UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

CREDIT REFERNCING BUREAUS, BANK CREDIT RISK AND PROFITABILITY: EVIDENCE FROM GHANA.

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DECLARATION

I, Baah Aye Kusi, an M-Phil (Finance) student of the University of Ghana Business School do hereby declare that this thesis is the product of my own original research. I further declare that this piece of research or part thereof has not been presented by anyone in this or any other University.

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CERTIFICATION

I, the undersigned, do certify that this thesis was supervised in accordance with the procedures laid down by the University of Ghana.

1st Supervisor's Signature: …….. Date……..

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2nd Supervisor's Signature: …….. Date……..

(Elipklim K. Agbloyor, PhD)

DEDICATION

In appreciation of His love, mercy and protection for my life throughout this program, I humbly dedicate this thesis work to the Almighty God.

I also dedicate this work to my brother Mr. Kwadjo Aye Kusi, for his relentless financial support and encouragement towards the completion of this program.

God bless you.

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This thesis was successfully completed not without the whole hearted assistance of some kind personalities. However, time, space and memory would allow me to mention a few of them.

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ABSTRACT

Using a dataset from universal banks in Ghana, the study takes advantage of the introduction of a Credit Referencing Bureaus (CRBs) by the Ghanaian Banking Industry in 2010 as a natural experiment to evaluate the impact of Credit Referencing Bureaus on bank credit risk and profitability. Making use of the Prais-Winsten estimation, the study established that CRBs were negatively related to bank credit risk in Ghana. This implies that banks that use the services and products of CRBs in their operations are able to reduce their credit risk by reducing information asymmetry. On the contrary, the study found that CRBs were positively related to bank profitability implying that as banks use the products and services of CRBs, they are able to boost or increase their profitability also by reducing incomplete or false information (information asymmetry) on bank clients. The study further established that the impact of CRBs on bank credit risk was more than bank profitability.

Finally, the study recommends that frequent usage or patronage of CRB services and products by banks in Ghana as it helps banks boost their profitability and at the same time help them to reduce their credit risk exposure. Also, though CRBs have significant impact on bank profitability and credit risk, there is more room for improvement since CRBs cover about only 10% of the Ghanaian adult population, hence expansion of the sources of data for CRBs could help capture more people for accurate, reliable and consistent evaluation of bank clients in order to boost and reduce bank profitability and credit risk respectively further. The study again recommends the publicity of CRBs activities in Ghana since the knowledge of CRBs existence puts pressure on bank client or borrowers to servicing their loans because they (borrowers) will be denied future credit or loan upon default.

TABLE OF CONTENTS

List of Tables **Pages**

List of Figures **Pages**

CHAPTER ONE

1.0 Introduction

This chapter provides a clear link between Credit Referencing Bureaus, Bank Credit Risk and Profitability and also highlights the importance of studying CRBs in the context of Ghana. To clearly establish this link, this chapter encompasses background of the study, statement of the problem, objectives of the study, research Hypothesis, significance of the study, chapter outline and Chapter Conclusion.

1.1 Background of the Study

Over the last two decades banks have been under serious scrutiny and have attracted considerable attention among academics and practitioners (Fujii, Managi and Matousek, 2014). This is due to the fact that they play crucial and fundamental roles in various economies which may lead to the break or make of those economies (Crotty, 2008). Through the functions performed by banks which include mobilization of savings, evaluation of projects and resource allocation, management of risk, monitoring of managers and facilitation of transactions, banks are exposed to various types of risk and the most pertinent among them is credit risk exposure. Also Karbo and Adamu (2009) and Becks and Levine (2004) suggest that profitable banks are less likely to face huge credit risk exposures.

Lending in developing countries is a challenging function for banks where judicial and legal structures are not strong enough. In such environments like Ghana, information about loan applicants' abilities and willingness to repay is not easily accessible while most of these potential borrowers (loan applicants) do not have collateral to guarantee repayment of loan (Gonzalez-Vega, 2003(a,b); Conning and Udry, 2007). One major function of commercial banks is to offer loans or

credit to borrowers where banks ascertain majority of their income. However, this function leads to a major risk exposure for banks called credit risk denoting the uncertainties that surrounds the borrower's ability and willingness to repay the loan or credit advanced to them (Greenidge and Tiffany, 2010). The above lending function of banks lead to less profitability and higher credit risk exposure in banks especially in developing nations like Ghana. That is, lending in Ghana is a direct juxtapose of the prevailing factors in developing and transitional economies.

Credit Risk has been defined by various authors in different ways. For instance Castro (2013) defines credit risk as the risk a firm is exposed to when a borrower defaults the total or partial repayment of a loan and further alludes that credit risk affect the profits of banks adversely. It is notable that credit risk is one of the major risks that threaten the survival and stability of banks and other lending institutions across the world (Mileris, 2012; Castro, 2013; Louzis, 2012). That is credit risk exposure can lead to bank failures and ultimately economic distress or pressure. Mauds and Pastor (2001) alludes that the stability and continuous existence of banks is tied to the economy of a nation. Studies have revealed that a stable and well- functioning banking system has positive effects on an economy (Schumpeter, 1911; Becks and Levine, 2004; Karbo and Adamu, 2009; Gumra, 2009; Bekuert et al, 2005). Likewise Blundell-Wignall (2008),Merouche and Nier (2010), Liu and Treichel (2012) allude that the recent global financial crisis was caused by banks and other financial institutions as they recorded huge defaults from clients resulting in credit risk exposure. The above gives reasons for putting in place measures to mitigate the credit risk exposure that banks are exposed to in their operations.

From the above, it is not surprising that many attempts including the introduction of credit referencing bureaus (CRBs) to improve the operations of banks and banking systems as a whole (Hartzberg et al 2011;Djankov et al 2007; Brown and Zehnder, 2007; Jappelli and Pagano, 2002;

Galindo and Miller, 2001). Studies have shown that credit referencing bureaus whether public or private helps to improve the lender's knowledge on the borrower (Millers 2003), increasing access to credit (Brown et al 2007; Louto et al., 2007; Cowan and Degregorio, 2003 and Galindo and Miller 2001),reducing interest rates (Love and Mchenko, 2003; Pagano and Jappelli, 1993), reducing default rates (Louto et al., 2007; Powell et al., 2004 and Kallberg and Udell, 2003) and also Stiglitz and Weiss (1981), Louto et al. (2007), Berger et al (2005) and Pagano and Jappelli (1993) all infer that CRBs can increase profitability.

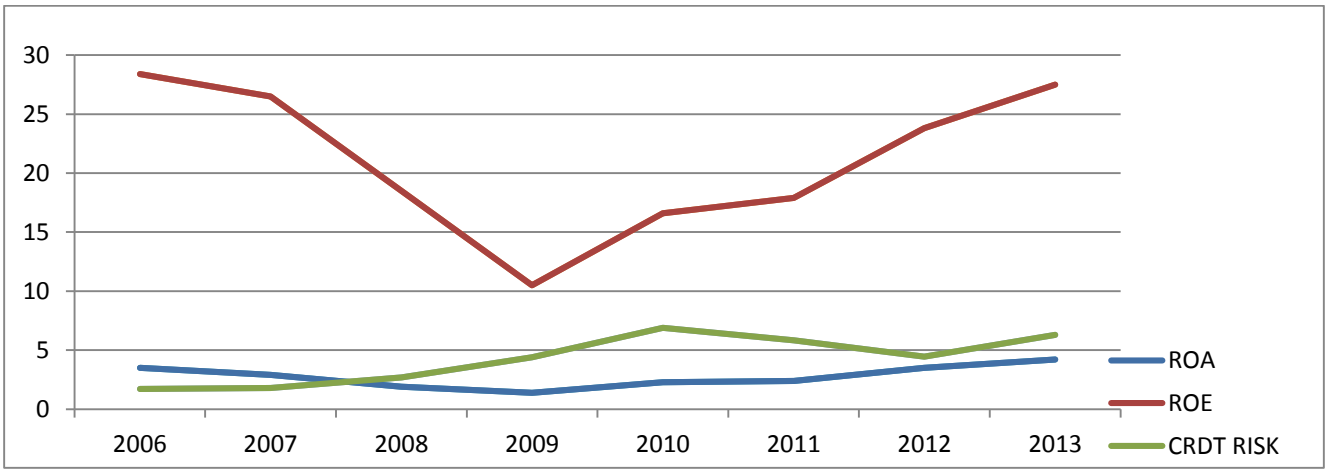
As at 2012, 8 out of 46 countries had established credit referencing bureaus in Sub-Sarahan Africa while 7 out of 19 countries have credit referencing bureaus established in Middle East and North Africa. Also, only two countries (Ghana and Nigeria) in the West Africa sub region have credit referencing bureaus at the time (World Bank, Doing Business Indicators, 2012). The concept of credit referencing was introduced in Ghana in 2007. The Credit Reporting Act (2007), Act 726 which was enacted in 2007, a CRB is a corporate body authorized by Bank of Ghana (BOG) to collect and keep data of credit records or history information, process credit related data and deliver credit reports based fully or partly on information not in the public domain. Seven years after the inception of credit referencing in Ghana, it appears no study has assessed its impact on the Ghanaian banking industry (especially bank credit risk and profitability).

1.2 Statement of the Problem

It is established that CRBs have some effects on banks and economies as a whole (Luoto et al 2007; Galindo and Miller 2001; Gaitho 2013). For instance Brown et al. (2007) reveals that lenders that share information (through Credit Referencing Bureaus) improves access to credit and reduce borrowing cost for firms in transition countries of Eastern Europe and the former Soviet Union. Hahon and Lee (2008) also find that CRB's and for that matter information sharing improves credit

scoring models. Berger and Frame, (2006) infer that CRBs help to improve profitability while Luoto et al (2007) found that CRB's help improve access to credit and also inferred that CRBs can increase profitability. Due to the numerous influence CRBs have on banks and the banking system as a whole, many countries have established CRBs to help improve the operations of the country's banking system. However, this study did not cite any study that examines the impact of information sharing through CRBs on bank profitability.

On the Ghanaian financial scene, the situation is threatening as banks still report huge non-performing assets and low profitability. Thus, records from Bank of Ghana depict that while bank profitability (ROA and ROE) and asset quality (Credit Risk) were on the decline but began to improve after 2010 when CRBs started their operations in Ghana. These trends in the Ghanaian banking industry are illustrated in **Figure 1.1** below:



Source: Bank of Ghana 2006 - 2013
ROE=Return on Equity (Red Series) ROA=Return on Asset (Blue Series);
CRDT RISK= Impaired Loans Ratio (Green Series)

The above occurrences (graphs) in Ghanaian banking industry appear to depict an improvement in the profitability and asset quality after the introduction of CRBs in the industry. However, the

impact of CRBs cannot be established using just a trend analysis as shown above because bank credit risk and profitability are also influenced by other factors. As part of attempts to enhance or improve the operations and functioning of banks in Ghana, the concept of credit referencing was introduced in Ghana in 2007 and the first CRB established in 2008 but operations of CRBs started in 2010. The concept is relatively new in the Ghanaian economy. However, after the inception of credit referencing in Ghana, it appears no study has examined that the impact of credit referencing bureaus on bank credit risk and profitability. However, the study of CRBs in Ghana is justified by a number of reasons. First, studies on CRBs such as Brown and Zehnder (2007), Brown, Jappelli and Pagano (2009), Berger and Frame (2006) and Barron and Staten (2003) were done in advanced countries where street naming and house addressing systems are well done. However, in the context of Ghana street naming and house addressing systems are poorly done making it difficult for banks to adequately and diligently track, monitor and evaluate their clients to recover their loans (principal plus interest) hence leading to high credit risk exposure and lower profitability. Since CRBs can help banks track and monitor their clients, it has therefore become important to investigate the impact CRBs have bank performance (Profitability and Credit risk) in Ghana after their introduction. Second, per World Bank's classification of countries, Ghana is rated as a Lower Middle Level Income country where most people are considered poor. Hence, collateral conditions required by banks cannot be met by most Ghanaians especially the poor but credit worthy bank clients. Since Berger and Frame (200) found in United States that the presence of CRBs helps overcome collateral conditions for banks to advance finance to marginalized individuals, it is therefore imperative to investigate CRBs in Ghana since when the marginalized have access to finance poverty can be alleviated once it is put to good use which can improve the rating of Ghana. Also findings could differ considering the nature or characteristics of bank clients in the context

rating of countries (developed and developing). Third, earlier studies (Behr and Sonnekalb, 2012; Luoto et al., 2007; Berger and Frame 2006) on CRBs have employed dummies and trends before and after introduction of CRBs to establish the impact of CRBs on banks and other institutions. However, this study computes a bank level variable to represent CRBs which is considered to a better measure than the dummies used by earlier studies. This variable of interest is computed to capture the cost of accessing CRB services and products per each bank multiplied by the frequency of usage for each bank. This cost is then divided by the total loans and advances since the bank incurs that cost because of the loans and advances. Hence this study make contribution to the body of knowledge on CRBs by coming up with a new and improved measure for CRBs. Fourth, the impact of CRBs on bank credit had received less attention especially in the African continent (more attention on access to credit, see Luoto et al., 2007). This study employs impaired loan ratios to measure bank credit risk. Chaibi and Ftiti (2015) argue that impaired loan ratio measured as impaired loans divided by total loans to be a better representation of credit risk as it reflects actual credit risk or loss that pertains to a given time period and less used in empirical study. Finally, the study attempts to establish the link between CRBs and bank profitability which is not cited in the literature. From the above it is undoubtedly significant to establish the impact of CRBs on bank credit risk and profitability especially in the context of Ghana. Hence, this study employs impaired loans ratio as a measure for bank credit risk.

1.3 Research Objectives

This study has a broad objective of establishing the impact of credit reference bureaus on bank credit risk and profitability in Ghana. To achieve this broad objective, the study breaks down this broad objective into two specific objectives which includes;

1. To establish the impact of CRBs output on bank credit risk in Ghana
2. To establish the impact of CRBs output on bank profitability in Ghana.

1.4 Research Hypotheses

The study sets two different hypotheses to be tested. First, following studies like Miller (2003), Brown et al. (2007) and Hahon and Lee (2008), the study expects a negative relationship between CRBs and bank credit risk implying that as banks increase their patronage for CRB products and services bank credit risk decreases. It is stated below as:

H_0: There is no significant impact of CRBs on bank credit risk in Ghana.

H_1: There is a negative significant impact of CRBs on bank credit risk in Ghana.

However, this study expects a positive significant impact of CRBs on bank profitability. This implies that as banks employ the services and products of CRBs in their lending function, it increases their chance of recovering their loans and advances in full thereby increasing bank profitability. This hypothesis is set following Klein (1982), Pagano and Jappelli (1993), Padilla and Pagano (2000) and Bennardo, Pagano and Piccolo (2009) as they argue that CRBs put pressure on bank client to promptly and adequately service their loans (which increases bank profitability) for the fear of denial of future credit upon default by other bank. The hypothesis is stated as:

H_0: There is no significant impact of CRBs on Bank profitability in Ghana.

H_1: There is a positive significant impact on bank credit profitability in Ghana.

1.5 Significance of the Study

The study of the impact of credit reference bureaus on bank credit risk and profitability in Ghana has much significance. This study will contribute to the body of knowledge in the area of credit reference bureaus, bank credit risk and profitability. It is clearly noted that although the impact of credit reference bureaus is well researched in Europe, United States and Asia, very little has been done in the context of Africa and for that matter Ghana. Hence this study will lead to more informed knowledge in Ghana and Africa as a whole.

The study will also serve as a guide that will inform policymakers, bank management and management of credit reference bureaus as to how to improve the operations and services of the credit reference bureaus so as to have the maximum benefits from the credit reference bureaus.

For interested researchers in the areas of Credit Referencing Bureaus, Bank Profitability and Credit Risk, this study will serve as a guide for future researchable areas under these broad topics in the context of Ghana and Africa as a whole.

1.6 Chapter Outline

The study consists of five chapters. The first chapter of this study is the introductory chapter. It encompasses background of the study, statement of the problem, objective of the study, research hypothesis, significance of the study and chapter outline.

Chapter two provides an overview of the usage of patronage of CRB products and services in Ghana. In addition, trend analysis of banks performances is reviewed in the light of before and after the introduction of CRBs in Ghanaian banking industry. Finally, the chapter provides an overview of main or key events that transpired during 1988 to 2010.

Chapter three captures both theoretical literature and empirical review of relevant and pertinent issues for adequate understanding of the principles, concepts and theories behind this topic of study. Topics captured in this chapter under the theoretical review are information asymmetry, information sharing and risk and return theories. The chapter also discusses key empirical studies in the areas of bank credit risk and profitability.

Chapter four discusses the research methodology employed. Subtopics that are discussed include research design, population, sampling and sampling technique, data collection, model specification, selection of dependent and independent variables and method of analyses.

Chapter five analyzes, presents and gives interpretations to the data collected for the study through the method applied in chapter three. Findings and results are also discussed in relation to earlier studies in the areas understudy.

Chapter six gives the summary, conclusion and recommendations for the entire research project.

1.7 Chapter Conclusion

In conclusion the chapter sought to provide a clear understanding of the links between the main subjects understudy and the motivations that necessitated the studying of such subjects in the context of Ghana. Again the chapter provided an overview of the entire study and sets the tone for the study to take off.

CHAPTER TWO

2.0 Introduction

This chapter attempts to provide the reader with an overview and history of Credit Referencing Bureaus and the Ghanaian banking industry. The chapter recounts and highlights main events that transpire from 1988 to 2010. The chapter also provides graphs and tables to assess, evaluate and examine the trends in the Ghanaian banking industry.

2.1 Brief History and Usage of Credit Referencing Bureaus in Ghana

The Credit Reporting Act (Act 726) was enacted in 2007 to establish credit reference Bureau (CRBs) to offer legal and regulatory framework to initiate credit reporting in Ghana. The Act is to enable banks share data on their clients or customers through CRBs and defined a CRB as "a corporate body authorized by Bank of Ghana (BOG) to gather and maintain data for credit history information, process credit related data and deliver credits reports based partly or fully on information not in the public domain". In the Act, banks were mandated to submit all their financial operation records to the CRBs present at the time. A year after the enactment of the Credit Reporting Act (Act 726), the first CRB company was established and called XDS Data Credit Referencing Bureau with its roots from South Africa. XDS Data Credit Bureau was given ample time by the Bank of Ghana to gather data from the banks, filter, process, evaluate, maintain and store the output for banking purposes. This was done to strengthen the lending proposition of banks which was clouded with many challenges and difficulties. Finally, the operations of CRBs commenced in 2010 with XDS data being the first and only CRB Company at the time. Until the latter part of 2013, XDS Data Company had enjoyed the monopoly of being the only CRB Company in Ghana. Hudson Price and Dun and Bradstreet Credit Bureau Limited have added to

the number of CRBs in Ghana making a total of three (3) CRBs in Ghana now. The latter two CRBs have presence in Europe, America and some African Countries. This study covers years when XDS Data Credit Referencing Bureau was the only CRB in Ghana.

CRBs for that matter XDS bureau offered five (5) different products to financial institutions within the periods under study (2010 - 2013). The Table 2.1 below presents the five products offered by the CRBs. The five products can be classified into two: consumer centered and business centered products. While the Consumer centered products allow financial institutions to check on the credit worthiness status of individual bank clients, the commercial centered products enable banks to check on credit worthiness of businesses and corporate entities. Consumer and Commercial Detail Credit Products provide information (qualitative and qualitative) that allows banks to trace, track and recover loans administered to individual clients and corporate entities respectively. Also, the Consumer and Commercial Basic Credit provide banks with information (quantitative) that assist in credit administration: appropriate limits credit, length or duration of credit and interest to be charged on consumer and corporate credit respectively. The Consumer Basic Trace only provides information on the demographics of individual clients for banks to know much about the clients they deal with.

Table 2.1: Products Offered by CRBs and their Usage

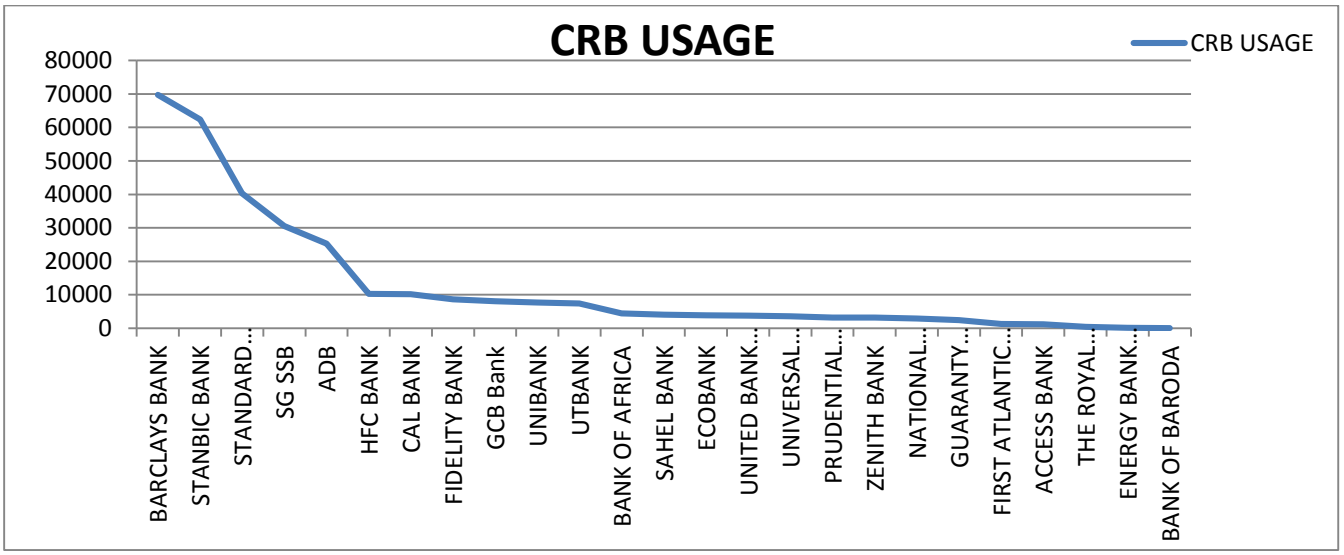
Years	Consumer Basic Credit	Consumer Basic Trace	Commercial Basic Credit	Commercial Detailed Credit	Consumer Detailed Credit	Grand Total
2010	7383	649	5726	23	0	13781
2011	49636	2931	26588	0	1	79156
2012	98693	5215	39366	4931	31291	179496
2013	61140	5141	6330	41782	228794	343187
2014	59504	4887	5636	40566	259241	369834

Source: XDS Data Credit Referencing Bureau

Table 2.1 presents the products offered by CRBs (XDS Data) and their usage by financial institutions (banking and non-banking institutions) from 2010 to 2014. From the table, the overall yearly usage of CRB products has increased from 2010 through to 2014. This is evident from the grand total column. Consumer Detailed Credit Product was not patronized in 2010 and was patronized only once in 2011. But in 2012 Consumer Detailed Credit Product had the third highest patronage and the highest patronage in 2013 and 2014. Although the patronage of Consumer Detailed Credit Product started on a flat foot, it has really picked up very sharply. Consumer Basic Credit Product was patronized 7383 time in 2010 and increased through 2011 and 2012 with a patronage of 49636 and 98693 respectively. There was a decreased from 98693 to 61140 in the patronage of Consumer Basic Credit Product in 2013 and a further decrease from 61140 to 59504 in 2014. Consumer Basic Trace Product saw an increasing patronage from 694 to 2931 and to 5215 in the first three years (2010 - 2012) but has declined continuously (from 5141 to 4887) for the last two years (2013 and 2014).

Commercial Basic Credit Product patronage started as the second highest patronized product for three years running (2010 - 2012) with 5726, 26588 and 39366 patronage for those years. The patronage for the Commercial Basic Credit Product has increased for the first three years but took a nose dive from 6330 to 5636 patronage for 2013 and 2014 respectively. Commercial Detailed Credit Product started with 23 and 0 patronage in 2010 and 2011 respectively. Since then Commercial Basic Detailed Product has increased patronage from 4931 to 41782 between 2012 and 2013 but its patronage declined in 2014 to 40566. On a whole, the table indicate that the patronage of CRB products have seen a considerable increase over the years. It is clear that the consumer centered products are patronized more than the commercial ones.

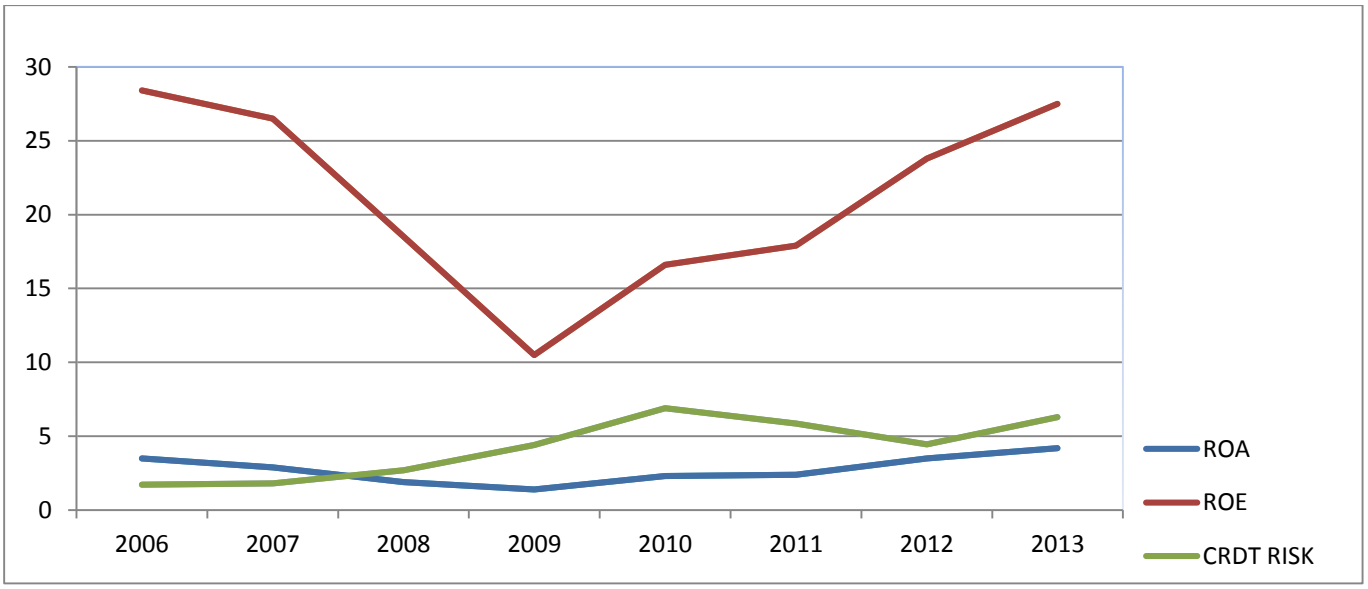
Figure 2.1: Usage of CRB Products by Banks



Source: ***XDS Data Credit Referencing Bureau***

Figure 2.1 presents the frequency of use of CRB products by banks in Ghana from 2010 to 2014. The Figure reads from left to right indicating the banks with the highest frequency of patronage. Thus, Barclays Bank Ghana has the highest frequency of patronage (69696) of CRB products while Banks of Baroda with the least frequency (45) of patronage. From Figure 2.1 it is evident that the first four (4) banks with the highest patronage are all foreign banks. Although foreign banks occupy the top four, the local banks (Ghanaian Banks) dominants the top ten (10) with Agric Development Bank placing fifth in overall and topping the local banks in the patronage of CRB products. The last ten (10) banks with least patronage are five (5) local and five (5) foreign banks. In range of the last ten (10) banks with highest patronage of CRB products, two (2) foreign banks occupy the last two (Energy and Bank of Baroda) slots while two (2) local banks (Universal Merchant Bank and Prudential Bank Limited) occupy the first four slots.

Fig 2.2 Key Industry Performance Indicators: Before and After CRB Introduction



Source: Ghana Bank Survey Reports (2006 – 2013) and XDS Data Credit Referencing Bureau

Figure 2.2 present two key bank performance indicators namely profitability and asset quality from 2006 to 2013 before and after the introduction of CRBs in Ghana. Yearly industrial bank profitability (ROA and ROE) is measured as assets (earnings before interest/total assets) and return on equity (net income/total equity) and asset quality also measured as impaired loans ratio (impaired loans/total loans and advances). As indicated in Fig 2.2, return on equity (red line) sharply declined from 2006 to 2009 and begins to rise after the introduction of CRB in 2010. ROE appears to be on the rise after the introduction on CRB. ROE also appears to have the highest ratio as compared with all the other ratios. Return on Assets (ROA) (blue line) also declined marginally from 2006 to 2009 and began to pick up in 2010 when CRBs are introduced in the banking industry. As shown above after the introduction of CRB, ROA continues to rise moderately. From the Fig. 2.2, it is observed that credit risk measured as impaired loans rises marginally from 2006 to 2007 and further rises quite sharply between 2008 and 2009 but begins to decline from 2010 to

2012 after the introduction of CRBs. However, impaired loans ratio increased between 2012 and 2013 where CRBs were in existence.

2.2 Industrial Rating and Coverage of CRBs (Information Sharing) in Ghana

World Develop Indicators (WDI) measures the depth of credit information sharing index in both developing and developed countries. WDI measures credit information sharing index by looking at "rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. The index ranges from 0 to 8, with higher values indicating the availability of more credit information, from either a public registry or a private bureau, to facilitate lending decisions" (www.worldbank.com).

Although CRBs were introduced in Ghana in 2008 and started operations in 2010, the WDI index for measuring information sharing through CRBs started in 2012. In 2010 and 2011, the information sharing index for Ghana was zero (0) indicating the lowest information sharing index. However, the index jumped from zero (0) in 2011 to five (5) in 2012 and further increased from five (5) to six (6) in 2013 and 2014; implying an improvement in the information sharing index. As it stands now, all the banks and non-banking financial institutions are mandated to submit records on their operations to the CRBs by Bank of Ghana. Ghana Banking Survey (2011) also states that over 80% of the Ghanaian population was unbanked at the time. Since these financial institutions are mandated to submit their records to the CRBs, one can infer that CRBs covered about 20% of Ghana's population as at 2011. However, Bank of Ghana anticipate that about 70% of the Ghanaian population is unbanked in 2013 and hence CRBs cover about 30% of the Ghanaian population in 2013 by inference (The Report, 2013). WDI indicates that credit referencing bureaus coverage in Ghana covers only 10% of the adult population in the country.

2.3 Overview of the Ghanaian Banking Industry

Most public sector banks were declared insolvent in the 1980's with about 41% non-performing loans attributable to the private sector (Kapur et al., 1991). This period also witnessed numerous prudential banking reforms in Ghana and many developing economies; spearheaded by World Bank. Since then, the Ghanaian banking industry has witnessed many major developments and reforms geared towards improving banking or financial institutions operation. These reforms as per Ghana Banking Survey (2008 and 2009) includes the Banking Law, 1989 (P.N.D.C.L. 225), Bank of Ghana Act, 2002, Act 612, Universal Banking License was introduced, the Banking Act, 2004a,b (Act 673), Foreign Exchange Act 2006 (Act 723), whistle blowers Act 2006 (Act 720), secondary reserve requirement (15%) was abolished, the Banking Amendment Act 2007 (Act 783), Credit Reporting Act 2007 (726), redenomination of the Cedi, National Reconstruction levy abolishment, Non-Bank Financial Institution Act, 2008 (Act 774) Home Mortgage Finance Act (Act 770), Borrowers and Lenders Act (Act 773) and Anti-money Laundering Act (Act 749), introduction of cheque code-line clearing system and meeting of minimum capital requirement by foreign banks were the key milestones achieved in 2009.

The Banking Law (P.N.D.C.L. 225) was revised in 1989 under the Financial Sector Adjustment Program (FINSAP I). Some of the new provisions in the Act included placing limits on risks exposure; capital adequacy ratio of 6%; setting uniform accounting standards and expansion of auditing scope and strengthening both on-site and off-site supervision of banks by the Bank of Ghana. The supervisory powers of the Bank of Ghana were enhanced with the revision of the Bank of Ghana Law (P.N.D.C.L 291) in 1992. In 2002, the Bank of Ghana Act 612 led to the establishment of the Banking Supervision Department responsible for the supervision and examination of all banking institutions in the country to strengthen the regulatory capacity of the

Bank of Ghana. The supervision of the banking and credit system was to ensure adherence to prudential banking reforms by Ghanaian banks. The universal banking introduced in 2003 enabled banks to operate outside their core or principal area of operation. This meant that banks could take on activities outside their functional area. This then broke the functional banking system where banks were to operate within a specified or specialized function or activity (commercial, merchant, development). This is view as a means to promote competition and enhance effectiveness and efficiency. The Banking Law, 1989 (P.N.D.C.L. 225), was replaced by Banking Act, 2004a,b (Act 673) to promote an effective banking system. The regulations in the Act covered the licensing of banks, capital requirements, liquidity, ownership and control, restrictions on lending, supervision and control and accounts and auditing. A notable reform in the Act was the increase in the minimum capital adequacy ratio from 6% to 10%. The Banking Amendment Act (2007), Act 738, replaced the Banking Act (2004) with an additional function of ensuring the soundness and stability of the financial system in Ghana and also the establishment of offshore banking and other offshore financial services such as insurance and leasing with a focus of positioning Ghana as the regional hub for financial activities in Africa and to attract diaspora investments. The Cedi redenomination cannot go unnoticed in 2007. The redenomination was to foster trade in conveniently carrying money and easy long queues in the banking hall. In this year the credit reporting act was passed to enable banks and other financial institutions share information on borrowers in the quest to reduce information asymmetry which is perceived to be the cause of huge nonperforming loans. The Borrowers and Lenders Act (Act 773) is to ensure high level disclosure in creditor and borrower relations. It aims to give clarity to lending conditions and rights and obligations of lenders and borrowers. Non-Bank Financial Institution Act (Act 774) is to provide a framework to provide effective prudential regulation and supervision of the wide range of

nonbank financial institutions. Home Mortgage Finance Act (Act 770) is to regulate home mortgage financing and applies to transactions between financial institutions and their customers (mortgagor) to finance the construction, purchase, completion, extension or renovation of residential property either for ownership, sale or rental. Anti-money Laundering Act (Act 749) seeks to prohibit money laundering and establish a Financial Intelligence Centre. Under the Act, a person commits the offence of money laundering if they knowingly convert, conceal, disguise, transfer, take possession of, or use property forming part of the proceeds of unlawful activity. 2009 also saw the introduction of the Cheque Code-line Clearing System which is to shorten the number of days cheques used for payments are settled. The Ghana Inter-Bank Payment and Settlement systems (GhIPSS) introduced the "cheque code-line clearing system." This system seeks to clear all cheques throughout the country within 48 hours, instead of the three days to three weeks. The improved efficiency in clearing is expected to encourage the use of cheques and reduce the use of cash. As evidenced from the above mentioned developments and reforms, most of the regulations have sought to ensure adherence to best baking practices and consequently a "risk free" banking system in Ghana.

The Ghanaian banking industry is relatively small consisting of 27 banks as of May, 2011. Of this number, fourteen are foreign banks (banks with foreign majority ownership) and thirteen local banks (banks with local majority owner). The banking system is based on the concept of universal banking where banks can offer all banking services. Some specialized banks have sprung up in the past only to be metamorphosed into banks.

The banking industry has also witnessed the proliferation of electronic banking products such as internet banking, Short Message Service (SMS) banking, and other innovative electronic based services to facilitate online transactions and enquiries. There have been collaborations between

some banks and telecommunication firms to fashion products to meet the needs of customers. While these platforms come with delightful products, adding value to banking services, it may also pose some risk of fraud if these platforms are not secured. The volume of online transactions would determine whether failure in these systems would have systemic impact on the industry as a whole. Bank of Ghana would have to foster information security policy and best practices to ensure that the banking public is protected. Amidst all these complexities, the industry is expected to remain buoyant with increase in foreign direct investment, the new oil find and improved budget deficit.

The phenomenal growth in the industry, coupled with expansion in branch network, and reinjection of capital across the spectrum of the industry have not succeeded in reducing the high interest rates. The industry still operates in a high interest rate regime despite attempts by Bank of Ghana in reducing the policy rate to which the interest rates have been egged. Commercial banks are expected to change their lending rates in response to change in the policy rate by the Monetary Policy Committee of Bank of Ghana. The high interest rate may account for the business and financial risk, market power or inefficient management in the sector. An empirical study may help answer these questions. The capital re-injection may improve the margin of protection for risk absorption. However, new regulation would continue to add to the complexity of the business environment. The new Basel Capital Accord (Basel II) which is expected to be operational in 2011 will constitute the most significant change to banking supervision. Under the Basel II Accord, a bank's capital requirement is based on their risk profile.

Table 2.2 Summary of Major Events in the Ghanaian Banking Industry from 1988 to 2010

Year	Major Events
1988	Private banks are authorized to operate. Decontrolled the minimum banks savings rate.

	Removed of sectoral credit controls except for agriculture. Established foreign exchange bureaus.
1989	Enacted new banking law to strengthen the regulatory environment and supervisory authority of the Bank of Ghana in the following areas: minimum capital requirement, disclosure, and prudential lending guidelines.
1990	Liberalisation of commercial banks interest rates and bank charges. Abolition of credit controls including credit allocation by sector. Non-performing loans of state enterprises in three financially distressed state owned banks are replaced by Bank of Ghana bonds Abolition of lending targets for the agriculture sector. Non-performing loan of private sector in three financially distressed state-owned banks are replaced by Bank of Ghana bonds. Restructuring of six financially distressed banks.
1991	Non-performing loans of private sector in four sound banks are replaced by Bank of Ghana bonds.
1992	New Bank of Ghana law is enacted to offer stronger supervisory and regulatory powers to the Bank of Ghana.
1995	Sale of 30 percent of government shares in Social Security Bank after merging with National Savings and Credit Bank: only 21percent was subscribed. Placement of 60 percent of the capital of the Social Security Bank through the Ghana Stock Exchange.
1996	Sale of 30 percent of government shares in Ghana Commercial Bank through the Ghana Stock Exchange; after oversubscription the public offer was raised to 42 percent.
1998	Government sold three quarters of the remaining 40 percent shares it held in Barclays Bank.
2000	Closure of three insolvent banks: Bank for Housing and Construction, Cooperative Bank and Bank of Credit and Commerce and transfer of guaranteed deposits.
2002	Bank of Ghana Act (2002) was passed to give independence to the central bank, Bank of Ghana, making price and financial stability as its primary function. Introduction of Real Time Gross Settlement (RTGS) System also known as the Ghana Interbank Settlement System.
2003	The universal banking license was introduced and as a result Bank of Ghana issued a directive requiring all banks to increase their minimum stated capital requirements to GH¢7million by the end of 2006 from GH¢20thousand. Maintenance, transaction, and transfer fees charges by commercial banks were abolished. The Payment System Act (2003) gave explicit powers to the Bank of Ghana to oversee payments system.

2004	Banking Act 2004 replaced the Banking Law 1989. Bank of Ghana began to strengthen its risk based prudential supervision policies. In addition, the minimum capital adequacy ratio was increased from 6% to 10%. Bank of Ghana introduced a paper-based credit clearing system.
2006	Foreign Exchange Act 2006 – to liberalise inflows of foreign exchange into Ghana for foreign direct investment purposes. Abolition of secondary deposits reserves requirement (15%) by banks.
2007	Banking Amendment Act 2007 – to allow Offshore banking; to enable establishment of international financial services in Ghana. The Credit Reporting Act (Act 726) was enacted to establish credit reference bureau to offer a legal and regulatory framework for credit reporting in Ghana. The International Financial Reporting Standards (IFRS) was introduced and all banks were to report their financial position and performance in accordance with IFRS. Implementation of risk-based supervision of banks. Re-denomination of the Cedi.
2008	The Anti-Money Laundering Act, 2007 (Act 749) enacted to provide structure for criminalizing money laundering. The Borrowers and Lenders Act (2008) was enacted to provide a framework for full disclosure in creditor and borrower relations and in particular the role of collateral in the delivery of credit. Operation of a common electronic platform, the National Switch (e-zwich) and a biometric smartcard.
2009	The ChequeCodeline Clearing (CCC) was introduced which reduced the cheque clearing period from 5 – 8 days to 2 days throughout the country. Minimum capital requirement was increased from 7 million cedi to 60 million cedi in order to strengthen the capital base of the banks to enable them assume greater levels of risk. Mobile payment services were authorized and launched.
2010	Commencement of electronic direct credit transfer system a component of the Automated Clearing House project.
2011	Requirement to maintain the statutory reserve requirement of 9% in Ghana cedis only
2013	Increase in the reserve requirement and monetary policy rate to 10% and 16% respectively
2013	Requirement for a minimum stated capital of GH¢120 million for banks.

Bank of Ghana Annual Reports, Ghana Banking Survey and International Monetary Fund Country Reports.

2.4 Conclusion

The chapter provided an overview of the CRBs and the banking industry in Ghana as whole. It is recognized that after the introduction of CRBs in Ghana, bank performance indicators such as ROA and Credit risk have all improved using a trend analysis. Again the chapter took account of main event that happen in the banking industry which were all meant to enhance the operations of the banking industry.

CHAPTER THREE

LITERATURE REVIEW

3.0 Introduction

The literature review chapter has three main sections. The first section looks at the theoretical concepts and models that back or support this study in order to fully comprehend the subject area of this study. The second section then looks at the relevant empirical contributions of earlier writers in the area of study and their findings so as to know what other writers have done and position this study to be different and make meaningful contribution to the subject matter.

3.1 Theoretical Concepts and Models Review

This study is backed by the theories of risk and return, information asymmetry and efficient market hypothesis. Each of the theories is explained and its relevance to the study is stated.

3.1.1 Information Asymmetry

Information asymmetry theory was initiated by Freimer and Gordon (1965) and later extended by Stiglitz and Weiss (1981). In the seminal paper of Stiglitz and Weiss (1981) they highlight that discontented agents are borrowers and this leads to credit rationing as lenders cannot distinguish between high quality and low quality borrowers. Nevertheless, this dominant view has not been without criticisms. De Meza and Webb (1987) in particular vigorously contest Stiglitz and Weiss (1981) results. De Meza and Webb (1987) argued that asymmetric information in credit market may lead to an excess of credit (over lending). Banks can diligently screen and monitor borrowers more efficiently than other investors can (Allen and Santomero, 1998). Freixas and Rochet (1999)

also state that banks are specialist (experts) in gathering private information and treating it. Banks in the quest of managing money and deposits accounts require greater strategic information on the firms' finances (receipts and expenditure) and how the firm is growing and developing (Diamond and Rajan, 2000). In spite of this excess of information, exchange of information between bankers and firms are not perfect. Banks suffer from informational asymmetries (Freixas and Rochet, 1999) such that development of prices (interest rates) cannot clear the credit market.

One interesting type of credit rationing is equilibrium rationing where the financial market has totally adjusted to the general public. That is why banks ration credit free, accessible information and demand for cost of loan (interest rate) for some market greater that supply. Stiglitz and Weiss (1981) argue that rationing of credit is adopted by banks because banks are unable to differentiate its borrowers (good and bad borrowers) because selecting borrowers is costly, hence a flat interest rate is charged for all kinds of borrowers. These assumptions are too simplified and hardly occur as explained above in the actual world circumstances. That is, banks encounter more than two types of borrowers as explained above and that banks are normal able to differentiate borrowers up to a certain limit (partial differentiation). Hence, banks charge different interest rates to different borrowers. Although high risk borrowers are charged high interest rates and credit rationing is less likely, banks cannot perfectly differentiate borrowers and screening them perfectly is not realistic.

Stiglitz and Weiss (1981) propose that adverse selection and thus credit rationing still occur because banks require collateral. They further argue that low-risk borrowers anticipate low rate of return on the average. Hence, low risk borrowers are less wealthy (lack collateral) than high-risk borrowers. This implies that low-risk borrowers are more likely not to be able to provide collateral. Hence the increasing demand for collateral by banks may have the same adverse selection effect as high interest rate. Bester (1985) also stipulated that banks only offer contracts (loan or credit

contracts) that have floating interest rates and collateral conditions because they (banks) want to reduce the occurrence of credit rationing

3.1.2 Information Sharing Theory

Studies on information sharing are quite recent and growing. Prior studies examine the effect of information sharing in the credit market based on asymmetric information either through adverse selection or moral hazard (Gehrig and Stenbacka, 2007). In the set of Moral Hazard, two main assumptions are made. First, information sharing presents borrowers with higher motivation to perform because information is accessible to all banks and lenders, hence borrowers are glad to perform because they (borrowers) no longer fear being held up by one lender (Padilla and Pagano, 1997). Second, borrowers have a disincentive to default because through information sharing default with one lender becomes known to other lenders and this will attract higher interest rate or at worst denial of credit by other lenders in the future (Padilla and Pagano, 2000)

Furthermore, information sharing may also resolve the problem of adverse selection within the banks where banks and lenders take advantage of already existing database on the records of borrowers to enable them select or classify good borrowers from bad ones to reach a good lending decision (Padilla and Jappelli, 1993 and Padilla and Pagano, 2000). This increases the predictive power of banks and lenders enabling them know what interest rate to charge to each individual borrower, the duration conducive for the borrower in question and other terms and conditions. From the assertion of Stiglitz and Weiss (1981), information sharing in the adverse selection model enables banks to take advantage of already existing database on borrowers which comes at a cheaper cost compared with the traditional approach where banks would have to examine and evaluate borrowers by deploying and employing resources (monetary and human) to search for

data on each borrower in order to adequately screen and select only good borrowers. They further argue that banks charge a flat interest rate to different types of borrowers because it is costly to differentiate types of borrowers. Hence this reduces the information rent to banks (Hauswald and Marquez, 2003). However, Gehrig and Stenbacka (2007) suggest that information sharing has a darkside where if both black and white information is shared among lenders. This according to them leads to welfare losses. Hauswald and Marquez (2003) illustrate that banks or lenders that have the ability to acquire and process borrower information have advantage of information rent which will safeguard those banks from competition and provide them with effective and efficient screening processes. This imply that, where banks have access to the same borrower information there is a level playing ground for all banks and lenders and no bank or lender can take advantage of cost of investigating borrowers to make excess return. Thus, information sharing enhances efficiency and leads to healthy competition.

3.1.3 Moral Hazard Theory

Moral Hazard refers to the probability that a party to a contractual agreement has not entered the agreement in good faith, has presented misleading information (incomplete or untrue information) about its liabilities, assets or credit capacity or has a motivation to take more than normal risk in a desperate attempt to make profit (Myerson, 1991). Myerson (1991) provide evidence that moral hazard in banks and other financial institutions were the root cause of the recent financial crisis. Put differently, moral hazard is the tendency that a fund receiver (borrower) may not employ the fund received for the agreed purpose or assume unnecessary risk after receiving the funds. Moral hazard fundamentally projects the change in behavior in terms of risk decision taking since the losses that arise to the other party to the contract. Theories that explained information economics in relation to moral hazard was not in existence but was first developed in 1970's as a result in

building or improving the game theory (Freixas and Rochet, 1997; Myerson, 1991; Kreps, 1990; Aumann, 1987)

Freixas and Rochet (1997) stated that in modern times banks rely on information economics which were not considered or available under the traditional Keynesian and monetarist theories. As economist are faced with the quest for deeper insights into factors that drive macroeconomics instability, there should be a need to consider novel models that can apply to the microeconomic and macroeconomic theories of banking in the business cycles which is a major function of human behavior (moral hazard). Contemporary microeconomic theory of performance in financial institutions require banks to crucially identify, examine and evaluate client behavior (moral hazard) since it seriously impact bank performance (including bank profitability and credit risk) (Freixas and Rochet, 1997).

3.1.4 Adverse Selection Theory

Stiglitz and Weiss (1981) originate the theory of adverse selection theory of credit markets. The theory depends on two main assumptions. First lenders cannot differentiate between the risk levels or appetite of borrowers. Second that credit contracts are subject to limitations. That is where project proceeds are less than debt responsibilities; the borrower has no responsibility to pay out of his own pocket. This examination is limited to involuntary default and presumes that borrowers pay back loans if they have the means to do so. A debt contracts between lenders and risk-neutral a borrower where limited liability of borrower is present imparts a favorite for risk among borrowers, and an equivalent aversion to risk among lenders. That is, the presence of limited liability of borrowers imply that lender must do due diligence before advancing credit because he (the lender) bears all the downside risk. Put differently, all gains above the loan repayment

obligation accrue to the borrower and hence increasing the interest rate will then affect the gains (profits) of low risk borrowers (because they anticipate lower return) disproportionately, causing them to drop out of the application group. The resultant effect of this is adverse compositional effect (implying that increase in interest rates causes the average riskiness of the average applicant pool to be rejected giving the chance to only borrowers who can potentially generate high gains or returns). Since lenders prefer to overestimate risk contrary to borrowers, lenders keep interest rates below the equilibrium (market-clearing point) to ration borrowers to attain that are better composition and lower risk in their loan portfolio. Hence, demand for credit in the credit market will exceed supply (due to interest rate held below equilibrium) and may continue even in the presence of flexible interest rates and competition. In the adverse selection theory, an increase in interest rates might not ensure that all applicants of loans or credit secure credit especially in times where loanable funds are inadequate. Borrowers with greater wealth may put in collateral to guarantee cheaper credit and also serves as an incentive to work hard and generate more income. Considering the disparities in assets within the borrowing class, it may lead to persistent poverty. By exchanging credit information among banks it can help improve the banks knowledge of applicants' characteristics and behavior. In theory, the reduction in information asymmetries through credit information sharing among banks can reduce the banks probability of selecting bad borrowers in the lending process and also create the incentive from borrowers to repay their loans.

Pagano and Jappelli (1993) showed that sharing information by lenders reduces adverse selection by improving information on credit applicants or borrowers. They assert that information exchange helps to assess the quality of non-local credit seekers, and lend to them as safely as they do with clients. Information sharing can also create incentives for borrowers to perform in line with banks' interest. Klein (1982) also shows that credit information sharing among banks and lenders

increases the borrowers' motivation to repay loans in settings where the legal system makes it complex for banks to enforce credit contracts. In this model borrowers repay their loans or credit because they (borrowers) do not want to be blacklisted by lender which leads to future denial of credit extension.

3.1.5 Risk and Return Theories

Theories on risk and return projects that risk or return as an output results from diverse sources that can be classified main into micro (unsystematic or firm specific) and macro factors (systematic). For instance, the Capital Asset Pricing Model (CAPM) shows the relationship between risk and expected (required) return as a function of risk-free (represented as government treasury bills) and a premium base on the systematic risk. The higher the systematic risk, the higher the return investors require on their investment. The underlying logic behind this model and its relevance in this study is based on the fact CAPM views the total portfolio risk or return as a function of systematic risk and unsystematic risk. The systematic risk is attributable to factors that affect the market as a whole such as government policies, changes in the economy and the political climate. The unsystematic risk is specific to a particular company such as industrial relations, quality of firm's management or a new competitor in the industry. Systematic risks cannot be avoided through diversification. However, unsystematic risk can be eliminated or reduced through diversification. Although the Capital Asset Pricing Model describes the Capital Asset Pricing Model (CAPM) describes stock and portfolio risk, it can be adopted and applied to firms. It proposes that when the market is at equilibrium, a security is expected to provide return commensurate with its systematic risk. Investors should not be rewarded for unsystematic risk as it presumes that rational and risk-averse investors will diversify the unsystematic risks. The Capital Asset Pricing Model (CAPM) has not gone unchallenged. It takes a very simplistic view of the

relationship between risk and return neglecting the effects of market imperfections (industrial factors). As a result of these challenges it does not reflect the reality in the market. The Asset Pricing Theory (APT) extends the idea of the Capital Asset Pricing Model. This theory asserts that in a competitive market arbitrage will assure equilibrium pricing according to risk and return. The security expected return is the risk-free rate plus risk premiums for risk factors which are uncertain (Horne and Wachowicz, 2008). The notion is the same as that of the Capital Asset Pricing Model with the exception the APT assumes multiple risk or return factors. These models are relevant because the study following these theories employs micro (unsystematic), industry, macro (systematic) determinants of credit risk exposure and profitability.

3.2 Empirical Literature Review

This section reviewed earlier studies that have been done in the areas of information sharing through credit referencing bureaus, bank credit risk and profitability. It enables us to know what earlier researchers have done to enable us position the study to be distinct from existing ones.

3.2.1 Information Sharing Empirical Review

Credit referencing bureaus (private or public) are responsive mediums to information asymmetry problems between borrowers and lenders in the credit market. A Credit Referencing Bureau can either be privately or publicly owned entity that collate and process information on borrowers or credit from lenders to assist lenders make informed lending decisions. Studies have proven how complete information sharing helps lenders better their predictive power on borrower default. Kallberg and Udell (2003) illustrated that historical information collated by credit bureaus have powerful default predictive ability. Barron and Staten (2003) also provide evidence that lenders can significantly reduce default rates by involving more complete and in-depth borrower

information in their predictive models. Again, Powell et al. (2004) employ banks in Brazil and Argentina and found similar results indicating that more information sharing leads to reduced default rates. Pagano and Jappelli (1993) reveal that information sharing reduces or counters adverse selection. That is information sharing among lenders allow loans to be advanced to good borrowers who would not have received loans or credit where banks or lenders did not share credit information on borrowers. This leads to increased aggregate lending in the credit market. Reducing moral hazard through Credit-sharing institutions can raise the borrowers' cost of defaulting loans or credit thereby increasing loan repayment by borrowers (Padilla and Pagano, 2000). Equally, credit information sharing has an added advantage of reducing information rent (information monopoly) to lenders in an attempt to screen, evaluate and monitor borrowers. For instance banks with longer-standing relationships with borrowers have their credit history which other banks and lender would not have. This gives the bank the advantage to charge higher interest rates and extract fees from good borrowers because other banks do not have that information and would cost the other banks to acquire such information (Padilla and Pagano, 1997). Bennardo, Pagano and Piccolo (2009) show that over-indebtedness can be reduced through sharing of credit information among lenders and banks as individual borrowers classified as highly indebted receive less credit and eventually reduce over-indebted borrowers.

Despite theory is uncertain on the impact of information sharing on the credit market, empirical evidence suggest numerous of evidence in support of the claim that sharing credit information has a positive effect on lending to the private sector. For example, Jappelli and Pagano (2002) prove that lenders that share credit related information increase the size of the credit market. Jappelli and Pagano (1993), Galindo and Miller (2001), Love and Mylenko (2003) and Powell et al. (2004) have all shown that the credit market can be expanded through sharing credit related information

by lenders. Brown, Jappelli and Pagano (2009) indicate that credit information sharing leads to increased and cheaper credit in transition countries in Eastern Europe. They show that credit related information sharing is associated with higher ratios of private credit to gross domestic product. In the United States, Berger and Frame (2006) demonstrated that information sharing increases quantity of small business loans and also extended credit to marginal borrowers.

Empirical evidence supports the theory that information sharing reduces moral hazard. For instance, Doblas-Madrid and Minetti (2013) proved that credit information sharing borrowers improve their repayment performance as delinquent repayment decreased. Brown and Zehnder (2007) empirically established that the credit market would collapse in the absence of credit information sharing and reputational banking. Their study further suggested that information sharing encourages borrowers to honor their loans thereby allowing lenders to identify borrowers with good credit history. Studies suggest that information sharing positively influence the credit market in two ways. First, without information sharing through credit referencing bureaus borrowers had a motivation or tendency to repay credit or loans only when they planned to maintain their present lending relationship. However, in economies with credit information sharing lenders, borrowers had a higher chance of honoring their loans to continue or keep their current lending relationship. That is, lenders have the chance to record and share borrower information which can positively impact borrower repayment. Second, information sharing reduces the information monopoly of a lender on its borrowers, thus decreasing the extra fees which lenders may charge borrowers of clients.

For instance, Doblas-Madrid and Minetti (2013) demonstrated that after lenders begin to share credit related information, lender were most likely to advance smaller and short term loans suggesting indirect evidence that credit information sharing allows lenders to know the complete

indebtedness of borrowers and appropriately reduce or deny highly indebted borrowers. Also Brown and Zehnder (2007) points out that information sharing helped lenders to reduce or avoid severe short term loss from borrowers.

While the effect of information asymmetry between borrowers and lenders has long been revealed by Stiglitz and Weiss (1981), it was recently that the effect of specific institutions in reducing asymmetry has been formally modeled. Pagano and Jappelli (1993) formulated a theoretical model to explain that information sharing by lenders is driven mostly by better information processing, mobility of borrowers and size of the credit market. They proved that the predictions of the model are consistent at a cross country level. The finding of Kallberg and Udell (2003) which state that information sharing is a robust predictor of business failure among U.S.A retailers. They employed data from Bradstreet, a privately run information sharing institution. Barth et al. (2009) also proved that information sharing helped reduce bank corruption. Djankov et al. (2007) employed macro level data and found that private credit is enhanced when there is a credit sharing information system in place. Their finding is consistent with Jappelli and Pagano (2002) who showed that credit information sharing through credit referencing bureaus increases bank lending and reduces default rates. Singh et al. (2009) similarly finds that the presence of credit referencing bureaus in sub-Saharan African reported higher levels of credit to private sector as a share of gross domestic product. Love and Mylenko (2003) used firm level data and revealed that the presence of credit referencing bureaus were associated with lower constraints to accessing finance or credit.

The ultimate test of the functioning of the credit market is whether credit-constrained firms are able to access finance when they need it. At the macro level, Djankov et al. (2007) found that private credit is enhanced by the presence of both credit referencing bureaus (private or public) across the 129 countries covered over 25 years in their sample. This result is consistent with

Jappelli and Pagano (2002), who showed that information sharing through Public Credit Registers (PCRs) and Private Credit Bureaus (PCBs) increases bank lending and reduces. Likewise, Singh et al. (2009) show that countries from sub-Saharan Africa that encourage credit information sharing report higher levels of credit to the private sector as a share of GDP. Using firm-level data, Love and Mylenko (2003) found that while the presence of PCBs is associated with lower obstacle to access finance, there is no such relationship in the case of PCRs. As pointed out by the authors, this finding does not conclusively show that PCBs have a causal effect on lower access to finance or that PCRs are ineffectual. PCBs are unlikely to be exogenous, as is obvious from predictions of Pagano and Jappelli (1993). For instance, the presence of a PCB is likely determined simultaneously with greater financial development, which can account for its positive relationship with firms' access to finance.

3.2.2 Types of Information Sharing Institutions: Public Credit Registers and Private Credit Bureaus

Although all private credit bureaus and public credit registries make available credit information to assist in reducing information asymmetry between borrowers and lenders, the extent to which this can be attained depends on their design and regulation. For instance, Galindo and Miller (2001) formulated a scalar index (briefing several features of their design) to cover the extent to which credit registries help reduce information asymmetry. Their findings suggest that credit registries have finer details on credit transactions (less disaggregated), gathered both negative and positive payment records and faced less regulation on their ability to share credit information to financial institutions tend to reduce financial constraints in middle and high income countries. As discussed in the earlier sections theory suggest that both Private credit bureaus and Public credit registries are perfect substitutes, empirical evidence suggests that private credit bureaus are more effective

and efficient. Below are some basic differentiating factors between private credit bureaus and public credit registries.

Table 3.1 Key Differences between Information Sharing Institutions: Private Credit Bureaus (PCB) and Public Credit Registries (PCR)

	PCR	***PCB***
Purpose	Banking supervision	Sharing of credit information to help lenders take informed decisions
Coverage	Mainly large corporate. Limited in terms of history and type of data provided.	Large corporations, SMEs, individuals. Longer history and more rich data provided.
Ownership	Government or central banks	Government/central banks, lenders, lenders' associations, independent third parties
Status	Not for profit	Mainly for profit
Data sources used	Banks and non-banks financial institutions	Banks, non-banks financial institutions, PCRs, tax authorities, courts, utilities
Access	Restricted to information providers	Open to all types of lenders

Sources: Pagano and Jappelli (1993), Jappelli and Pagano (2002), Miller (2003)

3.3 Bank Credit Risk Empirical Review

Credit Risk is one of the main risks in commercial banking business and the ability to manage it can immensely contribute to the stability of banks (Mileris 2012). DeGuimaraese Souza et al (2011) assert that higher levels of credit risk can be harmful to banks, the financial system and ultimately the entire economy. Credit risk remains a main component for determining bank spread and it's better management translates into how cost of borrowing (interest rate) and adequate supply of loans for improved economic performance. Due to the important nature of credit risk in banks as discussed, many studies have been conducted in the area of credit risk determinants. Bank credit risk is popularly proxied in empirical literature as Provision for Bad Loans ratio (PBL), Nonperforming loans ratio (NPL) and impaired loans ratio (IML) (De Guimaraes Souza et al.,

2011; Aver, 2008; Hasan and Wall, 2003; Castro, 2013; Chaibi and Ftiti, 2015; Louzis et al., 2012; Mileris, 2012; Otker-Robe and Podpiera, 2010). Findings on credit risk have varied across financial institutions, countries and continents.

Alhassan, Kyereboah-Coleman and Andoh (2014) employed micro and macro determinants of credit risk in examining asset quality in financial crises period in Ghana from 2005 to 2010. They employ a dynamic panel data regression of twenty-five (25) banks and found that credit risk persistence, loan growth, bank size, bank market structure, real exchange rate, inflation and GDP growth were the significant determinants of credit risk. Salas and Saurina (2002) also combine bank specific and macroeconomic variables to explain Non Performing Loans (NPL) in Spanish Banks for the period of 1985 to 1997. They focus on the NPLs' determinants for savings and commercial banks and found that bank specific determinants may give an earlier indication for NPL changes in the future. Zribi and Boujelbene (2011) also make use of micro and macro variables that are probable to explain credit risk. They employ a panel model for Tunisia commercial banks over the period of 1995 to 2008 and concluded that ownership structure, capital regulation, profitability, nominal exchange rate, interest rates and GDP growth were significant determinants of credit risk. Similarly, Louzis et al. (2012) investigates NPLs in the Greek banking industry for different categories of loans (corporate loans, consumer loans and mortgage) from 2003 to 2009. The reveal that NPLs are explained by macroeconomic variables such as unemployment rate, real GDP growth, interest rates, public debts. However, they find other bank specific variables such as performance and efficiency indicators to explain NPL at the bank level. Similar but earlier studies to that of above authors include Clair (1992) and Gonzlez-Hermosillo et al. (1997).

However, several studies have investigated the influence of macroeconomic conditions on loan problems (credit risk). In particular we find Castro (2013), Festic et al. (2011), Ali and Daly (2010), Berge and Boye (2007) and Rinaldi and Sanchis-Arellano (2006) to have exploited the impact of macroeconomic conditions on credit risk. For instance, Rinaldi and Sanchis-Arellano studied the household debt sustainability of seven (7) European countries namely; Belgium, Finland, France, Italy, Ireland, Spain and Portugal. They provide empirical evidence that unemployment, disposable income and monetary environment conditions have strong impact on bank credit risk. Berge and Boye (2007) also finds that real interest rates and unemployment were highly sensitive to loan problems using the Nordic banking system over the period of 1993 to 2005. Ali and Daly (2010) performs a comparative investigative analysis on macroeconomic variables and its impact in the US and Australia. They reveal that the same set of macroeconomic variables explained different default rates although the case of the US was more sensitive to undesirable macroeconomic shocks. With the aim of assessing the banking sector's exposure to credit risk (bad loan performance) in Bulgaria, Latvia, Romania, Estonia and Lithunia at the macroeconomic level, Festic et al. (2011) employed a panel of five countries and found that low economic growth, credit growth, availability of finance and the lack of banking supervision to explain NPL. Castro (2013) employs five European banking systems (Greece, Spain, Ireland, Portugal and Italy) to examine the effect of macroeconomic developments on credit risk. His results postulates that bank credit risk is significantly impacted by housing price indices, unemployment rates, credit growth, real exchange rate, interest rates and the recent financial crises.

Cifter et al. (2009) and Nkusu (2011) are all studies that investigate credit risk using systematic determinants. However, a small number of studies have employ on bank specific variables to investigate credit risk and this study cited Podpiera and Weill (2008), Ahmad and Ariff (2007) and

Berger and DeYoung (1997). Berger and DeYoung (1997) studied the relations between bank specific variables but focus on efficiency indicators and problem loans. They formulate possible mechanisms, namely "bad luck," "bad management," "skimping," and "moral hazard," involving efficiency and capital adequacy for US banks from 1985 to 1994. They conclude that cost efficiency is an important indicator for credit risk in the near future. Podpiera and Weill (2008) followed Berger and DeYoung (1997) and extended the relationship between efficiency and bad loans. They model a causality hypothesis by employing generalized methods of moments (GMM) in a panel of banks from 1994 to 2005 and discovered that deterioration in cost efficiency precedes increases in credit risk (NPL).

Ariff and Can (2008) also focused on the impact of bank specific determinants on credit risk in emerging and developed economies. Their results indicated that capital regulations and management quality were important explanatory variables for emerging economies.

3.4 Bank Profitability Empirical Review

Literature on bank profitability suggests that bank profitability is a function of both internal (bank specific) and external (macroeconomic) variables. While the internal determinants are factors that arise from within the bank, the external determinants arise from operational environment of the bank. Hence, the internal factors are controllable while the external factors are out of control of the banks.

Studies on banking profitability have measured bank profitability as Return on Assets (ROA), Return on Equity (ROE) and Net Interest Margin (NIM) (Dietrich and Wanzenried, 2011; Athanasoglou et al., 2005; Goddard et al 2004; Demirguc-Kunt and Huizinga, 1999; Berger, 1995(a, b)). Bank specific factors that explain bank profitability have traditional included bank

risk, size, market power and regulations. However, current studies have considered the effect of macroeconomic factors on bank profitability. For instance, Al-Haschimi (2007) employs an accounting decomposition in a panel regression to investigate the effect of macroeconomic variables on net interest margin in ten (10) Sub-Saharan African countries. He finds that credit risk and operational inefficiency explained NIM across the ten (10) countries while external factors had only limited impact on NIM. Also, Demirguc-Kunt and Huizinga (1998) analyzed how bank individuality factors and macroeconomic factors and their effect on interest rate margins and bank returns using bank level data for eighty (80) countries. They conclude that macroeconomic and regulatory conditions have important effects on bank margins and profitability. They also find a direct relationship between market concentration and bank margin and profitability. They also observed that foreign banks earn higher profit and margins in developing economies while the opposite is true for developed economies. Gelos (2006) evaluates the factors that determine bank interest margins employing bank level data in Latin America. His results suggested that interest rate margins are high due to the relatively high interest rates which are represented in the study as inflation, high inefficiency and high reserve requirements. Angbazo (1997) examines the factors that explain NIM in US and finds that while core capital, non- interest bearing reserves and management quality to be significant and positively related to NIM, liquidity risk was significant but negatively related to NIM. Saunders and Schumacher (2000) modeled to examine the factors that determine NIM in the US (using Ho and Saunders, 1981) and six (6) European Union countries over the period 1988 to 1995. The finding suggested that macroeconomic volatility and regulations have significant effects on NIM. Their results further indicated an important trade-off in ensuring bank solvency is defined by high capital to asset ratio and low cost of financial services to customers (measured as interest rates). Athanasoglou et al. (2005) examined profitability

behavior in south eastern European banking industry from 1998 to 2002. The results indicates that operating efficiency and new standard for risk management crucially affected bank profitability. Again Athanasoglou et al. (2008) employed a dynamic panel to evaluate the profit performance of Greek banks. The results of their study suggest that profit persistence and market structure shaped the profitability in the Greek banking industry. Barth, Nolle and Rice (1997) studied regulation, the structure and performance of the banking sector in the EU and G-10 countries using data from 1993.

3.5 Conclusion

The chapter reviewed the possible theories and empirical studies that support or all in line with the subject matter understudy. The Information Asymmetry, Information Sharing and Risk and Return Theories were reviewed and the relevant reasons given to support why these theories were in support of this study. The chapter also discussed empirical findings on CRBs, Bank credit risk and profitability. The chapter found fewer studies on CRBs ability to reduce Credit risk in Ghana and Africa as a whole while no study was found to establish CRBs ability to boost bank profitability.

CHAPTER FOUR

METHODOLOGY

4.0 Introduction

This chapter describes the research methodologies that were employed in the study. It indicates the type of study to be conducted, the research methodology and the reasons for employing such methods. Also the chapter uncovers the details and justifies the methods to be followed in achieving the set objectives of the study. The chapter again highlights the specification of the model for the study, defining the variables specified in the model and justifying why those variables are employed. The sample and source of data employed in this study is explained and data analysis tools and techniques are also discussed into details.

4.1 Research Design

This study made use of the quantitative research design. The quantitative research design was employed for a number of reasons. Yauch and Stendel (2003) postulate that quantitative research design results are independent of the researcher as it entail rigorous procedures and processes that limit the influence of the researcher thereby depicting the true state of affairs of the phenomenon understudy. Dudwick, Kuehnast, Jones and Woolcock (2006) also argue that findings of quantitative research designs are more accurate and reliable due to its rigorous nature and can be generalized to represent the view of the entire population. They further suggest that quantitative research design is often suitable for studies with large number entities. Despite the numerous advantages of the quantitative research design, it is challenged with the lack of detailed reporting of individual specific issues due to the inability of the quantitative research design to reduce some pertinent and important characteristics of the population understudy people to numeric data. Hence

some important findings or results may not be captured by the quantitative research design (Dudwick, Kuehnast, Jones and Woolcock, 2006).

4.2 Population

The group of interest for this study is all licensed universal banks in Ghana form 2006 to 2013. During this period understudy twenty-seven (27) universal banks were in operation (BOG, 2013). This population was selected based on the topic and the objectives of the study as the study sought to evaluate the impact of credit reference bureau output on bank credit risk and profitability in Ghana. For this purpose the study deemed it fit to employ this population.

4.3 Sample and Sampling Technique

For the purpose of this study twenty-four (24) and twenty- five (25) licensed universal banks in Ghana are employed in the bank credit risk and profitability models respectively. The rule of criteria for selecting banks in both models were that each bank to be included should have operated for more than one year and also data on explanatory variables for each bank should exceed half of the number of explanatory variables employed. In the case of the bank profitability model, twenty-five universal banks are employed leaving out Royal Bank Limited and First Capital Plus Bank Limited because they had been in operation for only one year. However, International Commercial Bank (ICB) was also not included in addition the two mentioned above in the credit risk model because data from bank of Ghana that was used to computing the explanatory variables were incomplete, hence difficulty in adding ICB.

4.4 Model Specification

The study seeks to empirically find out if credit referencing bureau have any impact on bank credit risk and profitability for a period from 2006 to 2013. This study then assumes the use of panel analytical methods to attain the set objectives. The importance of understanding the factors behind the time series variation in macroeconomic data, alongside those that shape the bank data variation, cannot be over emphasized. Given the importance of the time-series variation in macroeconomic data in modern times, an empirical investigation into the impact of credit referencing bureaus on bank risk and profitability must be able to account for its variation both across bank and over time. The study therefore utilize panel data techniques to shed light on the effects or contributions if any of credit referencing bureaus on bank credit risk and profitability in the Ghanaian banking industry.

Panel data estimation appear to provide more convincing results that the classical time series and cross sectional analyses since it exploits the advantages of time series and cross sectional data and at same time corrects the weakness of the latter two estimation techniques mentioned. It also helps to control for omitted variables and bank specific effects and also allows for both long and short run effects thereby overcoming the shortcomings of the cross sectional and time series estimation technique (Stock and Watson, 2001)

The general form of a panel data model is $Y_{it} = \alpha_i + \gamma_t + \beta X_{it} + \varepsilon_{it}$ ……..**(Eq. 4.1)**

Where: Subscript i denotes the cross sectional dimension (bank) i=1. . . *N* and t denotes the time series dimension (time), t=1…T;

Yit is the dependent variable.

α_i is scalar and constant term for all periods (t) and specific to a bank fixed effect (*i*),

γ_t is the time fixed effect t

β is a k×1 vector of parameters to be estimated on the independent variables or the factor loadings or parameter estimates for the explanatory variables.

Xit is a 1× k vector of observations on the independent variables comprising of independent variables in the model which includes controlled variables:

Eit which is iid is the error term.

This study in attaining its objective of establishing the impact of credit referencing bureau on bank credit risk and profitability in the Ghanaian Banking Industry uses a panel approach to establish the existence of this relationship. This is to allow each bank (observations) to be treated individually to adjust for bank specific factors and to account for the macroeconomic factors (factors of changing time) and their effects on financial bank credit risk and profitability in Ghana. The Specific models are stated as:

$$CR_{it} = \beta_1 CRBCR_{it} + \beta_2 CAP_{it} + \beta_3 SIZE_{it} + \beta_5 ROE_{it} + \beta_6 NON\text{-}INT_{it} + \beta_7 HHIL_t + \beta_8 GDPGROWTH_t + \beta_9 INFL_t + \varepsilon_{it} \quad \text{..... (Eq. 4.2)}$$

$$ROA = \beta_1 CRBCR_{it} + \beta_2 CAP_{it} + \beta_3 SIZE_{it} + \beta_4 INEFF_{it} + \beta_5 HHIL_t + \beta_6 GDPGROWTH_t + \beta_7 INFL_t + \varepsilon_{it} \quad \text{.....(Eq. 4.3)}$$

4.5 Variable Selection and Justification for Bank Credit Risk (CR)

This section defines and justifies the reasons for the selected dependent and explanatory the bank credit risk model. The section in addition specifies the expected signs for each variable selected

with the dependent variable (bank credit risk) in relation to relevant existing empirical studies and also states the measurement and source for each variable mentioned.

4.5.1 Dependent Variable for Bank Credit Risk

Credit risk has been at the centre of attraction for years in financial institutions all over the world. That is to say that credit risk is a well-researched area in banks. For instance, Jakubik (2007) states that credit risk is an important area of risk management in banks and helps banks to model their own credit risk appraisal models in an attempt to improve bank portfolio quality. Both academia and corporate worlds have made inputs to the methods useful for the evaluation of bank credit risk. Bank credit risk is popularly represented in finance literature as Provision for Bad Loans to Total Loans ratio, Total loans to Total Asset ratio and Nonperforming loans ratio (De Guimaraes Souza et al., 2011; Aver, 2008; Fofack, 2005; Jimenez and Saurina, 2005; Rajan and Dhal, 2003; Hasan and Wall, 2003). Chaibi and Ftiti (2015) states that the above credit risk ratios or method are said to be inappropriate as they do not reflect actual credit losses but estimated or perceived credit losses. In this regard, Chaibi and Ftiti (2015) propose impaired loans ratio measured as impaired loans divided by total loans to be a better representation as it reflects actual credit risk or loss that pertains to a given time period. Hence, this study employs impaired loan ratio as a measure for bank credit risk.

4.5.2 Explanatory Variables for Bank Credit Risk

This section defines and justifies the inclusion of the selected variables that explain the dependent variable, bank credit risk. The section in addition anticipates the expected signs for each variable selected with the dependent variable (bank credit risk) in relation to relevant theoretical and existing empirical studies and also states the measurement for each variable mentioned.

4.5.2.1 Credit referencing bureau

Credit referencing bureau presence or output is deemed to have a negative impact on bank credit risk (Behr and Sonnekalb, 2012; Berger and Frame, 2005; Kallberg and Udell, 2003, Barron & Staten, 2003; Powell et al., 2004). This study employs credit referencing cost ratio as a proxy for credit referencing bureau output which is deemed to impact bank credit risk. Credit referencing bureau output cost ratio is measured as cost of bureau enquiry divided by total loans and advances. This measures the cost incurred by a bank to ensure it recovers its loans and advances. The study expects an indirect relationship between bank credit risk and credit referencing cost ratio as a higher bureau output cost ratio should lead to a decrease in bank credit risk.

4.5.2.2. Capital Adequacy

Bank equity capital illustrates banks' ability to soak up losses recorded in their books. Following the moral hazard hypothesis (Berger and DeYoung, 1997), thinly capitalized banks generally take riskier loans, which potentially could lead to higher NPLs. Moreover, huge credit losses are budgeted using the equity available in the bank. That is, when banks incur credit losses the credit losses are charged to or set-off against a reserved fund setup from equity fund. Hence, the study anticipates a negative relationship between bank capital and credit risk. Put differently, well-capitalized banks turn to have enough resources (both monetary and personnel) to monitor borrowers and recover loans from the borrower; thereby reducing the credit risk of well-capitalized banks (Zangina and Bokpin, 2012). The events of Mergers and acquisitions are all evidence of banks trying to be well capitalized for smooth operations including reducing credit risk exposure (BoG, 2011; Zangina and Bokpin, 2012). Capital adequacy is measured total equity divided by total assets.

4.5.2.3 Return on Equity

Return on equity is a profitability measure measured as net income divided by total equity. It is postulated that return on equity has an inverse relationship with bank credit risk. This means that a higher bank profitability (ROE) indicates better profit prospects for growth and hardness to shocks, and hence associated with lower credit risk (Otker-Robe and Podpiera, 2010).That is an increase in ROE means more loans and advances are recovered and hence decrease in loans and advance loss leading to lower bank credit risk (Berger and DeYoung, 1997). ROE shows the return to equity holders or shareholders of their equity and equals ROA times the total assets-to-equity ratio. Furthermore, because the analysis of ROE ignores the risks associated with high leverage and financial leverage is mostly determined by regulation, the study expects a negative relationship between the two.

4.5.2.4 Bank Size

Bank size is measured as the natural logarithm of total bank assets. It is implicit that bigger banks have enhanced risk management systems that guarantee precise screening of loan applicants and hence lower default rate. Conversely, it is also suggested that as banks become too large and complex, evaluation, supervision and monitoring becomes complicated as large banks assumes more risk. Empirical outcomes on the relationship between bank credit risk and bank size however remains mixed. This study anticipates a negative relationship between bank credit risk and size as in Biekpe (2011). He proposes that larger banks in Ghana are able to reduce their risk exposure due to the benefits they enjoy in economies of scale. Bank size is measured as the natural log of total assets.

4.5.2.5 Non-interest income

Louzis et al. (2012), Alhassan et al (2014) and Chaibi and Ftiti (2015) employed non-interest income as a proxy for diversification opportunities. They suggest that this ratio reflects the fact that banks rely on alternative types of income other than the main or core income source (interest income), and therefore rely on diversified sources of revenue. The purpose of diversification is to reduce risk exposure of firms including banks. Consequently, the study expects a negative relationship between bank credit risks and non-interest income. However, a positive relationship could exist as suggested by Stiroh (2004b) ("dark sides" of diversification). He argues that as managers go into new businesses where they lack experience or the bank has no or less comparative advantage, the risk exposure of the bank may increase. Non-interest income is measured as non-interest income divided by total income.

4.5.2.6 Concentration

The Ghanaian banking industry has undergone many reforms all gearing towards financial liberation. Financial liberalization policies are largely embarked to advance the competitiveness of financial markets in emerging economies. To use concentration in this study, 'Herfindahl-Hirschman (HHI) index on loan is employed and it is measured as the sum of squares of Loans and advances. This study consequently monitors how the changes in banking market structure have impacted on credit risk. The relation between bank market structure and stability is enlightened by the competition-stability and competition-fragility hypotheses. According to the stated hypothesis, competition-driven efficiency results in banks' stability and enhances the soundness of the banking industry (Beck et al., 2007; Turk-Ariss, 2010; Schaeck and Cihak, 2010b). On the contrary, the competition-fragility hypothesis anticipates that banks with market power (in a concentrated

industry) produce lower credit risk to advance industry stability (Bordo et al., 1995; Hoggarth et al., 2005). With regards to Keeton and Morris (1987) and Pain (2003), this study also employs the Herfindahl-Hirschman Index (HHI) to determine lending concentration among banks in the economy. The study anticipates a positive relationship between bank credit risk and concentration.

4.5.2.7 Real GPD Growth

There appears to be empirical evidence of an inverse relationship between the growth in real GDP and credit risk exposure of banks (Salas and Suarina, 2002; Rajan and Dhal, 2003; Fofack, 2005; and Jimenez and Saurina, 2005). The justification presented by earlier empirical studies for this negative relationship is that strong positive growth in real GDP frequently translates or converts into more income which boots up the debt servicing ability of borrower which in turn adds to lower non-performing loans. Also, when there is a low or negative GDP growth, debts servicing declines resulting in increase in credit risk of banks. However, following the Pecking Order Theory and the loan growth analysis (see Keeton, 1999), there could also be a positive link between gross domestic product growth and bank credit risk. That is, during economic boom where businesses and individuals would have generated enough funds and prefer to rely on the internally generated funds (following Pecking Order Theory), bank borrowing is reduced. Hence to attract borrowers banks relax or loosen their lending conditions which may lead to higher credit risk since loan growth is induced from the banks' side (Keeton, 1999).

4.5.2.8 Inflation

Literature provides proof of a positive relationship between the inflation rate and bank credit risk. For instance, inflationary forces add up to the high level of impaired loans in a number of Sub-Saharan African countries (Fofack, 2005). He again argues that inflation is accountable for the

quick wearing a way of banks' capital or equity and subsequently higher credit risk in the banking industry of some African countries. Hence, this study expects a direct relationship between inflation and credit risk. That is as inflation soars up, it reduces the ability of borrowers to honor their loan repayment leading to high credit risk exposure for banks.

Table 4.1 Summary of Variables for Bank Credit Risk (CR)

VARIABLE	DEFINITION	MEASUREMENT	DATA SOURCE
CR_{it}	This measures the credit risk exposure for each bank across different time periods	Impaired loans/Total loan and advances	Computed by author based on data from Bank of Ghana
$CRBCR_{it}$	This measures the cost incurred by a bank to ensure it makes the right lending decision in order to recover all its loans and advances.	Cost of Bureau Enquires / Total loans and advances	Computed by author based on data from XDS Data
$CAPITAL_{it}$	This measures the liquidity in terms of bankruptcy of each bank across different time periods	Total Equity / Total Assets	Computed by author based on data from Bank of Ghana
ROE_{it}	This measures the return earn on total equity for each bank across different time periods.ROE indicates the return to shareholders on their equity.	Net Income / Total Equity	Computed by author based on data from Bank of Ghana

$SIZE_{it}$	This measures the natural log of total monetary value of the bank at a point in time.	Natural log of Total Assets	Computed by author based on data from Bank of Ghana
$NON\text{-}INT_{it}$	This measures income earned outside the main income sources (noninterest income) relative to total income for each bank across different time periods	Non-Interest income/Total Income	Computed by author based on data from Bank of Ghana
$HHIL_t$	This measure the concentration of bank loans for each time period.	$\sum_{i=1}^{N} l_i^2$	Computed by author based on data from Bank of Ghana
$GDPGROWTH_t$	This measures the change in GPD for different time periods.	WDI	WDI
$INFL_t$	Inflation is the change in the gross domestic product deflator	WDI	WDI

4.6 Variable Selection and Justification for Bank Profitability (ROA)

This section deals with the selection of dependent and independent variables and provides reasons or justification for such variables employed in the study. The section further provide how each variable is measured, their sources and anticipated signs.

4.6.1 Dependent Variable for Bank Profitability

Several profitability measurements have been used in finance literature which can mainly be classified into traditional accounting and economics measurements. For instance, traditional accounting ratios include ROA, ROE and NIM (Dietrich and Wanzenried, 2011; Athanasoglou et al., 2008; Gaddard et al 2004; Demirguc-Kunt and Huizinga, 1999; Berger, 1995a,b;). According to Pasiouras and Kosmidou (2007) traditional accounting profitability measures are mostly used in finance and other literature to represent profitability. Profitability measurement in economics has also included Economic Value Added (EVA), Market Value Added (MVA) and Risk Adjusted Return on Capital (Kimball, 1998). While the computation of the economic profitability measurements is difficult due to lack of internal information disclosure, the traditional profit measures are easy to compute due to the availability of ready information and hence its popularity (Goddard, 2004). This study employs the traditional accounting measure of profitability to measure bank profitability (ROA) similar to Dietrich and Wanzenried (2011) and Athanasoglou et al. (2008). ROA is measured as earnings before tax divided by total assets. The analysis towards determinants of banks' profitability employs only ROA and not ROE because Goddard et al. (2004) argue that the outcomes of using either ROE or ROA are comparable because the yearly variation in the numerator (net income) is greater than the yearly variation in the denominator (assets or equity). ROE has a major shortcoming since it ignores financial leverage and the effect of regulation on financial leverage (Athanasoglou et al., 2008; Dietrich and Wanzenried, 2011).

4.6.2 Explanatory Variables for Bank Profitability

This section defines and justifies the reasons for the selected variables that explain the dependent variable, bank profitability (ROA). The section further states the expected signs for each variable selected with the dependent variable (bank profitability) in relation to theoretical and previous empirical studies.

4.6.2.1 Credit Referencing Bureau (CRB)

Credit referencing bureaus are inferred or deemed to have a positive impact on bank profitability (Barron and Staten, 2003). This study employs credit referencing cost ratio as a proxy for credit referencing bureau which is deemed to impact on bank profitability. Credit referencing bureau cost ratio is measured as cost of bureau enquiry divided by total loans and advances. This measures the cost incurred by a bank to ensure it recovers its loans and advances. Specifically, this study computes CRB variable a bank level variable to which is considered to a better measure than the dummies used by earlier studies (Luoto, 2007, Behr and Sonnekalb, 2012). This variable of interest is computed to capture the cost of accessing CRB services and products per each bank multiplied by the frequency of usage for each bank. This cost is then divided by the total loans and advances since the bank incurs that cost because of the loans and advances. The study expects a direct relationship between bank profitability and credit referencing cost ratio. Thus, as banks employ the services of CRBs it will enhance their predictive power and reduce the banks' chances of adverse selection. This will imply that bank will be able to collect much of their interest earnings plus the principal amount which will then influence or increase bank profitability.

4.6.2.2 Capital Adequacy

Capital is likely to affect bank profitability. This study evaluates the leverage structure of banks in Ghana by employing the equity-to-total asset ratio (a converse of the leverage ratio). Equity-to-

asset ratio is a measure of how much of bank's assets are financed with owner's equity or capital and is a proxy for capital adequacy of a bank by forecasting the ability of a bank to soak up losses. Findings are inconclusive or mixed about the relationship between the equity-to-asset ratio and a bank's profitability. Following the risk-return tradeoff theory, a higher equity-to-asset ratio leads to a higher expected return. In line with the risk-return hypothesis, Berger (1995) studied the signaling hypothesis and bankruptcy cost hypothesis; indicating that a higher equity-to-asset ratio increase profitability because of signaling issues or lower costs of financial distress. Profits may be positively related to capital, when the profits earned are fully or partially ploughed back or reinvested. Athanasoglou et al., (2008) found a direct and significant effect of capital on bank profitability, reflecting the sound financial condition of Greek banks. Similarly, Berger (2005) points out a positive causation in both direction between capital and profitability. This study from the above existing studies also anticipates a positive relationship.

4.6.2.3 Bank Size

The study employs size of bank as a determinant of bank profitability (following Athanasoglou et al., 2008 and Goddard et al., 2004). To capture the relationship between bank size and bank profitability, the study proxy bank size by using the natural logarithm of total assets. Size is a specific bank variable, although the expected sign is ambiguous (see Athanasoglou et al., 2008). Due to the fact that governments are likely not to allow big banks to fail, a risk approach to size would expect that larger banks would require lower profits. Nevertheless, where bigger banks have a greater share of the domestic market, and operate in a less competitive environment, lending rates may stay high (while deposit rates for bigger banks are lower because they are perceived to be safer) and as a result bigger banks may enjoy higher profits. Moreover, current intermediation theory foretells there is efficiency gains that relate to bank size (economies of scale). This implies

that lower costs for bigger banks may result in higher profits if banks do not function in competitive environments.

4.6.2.4 Inefficiency (Expenses management)

The total cost of a bank (net of interest payments) could be grouped or divided into operating cost and other expenses (including taxes, depreciation etc.). From this, operating expenses can be viewed as a result of bank management (that is whether bank management is efficient or inefficient). The ratio of these expenses to total assets is measured as operating expenses divided by total assets (see Athanasoglou eta al., 2008; Alhassan et al., 2014) and also is projected to be negatively related to profitability. This is so because an improvement in the management of these expenses will increase efficiency and consequently raise profits. However, where banks are able to pass on their cost operations to their clients, a positive relationship could exist between bank inefficiency and profitability. The study labels this proxy as bank inefficiency.

4.6.2.5 Concentration

This study employs industry concentration as determinant of bank profitability as suggested by literature. To do this, the study uses 'Herfindahl-Hirschman (H-H) index on loan. This study computes concentration of loans as the summation of loans and advances squared. This study consequently examines changes in the banking market structure and how it impacts on bank profitability. The relationship between bank market structure and stability is explained by the competition stability and competition-fragility hypotheses. According to the stated hypothesis, competition driven efficiency results in banks' stability and enhances the soundness of the banking industry (Beck et al., 2007; Turk-Ariss, 2010; Schaeck and Cihak, 2010b). Nevertheless, the competition fragility hypothesis postulates that banks have market power (in a concentrated

industry) earn more or higher profits to improve industry stability (Keeley, 1990; Bordo et al., 1995; Hoggarth et al., 2005). With regards to Keeton and Morris (1987) and Pain (2003), this study also employs the Herfindahl-Hirschman Index (HHI) to determine lending concentration among banks in Ghana.

4.6.2.6 Real GDP Growth

Bank profitability is anticipated to be responsive to macroeconomic control variables. The effect of macroeconomic variables on bank profits has been highlighted in recent literature. This study employs real GDP growth as one of the control variable for cyclical output effects. The study takes this variable from World Development Indicators (WDI) and anticipates having a positive relationship between bank profitability and real GDP growth. As GDP growth slows down, example during recessions, bank borrowers or clients have difficulties in settling their loans which imply that banks will be able to accumulate less interest income, hence lower profitability. Demirguc-Kunt and Huizinga (1998), Athanasoglou, et al. (2005) and Bikker and Hu (2002) find a positive or direct correlation between bank profitability and the business cycle. The macroeconomic environment has some limiting effect on profitability in sub-Saharan African countries according to Al-Haschimi (2007). This assertion is in support of earlier results of other country-specific studies (Chirwa and Mlachila, 2004; Beck and Hesse, 2006).

4.6.2.7 Inflation

This study also employs inflation as a macroeconomic control variable retrieved from WDI. While the study anticipates a positive effect of commodity prices on bank profitability, the degree to which inflation influence bank profitability depends on whether future fluctuations in inflation are completely anticipated, and in turn, depends on the ability of banks management to accurately

forecast future movements in the relevant control variables. A completely projected inflation rate raises bank profits as banks can appropriately change interest rates in order to increase revenues. On the other hand, unexpected changes could raise bank expenses and costs due to imperfect interest rate adjustment. Other studies, for example, Bourke (1989), Molyneux and Thornton (1992), Demirguc-Kunt and Huizinga (1998) have found a direct or positive relation between inflation and bank profitability.

Table 4.2 Summary of Variables for Bank Profitability

VARIABLE	DEFINITION	MEASUREMENT	DATA SOURCE
ROAit	This measures the returns earned on total assets for each bank across different time periods	Earnings Before Tax / Total Assets	Computed by author based on data from Bank of Ghana
$CRBCR_{it}$	This measures the cost incurred by a bank to ensure it makes the right lending decision in order to recover all its loans and advances.	Cost of Bureau Enquires / Total loans and advances	Computed by author based on data from XDS Data
$CAPITAL_{it}$	This measures the liquidity in terms of bankruptcy of each bank across different time periods	Total Equity / Total Assets	Computed by author based on data from Bank of Ghana

$SIZE_{it}$	This measures the natural log of total monetary value of the bank at a point in time.	Natural log of Total Assets	Computed by author based on data from Bank of Ghana
$INEFF_{it}$	This measures the operational inefficiency in each bank across different time periods. It depicts management quality.	Operation Expenses/ Total Assets	Computed by author based on data from Bank of Ghana
$HHIL_t$	This measure the concentration of bank loans for each time period.	$\sum_{i=1}^{N} l_i^2$	Computed by author based on data from Bank of Ghana
$GDPGROWTH_t$	This measures the change in GPD for different time periods.	WDI	WDI
$INFL_t$	Inflation is the change in the gross domestic product deflator	WDI	WDI

4.7 Estimation Strategy

The use of the Ordinary Least Square estimator is likely not deemed fit for the estimation of the parameters in our panel regression model. This is mainly because the assumptions of the OLS are violated given the data available for the study (see Wooldridge, 2008). Another reason for the use of other estimation techniques other than the Ordinary Least Squares is because the independent

variables, bank credit risk and profitability, are seen as endogenous to the model (see Althanasoglou, 2008; Alhassan, 2014; Berger et al., 2000), generating biased estimates if the OLS is employed.

Arellano and Bover (1995) argue that a regressor is endogenous when it is not orthogonal to the error term. That is, if it does not satisfy the condition of orthogonality. Hence given an intercept in the equation, endogeneity arises if the regressors are correlated with the error. From the above argument, the normal assumptions of the Ordinary Least Square Estimator are violated. In estimating this model by OLS, the normal conditions are required to achieve unbiasedness, consistency or efficiency estimators. The key requirements for the OLS estimator are that the average of the error term should be equal to zero and uncorrelated with the regressors. Also, the data must suit the assumption of homoskedasticity. With bank credit risk and profitability being endogenous, the basic OLS estimations will produce biased estimations, therefore the use of an alternative method. Furthermore, Berger et al., (2000) postulates that bank performance indicators (like profitability and credit risk) turn to be persist over time, reflecting impediments to market competition, informational opacity and or sensitivity to regional (macroeconomic) shocks to the extent that these are serially corrected. Therefore, the study anticipates to adopt a Generalized Least Square approach specifically, the Prais-Winsten Estimstor ahead of the Cochrane-Orcutt Estimator (which are all generalized least square estimators).

The Prais-Winsten (1954) estimates linear regressions that are corrected for panel specific serially correlated residuals and heteroskedastic panel. The Prais-Winsten Estimator (see Judge et al., 1985) is derived from the AR (1) model from the error. Whereas Cochrane-Orcutt (1949) estimator employs lag definition and losses the first observation in the iteration process, Prais-Winsten estimator preserves the first observation. Hence, the Prais-Winsten estimator improves on the

Cochrane-Orcutt estimator by preserving the first observation making the Prais-Winsten much more reliable and accepted in small sample as in the case of this study. Prais-Winsten (1954) suggest as number of reasons why Prais-Winsten is a better estimator. First, Cochrane-Orcutt estimator does not effectively deal with the serial correlation is closer to one. Second, the OLS estimator is more robust in dealing with the variations in serial correlation than the first-differencing estimator. Third, the variance of the first observations error term is important for relative efficiencies of the estimators. Finally, the asymptotic results suggest that the feasible Prais-Winsten estimator is the best estimator in most applied situations. While the Breusch-Pagan/Cook-Weisberg Lagrange Multiplier post-estimation was employed to test for heteroskedasticity, the Wooldridge Test for Autocorrelation and graphic approach were employed to determine the existence of autocorrelation was employed.

4.8 Data Collection

This section highlighted the data type, data source and the procedures employed for the data collection.

4.8.1 Data Type

The study employed panel data to achieve its objectives. Panel data make use of both time series and cross sectional data (Brooks, 2008). The study employs a panel data which has the ability to overcome the shortcomings of time series and cross sectional data. While the time series data focus on variation in variables across time, the cross sectional focuses on observations in a point in time (Baltagi, 2005; Aranello, 2003; Stock & Watson, 2001). Thus, this study deems it fit to use panel

data to overcome the above mentioned shortcomings for a more consistent and reliable attainment of the objectives of this study.

4.8.2 Data Source

For the purpose of this study secondary data is employed. Secondary data is information which has usually been collected by researchers not part of the current assessment and has undergone at least one layer of analysis prior to inclusion in a study (Wooldridge, 2008; Brooks, 2008). In the case of this study data is taken from Bank of Ghana (BoG), XDS Data Referencing Bureau and World Development Indicators (WDI). Specifically, bank specific and industry data are computed from data collected from Bank of Ghana while macroeconomic data is taken from WDI. These data sources are deemed to be the most accurate and reliable data source for the attainment of the objectives of this study.

4.9 Procedure for Data Collection

To gather the needed data to accomplish this study, letters of introduction and request for data are collected from the University of Ghana Business School to Bank of Ghana (BoG), Pricewaterhouse Coopers (PWHC), Ghana Statistical Service (GSS) and XDS Data Referencing Bureau to assist the data collection process. Financial Statements of banks (Bank Specific data) from BoG took four (4) weeks while macroeconomic data from GSS was never received and had to rely on WDI. The data of interest was received from XDS Data Credit Referencing Bureau in three and half weeks after the data request letter was given to them. After all the required data needed for this study was received, data sorting took place, necessary computation were made and imported into Stata13 for further analysis. The needed ratios required for study were generated in Stata13. In all data sort and generation of ratios took five (5) weeks.

4.10 Conclusion

This chapter dealt with methods employed to attain consistent and reliable results. The chapter highlighted the research design suitable for this study and also discussed how banks were selected. Finally, the chapter documents the variables selected for the study and also provides reasons for selecting such variables. With the chosen variables the chapter highlighted estimations strategies that may be used for this study.

CHAPTER FIVE

RESULTS AND DISCUSSION OF FINDINGS

5.0 Introduction

This chapter discusses the data analysis, results and findings of this study. The chapter the descriptive statistics of the other variables used in the study. The relationships between the variables are included while discussing and presenting the empirical findings of the econometric models stated in chapter three. In this chapter, robustness checks with other estimations techniques are made on the empirical estimations to check for the consistency of the empirical findings when alternative estimation techniques are used.

5.1 Data Analysis and Presentation

This section documents the descriptive statistics and correlation analysis of the independent variables used in examining bank credit risk and profitability in Ghana for the period 2006 to 2013.

5.1.1 Bank Credit Risk Data

Table 5.1.1: Descriptive statistics for Bank Credit Risk Data

Variable	Obs	Mean	Std. Dev.	Min	Max
creditrisk	183	0.0470189	0.073744	0.0000197	0.636254
ccbr	98	0.0013418	0.010084	0.0000201	0.099906
Capital	185	0.1642093	0.133388	0.0089189	0.962169
ROE	178	0.2167078	0.155472	0.0018836	0.923193
size	185	19.80869	1.424208	12.26397	22.47146
noninterest	184	0.3396013	0.146748	0.0006132	0.63737
hhil	184	0.0787883	0.018561	0.05853	0.109418
gdpgrowth	185	0.0810993	0.030954	0.039913	0.150071
infl	182	0.1218438	0.035153	0.0872684	0.192507

Source: Computation on data collected from Bank of Ghana, XDS and WDI

Table 5.1.1 presents the differences across banks shown by the maximum and minimum values for eachvariable during the study period of 2006 to 2013. The overall variations for the bank specific variables (as measured by standard deviation) are moderately high. This indicates that banks in Ghana are quite similar (homogeneous). The study infers that the introduction of universal banking policy in 2003 may have influenced the homogenenity of the industry in Ghana. Credit risk has a mean of 4.70% and a maximum value of 63.63% during the period of study. The minimum percentage value of credit risk is almost negligible (0.00197%). The variable of interest, credit bureau usage cost ratio (ccbr) has a maximum of 9.99% and a negligible (0.00201%) minimum. The dispersion of credit bureau usage cost ratio is 1% indicating that the frequency of usage of credit bureaus is almost the same during the period of this study. The study again shows that income from other sources other than interest income (core income source) is 33.96% on the average. This implies that banks in Ghana earn a considerable amount of income from alternative sources other than the main interest income. Non-interest income recorded a maximum and minimum of 63.74% and 0.06% respectively. The non-interest income variable for the period varies across banks by 14.67%. On the average gross domestic product growth rate (gdpgrowth) and inflation rate (infl) are 8.1 % and 12.18% respectively during the periods understudy. Gross domestic product growth rate was highest and lowest at 15% and 3.99% respectively while

inflation rate was also lowest and highest at 8.73% and 19.25% respectively. This indicates that the Ghanaian economy is characterized by quite moderate inflation rates and relatively low growth rate. The Shaprio-Wilk (SW) Test was also employed to check the distribution of the variables around their mean. From the SW test (Appendix 3), the variables were all normally distributed around their mean.

Table 5.1.2: Correlation Matrix on Bank Credit Risk Variables

	credit~k	ccbr	Capital	ROE	size	nonint~t	hhil	gdpgrowth	infl
creditrisk	1								
ccbr	-0.0373	1							
Capital	0.0564	-0.0445	1						
ROE	0.1769	-0.0244	-0.2968	1					
size	-0.1222	-0.6455	-0.3134	0.1308	1				
noninterest	-0.0279	-0.0453	-0.238	0.0157	-0.0303	1			
hhil	0.006	0.168	-0.2273	0.0842	-0.3961	0.1591	1		
gdpgrowth	-0.0332	-0.0593	0.0406	-0.0291	0.1858	0.1118	-0.5599	1	
infl	0.0204	0.0561	-0.0312	0.0256	-0.146	-0.0159	0.4499	-0.6070	1

Source: Computation on data collected from Bank of Ghana, XDS and WDI

The table 5.1.2 above presents the correlation matrix for some the variables that explain bank credit risk in literature. The correlation coefficient shows the index of direction and magnitude of the relationship between two sets of variables without implying causality. While the sign of the coefficient indicates that direction of the relationship, the absolute value indicates the magnitude. The correlation matrix is employed to reveal whether there are elements of multicollinearity in the data. The situation where some or all the independent variables are highly correlated makes it difficult to know which independent variable is influencing the dependent variable. The existence of multicollinearity is evident when all the p-values of the coefficients in the regression model are insignificant but overall model is significant (as shown by the F statistic). The study sets a threshold of 0.7 (following Kennedy, 2008) of the Pearson's correlation to be considered as the

existence of high collinearity between a variable and other variables. From Table 5.1.2 it is evident that none of the variables employed in the credit risk model are highly correlated. Zhu et al, (2007) and Smith et al. (2009) suggest that variables with variance inflation factor (VIF) more than 10 should not be included in an empirical model. They further advise that where VIF of the pairs of variables are all below 10 then the variable with the highest VIF in the pair must be dropped in order to solve the problem of multicollinearity. The study finds no variable with variance inflation factor (Appendix 1) above 10, hence no variable is dropped in accordance with Smith et al. (2009).

5.1.2 Bank Profitability Data

Table 5.1.3: Summary Statistics on Bank Profitability Data

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	182	0.032598	0.038851	0.00045	0.353989
CRRBR	98	0.001356	0.010082	2.01E-05	0.099906
CAPITAL	184	0.159873	0.119964	0.008919	0.841811
SIZE	184	19.8285	1.402303	12.26397	22.47146
INEFF	183	0.069978	0.046528	0.00005	0.42372
hhil	184	0.078788	0.018561	0.05853	0.109418
gdpgrowth	184	0.081272	0.030899	0.039913	0.150071
infl	184	0.121539	0.035109	0.087268	0.192507

Source: Computation on data collected from Bank of Ghana, XDS and WDI

Table 5.2.1 above reports the summarized details of the variables employed in this study from 2006 to 2013 by reporting the maximum, minimum, mean and standard deviation. The dispersion of bank specific variables (as measured by standard deviation) is quite moderately. This suggests that banks in Ghana are quit homogeneous. It is believed that the introduction of universal banking policy has help reduced the heterogeneity (hence improvement in homogeneity) among the banks in Ghana. Bank profitability (ROA) employed as the outcome (dependent) variable has a mean of 3.26% and a maximum value of 35.40% during the period of the study. The minimum percentage value of ROA is almost negligible (0.045%). The variable of interest, credit bureau usage cost ratio

(CRRBR) has a maximum of 9.99% and a negligible minimum. The dispersion of credit bureau usage cost ratio is 1% indicating that the usage of credit bureaus is almost the same during the period of the study. The study finds inefficiency (ineff) to be maximum and minimum at 42.37% and 0.01% while the mean and dispersion of ineff are 7% and 4.65%. This implies that on the average inefficiency in banks in Ghana are 7% of total assets. On the average gross domestic product growth rate (gdpgrowth) and inflation rate (infl) are 8.12 % and 12.15% respectively during the periods understudy. Gross domestic product growth rate was highest and lowest at 15% and 3.99% respectively while inflation rate was also lowest and highest at 8.73% and 19.25% respectively. The Shaprio-Wilk (SW) Test (Appendix 4) was also employed to check the distribution of the variables around their mean. From the SW test, the variables were all normally distributed around their mean.

Table 5.2.2 below shows the correlation matrix between the various variables that are able to explain the variation in bank profitability from literature. The table mainly exhibits the Pearson's correlation which serves as a test for the collinearity of each variable compared with the other variables needed to achieve the set objectives. The study set a threshold of 0.7 (see Kennedy, 2008) for the Pearson's correlation to be considered as the existence of high collinearity between a variable and other variables. The correlation coefficient as explained in the credit risk pearson correlaion reports the magnitude and direction of the relationship that exist between two variables but does not indicate which variable influences the other (direction of causality). The magnitude of the relationship is determined by the absolute value while the sign indicates the direction of the relationship. From Table 5.2.2 it appears no variable is multicollinear. Also, variance inflation

factor (Appendix 2) was conducted and none of the variables had a VIF greater than 10. Hence, none of the variables is dropped as suggested by Zhu et al. (2007) and Smith et al. (2009).

Table 5.2.1: Correlation Matrix on Bank Profitability Variables

	ROA	CRRBR	CAPITAL	SIZE	INEFF	Hhil	gdpgro~h	infl
ROA	1							
CRRBR	-0.0392	1						
CAPITAL	0.1759	-0.0417	1					
SIZE	-0.0677	-0.6467	-0.2609	1				
INEFF	0.6287	-0.0346	0.1073	-0.1393	1			
hhil	-0.0588	0.1681	-0.2187	-0.4255	0.0217	1		
gdpgrowth	-0.067	-0.0447	0.0717	0.1891	-0.0895	-0.5778	1	
infl	-0.0201	0.0496	-0.0261	-0.1582	0.0418	0.4555	-0.6083	1

Source: Computation on data collected from Bank of Ghana, XDS and WDI

5.2 Empirical Results

The study first employed the Ordinary Least Squares (OLS) estimation in a regression to estimate and ascertain the impact of credit referencing bureaus on bank credit risk and profitability. Proceeding to these OLS estimations, the basic assumptions of the OLS were tested to ensure the OLS results provided the Best Linear Unbiased Estimator (BLUE) necessarily sufficient to meet the objectives of this study. The Gauss – Markov theorem suggest that, the OLS will be BLUE when there are no complexities of autocorrelation and heteroskedasticity. First, the study investigates for normality by employing Sharpiro-Wilk normality test. Second, the Breuch- Pagan / Cook- Weisberg (C-W) test for heteroskedasticity was employed to test for homoskedasticity

assumption of the Ordinary Least Squares. Third, the study tests for autocorrelation by employing both the graphical approach and Wooldridge Test for Autocorrelation.

The results for the univariate normality test (Sharpiro-Wilk normality test) for both models (Bank Credit Risk and Profitability) were performed and are shown in Appendix 3 and 4 respectively. The null hypothesis of the Sharpiro-Wilk normality test is that data is non-normally distributed and the alternate hypothesis is that data is normally distributed. As shown in Appendix 3 and 4 with p-values of 0.000 and 0.000 respectively (credit risk data and profitability data), the null hypothesis of non-normal distribution was rejected under all the variables implying that all the variables are normally distributed in both models. The study then applied the Breuch-Pagan/Coo-Weisberg (C-W) test for heteroskedasticity with a null hypothesis of constant variance. The null hypothesis of constant variance was reject with a p-value of 0.0175 (chi2 (1) of 5.65) under the credit risk model implying that the variance was not constant; hence heteroskedasticity existed in the model. Also, the study rejected the null hypothesis of constant variance with a p-value of 0.000 (chi2 (1) of 30.18) under the profitability model implying that the variance was not constant and hence heteroskedasticity exist in the model. To test for autocorrelation the study first employed the graphical approach where the residuals were plotted over the period under study. Where patterns are traceable in the plotted residuals then autocorrelation exist in the model. As shown in Appendix 5a and 6a respectively, patterns are not traceable in residuals of both credit and the profitability models. Hence, it is clear that no autocorrelation exist in both models. Since heteroskedasticity exist in both models and may cause our coefficients not to BLUE, hence the Generalized Least Squares approach (Fixed and Random Effect Models) was operationalized to deal with the problems of heteroskedasticity.

To initiate the generalized least squares (GLS) approach, the Hausman test was performed to determine the appropriateness of the model to be adopted, where the null hypothesis indicates that the random effect model (Appendix 8) and the alternative hypothesis states that the fixed effect model (Appendix 7) is preferred. As shown by the Hausman test (see Appendix 15) under the credit risk model (H= 1.94 with a p-value = 0.9629), the difference in coefficients between fixed effect and random effect is systematic presenting evidence in favor of the random effect model. Hence, the result of the random effect model is preferred to the results of the fixed effect model. Further, the Wooldridge Test for Autocorrelation (see Appendix 14) was employed confirming that credit risk model was free from first order autocorrelation. Further analysis was conducted to ensure robust coefficients. From the Random Effect Regression Model, the Breusch-Pagan Lagrangian multiplier test for random effect heteroskedasticity as conducted to detect heteroskedasticity. With a null hypothesis of constant variance, the result (*chibar2 (01)* = 4.82 with *Prob>chibar2* = 0.0140) indicated a rejection of the null hypothesis of constant variance and concluded that the model is heterskedasticity.

As indicated in the Hausman test results (H= 17.33 with a p-value = 0.0081) under the profitability model (see Appendix 16), the difference in coefficients between the fixed and random effect models is not systematic providing evidence in support of the fixed effect model. Hence, the result of the fixed effect model is preferred to the results of the random effect model. Additionally, based on the wald test for groupwise heteroskedasticity in the fixed effect model (*chi2 (25)* = 8044.04 *Prob>chi2* = 0.0000), the study rejected the null hypothesis of constant variance and conclude that heteroskedasticity exists in the model. The presence of autocorrelation was diagnosed employing Wooldridge Test for autocorrelation. Following the F statistics (*F(1,24)* = 4.171, *Prob*

> F = 0.0522), the study fails reject the null hypothesis of no autocorrelation and concluded that autocorrelation does not exist in the profitability model. The results of the heteroskedasticity and autocorrelation are reported in Appendix 11 and 13. Also, the study tests for normality of the residuals were conducted for both models (see Appendix 11a and 11b). While the results of the credit risk model gave evidence of normal distribution with a Shapiro-Wilk test, the profitability gave evidence of non-normal distribution of residuals. However, Brooks (2008) suggest that once the sample is large enough and all the other assumptions are met, one can over look the non-normality of residuals since the estimates will still be BLUE. Hence, the study proceeds to solve the problem of heteroskedasticity since it was the only assumption that was not met.

As indicated from the above paragraphs, heteroskedasticity exit in both models (Credit Risk and Profitability models) of the GLS approach and may cause the results or coefficients of the random effect (bank credit risk model) and fixed effect (bank profiability model) regressions not to be BLUE. Hence, the study employs the Prais – Winsten Estimator in order to correct the heteroskedasticity problems in models chosen from the Hausman test results. The results of the Prais- Winsten Regression for the Credit Risk and Profitability models are discussed.

5.2.1 Impact of Credit Referencing Bureaus on Bank Credit Risk

This section presents the Prais-Winsten regression results on the impact of Credit Referencing Bureaus on Bank credit risk. The study employed Credit risk (impaired loans / Total loans and advances) as dependent variable explained by bank specific, industry and macroeconomic variables. The bank specific variables include credit referencing bureau cost ratio (ccbr), Captial adequacy (capital), profitability (ROE), natural log of total assets (Size) and non-interest income

(noninterest), while the industry and macroeconomic variables includes loan concentration (hhil) and gross domestic product growth and inflation respectively. However, only the variable of interest and other significant variables are discussed.

Table 5.2.2 Impact of Credit Referencing Bureaus on Bank Credit Risk

creditrisk	Coef.	Std. Err.	z	P>z	[95% Conf. Interval	
ccbr	-0.6907718**	0.285001	-2.42	0.015	-1.249364	-0.13218
Capital	-0.0257662	0.032167	-0.8	0.423	-0.088812	0.0372797
ROE	0.0314556	0.027445	1.15	0.252	-0.0223361	0.0852472
size	-0.0067843**	0.002788	-2.43	0.015	-0.0122484	-0.00132
noninterest	0.0524966**	0.025967	2.02	0.043	0.001602	0.1033912
hhil	0.4161576	0.92165	0.45	0.652	-1.390244	2.222559
gdpgrowth	0.3134126*	0.18429	1.7	0.089	-0.0477897	0.6746149
infl	1.025035*	0.591744	1.73	0.083	-0.1347614	2.184831
R^2 = 0.5329					**Wald chi2 (8)=118.91**	
Number of Observation= 92					**Prob>chi2=0.0000**	

Significance Level: 1%(***), 5%(**) and 10%(*)

5.2.1.1 Bank Specific Variables

From the regression results above, the variable of interest, credit referencing bureau cost ratio (ccbr) has an indirect relationship with the dependent variable credit risk. This mean that one unit increase in credit referencing bureau cost ratio will lead to 0.6908 unit decrease in bank credit risk. This result mean that when banks increase the usage of CRB services by 100%, banks can reduce their credit risk by 69.08%. This finding implies that as banks increase their usage of CRB products (which increases credit referencing bureau cost ratio) bank credit risk reduces drastically. This finding is more interesting as credit referencing bureau cost ratio is statistically significant at 5%

significance levels. Vercammen (1995), Padilla and Pagano (1997,2000), Jappelli and Pagano (2002), Djankov et al., (2007) and Bennardo et al. (2010) have shown that information sharing (through CRBs) can have a disciplinary effect on borrowers and enhance lenders knowledge on borrowers to reduce adverse selection and moral hazard. They further argue that through information sharing, negative credit history (default information) recorded with one lender will become known to all lenders. This turns to reduce the borrower's ability to secure future access to credit and disciplines the borrower to improve loan performance. Consistent with the above findings and the expectation of this study, there exist a negative relationship between credit risk (impaired loans) and credit referencing bureau cost ratio. This implies that as banks patronize CRB products increases, credit risk exposure of banks in Ghana reduces.

The regression also indicates an inverse relationship between size and credit risk. This denotes that a unit increase in size leads to 0.0068 unit decrease in credit risk implying that as banks increase in size they gain the ability to manage and reduce the credit risk they are exposure to. Bank size is statistically significant determinant of bank credit risk exposure at 5% significance level. The size of the bank measured as natural log of total asset was negatively and strongly significant determinant of credit risk from the regression results. This empirical finding is in accordance with earlier studies (see Salas and Saurina, 2002; Hu et al., 2006 and Rajan and Dhal 2003). They explain this finding to mean that larger or bigger banks are more effective in screening loan applicants than smaller banks because they (larger banks) have enough resources (monetary and personnel). That is larger banks are able to reduce adverse selection and also monitor borrowers to recover their money (principal plus interest) because they have sufficient resources.

Conversely non-interest income was found to be directly or positively related to credit risk. Thus a unit increase in non-interest income leads to a 0.0525 unit increase in credit risk. From this it is induced that the non core banking activities undertaken by banks in Ghana adds up to their risk exposure and hence care must be taken. Although the non core banking activities add up to banks exposure, it is statistically significant determinant of bank credit risk at 5% significance level. Non-interest income ratio was used to proxy diversification. The results from the regression suggest that diversification is positively and statistically significant determinant of bank credit risk. This finding did not meet the study's expected sign and does not also support earlier studies including with Alhassan et al (2014), Salas and Saurina (2002), Hu et al. (2004) and Rajan and Dhal (2003). However, this finding may be attributed to the potential dark side of diversification suggested by Stiroh (2004b). He argues that as managers invest in new businesses (diversification) where they do not have experience and lack comparative advantage, the risk of the bank is increased. Hence the study finds that banks in Ghana rather increase their credit risk exposure through diversification rather than reducing their risk exposure.

5.2.1.2 Macroeconomic Variables

The regression also results present a direct relationship between credit risk and gross domestic product growth (gdpgrowth). From the results a unit increase in gdpgrowth will lead to a 0.3134 unit increase in credit risk implying that an improvement in the state of economy leads to an increase in credit risk, hence an decrease in asset quality. Interestingly, gdpgrowth is statistically significant at 10% significance level. Inconsistent with previous studies, this study finds a positive relationship between gdpgrowth and bank credit risk (see Salas and Suarina, 2002; Rajan and Dhal, 2003; Fofack 2005 and Jimenez and Suarina, 2005). These studies interpret their finding to imply

that an improvement in the real economy is likely to witness decrease in bank credit risk. However, in a booming economy (gdpgrowth) where economic activities are efficient, bank clients have disincentive to borrow as they turn to rely on internally generated funds (Pecking Order Theory). Hence, banks in an attempt to attract borrowers in order to maximize profitability relax their lending processes leading to high credit risk exposure for banks. This assertion is consistent with Keeton (1999) who argues that when banks increase their loans and advances by relaxing their lending processes, it leads to higher credit risk.

Also, inflation rate was significant at 10% level of significance. As inflation rate is a significant determinant of credit risk, one unit increase inflation rate will lead to a 1.025 units increase in credit risk. This implies that as inflation rate go up; borrowers' ability to pay their credit (loans and advances) reduces hence an increase in credit risk exposure. Consistent with previous studies like Sinkey and Greenwalt (1991), Fofack (2005), Jimenez and Suarina (2005), Wong, Wong and Leung (2010), Derbali (2011), Kochetkov (2012), Louzis (2012) and Chaibi and Ftiti (2015), the study finds a positive but insignificant association between the real inflation rate and bank credit risk. This indicates that banks in Ghana are able to adequately anticipate and adjust interest rates to pass on inflation to their clients or borrowers (see Derbali, 2011).

5.2.2 Impact of Credit Referencing Bureaus on Bank Profitability

This section shows the Prais-Winsten regression results on the impact of Credit Referencing Bureaus on bank profitability. The study employed profitability (earnings before tax / Total Assets) as dependent variable explained by bank specific, industry and macroeconomic variables. The bank specific variables include credit referencing bureau cost ratio (CRRBR), Captial adequacy

(Capital), size, Risk and inefficiency (ineff).While the industry variable employed in this study include Loan concentration (hhil), the macroeconomic variables included gross domestic product growth and inflation rate. From the regression results to explain the variation in bank profitability (ROA), four (4) bank specific variables employed including credit referencing bureau cost ratio, capital, size and inefficiency. While loan concentration (hhil) was employed as the only industry variable, gross domestic product and inflation were also employed as macroeconomic variables. However, only the variable of interest and other significant variables are discussed.

Table 5.2.3: Impact of Credit Referencing Bureaus on Bank Profitability

ROA	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
CRRBR	0.949558***	0.362516	2.62	0.009	0.23904	1.660077
CAPITAL	0.12268***	0.028733	4.27	0	0.066364	0.178996
SIZE	0.012494***	0.004469	2.8	0.005	0.003736	0.021253
INEFF	0.662862***	0.073554	9.01	0	0.518699	0.807024
Hhil	-0.30352	0.663003	-0.46	0.647	-1.60299	0.995937
gdpgrowth	-0.01362	0.126849	-0.11	0.914	-0.26224	0.234997
Infl	0.34877	0.369162	0.94	0.345	-0.37477	1.072314
R^2 = 0.6976				**Wald chi2(7) = 98.49**		
No. of Obs.= 97				**Prob> chi2 =0.0000**		

Significance Level: 1%(***), 5%(**) and 10%(*)

5.2.2.1 Bank Specific Variables

From the above regression, the variable of interest, credit referencing bureau cost ratio (CRRBR) is identified to be positively or directly related with bank profitability from the regression results. The results further suggest that a unit increase in credit referencing bureau cost ratio leads to a 0.9496 unit increase in bank profitability. This finding is interesting as credit referencing bureau cost ratio variable was statistically significant at 1% significance level. The study did not find any earlier study that directly indicates the impact of CRB on Bank profitability. However, the study finds traces of implied improvement in bank profitability in the presence of CRBs in the works of

Behr and Sonnekalb (2012), Barron and Staten (2003), Kallberg and Udell (2003), Powell et al., (2004), Louto et al. (2007) and Brown and Zehnder (2007). They assert that information sharing (through CRBs) can have disciplinary effect on borrowers behavior (due to future denial of access to finance by other lenders) and also enhance lenders knowledge on borrowers to reduce adverse selection and moral hazard. Hence banks can be more profitable because CRBs make borrowers disciplined and allows banks predict clients more accurately to ignore less credit worthy clients. That is banks are more likely to retrieve all the loans and advances (principal plus interest) in the presence of CRBs. Subsequently, this study finds CRRBR to be positive and significantly related to bank profitability in Ghana.

The results of the regression indicate that capital adequacy is directly related with bank profitability. This finding further suggests that a unit increase in capital adequacy will lead to a 0.1227 increase in bank profitability. At a p-value of 0.000, capital adequacy is statistically significant determinant of bank profitability at 1% significant level. In empirical studies, the relationship between capital and profitability has received much attention and varied outcome. This indicates that risk averse shareholder require larger return on investment or earnings to compensate for their risk and hence puts pressure on bank management to perform in order to meet the high compensation demand of shareholders (see Berger, 1995; Athanasoglou et al., 2005; Demirguc-Kunt and Huizinga, 2000; Iannotta et al., 2007 and Naceur and Omran, 2011). Also, profits may also lead to higher capital, if the profits earned are fully or partially reinvested (Athanasoglou, et al., 2005; Berger 2005).

However bank size (Size) is statistically significant at a p-value of 0.005 implying that size is significant at 1% level of significance. The results depict that a unit increase in bank size leads to a 0.0125 unit increase in bank profitability. Bank size defined as logarithm of total assets has been used as a control variable and thus the quest to see how it would influence bank profitability (ROA). The results revealed that bank size is positively and statistically significant. This means that in the banking sector of Ghana, size is important in determining banks' profit. However, it is interesting to note that as bank size increases bank profitability also increase in Ghana. The positive relationship between bank size and bank profitability suggests that larger banks tend to exhibit higher margins and is consistent with models that emphasize on economies of scale. This finding is consistent with Alhassan et al. (2014) and Biekpe (2011).

Likewise, bank inefficiency (ineff) also has a positive relationship with bank profitability. This denotes that when inefficiency increases by a unit, bank profitability will also increase by 0.6629unit. At a p-value of 0.000, inefficiency is statistically strong determinant of bank profitability at significance levels of 1%. Cost to total assets (ineff) is employed to measure the quality of management ability to control cost. A high ratio is an indication of management cost inefficiency. This study anticipated a negative relationship between management inefficiency and bank profitability (Althanasoglou, 2008; Pasiouras and Kosmidou, 2007; Al-Haschimi, 2007and Dietrich and Wanzenried, 2011). Contrary to the hypothesis and the authors mentioned above, the study finds a positive relationship and statistically strong significant at 1%, 5% and 10% levels of significance. Consequently, the study explains this finding as banks in Ghana having the ability to pass on their cost of inefficiency to depositors and lenders through the rates they charge which in turn increase the banks' profitability. Hence, the positive relationship between cost of

operational inefficiencies and bank profitability is possible because banks are able to push their cost of operation to their clients. . However, Maudos and Fernandez de Guevara (2004) argue that this positive relationship exists because operational inefficiency could mean higher volumes of banking activities and therefore higher profitability.

5.3 Conclusion

The chapter discussed the routines that led to the results of the Prais-Winsten estimation. The normality of variables and residuals, autocorrelation and hecteroskedasticity were all tested (under both OLS and GLS) before arriving at the Prais-Winsten estimation. The findings in the chapter show that CRBs reduces bank credit risk and increases bank profitability. Also, other variables like bank size, non-interest income, gross domestic product growth rate and inflation rate other than CRBs were found to impact bank credit risk. Also, bank capital, size and inefficiency in addition to CRBs were determined to impact bank profitability.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The chapter presents the summary of findings, conclusions and recommendations based on the results from the regression models. The summary gives a snapshot of the findings of this study. The deduction based on the empirical models is capture in the conclusion while recommendations are suggested based on the conclusions.

6.1 Summary of Findings

The significant role banks play in the economic development and growth of a country cannot be underplayed. A stable, sound and well-functioning financial sector is fundamental to a proper financial mediation leading to stable and sustainable private investment and the advancement of business enterprise. The banking sector has seen many reforms and policies over the past decades all gearing towards improving the operations and functioning's of the Ghanaian banking industry. The competitive and operational nature of the banking environment in Ghana has become more

dynamic. There is an increasing pressure on banks to compete as banks have become more incorporated into the global financial system. It is therefore not surprising to see the recent events of acquisitions and mergers in the banking sector of Ghana. In order to survive economic shocks and to uphold sound financial stability, there is a fierce need to ensure that banks minimize (or possibly eradicate) bank credit risk exposure while maximizing bank profitability. For this reason, credit referencing bureaus were introduced in Ghana in 2010 to help reduce bank credit risk and maximize bank profitability. Surprisingly, the study does not cite any empirical study that evaluates the impact of CRBs on bank credit risk and profitability in Ghana and Africa at large. Hence this study addressed the empirical gap of establishing the impact of CRBs on bank credit risk and profitability in the context of Ghana.

Employing a Prais-Winsten panel data estimation regression made of bank specific, industry and macroeconomic variables, the study finds that CRBs statistically and significantly determine bank credit risk and profitability. The study established that CRBs negatively impacted bank credit risk but positively impacted bank profitability. The implies that the patronage of CRB services by bank has helped reduced bank credit risk and improved bank profitability in Ghana during the period of 2010 to 2013. The study also found bank size, non-interest income, inflation rate and gross domestic product to be significant variables that impact credit risk. However, Capital adequacy, bank size and inefficiency were also found to be significant in the bank profitability model. The study used ROA to proxy bank profitability and impaired loans ratio to proxy bank credit risk. The study employed credit referencing bureau cost ratio, capital adequacy, size, risk and inefficiency as bank specific variables in the bank profitability model while employing credit referencing bureau cost ratio, capital adequacy, size and non-interest income as bank specific variables in the

bank credit risk model. However, the study employs the same industry variable (loan concentration) and macroeconomic variables (gdpgrowth and inflation) in both models.

The study identifies that the patronage of CRBs products have kept increasing but a decreasing rate since its inception in 2010. The study further finds that Barclays Bank Ghana, Stanbic Bank Ghana, Standard Bank Limited, SG-SSB and Agriculture Development Bank were the banks with the highest patronage of CRB products.

6.2 Conclusion

The study attempts to establish the impact of CRBs on bank credit risk and profitability in Ghana. The data to achieve this objective was collected from Bank of Ghana, World Development Indicators and XDS Data Credit Reference Bureau. The study finds that CRBs have a positive impact on bank profitability and a negative impact on bank credit risk in Ghana which is in accordance with earlier empirical results. It is clear that the patronage of CRB products by banks since its introduction in 2010 has helped reduce bank credit exposure and at the same time help boost bank profitability. However, the study was unable to establish whether the impact of CRBs on bank credit risk and profitability emanates from either the improved borrowers discipline or improved bank predictive ability (adverse selection and moral hazard) as suggested by information sharing empirical studies.

However, the study finds other statistically significant variables that impact on bank credit risk and profitability. The study however finds that CRBs patronage contributes 28.02% to the variation in bank credit risk model representing 52.58% of the R^2. Also, CRBs patronage contributes 13.88%

to total variation in the bank profitability (ROA) indicating 20.21% of the total variation in bank profitability. These were deduced by running both the bank credit risk and profitability models with and without the credit referencing bureau cost ratio and taking the difference in R squares.

6.3 Recommendations

The following recommendations are provided based on the findings of the study for policy making and future research directions:

1. The patronage of CRBs products by banks in Ghana help banks boost their profitability and at the same time help them to reduce their credit risk exposure. Hence, banks are advised to constantly patronize the services of credit referencing bureaus so as to enable them reduce the cost of loan administration, the chances of adverse selection and moral hazard (see Brown and Zehnder, 2007; Doblas-Madrid and Minetti, 2013; Powell et al., 2004; Barron and Staten, 2003). It is expected that as banks continue to do this they will be able to recover or retrieve all the loans and advances (principal plus interest).
2. Though CRBs have significant impact on bank profitability and credit risk, there is more room for improvement since CRBs cover about only 30% of the Ghanaian population. It is advised that parliament enact laws that will increase the data base of the CRBs from only universal banks, savings and microfinance institutions and rural banks to include other non banking financial institutions (insurance firms), tax agencies, utility companies and court rulings as done in some European countries and the America. These alternative sources makes the bank predictive ability more powerful, accurate and reliable as highlighted in the study of Barth et al. (2009), Kallberg and Udell (2003), Barron and Staten (2003) and Galindo and Miller (2001).

3. The study also recommend the publicity of CRBs activities in Ghana since it may force bank client or borrowers to be disciplined in servicing their loans when they (borrowers) are aware of future denial of loans or credits upon default (see Padilla and Pagano 2000; Doblas-Madrid and Minetti, 2013; Brown and Zehnder, 2007;Jappelli and Pagano, 2002; Klein, 1992).
4. For the purpose of future research direction, it is recommended that researchers take a look at the impact of CRBs on other areas such as bank liquidity, access to finance, bank efficiency and factors that make CRBs effectiveness and efficiency as highlighted in the literature of information sharing in the context of Europe and the America (see Love and Mylenko, 2003; Miller, 2003; Luoto et al., 2007).
5. Again, for future research purpose it is advised that researchers are able to establish whether the impact CRBs have on banks is as a result of improvement in bank predictive abilities or improvement in borrowers' discipline.

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APPENDIX

APPENDIX 1: VARIANCE INFLATION FACTOR: CREDIT RISK MODEL

Variable	VIF	1/VIF
size	4.42	0.226016
infl	4.03	0.248219
ccbr	2.91	0.343683
gdpgrowth	2.62	0.382018
hhil	1.88	0.530752
noninterest	1.54	0.649818
ROE	1.28	0.783545
Mean VIF	2.6	

APPENDIX 2: VARIANCE INFLATION FACTOR FOR PROFITABILITY MODEL

Variable	VIF	1/VIF
SIZE	4.18	0.239361
infl	3.36	0.29791
CRRBR	2.7	0.370442

gdpgrowth	2.59	0.385529
CAPITAL	2.05	0.487615
hhil	1.89	0.529052
INEFF	1.11	0.898608
Mean VIF	2.55	

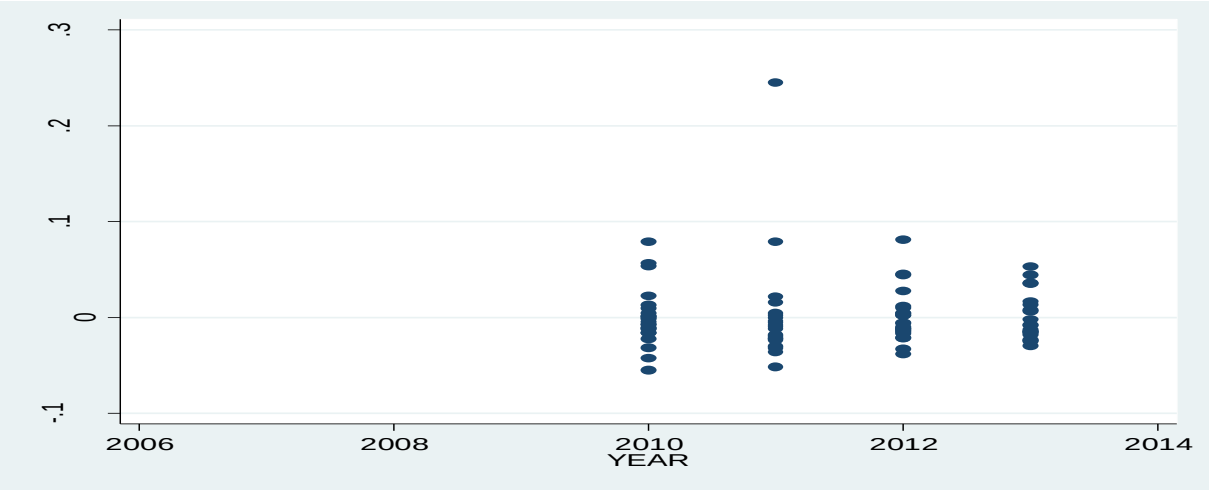
APPENDIX 3: SHAPIRO-WILK W TEST FOR NORMAL DATA FOR CREDIT RISK MODEL

Variable	Obs	W	V	z	Prob>z
creditrisk	183	0.49038	70.382	9.744	0.0000
ccbr	98	0.09789	73.237	9.514	0.0000
Capital	185	0.68014	44.593	8.703	0.0000
ROE	178	0.88288	15.791	6.312	0.0000
size	185	0.87189	17.861	6.606	0.0000
noninterest	184	0.9541	6.37	4.242	0.0000
hhil	184	0.89642	14.372	6.107	0.0000
gdpgrowth	185	0.84275	21.923	7.076	0.0000
infl	182	0.81841	24.96	7.367	0.0000

APPENDIX 4: SHAPIRO-WILK W TEST FOR NORMAL DATA ON PROFITABILITY

Variable	**Obs**	**W**	**V**	**z**	**Prob>z**
ROA	182	0.53773	63.54	9.507	0
CRRBR	98	0.09864	73.176	9.513	0
CAPITAL	184	0.72056	38.776	8.38	0
SIZE	184	0.86898	18.18	6.645	0
INEFF	183	0.73716	36.3	8.227	0
hhil	184	0.89642	14.372	6.107	0
gdpgrowth	184	0.84013	22.184	7.101	0
infl	184	0.80017	27.728	7.612	0

APPENDIX 5a: AUTOCORRELATION GRAPH ON CREDIT RISK MODEL



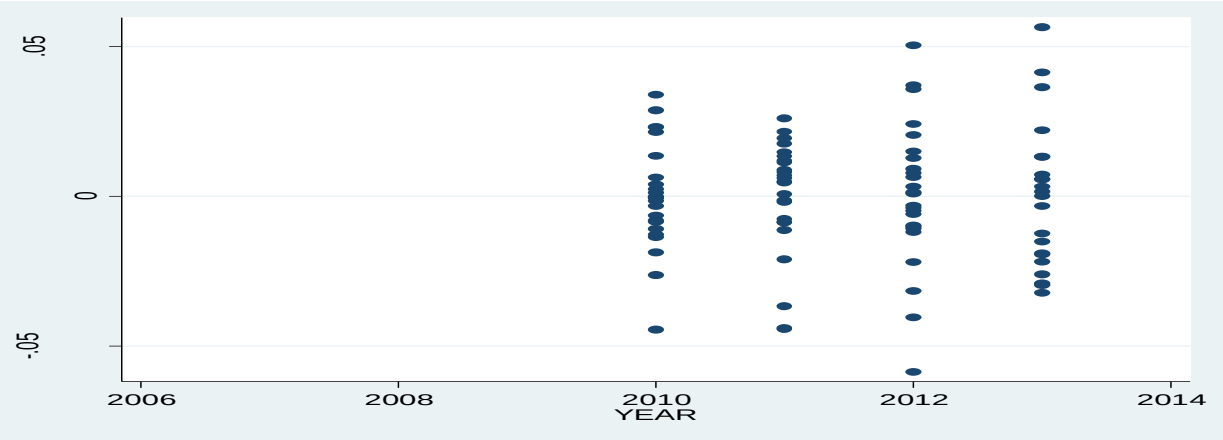
APPENDIX 5b: BREUSCH-PAGAN / COOK-WEISBERG TEST FOR HETEROSKEDASTICITY- CREDIT RISK

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance
Variables: fitted values of creditrisk

chi2(1) = 5.65
Prob >chi2 = 0.0175

APPENDIX 6a: AUTOCORRELATION GRAPH ON PROFITABILITY



APPENDIX 6b: BREUSCH-PAGAN / COOK-WEISBERG TEST FOR HETEROSKEDASTICITY - PROFITABILITY

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of ROA

chi2(1) = 30.18
Prob >chi2 = 0.0000

APPENDIX 7: FIXED EFFECT REGRESSION FOR CREDIT RISK

creditrisk	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
ccbr	-0.70058	1.439947	-0.49	0.628	-3.580908 2.17974	
Capital	-0.04607	.1015454	-0.45	0.652	-.2491931 .1570489	
ROE	0.05602	.0359395	1.56	0.124	-.0158692 .1279101	
size	-0.00922	.0194342	-0.47	0.637	-.0480909 .0296575	
noninterest	0.044892	.0442811	1.01	0.315	-.0436835 .1334672	
hhil	0.02671	1.700343	0.02	0.988	-3.374483 3.427903	
gdpgrowth	0.131718	.1977656	0.67	0.508	-.2638723 .5273078	
infl	0.509528	.8571143	0.59	0.554	-1.204956 2.224011	
_cons	0.144337	.4655915	0.31	0.758	-.7869846 1.075659	
sigma_u	**0.0252857**				**R^2 = 0.0986**	
sigma_e	**0.03555971**				**No. of Obs. = 92**	
rho	**0.33582656**					

APPENDIX 8: RANDOM EFFECT REGRESSION FOR CREDIT RISK

creditrisk	Coef.	Std. Err.	z	P>z	[95% Conf. Interval	
ccbr	-1.64796	0.73198	-2.25	0.024	-3.082613	-0.2133039
Capital	-0.10317	0.06165	-1.67	0.094	-0.2239967	0.0176662
ROE	0.04954	0.030308	1.63	0.102	-0.0098634	0.1089426
size	-0.02126	0.00856	-2.48	0.013	-0.0380409	-0.0044854
noninterest	0.034782	0.03375	1.03	0.303	-0.031367	0.1009304
hhil	-0.78125	1.095259	-0.71	0.476	-2.927915	1.36542
gdpgrowth	0.097988	0.187572	0.52	0.601	-0.2696459	0.4656216
infl	0.660434	0.677697	0.97	0.33	-0.6678278	1.988695
_cons	0.444206	0.222232	2.00	0.046	0.00864	0.8797723
sigma_u	**0.019821**				**R^2 = 0.1443**	
sigma_e	**0.03556**				**No. of Obs. = 92**	
rho	**0.237043**					

APPENDIX 9: BREUSCH AND PAGAN LAGRANGIAN MULTIPLIER TEST FOR RANDOM EFFECTS – CREDIT RISK MODEL

creditrisk[bankcode,t] = Xb + u[bankcode] + e[bankcode,t]

Estimated results:

	Var	sd = sqrt(Var)
creditr~k	.0016272	.0403387
e	.0012645	.0355597
u	.0003929	.0198208

Test: Var(u) = 0

chibar2(01) = 4.82

Prob > chibar2 = 0.0140

APPENDIX 10: FIXED EFFECT REGRESSION FOR PROFITABILITY

CRRBR	1.806297	1.030775	1.75	0.084	-0.2523	3.864896
CAPITAL	0.087138	0.061443	1.42	0.161	-0.03557	0.209847
SIZE	0.021945	0.014242	1.54	0.128	-0.0065	0.050388
INEFF	0.840753	0.063068	13.33	0	0.714798	0.966708
hhil	0.277733	1.17148	0.24	0.813	-2.06187	2.617341
gdpgrowth	-0.00305	0.115894	-0.03	0.979	-0.2345	0.22841
infl	0.013969	0.464318	0.03	0.976	-0.91334	0.941275
_cons	-0.50533	0.336718	-1.5	0.138	-1.1778	0.167143
sigma_u	**0.021592**				**R = 0.6489**	
sigma_e	**0.021537**				**No. of Obs.= 97**	
rho	**0.501272**					

APPENDIX 12: RANDOM EFFECT REGRESSION FOR PROFITABILITY

ROA	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
CRRBR	1.012877	0.431621	2.35	0.019	0.166915	1.858838
CAPITAL	0.120188	0.035128	3.42	0.001	0.051338	0.189038
SIZE	0.012714	0.004871	2.61	0.009	0.003167	0.022261
INEFF	0.699747	0.052386	13.36	0	0.597072	0.802423
hhil	-0.30315	0.687059	-0.44	0.659	-1.64976	1.043459
gdpgrowth	-0.01466	0.121859	-0.12	0.904	-0.2535	0.22418
infl	0.315338	0.379729	0.83	0.406	-0.42892	1.059593
cons	-0.30535	0.127225	-2.4	0.016	-0.5547	-0.05599
sigma_u	**0.007715**				**R= 0.6971**	
sigma_e	**0.021537**				**No. of Obs. = 97**	
rho	**0.113727**					

APPENDIX 11A: NORMALITY OF RESIDUALS (PROFITABILITY)

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
bkroa	96	0.98957	0.832	-0.406	0.65762

APPENDIX 11B: NORMALITY OF RESIDUALS (CREDIT RISK)

Variable	Obs	W	V	z	Prob>z
crisk	97	0.77394	18.196	6.425	0.00000

APPENDIX 13: WOOLDRIDGE TEST FOR AUTOCORRELATION IN PANEL DATA (PROFITABILITY MODEL)

H0: no first order autocorrelation

F(1, 24) = 4.171

Prob> F = 0.0522

APPENDIX 14: WOOLDRIDGE TEST FOR AUTOCORRELATION IN PANEL DATA (CREDIT RISK MODEL)

H0: no first order autocorrelation

F(1, 22) = 1.490

Prob> F = 0.2352

APPENDIX 15: HAUSMAN TEST ON CREDIT RISK MODEL

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	modfe	modre	Difference	S.E
ccbr	-0.7005839	-1.647959	0.9473748	1.192057
Capital	-0.0460721	-0.1031653	0.0570931	0.070106
ROE	0.0560204	0.0495396	0.0064808	0.0173317
size	-0.0092167	-0.0212632	0.0120465	0.0168274
noninterest	0.0448919	0.0347817	0.0101102	0.0266728
hhil	0.0267098	-0.7812476	0.8079574	1.236493
gdpgrowth	0.1317177	0.0979878	0.0337299	0.041565

infl	0.5095275	0.6604335	-0.150906	0.4837769
Ho	Difference in coefficients not systematic			
chi2(7)	**1.94**			
P>chi2	**0.9629**			

APPENDIX 16: HAUSMAN TEST ON PROFITABILITY MODEL

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	modfe	modre	Difference	S.E
CRRBR	1.806297	1.012877	0.7934205	1.024413
CAPITAL	0.087138	0.1201879	-0.0330498	0.0561842
SIZE	0.021945	0.0127137	0.0092313	0.0145662
INEFF	0.840753	0.6997474	0.1410058	0.0433782
hhil	0.277733	-0.3031522	0.5808853	1.060215
gdpgrowth	-0.00305	-0.0146597	0.011613	0.0277777
infl	0.013969	0.3153378	-0.3013691	0.3264125
Ho:	Difference in coefficients not systematic			
chi2(6)	**17.33**			
P>chi2	**0.0081**			

APPENDIX 17: MODIFIED WALD TEST FOR GROUPWISE HETEROSKEDASTICITY TEST FOR FIXED EFFECT REGRESSION

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

chi2 (25) = 8044.04

Prob>chi2 = 0.0000