description variables

3.4.1 Non-performing loans ratio (Credit risk)

This is the independent variable which is measured as non-performing loans to total loans ratio and it is used as an indicator of credit risk or quality of loans. If a bank increase a provision for loan losses it implies a higher cost of bad debt write-offs. Due to the risk-averse behavior by the commercial banks, banks facing higher credit risk are likely to pass the risk premium to the borrowers, leading to higher spreads. Therefore, as the risk increases so as the pricing of loans and advances to compensate the likely loss (Bonga, 2016; Were & Wambua, 2013b). Therefore the study expects a positive relationship to exist between non-performing ratio and interest rate spread in commercial banks.

3.4.2 Bank size

This is an independent variable which determines the interest spread. According to (Were & Wambua, 2013a) bank size is measured as the log of total bank's assets. preferably, we would expect bigger banks to be linked with lower interest rate spreads, possibly because large banks are expected to have large economies of scale and ability to invest in technology that would improve efficiency. However, to the extent that bank size have greater chance to control the power of the market in the deposit and loan markets, a positive relationship between interest rate spreads and bank size should not be surprising.

3.4.3 Operating costs ratio

This is an independent variable that affects the behavior of interest rate spread in commercial banks. The study by (Rebei, 2014) computed operating costs as a ratio of total net operating income to total income ratio. Preferably commercial banks incur costs of financial intermediation such as screening loan applicants to assess the risk profile of borrowers and monitor the projects for which loans are advanced. An increase in operating costs is expected to have positive influence on interest rate spreads. High operating costs are likely to include costs due to inefficiency, leading to higher spreads and hence, this variable is commonly used as an indicator of operational inefficiency. A higher cost of financial intermediation will drive up interest rates on loans while depressing interest rates on deposits (Aikoh, 2013). Nevertheless this study measures these variables as the ratio of operating expenses to the net operating income from the income statement of commercial banks in Tanzania.

3.4.4 Return on average assets ratio

This is an independent variable that affects interest rate spread; this variable is computed as net income divided by average total assets. This is generally considered as a good indicator to evaluate the profitability of the assets of a firm in comparison to other firms in the same industry (Bonga, 2016). A positive relationship with interest rate spreads is hypothesized. Return on Asset is calculated using an accounting formula as net income divided by average total assets of the bank.

3.4.5 Leverage ratio

This is an independent variable which affects interest rate spread in commercial banks. According to (Were & Wambua, 2013a), the increase of leverage ratio is expected to have influence in increase of solvent risk, whereby it is conducive to higher interest spread. This variable is measured as the ratio of total liabilities plus net worth to bank net worth. The study expects a positive relationship to exist between leverage ratio and interest rate spread in banking industry.

The macroeconomic variables used to capture the impact of the macroeconomic factors are GDP growth rate, inflation rate, real interest rate and market structure.

3.4.6. Growth Domestic Product growth rate

This is an independent variable capturing the influence of macro-economic effect on interest spread. According to (Beck, 2016) the study explains that a larger economy might be expected to allow for economies of scale and greater competition which drives interest spreads. At the same time, if real GDP rate move down, banks are faced with increased credit risk and they charge higher interest to borrowers (“Macroeconomic determinants of interest rate spreads in Ghana,” 2017). However, it is possible that larger economy allows for greater specification and deeper financial markets in which riskier borrowers have better access to funds. The study expects an inverse relation to exist between GDP growth rate and IRS.

3.4.7. Inflation rate

This is an independent variable with macro-economic effect on interest rate spread. This variable explains that in an inflationary environment, banks costs generally raise

leading to higher borrowing costs for the private sector. Further, high inflation is generally associated with an unstable and unpredictable economic environment. In other terms higher inflation is expected to lead to higher inflation adjusted spreads if it causes banks to charge a risk premium. We propose using actual inflation as a proxy for expected inflation(Aikoh, 2013; Were & Wambua, 2013a).

The banks take cash from depositors and lend to borrowers with some interest so that they make profit. The time value for money is an important concept in banking industry, this therefore makes inflation rate to be one of the core drivers of IRS (Bonga, 2016). Thus it takes part in inflationary environment such as Tanzania.

Therefore in inflationary environment lenders tend to demand more due to decrease of purchasing power whereby lower value products needs high compensation. As a result, an inflation rates increase leads to increase in interest rates.

3.4.8 Reserve requirements ratio

This also is an independent variable that catches macro-economic effect to describe interest rate spread in commercial banks. According to(Beck, 2016),reserve requirements with less than market remuneration lower net interest income, but the degree to which depends on the possible pass-through to bank customers. In general, un-remunerated reserves have lowered bank's net interest income, suggesting less than full pass-through to depositors and borrowers. The study expect a positive relationship to exist between reserve requirement ratio and interest rate spread.

Table 3.1 Variable description and their measurements

S/N	Variable standard name	Sources	Variable description as used in the study	Variable measurement
Banks specific variables				
1.	Non-performing loans ratio	Author : Bonga, Wellington Garikai Title : An Empirical Analysis of the Determinants of Interest Rate Year : 2016/09/06	This variable captures the effect of default risk where it allows commercial banks to maintain positive returns.	$\text{NPL} = \frac{\text{Non performing loans}}{\text{Total loans}}$
2.	Leverage ratio	Author :Were, Maureen; Wambua, Joseph Title : Assessing the determinants of interest rate spread of commercial banks in Kenya Year :2013	This is defined as the ratio of total liabilities plus net worth to bank net worth. Leverage ratio is conducive to higher interest spread.	$\text{LR} = \frac{\text{Total liabilities} + \text{Net worth}}{\text{Bank's net worth}}$
3.	Operating costs ratio	Author :Afanasieff, TarsilaSegalla; Lhacer, Priscilla M.; Nakane, Márcio I. Title : The determinants of bank interest spread in Brazil Year : 2002	This variable capture the effect of all cost the bank incurred in its operation.	$\text{OE} = \frac{\text{Operational expenses}}{\text{Net Operating income}}$
4.	Return on average assets ratio	Author :Bonga, Wellington Garikai Title :An Empirical Analysis of the Determinants of Interest Rate Spreads Year :2016	Return on Asset in the explanatory variable which evaluates the profitability of the bank in relation to its assets.	$\text{ROA} = \frac{\text{Operating profit}}{\text{Total assets}}$
5.	Bank size	Author :Were, Maureen; Wambua, Joseph Title :Assessing the determinants of interest rate spread of commercial banks in Kenya Year :2013	The bank size is usually approximated as the proxy of the total assets of the bank.	$\text{BS} = \text{Logarithm of the bank's total assets}$

Macroeconomic variables				
6.	Reserve requirement ratio	Author :Beck, Thorsten Title :Impediments to the Development and Efficiency of Financial Intermediation in Brazil Year :2000	The reserve requirement reduces banks revenue and this can pass to depositors which will face low interest and also pass to borrowers who will face high interest rate, therefore increase spread between the two.	$RR = \frac{\text{Aggregate reserves}}{\text{Total deposits}}$
7.	Inflation rate	Author :Brock, Philip; Rojas-Suarez, Liliana Title :Understanding the Behavior of Bank Spreads in Latin America Year :2000	This is the macroeconomic variable which captures the cost of doing business in the economy. The higher the inflation rate leads to higher interest rate spread.	IR=consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.
8.	Real Gross-Domestic Product	Author :Afanasieff, TarsilaSegalla; Lhacer, Priscilla M.; Nakane, Márcio I. Title :The determinants of bank interest spread in Brazil Year :2002	This is the macro-economic variable which shows the growth rate of the national income. If this growth rate slow down will likely reflect the interest rate of the bank's loans to rise up and hence leads to high spread.	GDP=The sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

3.5. Estimation techniques and model specification

This part explain the technique that takes part in the study for panel data regression analysis and the specification of the model to be used in examining the determinant of interest rate spread on commercial bank in Tanzania.

3.5.1 Fixed effect model

The fixed effect model assumes that the difference across case can be captured in differences in the constant term. It allows the unobserved individual case effect to be correlated with integrated variables. (Rebei, 2014) Fixed effect model is appropriate when you want to control for the effects of omitted variables that differ across case but are the same or constant over time. Fixed effect model presume the sample is not random in which the subjects have steady slopes but different cross-sectional intercepts. FEM can be one-way error element model or two-way error element

model (Bonga, 2016).The fixed effects model is mathematically expressed as follows;

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it} \dots\dots\dots (i)$$

Where; α_i ($i=1\dots n$) is the unknown intercept for each entity (n entity-specific intercepts). Y_{it} is the dependent variable where i = entity and t = time, X_{it} represents one independent variable, β_1 is the coefficient for that independent variable, and u_{it} is the distinctive error term. The fixed effects model specification is more appropriate when a study is focusing on a specific set of observation unit and inference is restricted to the behavior of these sets of units (Battagi, 2005)

Model under fixed effect model

From the above equation (i), the model for pure spread to be estimated in this study will be expressed as;

$$IRS_{it} = \alpha_i + NPL_{it} \beta_1 + BS_{it} \beta_2 + ROA_{it} \beta_3 + NII_{it} \beta_4 + OC_{it} \beta_5 + u_{it} \dots\dots\dots (ii)$$

Where; IRS = Interest Rate Spread

A = constant term

NPL= Non-performing loan ratio

BS= Bank size

ROA= Return on average asset ratio

LR= Leverage ratio

OC= Operational costs ratio

U = disturbance error term

The vector of macroeconomic variables contains the inflation rate variable, the GDP growth rate and required reserve ratio. However, the model for estimation of pure spread in the second step will be expressed as;

$$PS_t = \alpha_i + GDP_{it} \beta_1 + IR_{it} \beta_2 + RR_{it} \beta_3 + u_{it} \dots\dots\dots (iii)$$

Where; PS= Pure Spread

α_i = constant term

GDP= Real Gross Domestic Product growth rate

IR = Inflation rate

RR = Reserve requirement ratio

U = Statistical disturbance error term

3.5.2 Random effect model

Panel data models can be estimated in three ways depending on whether the individual cross section effects are considered to be constant, fixed or random. The choice of an appropriate model depends on the degree of homogeneity of the intercept and slope coefficients and the extent to which any individual cross-section effects are correlated with the explanatory variables (Song and Witt, 2000, Bonga, 2016) and this is testable.

The researcher used the panel data technique to ascertain the significance of the banks specific variables and macro economic variables in determining Interest rate spread. Hence the study will utilize the assumptions of random effect model where by the model applies when the individual specific effects are strictly uncorrelated with the included independent variables. It is appropriate when the sample is believed to be randomly selected and therefore is representative of the population. It is used when the effect of some omitted variables differs across case but are same over time, and yet still the effect of other omitted variables are the same across case but differ over time.

The Random effect is mathematically expressed as follows;

$$Y_{it} = \alpha + X_{it}\beta + \mu_i + \lambda_t + V_{it} \dots \dots \dots (iv)$$

Where, λ_t is the unobserved time series effects, α is the intercept, μ_i is unobserved cross-sectional individual effects and V_{it} is the idiosyncratic error.

The major advantage of the random effects model is that there is fixed number of parameters and efficient estimation methods can be derived.

Model under random effect model

From the above equation (ii), the model for pure spread to be estimated in this study will be expressed as;

$$IRS_{it} = \delta + \mu_i + NPL_{it} \beta_1 + BS_{it} \beta_2 + ROA_{it} \beta_3 + NII_{it} \beta_4 + OC_{it} \beta_5 + \lambda_t + \varepsilon_{it} \dots \dots \dots (v)$$

Where; IRS = Interest Rate Spread

Δ = constant term

μ_i = unobserved cross-sectional individual effects

NPL= Non-performing loan ratio

BS= Bank size

ROA= Return on average asset ratio

LR= Leverage ratio

OC= Operational costs ratio

λ_t = unobserved time series effects

E = disturbance error term

The vector of macroeconomic variables contains the inflation rate variable, the GDP growth rate and required reserve ratio.

However, the model for estimation of pure spread in the second step will be expressed as;

$$PSt = \varphi + \mu_i + GDP_t \lambda + IR_t \lambda + RR_t \lambda + \lambda_t + U_t \dots\dots\dots (vi)$$

Where; RS= Pure Spread

A = constant term

μ_i = unobserved cross-sectional individual effects

GDP= Real Gross Domestic Product growth rate

IR = Inflation rate

RR = Reserve requirement ratio

λ_t = unobserved time series effects

U = Statistical disturbance error term

Hausman test and the decision

This test enables the decision between fixed or random, whereby the null hypothesis is that the chosen model is random effect and the alternative the chosen is fixed model. It is an important test in which the individual errors are associated with the independent variables; the null hypothesis suggests that they are not correlated. We run a fixed effect model and save the estimates, then we run a random model and save the estimates, and then we performed the test.

3.8 Model specification

The methodology applied was based on the theory advanced by Ho and Saunders (1981). This is the best known theoretical interest spread model which provides the explanation of the determinants of interest rate spread (Bonga, 2016; Männasoo, 2013). The model was made by combining the hedging and expected utility of profit approaches. The model view banks as risk-averse dealers seeking to match the maturities of loans and deposits in order to avoid the interest rate fluctuation risk which arises if positions are either too short or too long.

The representative banks selected are risk averse that acts as the intermediary for the provision of deposits and loans. Due to fact that depositors and borrowers are likely to arrive at random according to Poisson process, hence the assumption of Ho and Saunders will be applied as it assume there is linear symmetric provision for the random arrival rates of loans and deposits(Afanasieff, Lhacer, & Nakane, 2002).the model is applicable in such a way that customers deposit in asymmetrical way and borrowers request for loans in a random manner and the banks should fulfill those request. Therefore this unbalance condition which comes from the way deposits came and the way customers request for loans cause risk in banks inventory, thus it needs to be fulfilled by the difference between deposit and lending rates, hence this is the pure interest spread (Were & Wambua, 2013a).

²An interest spread arising from Ho–Saunders model is obtained from the base in which banks offer similar product, and differences in interest margins across the banks is on account of average transaction costs, changes in interest rates, risk taking behavior of bank managers and the extent of competition within the bank’s market (Were & Wambua, 2013b)).

Therefore, the equation (ii) and (vi) are the estimated models for regression between residual spread and bank level variables and pure spread against macro-economic variables respectively.

² The detail explanation on the Bank Dealership Model is available in the article Ho and Saunders (1981), also see(Allen,1988)

3.9 Test for validity of the model

For regression results to be reliable for policy use, the valid of the model used should be tested. For the Pooled OLS and Fixed Effects model, an F-test will be performed to check on the significance of the whole model using an F-statistic. For the Random Effects model a Wald test statistic will be used (Bonga, 2016). The conclusions of both statistics on validity of the models are the same.

Ho: At least one variable from the included, explains interest rate spreads

H1: None of the variables included explain interest rate spreads

The decision when the model is appropriate will be to reject the null hypothesis, and an appropriate model is confirmed by the significance of the F-statistic or the Wald-statistic (Afanasieff et al., 2002). Adjusted R-squared (Pooled OLS) will also be used, though not very critical in panel data analysis, to check on the efficiency of the final model. It explains the level at which the included explanatory variables explains the variability in the dependent variable. Fixed Effects and Random Effects models make use of the within, between and overall R-squared.

CHAPTER FOUR

ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.0. Introduction

The current chapter gives explanation on the analysis of data and presentation of findings based on the determinants of interest rate spread on commercial banks in Tanzania. It comprises of descriptive statistic, diagnostic tests and regression results for the bank specific determinants and macroeconomic determinants of interest rate spread on commercial banks. Moreover this chapter focuses on estimation of the model in order to determine the coefficients, the significance and reliability of the factors determining interest rate spread of commercial banks.

4.1 Descriptive statistics

This study includes total of fifteen commercial banks in Tanzania as a sample during the period of 2000-2017. Some banks do not have eighteen years data, so after removing missing values we include 207 valid observations in the sample. The data are provided by the bank's annual reports and the report reviews from World Bank indicators, and analysis was done by using the econometric software called Stata 11.2. The reason for using Stata software is because it has a strong ability to handle and estimate unbalanced panels (Bonga, 2016).

The descriptive statistics dealt in this part are the Mean, Standard deviation, minimum and maximum values. The Table 2.0 below shows the summary statistic for variable list used in determining IRS in commercial banks.

Table 4.1 Descriptive statistics for the variables

```
. xtsumirstzs npl roa bs oc lr gdp ir rr
```

Variable		Mean	Std. Dev.	Min	Max	Observations	
irstzs	overall	.3158454	.577176	.02	6.28	N =	207
	between	.6322432	.05375	2.203333		n =	15
	within	.3547556	-1.647488	4.392512		T-bar =	13.8
npl	overall	6.42628	4.174345	0	19.3	N =	207
	between	3.951662	.5666667	13.125		n =	15
	within	2.02212	2.30128	13.68795		T-bar =	13.8
roa	overall	1.521208	3.213377	-22.62	7	N =	207
	between	2.7181	-4.9325	3.611111		n =	15
	within	2.292028	-16.16629	6.923708		T-bar =	13.8
bs	overall	11.60816	.5873203	8.7	12.77	N =	207
	between	.5393954	10.49833	12.37667		n =	15
	within	.3064512	9.138164	12.23816		T-bar =	13.8
oc	overall	-78.18657	2037.488	-29234	418.04	N =	207
	between	887.8415	-3362.811	124.9389		n =	15
	within	1912.667	-25949.38	3356.325		T-bar =	13.8
lr	overall	1.851546	.1026566	1.07	1.96	N =	207
	between	.1419939	1.328333	1.908333		n =	15
	within	.0380199	1.593213	2.083213		T-bar =	13.8
gdp	overall	6.651177	1.113704	4.660571	8.464381	N =	270
	between	0	6.651177	6.651177		n =	15
	within	1.113704	4.660571	8.464381		T =	18
ir	overall	7.396473	3.145378	4.735801	16.00109	N =	270
	between	0	7.396473	7.396473		n =	15
	within	3.145378	4.735801	16.00109		T =	18
rr	overall	20.47101	2.53349	15.54085	23.55208	N =	255
	between	0	20.47101	20.47101		n =	15
	within	2.53349	15.54085	23.55208		T =	17

Table 4.1 provides the explanation on the central tendency for all the variables in our study. This summary statistic table for panel data contains much more details about overall, between and within variation in our variables. For our dependent variable (interest rate spread), there is more of between variation than within variation. On other side for our independent variable, starting with bank specific variables the non-performing loan has more between than within variation. Return on average asset variable has almost the same variation on between and within variation. Bank size has more of between variations than within variation. However for our operational cost variable we have more of within variation than between variation. The leverage ratio variable has also more of between than within variation. Never the less our macro-economic variables have only within variation without between variations, this is because the macro-economic variables do not vary between banks.

The results shows that Operational cost ratio have the highest overall standard deviation of 2037.488 which explain the highest variation from the mean. The mean value for Operational cost ratio is -78.18657, the least amount value is -29234 and the highest value is 418.04.

On another side the leverage ratio which is measured as the ratio of total liabilities plus bank net worth to bank net worth have the lowest standard deviation. This explains the variation from the mean of 0.1026566, whereby its mean value is 1.851546, the minimum is 1.07 and the maximum is 1.96.

The minimum and maximum values for between variation will be the average for each individual bank while for within it shows how each individual differ if you take away the overall mean. The minimum and maximum descriptive also help the study in checking for outliers and it is efficient when applied to level data (Bonga, 2016).

Correlation analysis

Correlation analysis computes the sample correlations between variables in the study. The relationship for explanatory variable is very important for regression analysis. The strong correlation of variables may indicate presence of multicollinearity problem in the data.

Table 4.2 correlation matrix of variables

```
. cor np1 roa bs oc lr gdp ir rr
(obs=199)
```

	np1	roa	bs	oc	lr	gdp	ir	rr
np1	1.0000							
roa	0.0827	1.0000						
bs	0.0766	0.3192	1.0000					
oc	0.1149	0.3480	0.0269	1.0000				
lr	0.2002	0.2738	0.4306	0.0081	1.0000			
gdp	0.0019	-0.0200	0.0379	-0.0799	0.0091	1.0000		
ir	0.0299	-0.1179	-0.0572	-0.1067	0.0133	-0.4401	1.0000	
rr	0.0809	-0.2203	-0.0852	-0.0777	-0.1603	0.1411	0.3278	1.0000

Source: Data set used

Table 4.2 indicated the correlation analysis results for our variable whereby there is strong correlation between leverage ratio and bank size by a magnitude of 0.4306, the lowest correlation appeared between non-performing loan and growth domestic product growth rate. Return on average assets appear to have negative correlation with growth domestic product with a magnitude of -0.02, also by inflation rate with magnitude of -0.118 and reserve requirement ratio with a magnitude of -0.22. However bank size appeared to have negative correlation with inflation rate with magnitude of -0.057 and by reserve requirement ratio with magnitude of -0.085. Operational cost also appear to have negative correlation with growth domestic product, inflation rate and reserve requirement ratio with magnitudes of -0.08, -0.107 and -0.078 respectively. More over leverage ratio appear to have negative correlation with reserve requirement ratio by magnitude of -0.16 and growth domestic product have a negative correlation with inflation rate by a magnitude of -0.44.

The result suggested that there is no strong correlation between our explanatory variables and this implies that our data have no indication of seeking from multicollinearity problem. However this results show that each variable can explain the interest rate spread with different effect that does not correlate with the other dependent variable.

4.2 Effect of bank specific factors on interest rate spread

Referring from the previous chapter, the model I (equation iii) includes banks specific determinants of IRS among sample of commercial banks in Tanzania. According to (Brock & Rojas-Suarez, 2015), this model explains the portion of the spread that is determined by bank-specific characteristics. The constant term for this model regression is a measure of the ‘pure’ spread for the commercial banks in Tanzania. The model was tested to decide between the fixed or random effects by using the Hausman test on Stata software, after setting the data as the panel data set.

```
. xtset bankid periodyears
      panel variable:  bankid (strongly balanced)
      time variable:  periodyears, 2000 to 2017
                delta:  1 unit
```

Stata output indicated the panel data set are strongly balanced which means all observation contained some data. Regression analysis using fixed effect estimation was applied and the result was stored followed by regression using random effect and the results were stored respectively.

Table 4.3 Fixed effect and random effect model regression results

Variables	Fixed effect model	Random effect model
Non-performing Loans	-0.012 (0.012)	-0.016 (0.009)
Return on assets	0.014 (0.011)	-0.006 (0.011)
Bank size	-0.024 (0.077)	0.018 (0.069)
Operational cost	0.000 (0.000)	-0.000 (0.000)
Leverage Ratio	-4.087*** (0.619)	-3.375 (3.377)
R-Square	0.563	0.639
Prob> chi2	0.000***	0.000***

NOTE: IRS is a dependent variable; Standard errors are in parenthesis; *, **, *** represents significance level at 10%, 5% and 1% respectively.

Table 4.3 indicated the fixed effect regression results for bank specific indicators, the results shows a significant value F-test which means the coefficients in the model are different than zero and this test is the measure of the strength of our model. However the fixed effect regression table contains the within, between and overall R-square which explain the proportion of variance in the dependent variable that can be explained by independent variable. This also measure the strength of association but in panel data regression is not much the case. The result for fixed effect regression has only one significant two tailed p-value and this is not good to our model since most variable seems to have no significant influence on dependent variable.

However the Random effect model regression analysis for bank specific indicators contained the significant chi2 probability value of less than 1% which measures the strength of association between our outcome variable and predicting variable, the results suggest the model is ok. However the result for $p > [z]$ suggest that leverage ratio is the only significant determinant that has influence on interests rate spread with coefficient of -3.375363. Although the model is ok but still most of specific determinants have less significant influence on interest rate spread.

Hausman test

The Hausman test, tests the null hypothesis that random effect provides consistent estimates compared to fixed effect model. It enable us to determine either the fixed effect or the random effect models, more over from our study we used the alternative sigma more since the results for normal Hausman test provide negative outcome and hence we fail to make conclusion on the results so we used the alternative of sigma more as suggested by (StataCorp, 2013).

Table 4.4 Hausman test results

```
. hausman fe re, sigmamore
```

Note: the rank of the differenced variance matrix (4) does not equal the number
this is what you expect, or there may be problems computing the test. I
anything unexpected and possibly consider scaling your variables so that

	— Coefficients —		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
np1	-.0116844	-.0160798	.0043955	.0099531
roa	.0139351	-.005727	.0196621	.0063139
bs	-.0241148	.0184551	-.0425698	.0575713
oc	7.33e-07	-.0000162	.0000169	3.33e-06
lr	-4.087305	-3.375363	-.7119423	.6155297

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\begin{aligned}\chi^2(4) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= 11.88 \\ \text{Prob}>\chi^2 &= 0.0183\end{aligned}$$

Table 4.4 indicated the Hausman test between the fixed effect model and the random effect model. The results obtained from our test have a significant probability value of 0.0183 which is less than 5%, hence we reject null and conclude that the fixed effect model provides consistent estimates compared to random effect model.

4.2.1. Diagnostic tests for bank specific determinant model

By using the commercial banks data we will do diagnostic tests to our first model that were developed from bank specific determinants. First, we will perform Multicollinearity test, Homogeneity of variance test, Autocorrelation and Model specification test to the first model for pure spread.

Multicollinearity test

This is an important test in regression analysis which describes the problem in which independent variables explain each other. According to (StataCorp, 2013) the test for multicollinearity in panel data was done using variance inflation factor after normal regression on our variables. This test will show multicollinearity signs if our variables will have VIF of more than 10 or when the mean VIF is more than 5. We test multicollinearity because its presence in high degree causes regression model estimates of the coefficients become unstable and the standard errors for the coefficients can get uncontrollably inflated.

Table 4.5 Multicollinearity test results

Variable	VIF	1/VIF
roa	1.30	0.770239
lr	1.30	0.771736
bs	1.28	0.780530
oc	1.16	0.858641
np1	1.05	0.953004
Mean VIF	1.22	

Table 4.5 provides results for multicollinearity test for bank specific indicators. Results suggest that the model does not have multicollinearity problem, therefore the estimates of the coefficients are stable and the standard errors for the coefficients are not widely inflated.

Heteroskedasticity test

This is the test to check if the error variances are not constant (Schnepel, 2013). We used the user-written program command 'xttest 3' with a null hypothesis that there is constant variation, to test for heteroskedasticity for the fixed effect model. We tested the heteroskedasticity because the errors should be constant and also it causes the estimators to be biased.

Heteroskedasticity test results

```
. xttest3
```

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: $\sigma(i)^2 = \sigma^2$ for all i

```
chi2 (15) = 28632.13  
Prob>chi2 = 0.0000
```

Stata output for heteroskedasticity test contains p-value (prob>chi2) of less than 5%. The null is homoskedasticity (or constant variance). Hence from our results we reject null and conclude there is heteroskedasticity.

Autocorrelation test

Serial correlation test is an important test in panel data regression analysis which apply to panel with long time data (StataCorp, 2013). Serial correlation may results to the decrease of coefficient of standard error than the actual value and higher R-squared, hence we check if the model have the problem and solve it if it exists.

Autocorrelation test results

```
. xtserial firstzs npl roa bs oc lr
```

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

```
F( 1, 14) = 0.025  
Prob > F = 0.8772
```

The Stata output results for autocorrelation test contains f-statistic probability value (prob> F) of 0.8772 which is greater than 5%. Therefore we fail to reject null that there is no serial correlation, hence this test concludes that the data does not have first-order autocorrelation.

4.3 Regression improvement for bank specific determinants analysis

The results obtained in first step regression include unfavorable results due to presence of outliers in the dataset. According to (StataCorp, 2013) the solution of changing the variables into the natural logarithm is an econometric remedy to improve the results of the model and reshaping the data for best results. The fixed effect regression analysis for bank-level indicators was suggested by Hausman test, and the results for regression contains only one significant variable that influence dependent variable hence we changed some variables in to their natural logarithm to improve the results.

Stata output for new generated variables

```
. gen lnirs = ln(irstzs)
(63 missing values generated)

. gen lnnp1 = ln(np1)
(69 missing values generated)

. gen lnoc = ln(oc)
(71 missing values generated)
```

The Stata output for new generated variables contained three variables that were changed into their natural logarithm. Those variables are regressing variable interest rate spread, regressor's variables which are non performing loan ratio and operational cost ratio. These new generated variables are then regressed using fixed effect model to obtain better results.

Table 4.6 Regression results with new generated variables

```
. xtreg lnirs lnnp1 roa bs lnoc lr, fe
```

```
Fixed-effects (within) regression      Number of obs   =      197
Group variable: bankid                 Number of groups =      15

R-sq:  within = 0.1186                  Obs per group:  min =       2
        between = 0.0720                  avg   =      13.1
        overall = 0.0280                  max   =      18

corr(u_i, xb) = -0.1871                  F(5,177)        =      4.77
                                         Prob > F         =      0.0004
```

lnirs	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lnnp1	.0594011	.0578884	1.03	0.306	-.0548391	.1736413
roa	-.0243551	.0122231	-1.99	0.048	-.0484769	-.0002332
bs	-.3849633	.0978736	-3.93	0.000	-.5781127	-.191814
lnoc	-.3493073	.1547744	-2.26	0.025	-.654748	-.0438667
lr	-.1350814	.7855598	-0.17	0.864	-1.68535	1.415187
_cons	4.447988	2.151863	2.07	0.040	.2013783	8.694597
sigma_u	.87814212					
sigma_e	.32667985					
rho	.87843103	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(14, 177) =      29.38      Prob > F = 0.0000
```

```
.
```

Table 4.6 indicated fixed effect regression analysis by using the natural log of interest rate spread, non-performing loan and operational cost ratio. In the first step regression, the results obtained have majority of the variables that are not significant. The next regression using new generated variables produce results with massively improvements in significance level of the variables although the sign of variables changed, where by non-performing loan ratio changed to negative relation, return on asset changed to positive relation, operational cost ratio changed to negative relation, bank size and leverage ratio retain their sign of negative relationship. The results obtained suggest that return on asset, bank size and natural log of operational cost to have significant influence on the dependent variable which is the natural log of interest rate spread. Natural log of non-performing loan and leverage ratio appear to have no significant influence over the pure spread.

4.4 Solution for heteroskedasticity problem

The results obtained from heteroskedasticity test indicated that the model is suffering from heteroskedasticity which means there is no constant variation between variables. Therefore we use robust standard errors as explained by (Kezdi, 2003) to correct for this problem because the results will not give true suggestion when the model does not contained constant variation.

Table 4.7 Regression results with robust standard error

```
. xtreg lnirs lnnpl roa bs lnoc lr, vce(robust)
```

Random-effects GLS regression	Number of obs	=	197
Group variable: bankid	Number of groups	=	15
R-sq: within = 0.1175	Obs per group: min =		2
between = 0.1164	avg =		13.1
overall = 0.0429	max =		18
corr(u_i, x) = 0 (assumed)	wald chi2(5)	=	14.33
	Prob > chi2	=	0.0136

(Std. Err. adjusted for 15 clusters in bankid)

lnirs	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
lnnpl	.0516571	.0691366	0.75	0.455	-.0838483	.1871624
roa	-.0230326	.0219898	-1.05	0.295	-.0661318	.0200667
bs	-.3902789	.1265631	-3.08	0.002	-.638338	-.1422198
lnoc	-.3626225	.1386524	-2.62	0.009	-.6343762	-.0908688
lr	-.5005494	1.036292	-0.48	0.629	-2.531644	1.530545
_cons	5.37561	2.391537	2.25	0.025	.6882842	10.06294
sigma_u	.92677544					
sigma_e	.32667985					
rho	.88948205	(fraction of variance due to u_i)				

Table 4.7 provides the outcome after solving the problem of heteroskedasticity by using robust standard error. The result includes significant p-value (prob>chi2) of 0.0136 which is less than 5%, this indicated the model is ok and the coefficient are different than zero. The results suggested that the bank size determinant and natural log of operational cost ratio are the independent variables that have significant influence on pure spread.

4.5 Influence of macro-economic factors on interest rate spread

Referring from previous chapter (equation vi), the model II contains variables that captures the effects of macro-economic were the constant term for this model regression is ‘residual’ spread. According to (Ramful, 2001; Zhou & Wong, 2008), the pure spread is regressed against macro variables which includes the GDP growth rate, inflation rate measured as the annual percentage in the cost of consumer price index and the reserve requirement measured as the ration of bank liquid reserve to bank assets. The model was tested to decide between the fixed or random effects by using the Hausman test on Stata software, after setting the data as the panel data set. Firstly, the model was regressed using the fixed effect and the results were stored.

Table 4.8 Fixed effect and random effect model regression results

Variables	Fixed effect model	Random effect model
Growth domestic product	0.037 (0.029)	0.036 (0.03)
Inflation rate	0.007 (0.009)	0.007 (0.009)
Reserve requirement	-0.059*** (0.013)	-0.058*** (0.013)
R-Square	0.108	0.108
Prob> F	0.0001***	0.000***

NOTE: Ln IRS is a dependent variable; Standard errors are in parenthesis; *, **, *** represents significance level at 10%, 5% and 1% respectively.

Table 4.8 indicated the fixed effect regression analysis for macro-economic determinants. The F-statistic probability ($\text{prob} > F$) is 0.000, which is below 5%. This suggests that we can use the model and also all the coefficients are different than zero. Reserve requirement ratio appears to be the only significant variable that has influence on pure spread and it has a negative relationship. The coefficient for reserve requirement ratio is -0.0587531 with a two tail probability value of less than 1%. Gdp growth rate and inflation rate appear to have no significant influence on pure spread. However the regression analysis contains 199 numbers of observations and 15 numbers of groups.

On the other side, the random effect regression analysis for macro-economic determinants against pure spread the model appears to be ok since it have significant probability value ($\text{prob} > \chi^2$) of 0.0000 which is less than 5%. Reserve requirement variable is the significant variable to influence pure spread with probability value ($p > [z]$) of 0.000 and the coefficient value of -0.0579406, this shows the negative relationship in which reserve requirement decreases with the increase of pure spread. Gdp growth rate and inflation rate have no significant influence on pure spread with coefficient value of 0.0360914 and 0.0069623 respectively.

Regression analysis for fixed effect and random effect followed by the Hausman test to decide which model was appropriate for macro-economic determinant of interest rate spread. The Hausman test suggests that the random effect model provide consistent estimates compared to fixed effect model. To obtain the results we use probability value if it is significant or not significant and hence we reject null if it is significant, hence we don't refuse null hypothesis if probability value is not significant respectively.

Table 4.9 Hausman test results

. hausman fe re, sigmamore

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
gdp	.036787	.0360914	.0006956	.0003012
ir	.0070873	.0069623	.000125	.0000764
rr	-.0587531	-.0579406	-.0008124	.000514

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 6.13
Prob>chi2 = 0.1056

Table 4.9 provide results for Hausman test in which the probability value (prob>chi2) is 0.1056 which is above 0.05, hence we do not reject the null hypothesis that the random effect provides consistent estimates compared to fixed effect model. Therefore the Random effect model provides consistent estimates for the model.

4.5.1 Diagnostic tests for macro-economic determinants model

We will perform Multicollinearity test, Homogeneity of variance test, Autocorrelation and Model specification test to our model for residual spread with macroeconomic variables. After running the tests the problem identified will be solved accordingly.

Multicollinearity test

(StataCorp, 2013) the test for multicollinearity in panel data was done using variance inflation factor after normal regression on our variables. This test will show multicollinearity signs if our variables will have vif of more than 10 or when the mean vif is more than 5.

Table 5.0 Multicollinearity test results

```
. vif
```

variable	VIF	1/VIF
ir	1.54	0.651123
gdp	1.40	0.715006
rr	1.26	0.791496
Mean VIF	1.40	

Table 5.0 indicated the results for multicollinearity test in which the mean VIF is 1.40, this is below 5 and hence it shows that the model does not have multicollinearity problem. Therefore the estimates of the coefficients are stable and the standard errors for the coefficients are not widely inflated.

Heteroskedasticity test

This is the test to check if the error variances are not constant. We used the user-written program command 'xttest 3' with a null hypothesis that there is constant variance to test for heteroskedasticity for the fixed effect model.

Heteroskedasticity test results

```
. xttest3
```

```
Modified Wald test for groupwise heteroskedasticity  
in fixed effect regression model
```

```
H0: sigma(i)^2 = sigma^2 for all i
```

```
chi2 (15) = 1655.24  
Prob>chi2 = 0.0000
```

The Stata output for heteroskedasticity test shows the probability value (prob>chi2) is less than 5% hence we reject null which is homoskedasticity and we conclude heteroskedasticity in our Model.

Autocorrelation test

This test for first order autocorrelation and it apply for macro panel with long time series. This problem of serial correlation causes the standard errors of the coefficients to be smaller than they actually are and higher R-squared(Torres-Reyna, 2007).

Autocorrelation test results

```
. xtserial lnirs gdp ir rr
```

```
wooldridge test for autocorrelation in panel data  
H0: no first-order autocorrelation  
F( 1, 14) = 0.014  
Prob > F = 0.9085
```

The Stata output for autocorrelation test provide the probability value of 0.9085 which greater than 0.05 hence we fail to reject null that there is no serial correlation. This test concludes that the data does not have first-order autocorrelation.

Random effect model was the best model for macro-economic indicators of interest rate spread and the diagnostic test show that the model have a problem of heteroskedasticity, therefore we use robust standard errors as explained by (Kezdi, 2003) to correct for this problem.

Table 5.1 Regression results with robust standard error

```
. xtreg lnirs gdp ir rr, vce(robust)
```

Random-effects GLS regression	Number of obs	=	199
Group variable: bankid	Number of groups	=	15
R-sq: within = 0.1163	Obs per group: min =		6
between = 0.1081	avg =		13.3
overall = 0.0024	max =		17
corr(u_i, X) = 0 (assumed)	wald chi2(3)	=	22.50
	Prob > chi2	=	0.0001

(Std. Err. adjusted for 15 clusters in bankid)

lnirs	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
gdp	.0360914	.0162414	2.22	0.026	.0042589	.0679238
ir	.0069623	.0084192	0.83	0.408	-.0095391	.0234637
rr	-.0579406	.0124632	-4.65	0.000	-.0823681	-.0335132
_cons	-.5885619	.3581353	-1.64	0.100	-1.290494	.1133703
sigma_u	.82108859					
sigma_e	.35465092					
rho	.84277128	(fraction of variance due to u_i)				

Table 5.1 provides the results for solving heteroskedasticity problem using robust standard error. The result suggest that Gdp growth rate and reserve requirement are two significant variables with two-tail P-value of 0.026 and 0.000 which is less than 0.05. This means the variables have significant influence on the pure spread (spread that was derived from bank specific determinants regression). The macro-economic Gdp growth rate variable has a coefficient of 0.0360914 which positively influence pure spread and reserve requirement has a coefficient of -0.0579406 which is negatively related with pure spread. Inflation appears to have no significant influence on pure spread.

The overall probability value for chi2 test is also below 0.05 and this test if all the coefficients in the model are equal to 0. Therefore we conclude that our model is Ok since we reject null. However this wild test statistic helps us to check the validity of our model in which the probability of less than 5% implies that our model is appropriate.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Introduction

The current chapter explains the discussions on findings from regression analysis results for bank specific determinants and macro-economic determinant of IRS on commercial banks in Tanzania. This chapter also compares and contrasts this study with other relating studies.

5.1 Effect of bank specific factors on interest rate spread

The results for panel data regression were reported by Table 4.6 for first step regression on bank level indicators of interest rate spread. The result indicated that bank size and operational cost have significant influence on interest rate spread. Non-performing loans, return on average assets and leverage ratio appear to have no significant influence on interest rate spread in Tanzanian banking sector.

The regression results show a negative relationship to exist between the bank size and interest rate spread among commercial banks. The results show that as the size of the bank increases, the spread between the borrowing rate and deposit rate decreases. This result implies that large banks charge lower interest rate because of large economies of scale and ability to invest in technology which enhance efficiency. This result indicate that commercial banks obtains market power as it grows which enable them to gain more economies of scale and establish market power which in turn it makes intermediation cost cheaper to its customers. These results compile with the expectation of the study and the similar results were reported by the study of (Bonga, 2016; Männasoo, 2013; Peshev, 2015). However the results contradict with the results obtained by (Were & Wambua, 2013a), in which the study suggest that big banks are associated with relatively high interest rate spreads.

However the results indicated that there is negative significant relationship between operational cost and interest rate spread. This implies that the higher the cost of intermediation the lower the spread between the borrowing rate and the deposit rate. This result is against the hypothesis were by the study expect a positive relationship between operational cost and interest rate spread because, as the cost of operation increases banks tend to shift that cost to its customers and hence charge high borrowing rate and this increases the spread. However this study suggest that this negative relationship is observed because the increase in cost of operation imply that there is smoothening of the operation in supply of credit which enhance customers trust and automatically it increases customer base by the commercial banks, but the banks refuse to shift this cost to their customers in order to compete with large banks and make them maintain their borrowing rates and deposit rates. Never the less this results contrast with the results in similar study by (Bonga, 2016; Were & Wambua, 2013b) in Kenya and Zimbabwe also the study by (Brock & Rojas-Suarez, 2015; Zhou & Wong, 2008)in Latin America and China.

Never the less, the result obtained in this study in the behavior of operational cost relate with the results by (Brock & Rojas-Suarez, 2015) in Latin America in which the study revealed that interest rate spreads are significantly determined by operating cost. The result suggested that high operational cost raise banks spread as due to high levels of non-performing loans. The study by Aikoh in 2013 from Tanzania suggested that high responsiveness of commercial banks spreads to be regulated and this relate with this study as this study also suggest regulating policies to be established so that small banks can obtain room for growth.

5.2 Influence of macro-economic factors on interest rate spread

The results for macro-economic factors analysis on interest rate spread was indicated by table 4.11. In this second stage regression, we used macro-economic variables to explain the pure spread in which these variables explain the part of average spread that cannot be explained by the bank-specific factors. The study used three important macro-economic indicators which are gdp growth rate, inflation rate and reserve requirement ratio. The variables observed to determine pure spread significantly are gdp growth rate and reserve requirement ratio, while inflation rate appear to have no significant influence to explain interest rate spread in commercial banks.

The results indicated there is a positive relationship between gdp growth rate and interest rate spread by commercial bank. The observed positive sign means there is higher tendency of higher gdp growth rate to raise spread. This result is similar with the results by (Afanasieff et al., 2002) in which the study observe that the impact of gdp growth rate increase spreads. Increased economic activity can enhance demand for loans leading to higher lending rates. Never the less the decrease in economic activities can reduce demand for loan due to higher risks and hence banks tend to reduce the lending rate which reduces spread. On the other hand the study contradicts with the study of (Were & Wambua, 2013a) whereby increased economic activity can make projects more profitable, reduce defaults, and increase deposits, all of which reduce the spreads. The study also contradict with the study of (Bonga, 2016) whereby a larger economy might be expected to allow for economies of scale and greater competition which drives down interest spreads. At the same time, if real gdp rate drop down, the banks are faced with credit risk increase and they charge higher interest to borrowers. However this study suggested there is possibility that a larger economy allows for greater specialization and deeper financial markets in which riskier borrowers have better access to funds and hence banks tend to increase lending rate which in turn it increases the spread.

The results identified the negative relationship between interest rate spread and reserve requirement to exist. This implies that the higher cost of reserve requirement the lower the IRS in commercial banks. According to (Were & Wambua, 2013a), this explain the effect on changes in policy of the government towards banking sector efficiency. In this study the researcher suggested that changes in monetary policy can affect deposit and lending rates in which the increase in reserve requirement lower the spread and create bank capital channels. It means the tightening of monetary policy that raises policy rates makes it difficult for banks to get funds and hence they tend to pass that cost to customers by charging high borrowing rate and hence increases spread.

More over the results suggests that inflation rate does not have significant influence in Tanzania commercial banks interest rate spread. According to (Bank of Tanzania, 2018)inflation in Tanzania is expected to remain around the medium-term target of 5 percent, supported by expected improvement in food supply, stable power supply, sustained prudent monetary and fiscal policies, and sustained stability of the value of the Tanzanian shilling against the major currencies. However growing risks to inflation remain due to possible rise in oil prices following agreement among OPEC member countries to cut down production in 2017. The midyear review of monetary policy in 2017/2018 suggested that the Bank of Tanzania will remain attentive and take additional measures to maintain macroeconomic stability.

A study by (Aikaeli et al, 2011) in Tanzania observe that minimum reserve requirement influence commercial banks spreads. The result relate with our study but the method of analysis differ as this study used random effect model and fixed effect model while the study by Aikael used co integration and error correlation model to analyze the data from commercial bank in Tanzania.

5.3 Comparison between bank specific and macro-economic determinants

The analysis for determinants of bank IRS, indicated the bank specific variables appear to be more suggesting factors that determine IRS in commercial banks compared to macroeconomic factors, this were identified by showing high coefficient value that significantly affect IRS in Tanzania commercial banks. The bank individual factors capture the effect of management strategies, banks capital base, internal control and risk management tactics of the individual banks. The macro-economic indicators catch the effect of policy employed, market structure and regulation activities by the Government and other regulating bodies.

The bank specific variables explain the effect of bank size whereby larger bank have low spread and hence dominate the market and leave the lower banks into stiff competition. This competition makes banks incur more cost of operations which however undermine small banks but the banks tend to maintain the spread to survive the competition. Therefore this gave bank specific determinants high power over macro-economic determinants to explain interest rate spread. This study contradict with the study by (Beck, 2016) whereby the variables from macroeconomic view appeared to be more significant to explain IRS among Tanzanian banking sector.

The macro-economic variables capture the effect of policy influence over the spread where b the banking industry need to update the policies in place due to changing in economy and the advancement of technology that have some slightly influence to maintain the interest rate spread.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

6.0 Introduction

This part provides a brief summary of the study, the conclusion, objectives, suggestions for improvements and the policy implications.

6.1 Summary of the study

The main objective of the researcher in this study was to examine the determinants of interest rate spreads of commercial banks in Tanzania. The specific objectives were to examine the effects of bank specific factors on interest rate spread, to examine the influence of macro-economic factors on IRS, and compared the significance level between bank specific factors and macro-economic factors on interest rate spread in commercial banks in Tanzania. The study also provides recommendation on ways in which interest rate spreads could be minimized.

The main objective of the study was fully achieved. The study found that wide interest rate spreads in Tanzania commercial banks were driven by bank size as measured by natural log of total assets, operational cost ratio as measured by ratio of operational expenses to net operating income, Growth Domestic Product growth rate measured as annual percentage growth rate of GDP at market prices based on constant local currency and reserve requirement ratio measured as the ratio of bank liquid reserve to bank assets.

The study examined various bank specific factors which include bank size, operating cost ratio, non-performing loans ratio, return on average assets ratio and leverage ratio. Not all of these variables were found significant to determine interest rate spreads in commercial banks of Tanzania. The study identifies that bank size and operational cost ratio are the specific variables that significantly explain interest rate spread in Tanzania banking sector.

The study also identifies the influence of Macro-economic factors on interest rate spread. The study includes GDP growth rate, inflation rate and reserve requirement ratio as the explanatory variables for macro-economic determinants. GDP growth rate and Reserve requirement ratio are the macro-economic variables that were found significantly influencing interest rate spread in Tanzania. A larger economy might be expected to allow for economies of scale and greater competition which drives down interest spreads. At the same time, if real GDP rate drops down, banks are faced with credit risk increase and they charge higher interest to borrowers. However, it is possible that a larger economy allows for greater specialization and deeper financial markets in which riskier borrowers have better access to funds.

6.2 Conclusion

The study examined the determinants of interest rate spread in Tanzania; the study used data from annual reports of 15 commercial banks which are listed on Dar es Salaam Stock Exchange and the data from World Bank indicators. The study includes both local and foreign owned commercial banks. The study used data from the period of 2000 to 2017 which makes a total of 18 years, the study used long range of time so as to capture the effect of time on the analysis however the study was limited by availability of data from commercial banks which hinder the study to cover a longer range of time from the period of liberalization.

The study therefore concludes that both banking institutions and regulatory institutions have a role to play in minimizing banking sector interest rate spreads. Banks managers should make sure they expand the facilities of their banks so that they can be effective to reduce costs by investing on technology which in turn will result to reduction of borrowing costs therefore will lower the spread. Also the Government, Centre bank and policy makers should encourage growth of banking sector through employing stabilization policies that will control economy to facilitate investment and lower the reserves requirement by the banks.

Nevertheless the study conclude that smaller banks are undermined by large banks with high technology and high capital base hence high cost in managing their operation but still compete with large banks by charging low lending rate and lead to their perishing.

Hence, this study provides evidence of the main determinants of intermediation spreads both bank level view and broad macro-economic view. The estimation results show that interest rate spread is used not only to cover the cost of operating expenses and required reserves but also reflects the state of economy of the country since banking sector play major role in economic growth of the country. However additional progress needs to be made in achieving a more efficient and competitive financial system capable of operating with lower intermediation spreads. As to make deposit and lending rates more effective with the market, it is very important to have a wide range of instruments and an even wider range of financial intermediaries in order to promote sound competition in the domestic financial market.

6.3 Policy implications

This study suggests some implications to the Bank of Tanzania, commercial banks, the Government and Policy makers as the whole. Banks should invest in adequate forms of technology to increase their earning capacity as the results indicate a positive relationship between the size of the bank and spreads. The Central bank through its regulatory function should ensure proper research is carried out to ensure stabilized policies and to enable efficiency by setting reasonable reserve required by the commercial banks. Regulation that is ineffective will yield unfavorable results at the expense of the economy and the general public. The Government and central bank have control over the inflation and the economy of the country, hence they should ensure that stabilization policies are implemented to control the economy and ensure efficiency and effectiveness in regulation in the banking sector. Investors would always want to operate in a predictive environment hence in countries where interest rate spread levels are high and not stable, investors and institutions development expectations to be unclear and thereby causing no uniformity in the sector and hence promoting exploitation of some economic agents. Competition in the banking sector should be further enhanced and supported by policies that encourage and foster competition in the banking sector. Never the less actions to promote the growth and image of small and medium sized banks, in an effort to increase their ability to penetrate markets and break supremacy by few large banks.

Finally, appropriate monetary and fiscal policy measures should also be continuous in order to maintain stability in prices and the general macroeconomic environment. The Bank of Tanzania shall ensure the reliability of the financial system and support the general economic policy of the Government and promote sound monetary, credit and banking conditions conducive to the development of the national economy.

6.4 Area for further research

This study used panel data from fifteen commercial banks that are registered by the bank of Tanzania, out of forty registered commercial banks. A researcher suggests future studies to include every institution possible in the financial sector including micro-finance institutions and other deposit taking institutions. This study used annual data in its analysis, however some annual and quarterly data for other variables could not be found. Further studies should use more observation and make use of much more variable to increase the reliability of the study and obtain more information. However this study can be extended by exploring the impact of interest rate spreads in the development of financial sector and enhancement of efficiency in intermediation role by the financial sector. Never the less the study gives room for more research on the positive relationship existing between gdp growth rate and interest rate spread which is against economic theories whereby gdp growth rate facilitate borrowing due to increase in investment hence banks tend to lower borrowing cost and this lowers interest rate spreads.

REFERENCES

- Afanasieff, T. S., Lhacer, P. M., & Nakane, M. I. (2002). The determinants of bank interest spread in Brazil. *Money affairs*, 15(2), 183–207.
- Aikaeli, J., Mugizi, F. M. P., & Ndanshau, M. O.A. (2011). *The Determinants of Interest Rate Spreads in Developing Countries: Evidence on Tanzania, 1991-2009*.
- Aikoh, K. J. (2013). *Determinants of interest rate spread in commercial banks: A case study of selected local and foreign banks in Tanzania*. Mzumbe University. Retrieved from <http://scholar.mzumbe.ac.tz/bitstream/11192/661/1/MSc%20A%26F-%20Dissertation-Kenedy%20Jeremiah%20Aikoh-%202013.pdf>
- Akinci, O. (2013). *Global Financial Conditions, Country Spreads and Macroeconomic Fluctuations in Emerging Countries*.
- Al Shubiri, F. N., & Jamil, S. A. (2017). Assessing the determinants of interest rate spread of commercial banks in Oman: An empirical investigation. *European Research Studies*, 20(2), 90.
- Bank of Tanzania (2018, February). Monetary Policy Statement ENG: The Mid Year Review, 1–84. Retrieved from <http://www.bot.go.tz>
- Beck, T. (2016). *Impediments to the Development and Efficiency of Financial Intermediation in Brazil*.
- Benston, G. J., & Smith, C. W. (1976). A transactions cost approach to the theory of financial intermediation. *The Journal of finance*, 31(2), 215–231.
- Bonga, W. G. (2016). *An Empirical Analysis of the Determinants of Interest Rate Spreads: A Case of Commercial Banks in Zimbabwe*.
- Brock, P., & Rojas-Suarez, L. (2015). *Understanding the Behavior of Bank Spreads in Latin America*.
- Coase, R. H. (1991). The nature of the firm (1937). *The Nature of the Firm. Origins, Evolution, and Development*. New York, Oxford, 18–33.
- Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research*, 209, 240.
- Cukierman, A., & Hercowitz, Z. (1990). *Oligopolistic financial intermediation, inflation and the interest rate spread*: David Horowitz Institute for the Research of Developing Countries.
- Cúrdia, V., & Woodford, M. (2009). *Credit Spreads and Monetary Policy*.
- Délèze, F., & Korkeamäki, T. (2018). Interest rate risk management with debt issues: Evidence from Europe. *Journal of Financial Stability*, 36, 1–11. <https://doi.org/10.1016/j.jfs.2018.01.003>

- Demirguc-Kunt, A., & Huizinga, H. (1999). Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence. *The World Bank Economic Review*, 13(2), 379–408. <https://doi.org/10.1093/wber/13.2.379>
- Demirgüç-Kunt, A., & Huizinga, H. (1999). Determinants of commercial bank interest margins and profitability: Some international evidence. *The World Bank Economic Review*, 13(2), 379–408.
- Folawewo, A. O., & Tennant, D. (Eds.) (2008). *Determinants of interest rate spreads in Sub-Saharan African countries: A dynamic panel analysis*: CiteSeer.
- Ho, T. S. Y., & Saunders, A. (1981). The determinants of bank interest margins: Theory and empirical evidence. *Journal of Financial and Quantitative analysis*, 16(4), 581–600.
- Joseph, A., Larrain, M., & Singh, E. (2011). Predictive Ability of the Interest Rate Spread Using Neural Networks. *Procedia Computer Science*, 6, 207–212. <https://doi.org/10.1016/j.procs.2011.08.039>
- Kezdi, G. (2003). Robust standard error estimation in fixed-effects panel models.
- Khawaja, M. I., & ud Din, M. (2007). Determinants of interest spread in Pakistan. *The Pakistan Development Review*, 46(2), pp-129.
- Kikoti, B. (2015). *The dynamic determinants of interest rates in Tanzania: A focus on inflation, money supply and Exchange rates*. Mzumbe University. Retrieved from http://scholar.mzumbe.ac.tz/bitstream/11192/1096/1/MS_C_A%26F_Boniface%20Kikoti_2014.pdf
- Kiptui, M. C. (2014). Determinants of Interest Rate Spread: Some Empirical Evidence from Kenya's Banking Sector. *International Business Research*, 7(11), 94.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*: New Age International.
- Macroeconomic determinants of interest rate spreads in Ghana (2017). *African Journal of Economic and Management Studies*, 8(1), 76–88. <https://doi.org/10.1108/AJEMS-12-2015-0143>
- Manamba, E. (2017). An empirical analysis of interest rate spreads in Tanzania.
- Männasoo, K. (2013). Determinants of bank interest spreads in Estonia. *Eastern European Economics*, 51(1), 36–60.
- McGaghie, W. C., Bordage, G., & Shea, J. A. (2001). Problem statement, conceptual framework, and research question. *Academic Medicine*, 76(9), 923–924.
- Mujeri, M. K., & Younus, S. (2009). An analysis of interest rate spread in the banking sector in Bangladesh. *The Bangladesh Development Studies*, 1–33.
- Peshev, P. (2015). Determinants of Interest Rate Spreads in Bulgaria.

- Ramful, P. (2001). The determinants of interest rate spread: Empirical evidence on the Mauritian banking sector. *Research Department, Bank of Mauritius, May*, 1–20.
- Rebei, N. (2014). *Determinants of interest rate spreads in Solomon Islands*: International Monetary Fund.
- Rusuhuzwa, T. K., Karangwa, M., & Nyalihama, C. (2016). Determinants of interest rate spread in Rwanda: Empirical evidence. *Issues in Business Management and Economics Vol. 4 (3)*, ISSN: 2350-157X, 1–8.
- Schnepel, K. T. (2013). *Essays in Applied Microeconomics and Econometrics*: University of California, Santa Barbara.
- Sheriff, I., & Amoako, G. (2014). Macroeconomic determinants of interest rate spread in Ghana: Evidence from ARDL modelling approach. *Journal of Finance and Bank Management*, 2(2), 115–132.
- StataCorp, L. P. (2013). Stata multilevel mixed-effects reference manual. College Station, TX: StataCorp LP.
- Tobin, J. (1963). *Commercial banks as creators of money*'.
- Torres-Reyna, O. (2007). Panel data analysis fixed and random effects using Stata (v. 4.2). *Data & Statistical Services, Princeton University*.
- Vernimmen, P., Quiry, P., Dallochio, M., Le Fur, Y., & Salvi, A. (2014). *Corporate finance: Theory and practice*: John Wiley & Sons.
- Were, M., & Wambua, J. (2013a). Assessing the determinants of interest rate spread of commercial banks in Kenya: An empirical investigation. *KBA Centre for Research on Financial Markets and Policy Working Paper 01*, 13.
- Were, M., & Wambua, J. (2013b). Assessing the determinants of interest rate spread of commercial banks in Kenya: An empirical investigation. *KBA Centre for Research on Financial Markets and Policy Working Paper 01*, 13.
- Weth, M. A. (2002). The pass-through from market interest rates to bank lending rates in Germany. *Deutsche Bundesbank, Economic Research Centre Discussion Paper*. (11/02).
- World bank indicators (2018). interest rate spread(lending rate minus deposit rate, %): International Monetary Fund, International Financial Statistics and data files. Retrieved from <https://data.worldbank.org/indicator/FR.INR.LNDP>
- Zhou, K., & Wong, M. C. S. (2008). The determinants of net interest margins of commercial banks in mainland China. *Emerging Markets Finance and Trade*, 44(5), 41–53.
- (Afanasieff et al., 2002; Akinci, 2013; Beck, 2016; Bonga, 2016; Brock & Rojas-Suarez, 2015; “Macroeconomic determinants of interest rate spreads in Ghana,”

- 2017; Délèze & Korkeamäki, 2018; Demirgüç-Kunt & Huizinga, 1999; Joseph, Larrain, & Singh, 2011; Kikoti, 2015; world bank indicators, 2018)
- Bonga, W. G. (2016). *An Empirical Analysis of the Determinants of Interest Rate Spreads: A Case of Commercial Banks in Zimbabwe*.
- Brock, P., & Rojas-Suarez, L. (2015). *Understanding the Behavior of Bank Spreads in Latin America*.
- Kezdi, G. (2003). Robust standard error estimation in fixed-effects panel models.
- Männasoo, K. (2013). Determinants of bank interest spreads in Estonia. *Eastern European Economics*, 51(1), 36–60.
- Peshev, P. (2015). Determinants of Interest Rate Spreads in Bulgaria.
- Ramful, P. (2001). The determinants of interest rate spread: Empirical evidence on the Mauritian banking sector. *Research Department, Bank of Mauritius, May*, 1–20.
- Schnepel, K. T. (2013). *Essays in Applied Microeconomics and Econometrics*: University of California, Santa Barbara.
- StataCorp, L. P. (2013). Stata multilevel mixed-effects reference manual. *College Station, TX: StataCorp LP*.
- Were, M., & Wambua, J. (2013). Assessing the determinants of interest rate spread of commercial banks in Kenya: An empirical investigation. *KBA Centre for Research on Financial Markets and Policy Working Paper 01*, 13.
- Zhou, K., & Wong, M. C. S. (2008). The determinants of net interest margins of commercial banks in mainland China. *Emerging Markets Finance and Trade*, 44(5), 41–53.
- (Al Shubiri & Jamil, 2017; Mujeri & Younus, 2009)

Appendix

Appendix 1 Panel dataset for bank specific and macro-economic determinants

Bank Id	Period (years)	IRS(TZ S)	NPL(%)	ROA(%)	BS	OC (%)	LR	GDP(%)	IR(%)	RR(%)
1	2000							4.9338 47	5.9239 61	
1	2001							5.9978 29	5.1474 68	20.660 57
1	2002							7.1635 54	5.3178 34	17.584 43
1	2003							6.8862 27	5.3035 66	16.173 13
1	2004							7.8282 98	4.7358 01	18.919
1	2005							8.1733 36	5.0345 7	17.967 45
1	2006							4.6605 71	7.2509 73	15.540 85
1	2007	0.13	8.45	0.02	11.3 2	67.57	1.8 5	8.4643 81	7.0255 14	21.906 6
1	2008	0.53	8.76	0.18	11.2 9	68.99	1.8 4	5.5665 96	10.278 39	18.126 93
1	2009	0.32	9.34	0.12	11.3 5	77.54	1.8 3	5.3823 46	12.142 23	23.552 08
1	2010	0.53	10.45	0.17	11.4 6	82.35	1.8 4	6.3588 86	6.2001 56	22.886 86
1	2011	0.46	11.43	0.15	11.4 5	81.24	1.8 6	7.9045 08	12.690 97	23.536 08
1	2012	0.34	11.54	0.02	11.1 2	79.53	1.8 8	5.1410 14	16.001 09	22.042 64
1	2013	0.42	10.11	0.03	11.3 2	78.24	1.8 7	7.2630 61	7.8707 24	21.488 41
1	2014	0.32	9.32	0.14	11.4 3	83.12	1.8 7	6.9651 35	6.1316 14	22.219 49
1	2015	0.34	9.12	0.12	11.4 3	84.27	1.8 9	6.9593 14	5.5881 7	22.857 44
1	2016	0.41	7.1	0.01	11.3 1	83.46	1.8 5	6.9681 29	5.1747 66	20.039 15
1	2017	0.32	11.58	-0.37	11.3 2	79.26	1.8 5	7.1041 61	5.3187 16	22.505 98
2	2000	0.33	3.91	4.34	10.2 5	69.07	1.8	4.9338 47	5.9239 61	
2	2001	0.28	3.12	5.01	10.8 7	75.6	1.8 3	5.9978 29	5.1474 68	20.660 57
2	2002	0.25	3.32	4.75	10.5 6	75.78	1.8 4	7.1635 54	5.3178 34	17.584 43
2	2003	0.28	4.21	4.05	11.2 1	80.76	1.8 7	6.8862 27	5.3035 66	16.173 13
2	2004	0.32	4.35	2.35	11.2 3	80.04	1.8 6	7.8282 98	4.7358 01	18.919
2	2005	0.3	6.67	1.99	10.8 8	82.42	1.8 9	8.1733 36	5.0345 7	17.967 45
2	2006	0.26	7.54	1.89	10.9	82.67	1.9	4.6605	7.2509	15.540

					8			71	73	85
2	2007	0.24	8.47	2.67	11	77.76	1.8 7	8.4643 81	7.0255 14	21.906 6
2	2008	0.25	9.32	2.89	11.1 2	77.32	1.8 7	5.5665 96	10.278 39	18.126 93
2	2009	0.24	10.11	3.05	11.1 5	76.89	1.8 6	5.3823 46	12.142 23	23.552 08
2	2010	0.21	12.04	3.23	11.1 3	76.21	1.8 3	6.3588 86	6.2001 56	22.886 86
2	2011	0.2	12.45	2.45	11.0 7	84.75	1.8 5	7.9045 08	12.690 97	23.536 08
2	2012	0.24	9.12	1.99	11.0 9	84.89	1.8 7	5.1410 14	16.001 09	22.042 64
2	2013	0.28	7.43	1.99	11.1	82.25	1.8 6	7.2630 61	7.8707 24	21.488 41
2	2014	0.33	4.23	3.93	11.1 3	76.86	1.8 4	6.9651 35	6.1316 14	22.219 49
2	2015	0.25	5.76	3.21	11.2 1	79.13	1.8 5	6.9593 14	5.5881 7	22.857 44
2	2016	0.24	4.34	5.83	11.3 2	68.14	1.8 4	6.9681 29	5.1747 66	20.039 15
2	2017	0.3	3.23	-5.96	11.2 6	92.75	1.8 6	7.1041 61	5.3187 16	22.505 98
3	2000							4.9338 47	5.9239 61	
3	2001							5.9978 29	5.1474 68	20.660 57
3	2002							7.1635 54	5.3178 34	17.584 43
3	2003							6.8862 27	5.3035 66	16.173 13
3	2004							7.8282 98	4.7358 01	18.919
3	2005							8.1733 36	5.0345 7	17.967 45
3	2006							4.6605 71	7.2509 73	15.540 85
3	2007							8.4643 81	7.0255 14	21.906 6
3	2008							5.5665 96	10.278 39	18.126 93
3	2009	1.37	0	0	11.3 2	0	1.8 2	5.3823 46	12.142 23	23.552 08
3	2010	1.43	0	0	11.6 5	0	1.8 4	6.3588 86	6.2001 56	22.886 86
3	2011	1.67	0	-14	11.3 7	-2923 4	1.8 3	7.9045 08	12.690 97	23.536 08
3	2012	2.05	0	-12	11.3 2	-718	1.8 7	5.1410 14	16.001 09	22.042 64
3	2013	2.12	3.6	-7	11.3 6	-245	1.8 5	7.2630 61	7.8707 24	21.488 41
3	2014	1.72	3.1	-2	11.4 5	-132	1.8 8	6.9651 35	6.1316 14	22.219 49

3	2015	1.65	2.6	0	11.3 4	-76	1.8 7	6.9593 14	5.5881 7	22.857 44
3	2016	1.66	5.2	0	11.2 8	68	1.9	6.9681 29	5.1747 66	20.039 15
3	2017	1.71	5.7	0.5	11.3 1	71.7	1.8 8	7.1041 61	5.3187 16	22.505 98
4	2000	0.12	11.89	0.02	11.2 1	91.76	1.8 2	4.9338 47	5.9239 61	
4	2001	0.18	10.43	-0.53	11.2 4	92.01	1.8 4	5.9978 29	5.1474 68	20.660 57
4	2002	0.17	10.87	0.04	11.3 7	79.11	1.8 4	7.1635 54	5.3178 34	17.584 43
4	2003	0.18	9.54	0.73	11.4 3	82.97	1.8 3	6.8862 27	5.3035 66	16.173 13
4	2004	0.22	9.32	0.63	11.2 8	87.12	1.8 5	7.8282 98	4.7358 01	18.919
4	2005	0.21	9.65	1.65	11.2 9	85.34	1.9 2	8.1733 36	5.0345 7	17.967 45
4	2006	0.23	10.76	1.54	11.3 4	76.14	1.9 1	4.6605 71	7.2509 73	15.540 85
4	2007	0.2	10.78	2.43	11.4 3	72.27	1.8 9	8.4643 81	7.0255 14	21.906 6
4	2008	0.19	11.09	2.12	11.5 3	65.87	1.8 6	5.5665 96	10.278 39	18.126 93
4	2009	0.17	12.45	2.07	11.5 4	56.12	1.8 7	5.3823 46	12.142 23	23.552 08
4	2010	0.15	12.54	1.45	11.5 6	54.32	1.8 6	6.3588 86	6.2001 56	22.886 86
4	2011	0.17	12.23	0.25	11.4 5	65.12	1.8 9	7.9045 08	12.690 97	23.536 08
4	2012	0.14	10.1	0.13	11.4 3	74.23	1.8 8	5.1410 14	16.001 09	22.042 64
4	2013	0.12	8.21	1.77	11.6 4	75.12	1.8 7	7.2630 61	7.8707 24	21.488 41
4	2014	0.04	9.2	1.6	11.5 4	73	1.8 9	6.9651 35	6.1316 14	22.219 49
4	2015	0.13	8.14	-1.09	11.5 2	98.19	1.9	6.9593 14	5.5881 7	22.857 44
4	2016	0.18	13.13	-0.96	11.5 3	62.15	1.9 1	6.9681 29	5.1747 66	20.039 15
4	2017	0.04	13.4	1.4	11.5 2	97.86	1.9	7.1041 61	5.3187 16	22.505 98
5	2000							4.9338 47	5.9239 61	
5	2001							5.9978 29	5.1474 68	20.660 57
5	2002							7.1635 54	5.3178 34	17.584 43
5	2003							6.8862 27	5.3035 66	16.173 13
5	2004							7.8282 98	4.7358 01	18.919
5	2005							8.1733 36	5.0345 7	17.967 45
5	2006	0.26	3.5	1	10.8	69.59	1.9	4.6605	7.2509	15.540

					3		1	71	73	85
5	2007	0.27	3.2	1.1	10.9 5	77.1	1.9 2	8.4643 81	7.0255 14	21.906 6
5	2008	0.19	2.9	0.8	11.0 9	78.92	1.9 1	5.5665 96	10.278 39	18.126 93
5	2009	0.13	2.7	0.6	11.2 2	88.3	1.9 1	5.3823 46	12.142 23	23.552 08
5	2010	0.12	2.9	0.8	11.3 7	79	1.9 3	6.3588 86	6.2001 56	22.886 86
5	2011	0.1	2.6	0.4	11.4 5	86	1.9 1	7.9045 08	12.690 97	23.536 08
5	2012	0.11	3	0.7	11.5 4	86.3	1.9 1	5.1410 14	16.001 09	22.042 64
5	2013	0.11	2.7	0.9	11.6 3	85.6	1.9 2	7.2630 61	7.8707 24	21.488 41
5	2014	0.09	3.3	0.8	11.7	78.5	1.8 9	6.9651 35	6.1316 14	22.219 49
5	2015	0.09	3.06	0.9	11.7 6	77.7	1.8 8	6.9593 14	5.5881 7	22.857 44
5	2016	0.11	4.96	0.6	11.8	78	1.8 9	6.9681 29	5.1747 66	20.039 15
5	2017	0.12	11	0.6	8.7	-74.3	1.8 8	7.1041 61	5.3187 16	22.505 98
6	2000	0.46	8.43	0.87	11.8 3	49.34	1.9 2	4.9338 47	5.9239 61	
6	2001	0.45	8.05	0.82	11.9 2	50.5	1.9 4	5.9978 29	5.1474 68	20.660 57
6	2002	0.31	6.79	0.4	11.8 6	52.12	1.9 5	7.1635 54	5.3178 34	17.584 43
6	2003	0.29	5.68	0.35	12.0 4	52.34	1.9 6	6.8862 27	5.3035 66	16.173 13
6	2004	0.27	5.98	0.31	12.3 4	50.75	1.9 4	7.8282 98	4.7358 01	18.919
6	2005	0.23	6.23	2.67	11.9 7	50.65	1.9 3	8.1733 36	5.0345 7	17.967 45
6	2006	0.15	6.21	4.28	11.9 5	49.26	1.9 2	4.6605 71	7.2509 73	15.540 85
6	2007	0.13	6.07	5.07	12.0 6	50.4	1.9 1	8.4643 81	7.0255 14	21.906 6
6	2008	0.13	4.47	4.63	12.1 6	52.8	1.8 7	5.5665 96	10.278 39	18.126 93
6	2009	0.13	6.17	3.75	12.2 7	51.9	1.8 9	5.3823 46	12.142 23	23.552 08
6	2010	0.12	11.5	3.08	12.3 6	57.4	1.9	6.3588 86	6.2001 56	22.886 86
6	2011	0.12	9.14	2.03	12.4 3	62.7	1.9 1	7.9045 08	12.690 97	23.536 08
6	2012	0.12	6.9	3.75	12.4 9	56.2	1.9	5.1410 14	16.001 09	22.042 64
6	2013	0.13	6.2	3.7	12.5 5	62.50 4	1.9	7.2630 61	7.8707 24	21.488 41
6	2014	0.12	5	3.6	12.6 2	65.87 3	1.8 9	6.9651 35	6.1316 14	22.219 49
6	2015	0.13	8.4	4.2	12.7 3	63.11 6	1.8 7	6.9593 14	5.5881 7	22.857 44

6	2016	0.14	13.9	2.1	11.7 3	77.70 7	1.8 7	6.9681 29	5.1747 66	20.039 15
6	2017	0.16	12.6	0.9	12.7 7	88.55 1	1.8 8	7.1041 61	5.3187 16	22.505 98
7	2000	0.1	3.1	2.1	11.5 4	52.05	1.8 7	4.9338 47	5.9239 61	
7	2001	0.1	3.5	2.1	11.5 6	52.13	1.8 8	5.9978 29	5.1474 68	20.660 57
7	2002	0.15	3.5	1.9	11.8 6	54.36	1.8 7	7.1635 54	5.3178 34	17.584 43
7	2003	0.14	2.2	1.8	11.8 7	56.87	1.8 5	6.8862 27	5.3035 66	16.173 13
7	2004	0.14	2.1	2.1	11.4 3	56.32	1.8 9	7.8282 98	4.7358 01	18.919
7	2005	0.15	2	2.3	11.4 2	59.13	1.8 6	8.1733 36	5.0345 7	17.967 45
7	2006	0.13	1.9	2.5	11.6 4	62.12	1.8 6	4.6605 71	7.2509 73	15.540 85
7	2007	0.13	1.7	2.5	11.5 3	62.14	1.8 7	8.4643 81	7.0255 14	21.906 6
7	2008	0.1	0.2	2.4	11.6 5	61.87	1.8 8	5.5665 96	10.278 39	18.126 93
7	2009	0.09	0.1	2.1	11.3 1	61.67	1.8 9	5.3823 46	12.142 23	23.552 08
7	2010	0.1	0.6	2.1	11.4 3	59.82	1.9	6.3588 86	6.2001 56	22.886 86
7	2011	0.1	0.5	2.4	11.5 1	59.13	1.8 9	7.9045 08	12.690 97	23.536 08
7	2012	0.09	0.8	2.3	11.6	56.29	1.8 6	5.1410 14	16.001 09	22.042 64
7	2013	0.1	0.7	2.5	11.7	53.29	1.8 7	7.2630 61	7.8707 24	21.488 41
7	2014	0.1	1.5	2.3	11.8 4	51.26	1.8 9	6.9651 35	6.1316 14	22.219 49
7	2015	0.1	1.9	2.5	11.9 5	49.66	1.8 6	6.9593 14	5.5881 7	22.857 44
7	2016	0.12	2.6	2.3	12	50.61	1.8 5	6.9681 29	5.1747 66	20.039 15
7	2017	0.13	4.3	1.9	12.0 6	52.22	1.8 6	7.1041 61	5.3187 16	22.505 98
8	2000							4.9338 47	5.9239 61	
8	2001							5.9978 29	5.1474 68	20.660 57
8	2002							7.1635 54	5.3178 34	17.584 43
8	2003							6.8862 27	5.3035 66	16.173 13
8	2004							7.8282 98	4.7358 01	18.919
8	2005							8.1733 36	5.0345 7	17.967 45
8	2006							4.6605 71	7.2509 73	15.540 85
8	2007							8.4643	7.0255	21.906

								81	14	6
8	2008							5.5665 96	10.278 39	18.126 93
8	2009							5.3823 46	12.142 23	23.552 08
8	2010	0.05	2	-22.62	10.4 7	75.16	1.7 7	6.3588 86	6.2001 56	22.886 86
8	2011	0.07	2.9	-10.48	10.8 2	89.34	1.8 7	7.9045 08	12.690 97	23.536 08
8	2012	0.06	3.4	-6.03	11.0 6	72.42	1.8 2	5.1410 14	16.001 09	22.042 64
8	2013	0.08	6.4	-1.94	11.2 9	67.34	1.7 9	7.2630 61	7.8707 24	21.488 41
8	2014	0.08	5.6	0.47	11.4 1	57.86	1.8 4	6.9651 35	6.1316 14	22.219 49
8	2015	0.03	3.5	0.45	11.5 4	65.21	1.8 7	6.9593 14	5.5881 7	22.857 44
8	2016	0.04	3.2	0.36	11.6 5	68.05	1.8 6	6.9681 29	5.1747 66	20.039 15
8	2017	0.02	4.6	0.33	11.6 7	73.43	1.8 7	7.1041 61	5.3187 16	22.505 98
9	2000	0.11	2.01	6	11.2 3	72	1.8 9	4.9338 47	5.9239 61	
9	2001	0.13	1.98	2	11.3 4	70	1.8 8	5.9978 29	5.1474 68	20.660 57
9	2002	0.13	1.23	5	11.5 6	67	1.8 9	7.1635 54	5.3178 34	17.584 43
9	2003	0.12	1.03	6	11.3 2	65	1.9	6.8862 27	5.3035 66	16.173 13
9	2004	0.11	1.23	4	11.1 8	61	1.9 3	7.8282 98	4.7358 01	18.919
9	2005	0.12	1.24	5	11.3 3	62	1.9 1	8.1733 36	5.0345 7	17.967 45
9	2006	0.12	2.05	5	11.4 6	57	1.9 2	4.6605 71	7.2509 73	15.540 85
9	2007	0.14	2.32	2	11.5 8	49	1.9 2	8.4643 81	7.0255 14	21.906 6
9	2008	0.13	3.54	4	11.6 8	50	1.8 7	5.5665 96	10.278 39	18.126 93
9	2009	0.12	3.89	3	11.7 5	50	1.8 9	5.3823 46	12.142 23	23.552 08
9	2010	0.12	4.13	3	11.8 4	50	1.8 9	6.3588 86	6.2001 56	22.886 86
9	2011	0.16	4.34	2	11.9 1	56	1.8 9	7.9045 08	12.690 97	23.536 08
9	2012	0.14	3.97	2.12	11.9 6	72	1.8 8	5.1410 14	16.001 09	22.042 64
9	2013	0.11	2.98	2.12	12.0 3	70	1.8 6	7.2630 61	7.8707 24	21.488 41
9	2014	0.12	2.65	2	12.0 3	67	1.8 2	6.9651 35	6.1316 14	22.219 49
9	2015	0.12	2.76	3	12.0 5	65	1.8 3	6.9593 14	5.5881 7	22.857 44
9	2016	0.11	3.15	7	12.0 8	48	1.8 3	6.9681 29	5.1747 66	20.039 15

9	2017	0.11	4.32	1	12.1	65	1.8 3	7.1041 61	5.3187 16	22.505 98
10	2000							4.9338 47	5.9239 61	
10	2001							5.9978 29	5.1474 68	20.660 57
10	2002							7.1635 54	5.3178 34	17.584 43
10	2003							6.8862 27	5.3035 66	16.173 13
10	2004							7.8282 98	4.7358 01	18.919
10	2005							8.1733 36	5.0345 7	17.967 45
10	2006							4.6605 71	7.2509 73	15.540 85
10	2007							8.4643 81	7.0255 14	21.906 6
10	2008							5.5665 96	10.278 39	18.126 93
10	2009	0.19	7.1	3	9.94	418.0 4	1.6 5	5.3823 46	12.142 23	23.552 08
10	2010	0.23	7.2	4	10.4	149.3 2	1.6 4	6.3588 86	6.2001 56	22.886 86
10	2011	0.21	7.2	4	10.5 3	93.65	1.7 6	7.9045 08	12.690 97	23.536 08
10	2012	0.25	6.7	2	10.6	82.05	1.7 5	5.1410 14	16.001 09	22.042 64
10	2013	0.24	6.4	3	10.8 1	87.17	1.7 6	7.2630 61	7.8707 24	21.488 41
10	2014	0.27	6.5	2	10.9 9	66.99	1.7 9	6.9651 35	6.1316 14	22.219 49
10	2015	0.2	6.4	2	11.0 5	66.23	1.8	6.9593 14	5.5881 7	22.857 44
10	2016	0.19	7	1	11.1 1	79	1.8 2	6.9681 29	5.1747 66	20.039 15
10	2017	0.18	7	1	11.1 8	82	1.8 4	7.1041 61	5.3187 16	22.505 98
11	2000							4.9338 47	5.9239 61	
11	2001							5.9978 29	5.1474 68	20.660 57
11	2002							7.1635 54	5.3178 34	17.584 43
11	2003							6.8862 27	5.3035 66	16.173 13
11	2004							7.8282 98	4.7358 01	18.919
11	2005							8.1733 36	5.0345 7	17.967 45
11	2006							4.6605 71	7.2509 73	15.540 85
11	2007							8.4643 81	7.0255 14	21.906 6
11	2008							5.5665	10.278	18.126

								96	39	93
11	2009							5.3823 46	12.142 23	23.552 08
11	2010							6.3588 86	6.2001 56	22.886 86
11	2011							7.9045 08	12.690 97	23.536 08
11	2012	0.64	0.8	1.03	10.4 3	72	1.5 6	5.1410 14	16.001 09	22.042 64
11	2013	2.67	0.4	0.06	10.5 3	94	1.4 3	7.2630 61	7.8707 24	21.488 41
11	2014	1.05	1.2	-3.02	10.4 5	87	1.2 9	6.9651 35	6.1316 14	22.219 49
11	2015	2.34	1	-2.1	10.4 7	102	1.3 4	6.9593 14	5.5881 7	22.857 44
11	2016	6.28	0	-2	10.5 3	119	1.0 7	6.9681 29	5.1747 66	20.039 15
11	2017	0.24	0	-11	10.5 8	225	1.2 8	7.1041 61	5.3187 16	22.505 98
12	2000	0.29	16.04	1.1	12.0 2	68.75	1.7 6	4.9338 47	5.9239 61	
12	2001	0.31	15.67	0.8	11.8 7	74.78	1.8 9	5.9978 29	5.1474 68	20.660 57
12	2002	0.32	12.76	0.6	11.5 6	89.34	1.8 7	7.1635 54	5.3178 34	17.584 43
12	2003	0.27	12.52	0.7	11.5 9	85.53	1.8 9	6.8862 27	5.3035 66	16.173 13
12	2004	0.28	9.78	2.3	12.3 1	82.13	1.9	7.8282 98	4.7358 01	18.919
12	2005	0.25	8.56	0.8	12.0 3	72.65	1.9 6	8.1733 36	5.0345 7	17.967 45
12	2006	0.2	8.43	1.4	12.6 5	70.32	1.9 2	4.6605 71	7.2509 73	15.540 85
12	2007	0.18	9.65	1.9	12.7 6	69.54	1.9 2	8.4643 81	7.0255 14	21.906 6
12	2008	0.19	9.98	1.6	12.3 4	64.05	1.8 4	5.5665 96	10.278 39	18.126 93
12	2009	0.25	10.87	1.2	12.2 3	76.23	1.8 5	5.3823 46	12.142 23	23.552 08
12	2010	0.21	12.24	1.2	12.4 5	75.43	1.8 7	6.3588 86	6.2001 56	22.886 86
12	2011	0.18	12.05	1	12.3 4	86.38	1.8 7	7.9045 08	12.690 97	23.536 08
12	2012	0.15	16.54	0.8	12.3	89.12	1.8 9	5.1410 14	16.001 09	22.042 64
12	2013	0.18	19.3	0.5	12.2	90.47	1.8 6	7.2630 61	7.8707 24	21.488 41
12	2014	0.17	12.6	0.5	12.2 1	91.91	1.8 6	6.9651 35	6.1316 14	22.219 49
12	2015	0.14	8.2	0.7	12.2 3	89.32	1.8 5	6.9593 14	5.5881 7	22.857 44
12	2016	0.17	9.1	0.8	12.2 3	85.81	1.8 4	6.9681 29	5.1747 66	20.039 15
12	2017	0.18	12.4	0.9	12.2 5	86.57	1.8 4	7.1041 61	5.3187 16	22.505 98

13	2000	0.19	5	5	11.9 8	52	1.8 4	4.9338 47	5.9239 61	
13	2001	0.19	5	4	12.0 6	57	1.8 6	5.9978 29	5.1474 68	20.660 57
13	2002	0.21	2	3	12.1 2	59	1.8 9	7.1635 54	5.3178 34	17.584 43
13	2003	0.21	2	3	12.4 3	55	1.8 9	6.8862 27	5.3035 66	16.173 13
13	2004	0.22	4	4	12.4 2	56	1.8 7	7.8282 98	4.7358 01	18.919
13	2005	0.23	4	4	12.4 3	50	1.8 6	8.1733 36	5.0345 7	17.967 45
13	2006	0.32	3	5	12.3 2	53	1.8 7	4.6605 71	7.2509 73	15.540 85
13	2007	0.32	3	4	12.3 4	55	1.8 8	8.4643 81	7.0255 14	21.906 6
13	2008	0.23	3	4	12.1 4	50	1.8 8	5.5665 96	10.278 39	18.126 93
13	2009	0.2	4	3	12.2 2	55	1.8 8	5.3823 46	12.142 23	23.552 08
13	2010	0.16	4	3	12.3 2	60	1.8 9	6.3588 86	6.2001 56	22.886 86
13	2011	0.17	2	3	12.3 4	57	1.8 7	7.9045 08	12.690 97	23.536 08
13	2012	0.21	2	3	12.4 5	55	1.8 7	5.1410 14	16.001 09	22.042 64
13	2013	0.21	2	4	12.5 2	53	1.8 6	7.2630 61	7.8707 24	21.488 41
13	2014	0.2	3	4	12.5 9	53	1.8 5	6.9651 35	6.1316 14	22.219 49
13	2015	0.16	2.1	4	12.6 6	57	1.8 5	6.9593 14	5.5881 7	22.857 44
13	2016	0.17	5	3	12.7	59	1.8 5	6.9681 29	5.1747 66	20.039 15
13	2017	0.18	6	2	12.7 4	58	1.8 5	7.1041 61	5.3187 16	22.505 98
14	2000							4.9338 47	5.9239 61	
14	2001							5.9978 29	5.1474 68	20.660 57
14	2002							7.1635 54	5.3178 34	17.584 43
14	2003							6.8862 27	5.3035 66	16.173 13
14	2004							7.8282 98	4.7358 01	18.919
14	2005							8.1733 36	5.0345 7	17.967 45
14	2006							4.6605 71	7.2509 73	15.540 85
14	2007							8.4643 81	7.0255 14	21.906 6
14	2008							5.5665 96	10.278 39	18.126 93
14	2009							5.3823	12.142	23.552

								46	23	08
14	2010	0.12	13	1.4	11.3 3	62.46	1.8 3	6.3588 86	6.2001 56	22.886 86
14	2011	0.15	17	0.3	11.3 4	62.75	1.8 5	7.9045 08	12.690 97	23.536 08
14	2012	0.14	11	0.1	11.4 2	75.34	1.8 5	5.1410 14	16.001 09	22.042 64
14	2013	0.14	17	2.8	11.4 3	79.36	1.8 6	7.2630 61	7.8707 24	21.488 41
14	2014	0.1	14	2.5	11.2 4	46.3	1.8 3	6.9651 35	6.1316 14	22.219 49
14	2015	0.1	14	1	11.2 6	48.35	1.8 4	6.9593 14	5.5881 7	22.857 44
14	2016	0.1	10	1.4	11.2 7	45.45	1.8 3	6.9681 29	5.1747 66	20.039 15
14	2017	0.73	9	0.3	11.2 6	54	1.8 2	7.1041 61	5.3187 16	22.505 98
15	2000	0.22	8.67	4.02	11.6 4	69.21	1.8 7	4.9338 47	5.9239 61	
15	2001	0.25	9.52	4.21	11.7 5	68.05	1.9	5.9978 29	5.1474 68	20.660 57
15	2002	0.3	4.98	2.87	12.0 4	67.32	1.9 1	7.1635 54	5.3178 34	17.584 43
15	2003	0.3	4.87	2.76	11.9 6	64.67	1.8 9	6.8862 27	5.3035 66	16.173 13
15	2004	0.34	6.84	3.16	12.1 9	64.13	1.8 7	7.8282 98	4.7358 01	18.919
15	2005	0.2	9.23	3.16	12.1 3	62.64	1.8 7	8.1733 36	5.0345 7	17.967 45
15	2006	0.21	9.57	4.15	11.9 8	62.45	1.8 8	4.6605 71	7.2509 73	15.540 85
15	2007	0.21	9.76	4.12	11.9 8	59.12	1.8 9	8.4643 81	7.0255 14	21.906 6
15	2008	0.23	12.12	3.23	12.1 6	59	1.8 9	5.5665 96	10.278 39	18.126 93
15	2009	0.21	12.08	3.05	12.0 5	58.92	1.8 8	5.3823 46	12.142 23	23.552 08
15	2010	0.17	8.34	2.67	11.8 6	56.54	1.8 4	6.3588 86	6.2001 56	22.886 86
15	2011	0.16	8.12	2.89	11.8 7	56.87	1.8 7	7.9045 08	12.690 97	23.536 08
15	2012	0.18	6.56	3.65	11.8 9	59.32	1.8 7	5.1410 14	16.001 09	22.042 64
15	2013	0.14	6.21	3.07	11.8 9	58.12	1.8 6	7.2630 61	7.8707 24	21.488 41
15	2014	0.15	6.75	4.89	11.8 8	66.34	1.8 6	6.9651 35	6.1316 14	22.219 49
15	2015	0.15	6.75	4.89	11.8 9	66.56	1.8 8	6.9593 14	5.5881 7	22.857 44
15	2016	0.16	7.04	3.92	11.6 7	68.39	1.8 7	6.9681 29	5.1747 66	20.039 15
15	2017	0.19	7.23	4.02	11.6 6	65.11	1.8 7	7.1041 61	5.3187 16	22.505 98

Appendix 2: Fixed effect regression results for bank level determinants

. xtreg irstzs npl roa bs oc lr, fe

Fixed-effects (within) regression	Number of obs	=	207
Group variable: bankid	Number of groups	=	15
R-sq: within = 0.1917	Obs per group: min	=	6
between = 0.5632	avg	=	13.8
overall = 0.3607	max	=	18
corr(u_i, Xb) = -0.2348	F(5,187)	=	8.87
	Prob > F	=	0.0000

irstzs	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
npl	-.0116844	.0116553	-1.00	0.317	-.0346772	.0113085
roa	.0139351	.010943	1.27	0.204	-.0076524	.0355226
bs	-.0241148	.0769789	-0.31	0.754	-.1759734	.1277438
oc	7.33e-07	.000013	0.06	0.955	-.0000249	.0000263
lr	-4.087305	.6198216	-6.59	0.000	-5.310046	-2.864564
_cons	8.217553	1.435215	5.73	0.000	5.386259	11.04885
sigma_u	.43410751					
sigma_e	.3347636					
rho	.62708585	(fraction of variance due to u_i)				

F test that all u_i=0: F(14, 187) = 12.06 Prob > F = 0.0000

Appendix 3: Random effect regression results for bank level determinants

. xtreg irstzs npl roa bs oc lr, re

Random-effects GLS regression	Number of obs	=	207
Group variable: bankid	Number of groups	=	15
R-sq: within = 0.1542	Obs per group: min	=	6
between = 0.6393	avg	=	13.8
overall = 0.4060	max	=	18
corr(u_i, X) = 0 (assumed)	wald chi2(5)	=	111.21
	Prob > chi2	=	0.0000

irstzs	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
npl	-.0160798	.0092305	-1.74	0.082	-.0341714	.0020117
roa	-.005727	.011071	-0.52	0.605	-.0274256	.0159717
bs	.0184551	.0687272	0.27	0.788	-.1162477	.1531578
oc	-.0000162	.0000147	-1.10	0.272	-.0000451	.0000127
lr	-3.375363	.3771419	-8.95	0.000	-4.114547	-2.636178
_cons	6.47307	.8544369	7.58	0.000	4.798405	8.147736
sigma_u	.11851866					
sigma_e	.3347636					
rho	.11138133	(fraction of variance due to u_i)				

. estimates store re

Appendix 3: Fixed effect model regression results for macroeconomic

determinants

```
. xtreg lnirs gdp ir rr, fe
```

```
Fixed-effects (within) regression      Number of obs   =      199
Group variable: bankid                 Number of groups =       15

R-sq:  within = 0.1163                  Obs per group:  min =        6
      between = 0.1081                      avg =      13.3
      overall  = 0.0024                      max =       17

corr(u_i, Xb) = -0.1268                  F(3,181)        =       7.94
                                          Prob > F         =      0.0001
```

lnirs	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
gdp	.036787	.0294329	1.25	0.213	-.0212887	.0948627
ir	.0070873	.0092208	0.77	0.443	-.0111068	.0252815
rr	-.0587531	.0125453	-4.68	0.000	-.0835068	-.0339993
_cons	-.6869949	.2786567	-2.47	0.015	-1.236828	-.1371615
sigma_u	.92031517					
sigma_e	.35465092					
rho	.87070025	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(14, 181) =      57.30      Prob > F = 0.0000
```

```
. estimates store fe
```

Appendix 4: Random effect model regression results for macroeconomic

determinants

```
. xtreg lnirs gdp ir rr, re
```

```
Random-effects GLS regression      Number of obs   =      199
Group variable: bankid             Number of groups =       15

R-sq:  within = 0.1163                  Obs per group:  min =        6
      between = 0.1081                      avg =      13.3
      overall  = 0.0024                      max =       17

corr(u_i, X) = 0 (assumed)            Wald chi2(3)    =      22.84
                                          Prob > chi2     =      0.0000
```

lnirs	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
gdp	.0360914	.029671	1.22	0.224	-.0220627	.0942454
ir	.0069623	.0092956	0.75	0.454	-.0112567	.0251813
rr	-.0579406	.0126369	-4.59	0.000	-.0827086	-.0331727
_cons	-.5885619	.354595	-1.66	0.097	-1.283555	.1064316
sigma_u	.82108859					
sigma_e	.35465092					
rho	.84277128	(fraction of variance due to u_i)				

```
. estimates store re
```