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THE IMPACT OF NTERST RATE SPREADS ON THE PROFITABILITY OF COMMERCIAL BANKS IN GHANA; A CASE STUDY OF STANDARD CHARTERED BANK GHANA LIMITED

A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR AWARD OF THE DEGREE

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DECLARATION

I hereby declare that this thesis is the result of my own original work towards the Master of Science Degree in Economics and that to the best of my knowledge, it neither contains materials published by another person nor materials which have been accepted for the award of any other degree in the university, except where due acknowledgements have been made in the text.

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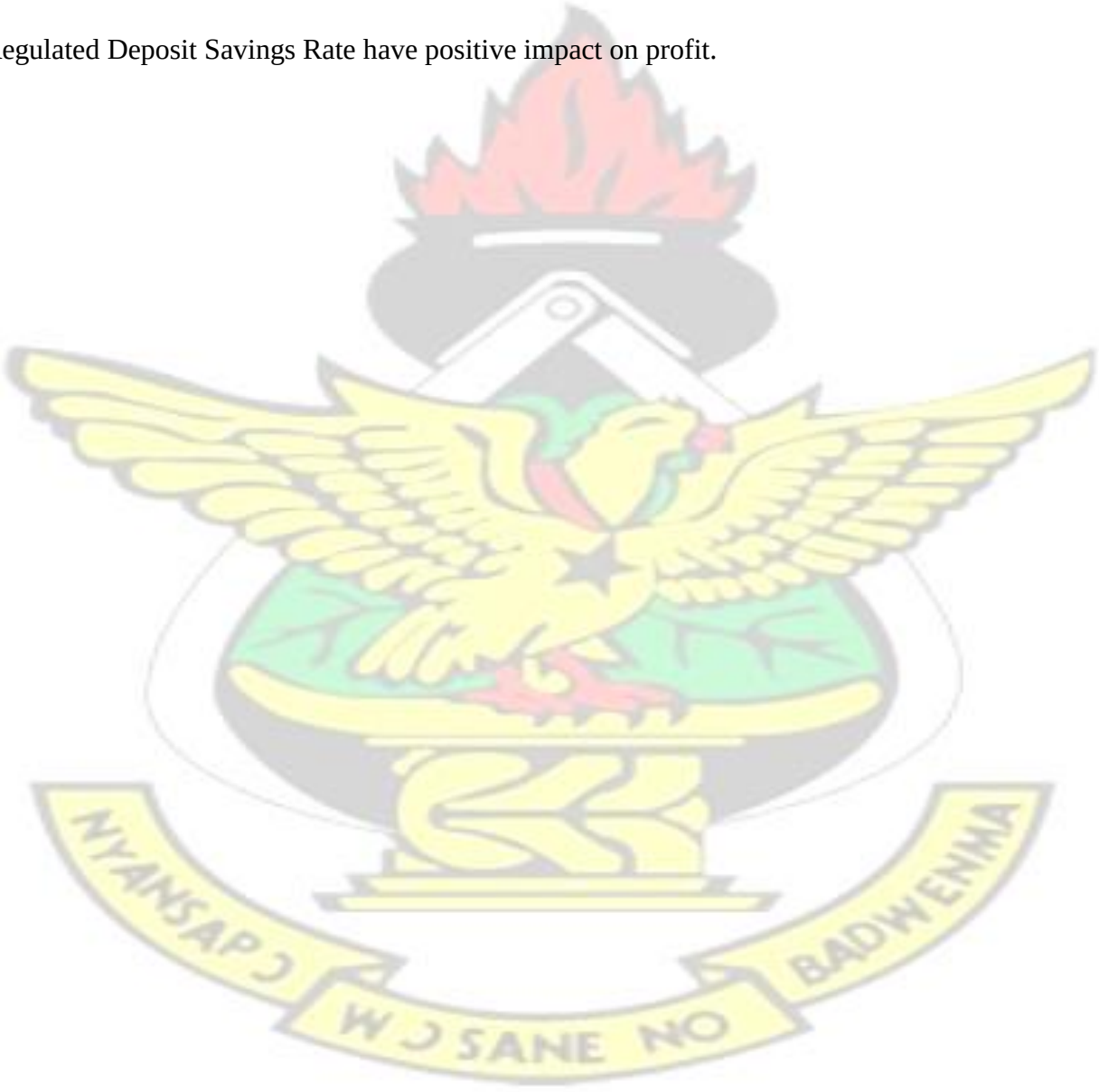
ABSTRACT

Financial intermediation is the main business of financial institutions; transferring of funds from those with excess liquidity but do not have a use for it now to those with shortage of funds but have the need for it. The existence of market imperfections resulting from information asymmetry

and transaction cost, allows for some level of interest rate spread resulting from the wedge that exist between what borrowers pay and what lenders receive. The study sought to assess the impact of interest rate spreads on the profitability of Standard Charted Bank (SCB) in Ghana using annual data from 1990 to 2015.The study found evidence that interest rate spreads drives profitability for the bank. This indicates that the high trends in the interest rates spreads among banks is an avenue for the banks to make profit. The study also showed that liquidity risk, operating efficiency and Regulated Deposit Savings Rate have positive impact on profit.



DEDICATION

With great joy, this work is dedicated to the Almighty God for his steadfast love and mercies that never ceases. Also dedicated to my biggest fan Mrs Juliette Ameevor, my children; Sena, Selorm, Seyram and Setiakor. And my girls Elict and Enyonam without whose encouragement and support I would not have come this far.

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TABLE OF CONTENT

CONTENTS **PAGES**

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Interest rate is the price that borrowers pay for the use of money they borrow or simply, a charge on a borrowed asset. Ngugi (2001) described interest rates as the price of money and thus gives information about expected changes in the purchasing power of money in the market. Interest rates are considered as primary economic factors that influences economic growth worldwide. Interest rates influences the cost of capital to an investor and also the returns on savings, thus impelling the desired level of capital stock in the economy as well as productivity. It influences people's decision to either save or spend and also investors decision to invest or not. Because the value of money declines with time, interest rates are supposed to preserve the value of money overtime.

Financial intermediation is the main business of financial institutions; transferring of funds from those with excess liquidity but do not have a use for it now to those with shortage of funds but have the need for it. Interest rate spread is the margin between the interest charged to borrowers and the interest paid to depositors. When banks receive deposits, they pay interest on it, so that the funds do not lose value over the time that it is been kept. The interest on the deposits also compensates customers for lending their money to the banks. On the other side, banks charge interest when they lend money to customers, which serves as compensation for risk, preserve the value of the currency and also for profit (Sheriff and Amoako, 2014).

Interest rate spreads are set by the banks with total understanding about the financial environment and also to serve the interest of their customers. Therefore, competition in the financial

environment should encourage the reduction in the spread. As noted by Nduati (2013), because financial institutions target their customers in the vein to make profit, they adopt pricing strategies that could influence their financial performance. And hence the need to set interest rate spread that can make them competitive in the market.

The existence of market imperfections resulting from information asymmetry and transaction cost, allows for some level of interest rate spread resulting from the wedge that exist between what borrowers pay and what lenders receive. However, potential exercise of monopoly by the commercial banks has consequently resulted in the widen of the spread. Chirwa (2002) proved that if interest rates are not controlled, relatively larger banks (who have major market share and control) are likely to exploit their customers by increasing the lending rate while giving lower interest on deposits. Thus a wide interest rate spread is an indicator of the financial sector inefficiency.

Interest rate spread in any economy has significant implications on the growth and development. Folawewo and Tennant (2008) opined interest rate spread shows the efficiency of the financial intermediation. Efficient financial intermediation on the other hand, allows higher returns for savers whereas providing lower cost of borrowing for lenders. This has the tendency to mobilize investable resources and thus increase investments and ultimately increase economic growth.

1.2 PROBLEM STATEMENT

Interest rates spread in most developing countries has been found to be higher relative to the developed countries (Brock and Rojas- Suarez, 2000; Gelos, 2006; Crowley, 2007). This wide

spread is very crucial in the growth and development prospect of any economy as it reflects the lack of financial development in the economy. Valverde et al. (2004) postulated the wide spread allows only a small fraction of savings mobilized to be directed into investments, showing clearly that wide interest rates spread limits the ability of financial institution to mobilize investable resources effectively. This is because it discourages savings due to low expected returns and restrict the financing of borrowers.

Ghana's experience of interest rate spreads has surprisingly widened despite series of efforts to liberalize the financial sector and has been noted as one of the countries in Africa with a highest interest rate spreads over the years (WDI, 2015). The liberalization era following Churchill *et al*. (2014) was characterized mainly by high implicit costs coupled with contractionary monetary policy, which were realized through the rising cash ratios and reserves. Bawumia *et al*. (2005) also argued that the gains from macroeconomic stability is yet to be translated into lower interest rate spreads in Ghana. The McKinnon-Shaw hypothesis posits the removal of financial repression, like interest rate controls, credit rationing and ceilings should result in a significant enhancement in economic growth. As this should occur due to increase in deposits through the increase of real interest rate which intend attract savings and through increasing the efficiency of the financial system. But this hypothesis is yet to materialized in Ghana.

Series of arguments advanced for the inability of interest rates spread to decline despite the financial liberalization in developing countries, of which Ghana is no exception, has been the inadequate changes in the institutional and structural behavior in the financial sector, the high

reserve requirements, moral hazard and adverse selection (which increases the provision of doubtful debts due to increasing non-performing loans), persistent increase in operational (transaction) costs and the relatively higher cost of capital needed to safeguard banks against risk (Bawuwia *et al*. 2005).

Scores of studies have noted interest rates spread in Ghana has been too wide to allow for efficient financial intermediation between savers and borrowers (Bawuwia *et al.* 2005, Garr and Kyereboah-Coleman; 2013; Sherriff and Amoako, 2014). This may probably be accounting for the slow growth rate of the economy, since borrowing by private investors are becoming increasingly expensive, and thus limits the ability for them to expand their businesses, increase output and also create employment. This confirms the general assertion that while lending rates are very wide to induce any meaningful private sector investment, deposit rates are relatively too small to encourage savings mobilization in Ghana.

Understanding banks' interest rate spread is essential to the understanding of financial intermediation process and the macroeconomic environment in which banks operate and thus a good indicator on the position of the economy with regards to the business cycle (Stock and Watson, 1989; Bernanke, 1990). The implications of interest rate spreads and consequently efficiency in the financial intermediation process for economic growth, arguably necessitated the need to establish empirically the impact of the wide spread on the profitability of banks in Ghana. Scores of studies (such as Bawuwia *et al*. 2005; Garr and Kyereboah- Coleman, 2013; Churchill *et al*., 2014) have studied the behavior of interest rates spreads in the Ghanaian economy, it is worth noting that not much attention has been given to the impact of interest rate spreads on the

profitability of the individual banks. Though empirical literature indicates interest rate spread has an adverse impact on profitability of banks (Boldbaatar, 2002; Ngugi, 2001), not much attention has been given to the analysis of specific banks in Ghana.

It is against this backdrop that this study attempts to share more light on the impact of interest rate spreads on the profitability of Standard Chartered bank (SCB) Ghana Limited. The study considered the Standard Chartered bank mainly because it is classified as one of the tire-one banks in Ghana which has been witnessing a decline in its market share for some time and controls about only 8.3 % of the total market share as opposed to 9.7% in 2010 and 8.7% in 2012 (PWC; 2014, Ecobank Research, 2015). It is very important to ascertain if the decline in the market shares and more importantly profitability can be attributed to interest rate spreads.

1.3 OBJECTIVES

The main objective of the study is to assess the impact of interest rate spreads on the profitability of the Standard Chartered Bank (SCB) Ghana Limited. Specifically, the study aims to:

i. Analyze the trends in interest rate spreads and profitability of SCB from 1990 to 2015.

ii. Investigate effect of interest rate spread on the profit of SCB in Ghana. iii. Determine the effect of other bank specific factors on the profitability of SCB.

1.4. HYPOTHESIS

To achieve the objectives stated, the study tests the following hypothesis

i. There have not been any significant changes in the trends of interest rate spreads and profitability of SCB.

ii. Interest rate spread does not have any significant influence on the profitability of SCB. iii. Other bank specific factors do not have any effect on the profitability of SCB

1.5. SCOPE OF STUDY

The study will employ mainly secondary data source. Data from 1990 to 2015 will be employed for the study, data will be obtained from the annual financial statements and reports of the Standard Chartered bank. The study modeled the profitability of the bank as a function of interest rate spread, operating efficiency, liquidity risk and regulated saving deposited rate

1.6 SIGNIFICANCE OF THE STUDY

Interest rates spread has significant impact on the development agenda of every economy, as it signals the performance of the financial sector and provides information about the position of the economy on the business cycle (Sherrif and Amoako, 2014). Understanding the impact of interest rate spread on the profitability of the various banks is very crucial.

The study will serve as a source of information for the bank as it will bring to bear the implication of their interest rate spread on their profit. It will also make the management of the bank understand the key drivers of the bank's profitability. This will inform management on appropriate policy formulation on how to tackle their profitability issues and aid them plan and forecast the impact of their policies to ensure banks operate efficiently without exploiting their customers at the same time.

The findings of the study will contribute significantly to the pool of knowledge on interest rate spreads in Ghana and may be of great important to future researches, in both the academia and industry.

1.7 ORGANIZATION OF THE STUDY

The study will be structured into five chapters. The first chapter introduces the study with the background, research problem and objectives as well as the significance and scope of the study. The second chapter covers the review of both hypothetical and experimental literature. Chapter three will present the methodology to be employed for data analysis. The fourth chapter will also focus on the results and analysis of the study and conclusions of the study with the findings, recommendations and suggestions for further research in the area will be presented in the last chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents various theoretical and empirical literatures on the determinants of interest rate spreads in Ghana. The theoretical review brings to bare vast theories and arguments about the subject area whereas the empirical review puts forward varied works by scholars pertaining to interest rates spread.

2.2 Theoretical Review

Various theories have sprung all in the attempt to assess interest rates in the banking industry. The prominent theories considered in the study includes the loanable fund theory, classical theory of interest, Rational expectations theory of interest and Keynes theory of money demand.

2.2.1 The Classical Theory of Interest

The Classical theory of interest dates back to the early writers in the 18th century. The classicalists defined interest rate is the marginal productivity of capital and thus the reward one gets from the productive use of physical capital. The theory is based on the assumption of the general equilibrium theory. Therefore, the intersection of demand and supply for capital determines the interest rate. Following Caplan (2000), the equilibrium interest rate is determined when demand equals to the supply of capital. Investments are the main reasons for the demand of capital. Therefore, the investment schedule represents the demand curve for capital and the supply curve for capital represents savings. Thus savings and investments are the most important determinants of the rate of interest in the economy.

Fredman (1991) following the classical theory postulated the demand for capital is influenced by the availability of savings as well as the productivity of capital whereas the supply of capital or savings is determined by prudent habit of individuals in the economy. The classical theory of interest thus suggests thrift, productivity and real factor as the main variables that determines interest rates in any economy.

Keynes (1938) levelled major criticisms against the classical theory of interest. Firstly, he disputed the assertion that interest is a reward for saving only but further points out that an interest can be earned on the funds that are not saved like interest earned on funds lend out that may have been inherited and also the amount of savings is not only influence by the rate of interest but also the level of income. He also undermined the classicalist theory of interest by arguing that it is indeterminate as one can only know the interest rate unless the saving and investment functions are known. Keynes further argued that people hold money for other reasons than just a medium of exchange, there are other roles of money which is not considered by the classical theory.

2.2.2 Keynes theory of money demand

Keynes (1938) theory of money demand also known as the liquidity reference theory came about as a result of the criticism he levied against the classical theory of interest. The theory postulates people prefer their assets in a more liquid form therefore people have to be compensated for parting with their liquidity (Fry, 1995). The theory indicates that peoples demand for money rests on three motives; transactions, precautionary and speculative motives. The transactions motive, that is holding money for current transactions of goods and services. However, in periods of inflation, the cost of holding money for transactional purposes increases, this is because in order to acquire the same level of goods and services more money is required. Thus banks charge higher interest for their services so that funds in their possession do not lose their value (Ross, 1976A). Demand for transactional purposes is independent of the rate of interest but rather, it is influenced by income (Moore and Craigwell, 2006).

The second motive for holding money is for precautionary purposes; the need to hold money to safeguard against unforeseen circumstances or emergencies which includes accidents and health related problems. Crowley (2007), stated the desire to hold money for precautionary purposes is influenced by the level of financial confidence, availability of credit facilities, income and the level of economic activities in the economy. Due to uncertainties and risks, banks charge interest to help compensate for the risk associated with default.

Finally, people hold money for speculative purposes, that is to invest in business or ventures that might produce higher returns. The third motive indicates people can hold assets that yield interest if they have money that they do not have an immediate use for it. An example of such assets includes bonds. According to Keynes, an individual may decide to hold bond depending on the interest that can be earned and the capital gained from holding the bond. There is however an inverse relationship between the price of the bond and the expected rate of interest. This means that as the rate of interest increases, the price of the bonds is expected to fall. On the other hand, if interest rates are falling, people will demand more bonds in the anticipation to make capital gains when bond prices increase. This relationship Fry (1995) indicates is the basis for interest offered in forward rates as opposed to spot rates.

The liquidity preference theory by Keynes provides a strong basis for interest rate spread in the financial sector. This is because if people prefer holding money instead of saving, it will case the interest rate spread to widen (because the banks will have only limited liquidity and thus they will intend charge a higher interest due to high demand). But if people are willing to part with their funds easily by saving, then the spread will be low.

2.2.3 The Loanable Fund theory

The Loanable funds theory is based on the idea that the rate of interest at any point in time is determined by the demand and supply of loanable funds. Loanable funds according to Turnovsky (1985), is the quantum of funds supplied and demanded in the money market at any point in time. The demand for loanable funds can be for investment ventures or the desire to hoard money by individuals, governments or businesses. The supply of loanable funds is determined by savings and also credit creations by banks.

This theory is an improvement of the classical theory of interest which captures the idea that money plays other roles in the saving-investment function by causing variations in income levels. If banks give out loans without adequate background check and scrutiny, tendency to default and nonperforming loans increases. The risks of banks also increase; thus they are likely to charge higher interest to compensate for the risks.

Dumirguc and Huizinga (1998) suggested that the loanable funds theory implies that once equilibrium achieved, both savers and borrowers will be adequately compensated. The theory explains interest rate spread would be high if the supply of loanable funds falls short of the demand for loanable funds. In that case banks may not have enough funds to lend out, therefore the only way to savage the situation is to increase the lending rates. Also inflation may also cause the interest rate spread to widen (Claeys and Vander, 2008).

2.2.4 Rational Expectations Theory of Interest Rate

The theory shows that people form their expectations based on the kind of information at their disposal. And the expectations formed have significant on the demand and supply in the financial sector. Thus the best predictor of future interest rates is the current interest rate and the changes in interest rates can also be attribute to unexpected information as well as perceived economic factors (Weth, 2002). For instance, if people expects inflation to increase, this will mean deposits will fall and thus low supply of funds. This will mean banks will have to give out expensive loans which will subsequently lead to a high rate of interest.

Bekaert (1998), opined that if people perceive interest rate to rise, it will deter potential borrowers from borrowing even when the banks are willing to give out loans and thus adversely affecting the performance of banks. On the other hand, if they perceive the rate of return to fall, this will motivate borrowers to borrow more. The rational expectation theory is based on the assumption the demand and supply of loanable funds are the predominant determinant of interest rate (Fry, 1995).

2.2.5 Ho- Saunders Model

The model was propounded by Ho- Saunders in 1981. It indicates that the size of interest rates spread is attributed to the uncertainties that characterize the financial market., expected utility maximization as well as the hedging behavior. In the discharged of the functions, banks are considered as risk-averse.

The model considered the fact that savings are made in random intervals whereas the demand for funds are stochastic in nature. The uncertainty results from the different manners in which savings

and loan request are made, and this implies banks are likely to face the risk of inventory. The inventory risk is thus compensated using the difference between the interest on loans and the interest on deposits.

McShame and Sharpe (1984) made some modifications to the model. They assumed that banks in their financial intermediary functions may face uncertainty in the short term interest rate in the money market, as opposed to the loan and deposit rates. Banks are risk averse and maximize their expected utility in the deposit and loans markets. They further justified interest rate spreads, arguing that the spread serves as the reward for financial intermediation role because of the differences in the manner which deposits and loans are made, as well as the short term interest rate uncertainties. Interest rates spread is thus positively influenced by the risk aversion of banks, uncertainty in the rate of interest, the market power of the bank and also the transactions of the bank on the average.

2.3 Empirical Review

This section presents a review of related studies on interest rate spread undertaken by scholars. Following the two-step approach advanced by Ho and Sunders, Afanasieff et al. (2002) studied the interest spread in Brazil using monthly data series from 1997:2 to 200:11 for 142 commercial banks. The study identified the spread has seen an impressive falling trend in current periods though has been comparatively high by international standards, which were attributed to the stable macroeconomic happenings and the priority of policies to reduce the spread by authourities. The study found macroeconomic factors has a larger influence on interest rate spread relative to the banks' specific characteristics.

Angbazo (1997) analyzed the factors that determines interest rate spread in the US using annual data series from 1989-1993. The study considered interest rate risk, default risk (measured as the ratio of net loan charge-offs to total loans), implicit interest payments, management efficiency, an interaction between default and interest risk, leverage (measured as the ratio of core capital to total assets), liquidity risk (ratio of liquid assets to total liabilities), opportunity cost of non-interest bearing reserves and branch restriction as the factors that could influence spread. The result from the pooled analysis indicated low liquidity risks is inversely related to banks' interest rate spread whereas, default risk, management efficiency, the opportunity cost of non-interest bearing reserves and leverage influence the spread positively.

Brock and Franken (2003) measured the determinants of average and marginal interest rate spreads of banks in Chile. The study employed a panel data analysis on monthly data on the various banks from 1994 to 2001. The study made use of a disaggregated unit of account, which includes, inflation-indexed, peso and dollar. The study found that monetary policy variables, business cycle variables and industry concentration impacts interest rate spread differently depending on how the spread is computed; either from disaggregated loan or banks' balance sheet.

Also Demirguc- Kunt and Huizinga (1998) investigated the spread of interest rates using a crosssection data on banks from 80 countries. The study found interest rate spreads are influenced by factors such as macroeconomic variables, implicit and explicit bank taxation, deposit insurance regulation and banks' specific characteristics. The study further found lower spreads can be attributed to a larger banks' asset to GDP ratio and also a lower ratio of market concentration. The study further concludes foreign banks in developing countries are more likely to have wider

spreads and thus larger profits than domestic banks counterparts. The opposite is however true for developed economies.

Gambacorta (2004) studied how banks set interest rates in the Italian banking system. A panel analysis using quarterly series from the period 1993:3 to 2001:3 on 73 banks was done. The study considered variables such as the monetary policy rate and reserve requirements as proxies for monetary policy, loan and deposit demand, the industrial structure, interest rate volatility, operating costs, bank size, inflation, real GDP and credit risk. The results indicate interest on short term loans are less sensitive to monetary policy. Also interest rate spread is not influenced by the size of banks, and also inflation and real GDP is positively related to lending rate but inversely related to the deposit rates after controlling for any differences in the banks specific characteristics. Higher credit risk and operating cost results in higher cost of financial intermediation which then translates into higher lending rates because banks may attempt to recover some of their costs.

Grenade (2007) also assessed the determinants of interest rate spread in commercial banks in the Eastern Caribbean Currency Union. The study made use of the panel data technique with annual data spanning from 1993 to 2003. The variables included in the study were the regulated saving deposit rate, opportunity cost of non-interest bearing reserves, liquidity risk, operating efficiency, provision for loan losses, economic growth and market power. The empirical estimates brought to bear market power or concentration in the banking system, regulated savings deposit rate, provision for loan losses and high operating cost have a positive relationship with interest rate spread. The study suggested banks deal more importantly with non-performing loans as it has proven to widen the spread and also to promote economic growth, attention should be given to measure to reduce the spread.

Barajas et al (1999A) analyzed interest rate spreads in Columbia using quarterly data from 1974 to 1996 based on 22 banks. The study found interest rate spread to be positively influenced by market power, operating cost, financial taxation and changes in loan quality, which is driven by the degree of nonperforming loans. In another study, Barajas et al (1999B) studied the impact of liberalization on the financial sector in Columbia using a panel data estimation technique. The study employed semi-annual data on 32 banks from 1985(1) to 1998 (1). The study indicated foreign banks have lower administrative cost and also high loan quality compared to their domestic counterparts, thus foreign banks are more likely to have lower interest rate spreads. Other liberalization variables such as increase in competition resulting from increased entry of foreign and domestic banks and loan quality impacts interest rate spread significantly.

Khan and Sattar (2014) investigated the importance of interest rate changes on the profitability of banks in Pakistan. The study was based on the financial statements and reports of 5 banks from 2008 to 2012. The study made use of the Pearson Correlation method to estimate the relationship. The study found a strong positive relationship between interest rate and the profitability of the banks.

Obidike et al. (2015) analyzed the impact of interest rate spread on the profitability of banks in Nigeria. The study employed the Ordinary Least Square (OLS) estimation technique with data on the banking sector from 1986 to 2012. The study considered the impact of interest rate spread, GDP and Exchange rate on financial performance. The study found that interest rate spread has a negative and significant effect on financial performance of banks in the long run but insignificant

in the short run. GDP and exchange rate had a positive and significant influence on bank's financial performance in the long run.

Folawewol and Tennat (2008) used the dynamic panel estimation technique with dataset ranging from 1988 to 2005 to investigate the determinants of the banking industry interest rate spread for 33 Sub Saharan African (SSA) countries. The results from the study indicates higher interest rate spreads are associated with the population size, economic development, money supply, inflation, reserve requirement, level of government crowding out in the financial sector, public sector deficits and the discount rate.

Similarly, Ahokposi (2013) studied the determinants of interest rate spread in 41 SSA countries. The study made use of data from 1995 to 2008 on 456 banks. The estimated results indicate market concentration of banks, credit risk, equity, bank inefficiency (which is measured as banks' overhead to average assets ratio) and inflation positively influence the interest rate spread. Bank liquidity ratio on the other hand influences the spread negatively.

Beck and Hesse (2006) studied the interest rate spread in Uganda, using bank-level, macroeconomic and banking system factors with data set spanning from 1999 to 2005. The study employed the pooled Ordinary Least Squares (OLS) and the fixed effects regression. The study found most of the variations in interest rate spread can be attributed to bank-level factors such as banks' overhead costs, composition and size of loan portfolio. However, macroeconomic factors had little influence on the spread of interest rates.

Influential papers in Ghana have also attempted to study the determinants of the widening interest rate spread in the financial sector. Bawumia et al. (2005) assessed the contributions of market determinants and policy related factors of interest rate spreads in Ghana using monthly data from 2000:1 to 2004:4. The study used the generalized least squares estimation technique and found that high operating cost (resulting from high labour cost), cross subsidization between interest and non-interest income, market share (which is an indicator of the competition in the banking sector), inflation, liquidity reserves and taxes are very important in explaining the spread in interest rates.

Also, Aboagye et al. (2008) investigated the response of interest rate spreads to bank specific characteristics and macroeconomic factors following the Ho and Saunders model. The study found factors such as the bank size, staff and administrative cost, inflation, market power and the degree of risk aversion, have a positive impact on the spread whereas the Bank of Ghana's lending rate, excess reserves of the banks and management efficiency negatively affect the spread. The study further recommends policies to reduce the capital adequacy ratio and also to ensure the reduction is adequately passes on to consumers. Also banks should not get too big, to ensure efficient competition in the financial sector.

Garr and Kyereboah-Coleman (2013) also investigated the bank specific characteristic, industry specific and macroeconomic determinants of interest rates in Ghana. The study used an unbalanced panel data estimation from 1990 to 2010 on 33 commercial banks. The results suggest that factors such as management inefficiency, GDP per capita, bank ownership, and Government securities have a positive effect on the interest rate spread. However, Government borrowing negatively influence the spread. The study further indicated domestic banks have a wider spread than their

foreign counterparts, suggesting the domestic banks are likely to be less efficient than the foreign banks.

Sherriff and Amoako (2014), assessed the macroeconomic determinants of interest rate spread using the ARDL cointegration technique and the Vector Error correction model with monthly data series for the period between 1999:1 and 2010:12. The study considered for macroeconomic indicators; inflation, treasury bill rates, the total banking sector deposits, and public sector domestic borrowing. The study found evidence that high interest rate spreads are positively influenced by inflation, total deposit, government borrowings but negatively influenced by treasury bills.

Churchill et al. (2014) employed both exploratory and explanatory (the Multiple Regression Model Pearson's Correlation) studies to identify the determinants of interest rate spread in Ghana using a sample period between 2004 to 2012. The study included the following variables loan loss provision, prime rate, profit margins, liquidity, overhead cost, exchange rate, inflation, treasury bill rate and real GDP per capita. The result showed the factors that influence interest rate spread include Exchange rate, liquidity, GDP per capita, overhead cost, Prime rate, profit margin loan loss provision.

2.4 Conclusions

The review of empirical literature has shown different authours have different findings. This suggest that this area of research has not been completely exhausted. Thus there is the need to expand literature to establish a precise relationship between interest rate spread and other variables.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology and the sources of data for the analysis. The chapter is organized into three broad sections. Section 3.2 provides the description of the model specification, the variables included in the model and the prior expectations of the parameters. In section 3.3 the estimation strategy adopted in the study is outlined. And in the last section, the data measurements and sources are described.

3.2 Model specification

The study follows the Ho – Saunders (1981) model which indicates that bank's interest rate spread is justified because the spread provides a reward for their financial intermediary role and also the need to make profit (McShane and Sharpe 1984). Thus to investigate the impact of interest rate spread on the profitability of SCB, the baseline model following Obidike et al (2015) may be specified as;

$$ROA_t = f(IRS_t) \quad (3.1)$$

$$ROE_t = f(IRS_t) \quad (3.2)$$

where *ROA* represents the return on assets, *ROE* represents return on equity and *IRS* represents the interest rate spread. *ROA* and *ROE* are the measures of profitability of banks considered in the

study. From equation (3.1) and (3.2) interest rate spread is expressed as a function of return on asset and return on equity of SCB respectively.

In the banking industry because there are other factors that are likely to influence their profitability, the study further considers some bank specific factors that may affect the profitability. These variables include operating efficiency, liquidity risks and regulated savings deposit rate. Equations (3.1) and (3.2) is thus modified as;

$$ROA_t = f(IRS_t, OE_t, LR_t, RDSR_t) \quad (3.3)$$

$$ROE_t = f(IRS_t, OE_t, LR_t, RDSR_t) \quad (3.4)$$

Where *OE* represents the operating efficiency, *LR* represents the liquidity risk of SCB and *RDSR* shows the regulated savings deposit rate of the bank. Equations (3.3) and (3.4) implies that ROA and ROE of SCB are functions of the bank's interest rate spread, operating efficiency, liquidity risks and regulated savings deposit rate.

Equations (3.3) and (3.4) can be transformed into an explicit parametric regression model as;

$$ROA_t = \beta_0 + \beta_1 IRS_t + \beta_2 OE_t + \beta_3 LR_t + \beta_4 RDSR_t + \varepsilon_t \quad (3.5)$$

$$ROE_t = \beta_0 + \beta_1 IRS_t + \beta_2 OE_t + \beta_3 LR_t + \beta_4 RDSR_t + \varepsilon_t \quad (3.6)$$

The study expects the coefficients of Regulated savings deposit rate (β_4 and α_4) to be positively related to profitability (ROA and ROE). Whereas negative coefficients are expected for liquidity risk (β_3 and α_3). The coefficients of Interest rate spread ($\beta_1$and α_1) and operating efficiency (β_2 and α_2) may be positive or negative (Werner and Moormann, 2009).

3.3 Data Analysis

The study employed quantitative analysis. The correlation analysis will bring to bear the level of association among the variables. A positive correlation coefficient indicates the variables move together in the same direction. That is, they either increase together or decrease together. The study employs the Ordinary Least Squares approach to assess the relationship between the independent variables and the profitability of SCB. The study in order to ensure the OLS estimates are consistent and robust, will test the fundamental assumptions of the OLS. That is the possibility of multicollinearity, heteroscedasticity and autocorrelation in the series.

3.3.1 Multicollinearity

Multicollinearity comes to play when two independent or explanatory variables in a multiple regression are highly correlated thus making either variable be predicted with accuracy from the others (Green, 2008). The implication of this outcome is that the individual regression coefficients would not be identified with certainty. It can also lead to high level of standard errors; it therefore becomes necessary to minimize the possibility of collinearity in a regression. The study attempts to test for the presence of multicollinearity by using the Pearson correlation matrix analysis. A High correlation coefficient of 0.9 and above among the predictor variables indicates the presence

of multicollinearity (Saunders, 2009). In computing the correlations all pairs of predictors, any coefficient close to 1 or -1 implies at least one of the predictor should be eliminated from the regression.

3.3.2 Autocorrelation

Another major assumption to ensure a best linear unbiased estimator in a regression is the test for the presence of autocorrelation. Autocorrelation is a situation when the error terms of a multiple regression are serially dependent (Gujarati, 2010). The assumption of the CLRM however states that the errors should be serially independent specifically $E(\varepsilon_i \varepsilon_j | X) = 0$ for all $i \neq j$. The presence of autocorrelation leads to two serious consequences, especially in the instance of a high autocorrelation coefficient. First, the estimates of the regression coefficients have an unduly large and inaccurately estimated variance. Secondly, the procedures for statistical inference are inapplicable. The presence of autocorrelation in one-dimensional data, such as the values to a cross-section through space, may be tested for by means of the Durbin-Watson *d* statistic: specifically, this test for the existence of dependence between successive residuals

$$d = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t-1}^{T} e_t^2} \qquad (3.9)$$

Where d is the Durbin-Watson test outcome, T is the number of observations and $e_t$and e_{t-1}represent the error term in time t and $t-1$ respectively. The value of d ranges between 0 and 4, if there is evidence of a d less than 2 it indicates the presence of positive serial correlation. A d of less than 1 raises an alarm as it implies thesuccessive error terms are on average close in value to each other.

3.3.3 Heteroscedasticity

When the variances of the error terms of any linear regression model are not constant over time, it means there is the presence of heteroscedasticity i.e $(\varepsilon_i{}^2 \backslash X) = \sigma^2{}_i$. This difference in variance in each observation means a violation of the homoscedastic nature of the regression where the variance of the error term should be constant over time (Gujarati, 2010). In order to test for the presence of heteroscedasticity; researches make use of the famous Breusch-Pagan test.

3.4 Data Source and Types

Data on all the variables were obtained from the annual reports and financial statements of SCB as well as from the finance department of the bank. Annual data series spanning from 1990 to 2015 was employed for the study. The variables include Return on Assets and Return on Equity as measures of profitability, interest rate spread, operating efficiency, liquidity risks and share of market power of the Standard Chartered Bank (SCB). The variables considered in the study are described below;

34.1 Return on Assets

Return on Assets measures the amount of income or revenue that is earned by banks from the total assets they own. It measures the financial performance (profitability) of banks because it shows what the various banks can do with what they own (Ara et al, 2009). The ROA also shows the efficiency and the level of management of funds in the bank. It has been used by various studies such as Awo and Akotey (2011), Haron (2004), Athanasoglou et al (2005), Mills and Amowine (2013) as proxy for banks financial performance or profitability. It is expressed as the ratio of the profit before interest and tax (PBIT) to the total assets of the bank.

$$ROA_t = \frac{PBIT_t}{TOTAL\ ASSETS_t} \quad (3.11)$$

3.4.2 Return on Equity

ROE measures the amount earned by the bank within a specific period in association with the amount that is invested in its stocks by shareholders. It shows how banks uses investments to generate earnings. It is also considered as a measure of profitability or financial performance of the banks and thus a dependent variable. The study follows studies such as Loukoianova (2008), Petersen and Schoeman (2008) and Werner and Moormann (2009) who also employed ROE as a measure of profitability of banks. The ROE is mathematically defined to be the ratio of the profit after tax (PAT) to the total equity of the bank.

$$ROE_t = \frac{PAT_t}{TOTAL\ EQUITY_t} \quad (3.12)$$

3.4.3. Interest rate spread (IRS)

Interest rate spread is the difference between the lending rate and the deposit rate. IRS shows the difference between the average interest rate of banks' loans given to their customers and the average interest rate banks pay on the deposits received. IRS defines the transaction or intermediation cost of banks. Barajas and Salazar (1998) indicated that high interest rate spread is associated with lack of competition and inefficiencies in the banking sector and may have adverse effect on bank's profit. However, a wide interest rate spread may contribute to the incomes of

commercial banks and thus their profitability (Sheriff and Amoako, 2014; Obideke *et al.*, 2015). IRS is measured as the difference between the lending rate (LDRate) and the deposit rate (DRate) of SCB.

$$IRS_t = LDRate_t - DRate_t \quad (3.13)$$

3.4.4 Operation Efficiency (OE)

OE is measured by the cost of monitoring and servicing of transactions by the bank. It measures how banks are able to utilize their resources efficiently. Banks with larger operational cost are likely to be less efficient and may be considered riskier, and are likely to have a lower operational efficiency (Almarzoqi and Naceur, 2015). Banks with higher operational efficiency are noted with better cost administration are and thus more likely to be more profitable. The study follows studies such as Werner and Moormann (2009) and Almarzoqi and Naceur (2015).

It is measured by the ratio of operating expenses (OPE) to the bank's total assets.

$$OE_t = \frac{OPE^t}{TOTAL\ ASSETS_t} \quad (3.14)$$

3.4.5 Liquidity Risks (LR)

Liquidity risk may be considered as the situation where the bank may not have the sufficient liquidity (cash flow) to meet its short term obligations. This is the risk of the bank not having enough liquid assets to meet the needs of depositors and borrowers. This situation is likely to occur

due to the inability to easily convert the bank's assets and securities into cash within a very short time. Liquidity risk is an important factor of profitability among banks because it captures the tendency and source of failure in the banking sector, with regards to the bank's ability to absorb liquidity shocks (Said and Tumin, 2011). Liquidity risk is measured by the ratio of liquid assets (LA) to the total asset of the bank.

$$LR_t = \frac{LA^t}{TOTAL\ ASSETS_t} \quad (3.15)$$

A higher ratio of liquid assets to total assets measures the ability of the bank to adequately absorb any liquidity shock. However, a higher ratio may also be associated with inefficiency, because holding a higher fraction of its assets in liquid form may result in a lower net interest rate spreads. The study expects a negative relationship between liquidity risk and profitability following Molyneux and Thornton (1992) and Barth et al (2003)

3.4. Regulated Deposit Savings Rate

It is the ratio of bank's saving deposit to its total deposits. A high level of RDSR is an indication that the bank gets access to lower sources of funds. Because banks usually have to pay a relatively higher interests on current account deposits and other sources of funds compared to the saving deposits. Thus, if a large fraction of the bank's deposits is from saving deposits it means the bank gets funds at cheaper interest rates. The study expects a positive relationship between RSDR and profitability of SCB. This is because increasing RDSR will mean SCB can have access to cheaper sources of financing its operations and thus improve the financial performance of the bank (Nduati,2013). The RDSR is measure as the ratio of saving deposit to total deposits.

$$RDSR_t = \frac{Saving\ Deposits^t}{Total\ Deposits_t} \quad 3.16$$

CHAPTER FOUR

EMPIRICAL RESULTS AND ANALYSIS

4.1 Introduction

This chapter presents the estimated results of the models specified in Chapter Three. First, we begin with the presentation of the descriptive and correlation analysis of the variables included in the analysis. This is followed by the trend analysis of interest rate Spread. Finally, the results from the estimated relationships with discussions and interpretations follows.

4.2 Descriptive Statistics

The study provides a brief description about the general statistics of the variables used in the model. The overview of the number of observations, the mean, standard deviation as well as the minimum and maximum values in the series are presented in Table 4.1.

Table 4.1 Summary of the Descriptive Statistics

Variable	Observation	Mean	Std. deviation	Min value	Max Value
ROA	25	1.483	0.437	0.0745	1.997
ROE	25	3.487	0.473	1.785	3.892
IRS	25	3.029	0.227	2.772	3.492
LR	25	3.513	0.137	3.326	3.722

OE	25	3.697	0.141	3.420	3.859
RDSR	25	4.194	0.093	4.038	4.345

Source: Author's estimation 2016

Over the 25-year period employed for the analysis, there were no missing observations, as 25 observations were reported for the various variable. Over this sample period, Regulated Savings Deposit Rate (RSDR) recorded the highest mean of 4.194 followed by Operating Efficiency (OE), which also obtained 3.697. Liquidity risk (LR), Return on Equity (ROE) and Interest Rate Spread (IRS) followed closely with 3.513, 3.487 and 3.029 respectively. Return on Asset (ROA) recorded the least mean among the series, which was 1.483. ROA surprisingly obtained the second highest standard deviation, with 0.437, after ROE, which recorded 0.473. This indicates that the various measures of profitability for SCB in the study, do not have their series closely clustered around their mean and also confirms the wide spread between their minimum and maximum values. ROA and ROE recorded minimum values of 0.0745 and 1.785, and maximum values of 1.997 and 3.892 respectively.

RDSR recorded the least standard deviation among the series, which was 0.093 with a maximum value of 4.345 and a minimum value of 4.345. Followed by IRS which had a stand deviation of 0.141 and its series ranging between 2.772 and 3.492. OE and LR follows with a standard deviation of 0.227 and 0.137 respectively. With OE having a maximum value of 3.420 and a minimum value of 3.859. LR also recorded a maximum value of 3.722 and a minimum value of 3.326.

4.3 Correlation Analysis

The analysis of correlation is justified as it checks the extent of multicollinearity among the independent variables. This would help clarify the highly correlated variables so as to avoid the use of the all the highly correlated variables in the regression. The result of the correlation matrix is presented in Table 4.2

Table 4.2 Pairwise Correlation Analysis

Variable	ROA	ROE	IRS	LR	OE	RDSR
ROA	1.000					
ROE	0.932	1.000				
IRS	0.314	0.289	1.000			
LR	0.305	-0.218	0.121	1.00		
OE	-0.456	-0.359	-0.328	-0.202	1.00	
RDSR	0.385	0.466	0.237	0.059	0.270	1.00

Source: Author's estimation 2016

The result from Table 4.2 indicates the principal diagonal tells the relationship between a variable and itself with a correlation coefficient of 1, which spells out a perfect correlation. With respect to Considering the off-diagonals or the bivariate correlation it is evident that IRS has a relatively weak but positive correlation with ROA, with a coefficient of 0.314. The correlation is even less with ROE, which is 0.289. This suggest the correlation between IRS and ROA is more evident compared with ROE. LR is positively correlated with ROA (0.305) but interestingly had a negative

correlation with ROE, with a coefficient of -0.218. the correlation between IRS and LR is however positive and recorded a coefficient of 0.121.

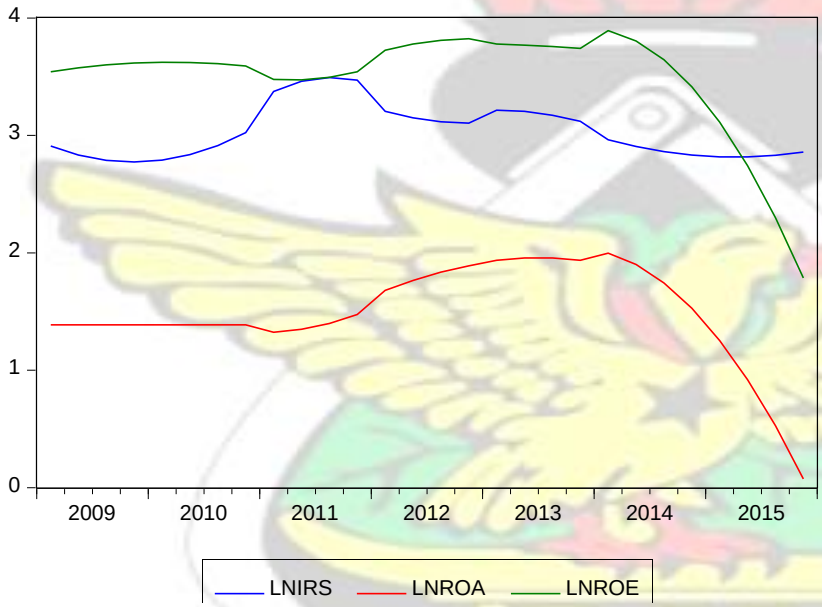
OE was found to be negatively correlated with all the other variables in the model except RDSR (which was 0.270). OE record coefficients of -0.456 and -0.359 respectively for ROA and ROE and also -0.328 and -0.202 for IRS and LR respectively. Similarly, RDSR had a positive correlation coefficient with the various measures of profitability; ROA and ROE. Obtaining a correlation coefficient of 0.385 for ROA and 0.466 for ROE. The correlation coefficient for RDSR and LR was also found to be positive, obtained as 0.059.

The regression however, does not have a multicollinearity problem since the correlation between the independent variables are relatively low. And also in the regression models are those in which the independent variables each correlate highly with the dependent variables but correlate at most only minimally with each other. The high correlation between the two dependent variables (ROA and ROE) recorded as 0.932 may not pose any multicollinearity problem since the two variables are both different measures of profitability and will not be included in the same regression.

4.4 Trends in Interest Rate Spread of SCB

The study further looks at the trends in Interest Rate Spreads as well as the profitability of SCB over the study period. The relevance of the trend analysis is to explain the behavior of these variables since it gives an informal way of checking for Stationarity. The trends of the series are presented in Figure 4.1

Figure 4.1. Trends in IRS and Profitability of the SCB (ROA and ROE)



Source: Author's estimation 2016

From Figure 4.1, the trends show the path IRS, ROA and ROE of the SCB has taken so far. From the trends, it is clear that the level of the bank's profitability has been relatively stable over time, until it witnessed a sharp decline in its returns after 2014. IRS has however, seen substantial downturns and upturns, and seem to have stabilize in periods after 2014. Specifically, profits (ROE and ROA) recorded its peak in the 2014 before declining sharply afterwards. This suggest that

profits for the SCB has been relatively smaller in 2015 than in the previous years. This probably confirms the decline in market share reported Ecobank Research (2015). IRS has also been relatively stable over the study period, this points to the fact that SCB do not change their rates of deposit and lending frequently. It recoded it highest values in 2011.

4.5 Regression results

In order to ensure the robustness and consistency in the outcomes of the results for this study's analysis, the impact of IRS on the profitability of SCB is reported and then the controlled variables are sequentially reported. Table 4.3 presents the results from the OLS estimation.

Table 4.3 OLS Estimation Results

Variables	MODEL 1 (ROA)	MODEL 2 (ROE)
IRS	1.122***	1.672**
	(0.467)	(0.716)
LR	-0.712**	0.834**
	(0.351)	(0.306)
OE	-0.209	1.255**
	(1.618)	(0.943)
RDSR	3.432**	4.722**
	(1.456)	(1.837)
C	2.747***	6.651**
F-Statistics	10.850***	6.47***
R- Squared	0.653	0.529
Adj. R-Squared	0.593	0.449

Note: Standard errors are reported in (). *, ** and * indicates significance levels at 10%, 5% and 1% respectively.**

The results from the Table 4.3, IRS was found to have a positive and significant effect on the profitability of SCB. Specifically, in model 1 where ROA was the measure for profitability, increasing IRS by 1% will result in an increase in their profits by 1.12%. Similarly, in model 2 with ROE, increasing IRS by 1% will drive profits by 1.672%. This proves that increasing IRS impacts positively on the financial performance of SCB, thus to ensure profit, increasing their IRS will not actually be a bad idea. The effect in both models are elastic, indicating that increasing IRS will lead to a more than proportionate increase in profits. The result confirms the findings of Khan and Sattar (2014) for commercial banks in Pakistan but contradicts that of Obidike et al. (2015) for banks in Nigeria.

The results in Model 1 further found evidence that, Liquidity risks has a negative influence on the profits of SCB. Specifically, an increase in the liquidity risk of the bank by 1% will cause profits to fall by 0.712%. This further indicates that as the liquidity risk of the bank increases, it has adverse effect on the ROA. However, in model 2, liquidity risk had a positive and significant effect on ROE. That is, a 1% increase in liquidity risk will increase the ROE by 0.834%. This means that increasing the liquidity risk can increase the profitability of SCB when ROE is used as the measure of profitability.

The result from the results also indicates that Operational efficiency though negative, had no significant impact on profitability in Model 1. This outcome is not surprising, because the study expects that as OE increases, it means the bank is operating efficiently and thus, efficiency in its operations should result in increase in profits. In model 2, OE had a significant positive influence

on ROE. Specifically improving the operational efficiency of the bank by 1% will result in an increases in profits by 1.25%.

The study further found a positive relationship between RDSR and the profitability of the banks in both models. Specifically, increasing the regulated deposit savings ratio by 1% will increase ROA by 3.42%. Similarly, increasing RDSR by 1% will causes ROE to increase by 4.722%. These positive relationships confirm the correlation analysis presented in Section 4.3. This suggest that as the ratio of savings deposit to the total deposits of the bank increases, the bank has access and make use of this relatively cheaper source of funds in its operations, which have the tendency of driving the profit of the bank.

The overall test of significance (F-Statistics) in both models are statistically significant; 10.85 and 6.47 for Model 1 and Model 2 respectively. This indicates that the independent variables collectively have a significant impact on ROA and ROE in the various models although some of the independent variables individually may not have may significant influence on ROA and ROE. The coefficient of determination (R-Squared) of 0.65 in model 1 (ROA) indicates that the selected independent variables explains 65% of the variations in ROA. The Adjusted R-Squared further indicates that 59 % of the variations in ROA is explained by the independent variables. In model 2, the R-squared indicates that the independent variables explain about 53% of the variations in ROE and the adjusted R-squared suggest the independent variables explains only 45% of the variations in ROE.

4.4 Diagnostics tests

To ensure that the estimates from the model are consistent and does not have any econometric problem, the study goes further to conduct the various diagnostics test for OLS estimates. The results from the diagnostic tests are presented in Table 4.4

Table 4.4: Diagnostic and Stability test results

Test	MODEL 1 (ROA)	MODEL 2 (ROE)
Normality	4.120	2.503
	(0.127)	(0.286)
Heteroscedasticity	2.297	2.621
	(0.189)	(0.161
Autocorrelation	16. 895**	16.118
	(0.02)	(0.02)

Note: In parenthesis are the computed probability values Source: Author 2016

The diagnostics test results show that from the Jacque-Bera test, the residuals of the series are normally distributed in all two models since the estimated values are statistically insignificant.

The results also prove the absence of heteroscedasticity in the two models based on the BreuschPagan-Godfrey test as the F-statistics were statistically insignificant for the two models.

The models are however faced with the problem of autocorrelation since the F-statistics were statistically significant.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides the summary of key findings, conclusions and provides recommendations based on the findings of the study.

5.2 Summary of Findings

The study sought to assess the impact of interest rate spreads on the profitability of Standard Charted Bank (SCB) in Ghana using annual data from 1990 to 2015. The trends in interest rate and the various profitability of the bank depicts a fairly stable trends over the sample period. The correlation results also indicate that interest rate spread have a positive correlation with ROE and ROA indicating that IRS move together with profitability. However, the positive correlation is higher in ROA than in ROE.

The results from the OLS estimation proved that interest rate spreads drives profitability in both models. This indicates that rising interest rates spreads can be used as a measure of promoting profitability for the bank. However, a wide spread may also have the tendency of reducing savings to the bank.

The study further indicates that liquidity risk has adverse effect on ROA but it had a positive relationship with ROE. This indicates that, whiles rising liquidity risks may increase ROE, it also decreases the bank's ROA.

The study further found evidence that operating efficiency had a positive impact on ROE. That is ensuring efficiency in the banks operation is a means of increasing the banks ROE. The study however found a statistically insignificant relationship between Operational efficiency and ROA

The study also found evidence that Regulated Deposit Savings Rate drives profitability in both models. This proves that as the bank has access to cheaper sources of funds, it is able to finance its operations efficiently and thus increase profits.

5.3 Recommendations

The empirical evidence brings to bear that increasing interest rate drives profitability in the bank. In view of this the bank will be tempted to increase the spread in order to increase its profits. However, increasing the spread will mean will mean higher interests for borrowers, which is a disincentive to borrowers. Thus, the study recommends that the bank ensures interest rate spreads increase fairly, so that the adverse effect associated with higher interest rates spreads may be passed on to profits.

Also because regulated deposit savings rate drives profitability, the study recommends the bank conducts promotions and attractive packages to increase the saving deposits accrued to the bank. Increasing the savings deposit to the bank will sufficiently increase the profits of the bank.

The study also recommends the bank implement policies that sufficiently reduces its liquidity risks, since increasing liquidity risks reduces the profitability of the bank.

Finally, policies that ensures the bank operates efficiently should be conducted. This includes cutting down cost in its operation given a constant output.

5.4 Conclusion

The banking industry in Ghana has been faced with high interest rates spreads over the years. The study which was based on the influence of interest rate spreads on the profitability of the SCB provided evidence that rising trends in the interest rate spreads is justified by banks because of their desire to make profits. It is however important for the banks to understand the possibility of adverse effect on the overall economy because of the wider spreads.

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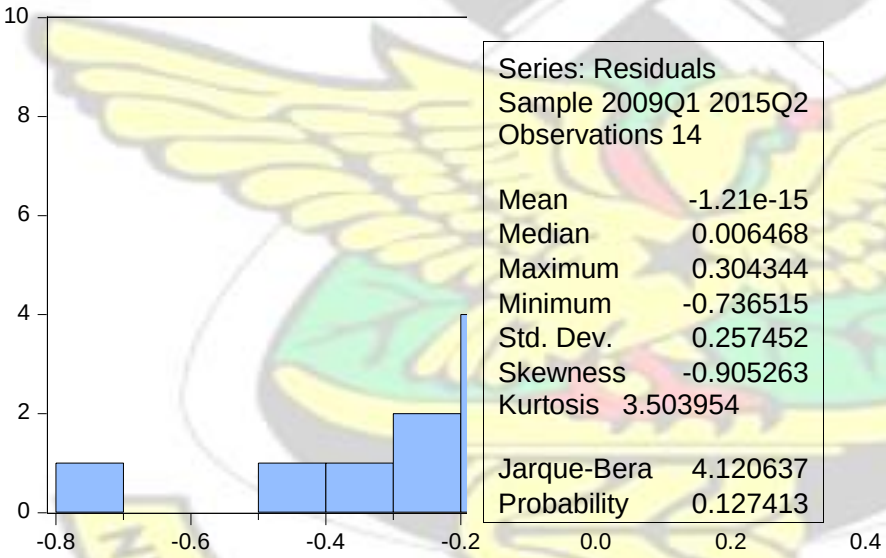
APPENDIX

Dependent Variable: LNROA
Method: Least Squares
Date: 09/27/16 Time: 21:17

Sample: 2009Q1 2015Q2
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.74769	0.110541	1.511516	0.0043
LNIRS	1.122882	0.467603	1.278290	0.0400
LNLR	-0.712850	0.351685	-0.527379	0.0320
LNOE	-0.209167	1.618788	-0.129212	0.8983
LNRDSR	3.432565	1.456053	2.357445	0.0273

R-squared	0.653633	Mean dependent var	1.483066
Adjusted R-squared	0.593395	S.D. dependent var	0.437449
S.E. of regression	0.278942	Akaike info criterion	0.444805
Sum squared resid	1.789595	Schwarz criterion	0.682699
Log likelihood	-1.227270	Hannan-Quinn criter.	0.517531
F-statistic	10.85087	Durbin-Watson stat	0.436825
Prob(F-statistic)	0.000043		



Breusch-Godfrey Serial Correlation LM Test:

F-statistic	16.89531	Prob. F(2,10)	0.0000
Obs*R-squared	17.26823	Prob. Chi-Square(2)	0.0002

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 09/27/16 Time: 21:23

Sample: 2009Q1 2015Q2
Included observations: 14
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.512086	4.615589	0.327604	0.7465
LNIRS	0.039041	0.368231	0.106022	0.9166
LNLR	-0.204357	0.877371	-0.232920	0.8181
LNOE	-0.167633	1.053336	-0.159144	0.8751
LNRDSR	-0.071743	0.956273	-0.075024	0.9409
RESID(-1)	1.191302	0.212179	5.614617	0.0000
RESID(-2)	-0.555669	0.239423	-2.320870	0.0304

R-squared	0.616723	Mean dependent var	-1.21 E-15
Adjusted R-squared	0.507215	S.D. dependent var	0.257452
S.E. of regression	0.180728	Akaike info criterion	-0.371334
Sum squared resid	0.685911	Schwarz criterion	-0.038283
Log likelihood	12.19868	Hannan-Quinn criter.	-0.269517
F-statistic	5.631769	Durbin-Watson stat	2.087778
Prob(F-statistic)	0.001289		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.297210	Prob. F(4,10)	0.1897
Obs*R-squared	7.993066	Prob. Chi-Square(4)	0.1918
Scaled explained SS	6.752263	Prob. Chi-Square(4)	0.2496

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/27/16 Time: 21:23
Sample: 2009Q1 2015Q2
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.599761	2.404504	-1.081205	0.2908

LNIRS	-0.165789	0.191941	-0.863750	0.3966
LNLR	0.306567	0.457086	0.670697	0.5091
LNOE	0.142247	0.547410	0.259854	0.7973
LNRDSR	0.372606	0.492380	0.756745	0.4569

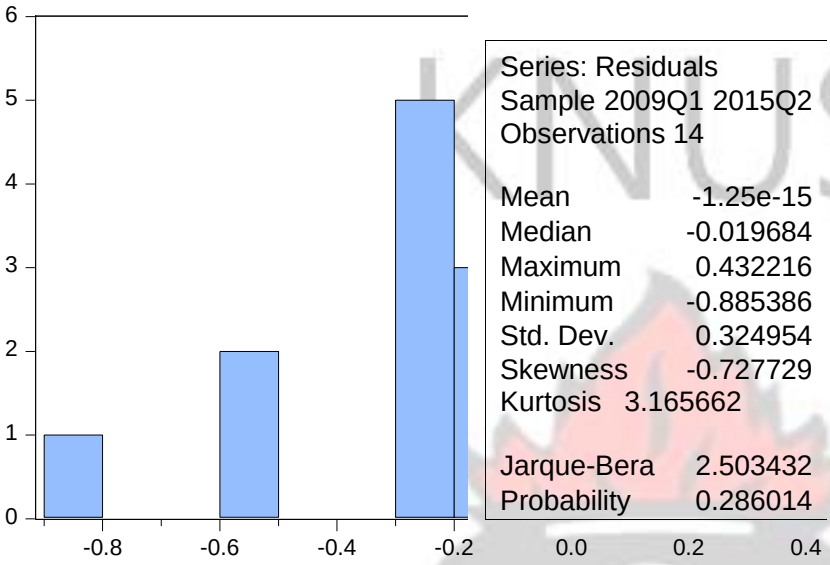
R-squared	0.285467	Mean dependent var	0.063914
Adjusted R-squared	0.161200	S.D. dependent var	0.102993
S.E. of regression	0.094327	Akaike info criterion	-1.723665
Sum squared resid	0.204645	Schwarz criterion	-1.485771
Log likelihood	29.13130	Hannan-Quinn criter.	-1.650938
F-statistic	2.297210	Durbin-Watson stat	0.846768
Prob(F-statistic)	0.089741		

Dependent Variable: LNROE
Method: Least Squares
Date: 09/27/16 Time: 21:26
Sample: 2009Q1 2015Q2
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.65110		2.186766	
		1.974898		0.0474
LNIRS	1.672905	0.716426	2.335072	0.0286
LNLR	0.834015	0.306091	2.488845	0.0496
LNOE	1.255913	0.943228	2.114671	0.0448
LNRDSR	4.722080	1.837825	2.569386	0.0171

R-squared	0.529700	Mean dependent var	3.487160
Adjusted R-squared	0.447909	S.D. dependent var	0.473844
S.E. of regression	0.352079	Akaike info criterion	0.910511
Sum squared resid	2.851074	Schwarz criterion	1.148405
Log likelihood	-7.747157	Hannan-Quinn criter.	0.983238
F-statistic	6.476250	Durbin-Watson stat	0.433228
Prob(F-statistic)	0.001211		

C	1.485022	5.914821	0.251068	0.8042
LNIRS	0.057821	0.471542	0.122621	0.9036
LNLR	-0.197442	1.128123	-0.175019	0.8627
LNOE	-0.137567	1.356027	-0.101448	0.9202
LNRDSR	-0.111514	1.224515	-0.091068	0.9283
RESID(-1)	1.156651	0.212898	5.432890	0.0000
RESID(-2)	-0.527236	0.239315	-2.203107	0.0389



Breusch-Godfrey Serial Correlation LM Test:

F-statistic	16.11840	Prob. F(2,10)	0.0001
Obs*R-squared	16.95501	Prob. Chi-Square(2)	0.0002

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 09/27/16 Time: 21:27
Sample: 2009Q1 2015Q2 Included observations: 14
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.

	0.605536		
R-squared		Mean dependent var	-1.25 E-15
Adjusted R-squared	0.492832	S.D. dependent var	0.324954
S.E. of regression	0.231419	Akaike info criterion	0.123141
Sum squared resid	1.124646	Schwarz criterion	0.456192
Log likelihood	5.276025	Hannan-Quinn criter.	0.224958
F-statistic	5.372798	Durbin-Watson stat	2.049668
Prob(F-statistic)	0.001690		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.621201		
		Prob. F(4,10)	0.1612
Obs*R-squared	8.767396	Prob. Chi-Square(4)	0.1672
Scaled explained SS	6.405763	Prob. Chi-Square(4)	0.2708

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/27/16 Time: 21:27
Sample: 2009Q1 2015Q2
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.064420	3.492932	-1.449905	0.1606
LNIRS	-0.172629	0.278825	-0.619132	0.5419
LNLR	0.627593	0.663992	0.945181	0.3544
LNOE	0.444423	0.795202	0.558881	0.5816
LNRDSR	0.438891	0.715261	0.613610	0.5455

R-squared	0.313121	Mean dependent var	0.101824
Adjusted R-squared	0.193664	S.D. dependent var	0.152596
S.E. of regression	0.137025	Akaike info criterion	-0.976869
Sum squared resid	0.431847	Schwarz criterion	-0.738975
Log likelihood	18.67616	Hannan-Quinn criter.	-0.904142
F-statistic	2.621201	Durbin-Watson stat	0.806134
Prob(F-statistic)	0.061230		