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Determinants of Credit Risk in the Banking Industry of Ghana.

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Abstract
This paper examines bank-specific, industry-specific and macroeconomic factors that influence credit risk (CR) in commercial banks in Ghana using unbalanced panel data set from 33 commercial banks covering the 21-year period 1990 to 2010. The study employed annual time series data from 1990 to 2010. The paper is the first of its kind in Ghana, a developing country with emphasis on macroeconomic tools relied on by the central bank for creating a stable macroeconomic environment.
Results suggest that credit risk in Ghana is significantly influenced by management efficiency, GDPPC, Government borrowing and the financial sector development. Government borrowing and financial sector development have a negative relationship with credit risk while management inefficiency and GDPPC have a positive relationship.
Keywords: Ghana, Credit risk , Bank-specific factors, Industry-Specific factors, Macroeconomic variables

1. Introduction and Background

The purpose of this paper is to develop a conceptual model to be used further in understanding credit risk management system of commercial banks in an economy with a less developed financial sector. This research reviews existing literature that consists of evidence from both developed and developing countries. A study model is proposed with amendment to fit Ghana's environment. This is achieved through the use of secondary data (annual financial reports) of commercial banks.

Credit risk management is indeed a very difficult and complex task in the financial industry because of the unpredictable nature of the macroeconomic factors coupled with the various microeconomic variables which are peculiar to the banking industry or specific to a particular bank. Unfortunately, banks in Ghana have found themselves in such an unpredictable macroeconomic environment for a very long time. While there are several strategies of addressing the problem of instability and efficiency, the research attempts to investigate the factors that influence the determination of the banks' credit risk.

The business of banking involves taking and managing risks. A major activity of banks is lending which involves the risk that the borrower will not pay back the loan as promised, and paying a fixed rate of interest on term deposits. This involves the risk that lending rates will drop, leaving the bank earning less on its investments than it is paying out on deposits. The Ghanaian banking industry is currently one of the most buoyant and competitive yet profitable sectors of the economy; a study of the profit and loss statements of new entrants shows that majority of them start making profit barely two years in operation, despite the intense competition within the industry. But this does not mean the sector does not have problems.

The rest of the paper is organized as follows: Section 2 reviews the literature, Section 3 looks at the methodology, Section 4 discusses the empirical findings, describes the data and the econometric methodology, while Section 5 concludes the study.

2. Review of Literature

2.1 Theoretical Literature

Credit risk is defined as the risk that the promised cash flows from loans and securities held by financial institutions may not be paid in full (Saunders & Cornet,2008 and Al-Smadi & Ahmed, 2009). Credit risk is the main cause of bank failures, and the most visible risk facing banks' managers (Gup et al, 2009). In the view of Rose and Hudgins (2008) credit risk is the probability that some of the financial institution's assets, especially its loans, will decline in value and perhaps become worthless. Al-Smadi and Ahmad 2009) indicate that an in-depth study and understanding on the manner in which internal and external factors contribute to credit risk warrant further analysis. At macro level, GDP, inflation and market interest rate have been identified as having significant impact on credit risk. While at micro level, previous non-performing loans, loan growth, loan concentration and bank size are significant determinants.

This research examines factors affecting credit risk in the Ghanaian banks. About seventy percent of bank business in Ghana is made up of credit. Therefore credit risk is the most dominant risk faced by banks in Ghana. Credit risk is a determinant factor in interest rate spread. The higher the risk the greater the interest rate spread and vice versa. According to Demirguc-Kunt and Huizinga (1998) differences in interest margins reflect differences in bank characteristics, macroeconomic conditions, existing financial structure and taxation, regulation, and other institutional factors. The result of Ngugi's (2001) work show that when the profit margin is threatened, banks sustain a widening spread. Faced with a rising credit risk due to distress borrowing and poor macroeconomic conditions, banks charge a higher risk premium on their lending rate.

2.2 Empirical Literature

Empirical literature identifies bank-specific, industry-specific and macroeconomic variables as affecting CR. In this research, bank ownership (whether locally-owned or foreign) and management efficiency are the bank-specific factors investigated, while industry specific factors are financial sector development and competition. The macroeconomic variables considered are the required reserve, the discount rate, inflation, Government borrowing, Treasury bill and the Gross Domestic Product Per Capita (GDPPC).

2.2.1 Bank Specific Factors

Existing literature identifies the following as some of the bank-specific factors that impact credit risk: bank ownership structure, Operating expenses, efficiency of management, deposit composition and quality, asset quality, capital and size and bank reserve requirement. In this research, bank ownership and efficiency of management are the two bank-specific variables used.

For bank ownership and structure, Demirguc-Kunt and Huizinga (1998), find in their research study that foreign banks have higher margins and profits compared to domestic banks in developing countries, while the opposite holds in developed countries. Garcia-Herrero (2006), also observes that foreign banks generally count with a better production technology, which allows them to be more efficient and, thereby, more profitable. Second, foreign banks could actually enjoy better regulatory or tax conditions (as a way to attract them), which should also improve profitability. On the other side of the coin, foreign banks may face information disadvantages. Dietrich and Wanzenried (2009) however indicate that foreign banks in Switzerland are less profitable than Swiss owned banks. Bashir (2000) also maintains that foreign-owned banks are more profitable than their domestic counterparts among Islamic banks.

Technically speaking, a more efficient bank should have higher profit since it is able to maximise on its net interest income. Molyneux and Thorton (1992) observe a positive relationship between efficiency and profitability. Al-Smadi and Ahmed (2009), conclude that at the micro level, precautionary credit policies adopted by the banks during periods of high demand on loans lead to reduce the banks' credit risk exposure. Also according to Ramlall (2009) the higher the efficiency level of the bank, the higher its profit level. Hence a positive relationship is posited between efficiency and profitability of banks. Angbazo (1997), and Maudos and Fernández de Guevara (2004) maintain that a good management means picking up high quality assets (low risk and high return assets) and low cost liabilities.

Garcia-Herrero (2006) and Ramlall (2009) identify poor asset quality, as indicated by the high levels of non-performing loans (NPLs) to be responsible for the low profitability. The negative effect of non-performing loans on bank profitability has been collaborated by Sarpong et al (2011) in their research on Ghana. Bashir (2000) also concludes that large loans to asset ratios lead to higher profitability.

2.2.2 Industry-Specific Factors

Two industry-specific factors have been used in this research. These are competition and the financial sector development. On competition, Anginer et al. (2012), Rose and Hudgins (2008) and Demirguc-Kunt and Huizinga (1998) all agree that competition is good for the banking sector as greater competition encourages banks to take more diversified risks, making the banking system less fragile to shocks. That competition tends to squeeze the difference between average asset yields and average liability costs. In the view of Jimenez and Saurina (2006) strong competition among banks or between banks and other financial intermediaries erodes margins as both loan and deposit interest rates get closer to the interbank rate.

Two major indicators are used to represent financial sector development in literature: the ratios of M2+ to GDP

referred to in this research as FSD1 and bank total asset to GDP also referred to in this paper as FSD2. These ratios, according to Tennant and Folawewo (2008) reflect the overall level of development of the banking sector and the level of competition in well-developed banking sectors. This research adopts these two ratios to represent the financial sector development. An increase in any of these ratios is an indication of improvement in the development of the financial sector. According to Ngugi (2001) inefficiency in the intermediation process is a characteristic of a repressed financial system. This is because in a control policy regime, selective credit policies involve substantial administrative costs, and interest rates with set ceilings fail to reflect the true cost of capital.

2.2.3 Macroeconomic Variables

The importance of the macro economy is captured in the words of Jimenez and Saurina (2006) who observe that banks' lending mistakes are prevalent during upturns than in the midst of recession. Bashir (2000) observes that favourable macroeconomic conditions impact performance measures positively. Similarly, Al-Smadi and Ahmed (2009) also reveal that at macro level, conditions associated with good economic periods contribute in decreasing the banks' credit risk exposure. Ramlall (2009) considers the following macroeconomic factors in his research: interest rate, cyclical output, the level of economic development and stock market capitalisation. Cyclical output and the level of economic development are usually used to represent the business cycles since banks' profits are expected to be correlated with the business cycles, being higher in case of upswings and lower in case of downswings (Demirguc-Kunt & Huizinga 1998 and Bikker & Hu, 2002).

This research has investigates the following variables and their effect on credit risk: the Treasury bill rate, the discount rate, Government borrowing, inflation, the GDPPC and the required reserve. Generally, not much research work has investigated the relationship between most of these macroeconomic variables and credit risk. This is what has made this research very unique. However, there are research works in related subjects such as the effect of these macroeconomic factors on the interest rate spread and the interest margin.

Treasury bill and other bond rates fall when the government lowers interest rates, which means that the value of Treasury bill rises. Lower rates also mean lower interest payments for individual investors and businesses, which may lead to more consumer spending and business investment. Ngugi (2001) identifies an asymmetric response with the treasury bill rate where lending rates increase with the treasury bill rate, and become sticky downward when the treasury bill rate declines. Treasury bills in Ghana are classified on the maturity period like 91-days, 182-days and 364-days. In this research the 91-day bill has been adopted as a benchmark for measuring the cost of doing business in Ghana.

The Discount Rate is an instrument of Discount Policy, and is used by the Bank to influence the flow of money and credit in a desired direction. The discount rate serves as an important indicator of the condition of credit in an economy. Because raising or lowering the discount rate alters the banks' borrowing costs and hence the rates that they charge on loans, adjustment of the discount rate is considered a tool to combat recession or inflation. The discount rate was highly significant in the models of Folawewo and Tennant (2008), where it is positively correlated with banking sector spreads.

Boyd et al. (2001) show that countries with high inflation have underdeveloped financial systems and that banks with higher inflation rates are positively associated with net interest margins. According to Athanasoglou et al. (2006) Demirguc-Kunt and Huizinga (1998) a widely used proxy for the effect of the macroeconomic environment on bank profitability is inflation. And in their respective works find a positive relationship between inflation and bank profitability. Voridis (1993) on the other hand claims that increased uncertainty in the economy causes the banks to ration credit and lead to disequilibrium in credit markets. Al-Smadi and Ahmed (2009) associate high inflation with decrease in credit risk.

Raising reserve requirements forces banks to withhold a larger portion of their funds, thereby reducing the money supply, while lowering requirements works the opposite way to increase the money supply. The reserve requirement sets the minimum reserves each bank must hold to demand deposits and bank notes. The reserve requirement in the banking sector may constrain credit supply and for that matter bank profitability. Navneet et al. (2009) maintain that increase in non-interest bearing reserve requirements results in a widening of banking spread as banks face reduced liquidity. Sapong et al (2011) also confirm that in Ghana, commercial banks respond to increases in reserve requirements by increasing the margin between lending and deposit rates. In the view of Kwakye (2010), the fact that the reserves are unremunerated constitutes a cost to the banks, as they have to pay interest to depositors, however low that may be.

Investigating Government borrowing, Looney and Frederiken (1997) suggest crowding out might occur if the

government uses the limited physical or financial resources or produces an output to compete with the private sector. If the Government competes with the private sector for credit this may lead to an increase in cost of loans. Thus, the net effect of government investment on private investment depends on the extent of crowding out on the one hand and the complementarity of public and private investment on the other hand. In this research Government borrowing takes two forms-Government direct borrowing from banks and Government indirect borrowing through the issue of Government securities, which is represented by the amount of Treasury bills.

A rise in per capita GDP signals growth in the economy and tends to translate as an increase in productivity. Real per capita GDP should have a negative effect on interest rate spread, as it is included as a general index of economic development, and should reflect differences in banking technology and mix of banking opportunities (Demirguc-Kunt and Huizinga, 1998). A higher GDPPC is an indication of increase in purchasing power and for that matter the ability of borrowers to pay their loans. It also means the ability of savers to increase their savings. It is supposed to have a negative relationship with credit risk which is represented by the loan loss provision.

3. Methodology

3.1 Data and Sources

An annual time series data for the period 1990 to 2010 has been used for this study. Information on the above mentioned factors have been used. The sources of data are Bank of Ghana and Ghana Statistical Services.

3.2 Empirical Model

Empirical literature identifies several factors as impacting credit risk in the banking industry. These have categorized the factors into three broad groups: bank specific factors, industry and macroeconomic factors. Das and Ghosh (2007), Gonzalez-Hermosillo et al (1997), Demetriades and Luintel, (1996) among others find bank specific factors including real loan growth rates, size of loan portfolio, bank size, operating efficiency, branch outlets among others as affecting credit risk. Rajaraman et al (1999), Das and Ghosh (2007) identified macroeconomic factors affecting credit risk. This study investigates the influence of micro and macroeconomic factors on credit risk using the panel model below. The model expresses credit risk as a function of a vector of controls including bank level characteristics, industry variables and macroeconomic indicators:

$$CR_{it} = \alpha_i + \sum \varphi_j X^{F}_{jit} + \sum \psi_j X^{I}_{jit} + \sum \gamma_j X^{M}_{jit} + \varepsilon_{it}$$

Where CR represents credit risk, measured by two ratios which are (1) the ratio of Loan Loss Provision to total assets of banks referred to in this paper as CR1 and (2) the ratio of net interest income to total assets also referred to as CR2 in this research; X^{F} represents a vector of bank level characteristics, X^{I} represents industry characteristics and X^{M} represents macroeconomic indicators including inflation volatility; α_i represents bank specific unobserved heterogeneity and ε_{it} is the error term.

3.3 Estimation Technique

The concept of panel data is used to analyse the relationships between the dependent variables in the model and the chosen explanatory variables. Unlike the usual pooled ordinary Least Squares (OLS), Panel data regression techniques take into account various biases and other disturbances in regression analyses by controlling for unobservable or unspecified differences among firms not easily incorporated in practice. The study employs the panel data model below:

$$Y_{it} = \alpha_i + \delta_t + \beta' X_{jit} + \varepsilon_{it} \qquad t = 1,\ldots,T; \quad j = 1,...,k \ \& \ i = 1,....N$$

Where α represents cross sectional heterogeneous effect which is time invariant, δ time variant effect but cross-sectionally invariant, X_{it} is a vector of explanatory variables, i represents the number of Banks, j is the number of explanatory variables and t represents time period, measured in years. ε is the unobserved time specific effect and μ is the idiosyncratic error term.

3.3.1 Bank Specific Variables

Ownership Structure is a binary variable assuming the value 1 for locally owned bank 0 for foreign owned banks. Foreign owned banks are expected to report lower IRS than the locally owned banks. To assess the role of

management and officers of banks, the efficiency of management is measured. Management Efficiency is measured by the ratio of operating expenses to total income. It is expected that more efficient management should lead to reduced credit risk.

3.3.2 Banking Industry Variables

The two banking industry variables used in this research are the financial sector development and competition. Two major indicators are used to represent financial sector development-the ratio of M2+ to GDP (FSD1) and the ratio of bank total asset to GDP (FSD2). This study also uses the Hirschman-Herfindahl Index (HHI) as an indicator of industry competition. It is measured as the sum of square of the market shares of all firms in industry j for year t, the market share of each bank is the ratio of total asset (ta) the ith bank to the industry's total asset (TA). Thus:

$$HHI_t = \sum_{i=1}^{n_{jt}} s_{it}^2 = \sum_{i=1}^{n_{jt}} \left(\frac{ta_{it}}{TA_t} \right)^2$$

3.3.3 Macroeconomic Variables

The macroeconomic determinants of credit risk included in this study account for the impact of macroeconomic instability and the macro-policy environment on banking sector CR. The macro-policy environment is captured in the model through the use of five variables: the extent of government reliance on the banking industry, discount rates and treasury bills, inflation and required reserves. GDPPC is used as a proxy for economic growth. Consumer Price Index, CPI is used as a proxy for inflation. This variable is an indicator of the cost of doing business in an economy, and it is expected to be positively correlated with credit risk. The GDPPC represents the average income level of the population. Government Borrowing represents the extent of government dependence on the domestic banking sector for the financing of its fiscal deficit. This variable measures for the entire banking sector, public sector borrowing as a percentage of GDP. Governments' heavy reliance on domestic banking sectors for deficit financing increases competition for funds and causes interest rates to rise. Governments borrow directly from the banks and also through the issue of Government Securities which in this case is the Treasury bill.

The Discount Rate is defined as the cost faced by commercial banks when borrowing from the central bank. It serves as a leading indicator of interest rates in the economy. If the policy rate is increased, transaction interest rates should move upwards and vice versa. The policy rate works by directly controlling the amount of money available to the public and consequently inflation. Treasury Bill rate is generally regarded as an indicator of the interest rate policy being pursued by the government, and a benchmark for the rates charged by commercial banks while the Required Reserves is used as a proxy for the influence of regulatory and supervisory institution. As put forward by Tandelilin et al (2007), the enforcement of regulations such as the required reserves limits the ability of bank managers to over-issue liabilities or divert assets into high-risk ventures.

4. Discussion of Empirical Findings

4.1 Descriptive Statistics

Several descriptive statistics are calculated of the variables under study in order to describe the basic characteristics of these variables. Table 1 presents the descriptive statistics of the data, containing sample means, medians, maximums, minimums, standard deviations, skewness, kurtosis as well as the Jarque-Bera statistics and probabilities (p values).

As can be seen from Table 1, all the variables exhibit a positive mean. Also the sum squared deviation row represents the net change over the sample period. In terms of skewness, CR2 and Ownership have distribution that are negatively skewed while the remaining variables exhibit a positive skewness which implies that it has a fat right tails. Kurtosis value of Competition (Compt), Credit Risk (CR1), Government Borrowing, Government Security, CPI, Management (MGT) and Bank Reserve show that data is not normally distributed because values of kurtosis are deviated from 3. The reported Jarque-Bera statistics and corresponding p-values are used to check for the normality assumption. Based on the Jarque-Bera statistics and p-values this assumption is rejected at 5 percent level of significance for Competition (Compt), Credit Risk (CR1), Government Borrowing, Government Security, CPI, Management (MGT) and Bank Reserve variables, with the remaining variable being normally distributed. The descriptive statistics indicates that the values are not normally distributed about its mean and variance and therefore, being sensitive to speculation and shows periodic change.

Table 1: Descriptive Analysis of Variables

	COMPT	CR1	CR2	D/RATE	FSD1	FSD2	GDPPC	GOVT BOR.	GOVTSECUR	CPI	OWNERSHIP	MGT	RESERVE	TBILL
Mean	0.5832	5.06619	171.417	27.3814	0.02387	1.95995	465.29	3891.947	34320.9	23.2429	0.6667	13.3286	15528.72	26.9767
Median	0.0612	5.08	171.294	27	0.02379	2.00776	214	1885.2	17937.4	19.3	1	11.73	5154.53	27.13
Maximum	4.6528	9.26	270.88	45	0.03338	2.87669	1554	19249.68	178107	58.5	1	31.4	74117.44	47.88
Minimum	0.0001	3.53	57.0798	13.5	0.01532	1.10481	19.668	854.3	1139.23	10	0	4.53	348.31	9.83
Std. Dev.	1.198	1.37635	50.5438	10.1114	0.00582	0.46846	515.53	4784.994	43369.8	12.7506	0.483	6.09298	20831.64	12.1445
Skewness	2.4329	1.33401	-0.0723	0.43798	0.01507	0.13411	1.0708	2.197293	1.98507	1.32609	-0.707	1.31425	1.620149	0.26911
Kurtosis	7.993	5.11947	3.09031	2.08529	1.81349	2.3725	2.8135	6.780886	6.92183	4.23699	1.5	4.98141	4.595923	1.98046
Jarque-Bera	42.531	10.1591	0.02543	1.4035	1.23263	0.40749	4.0438	29.40654	27.25	7.49364	3.7188	9.48063	11.41569	1.163
Probability	0	0.00622	0.98736	0.49572	0.53993	0.81567	0.1324	0	1E-06	0.02359	0.1558	0.00874	0.00332	0.55906
Sum	12.247	106.39	3599.76	575.01	0.50133	41.1589	9771.2	81730.89	720740	488.1	14	279.9	326103.1	566.51
Sum Sq. Dev.	28.704	37.8865	51093.5	2044.8	0.00068	4.38902	5E+06	4.58E+08	3.76E+10	3251.57	4.6667	742.489	8.68E+09	2949.78
Observations	21	21	21	21	21	21	21	21	21	21	21	21	21	21

Table 2: Correlation Analysis of Variables

	COMPT	CR1	CR2	D/RATE	FSD1	FSD2	GDPPC	GOVT BOR.	GOVTSECUR	CPI	OWNERSHIP	MGT	RESERVE	TBILL
COMPT	1	-0.309	0.163	-0.473	0.352	-0.475	0.878	0.984	0.946	-0.339	-0.662	0.019	0.96	-0.47
CR1	-0.309	1	-0.785	0.09	-0.316	-0.081	-0.289	-0.345	-0.3	0.073	0.209	0.528	-0.308	-0.063
CR2	0.163	-0.785	1	0.084	0.252	0.079	0.114	0.164	0.211	0.136	-0.028	-0.461	0.145	0.256
D/RATE	-0.473	0.09	0.084	1	-0.603	0.25	-0.734	-0.443	-0.631	0.698	0.764	0.045	-0.638	0.877
FSD1	0.352	-0.316	0.252	-0.603	1	0.221	0.513	0.273	0.512	-0.32	-0.404	-0.349	0.489	-0.451
FSD2	-0.475	-0.081	0.079	0.25	0.221	1	-0.561	-0.52	-0.459	0.262	0.556	0.105	-0.508	0.387
GDPPC	0.878	-0.289	0.114	-0.734	0.513	-0.561	1	0.867	0.915	-0.457	-0.88	-0.16	0.97	-0.683
GOVTBOR.	0.984	-0.345	0.164	-0.443	0.273	-0.52	0.867	1	0.908	-0.307	-0.666	0.016	0.94	-0.449
GOVTSECUR	0.946	-0.3	0.211	-0.631	0.512	-0.459	0.915	0.908	1	-0.41	-0.768	-0.101	0.956	-0.615
CPI	-0.339	0.073	0.136	0.698	-0.32	0.262	-0.457	-0.307	-0.41	1	0.487	0.073	-0.398	0.685
OWNERSHIP	-0.662	0.209	-0.028	0.764	-0.404	0.556	-0.88	-0.666	-0.768	0.487	1	0.222	-0.784	0.754
MGT	0.019	0.528	-0.461	0.045	-0.349	0.105	-0.16	0.016	-0.101	0.073	0.222	1	-0.084	0.005
RESERVE	0.96	-0.308	0.145	-0.638	0.489	-0.508	0.97	0.94	0.956	-0.398	-0.784	-0.084	1	-0.607
TBILL	-0.47	-0.063	0.256	0.877	-0.451	0.387	-0.683	-0.449	-0.615	0.685	0.754	0.005	-0.607	1

4.2 Correlation of Matrix

The correlation analysis is performed to measure the extent of multicollinearity among variables. The logic behind the assumption of no multicollinearity is simply that if two or more independent variables are linearly dependent on each other, one of them should be included instead of both. If the value of correlation coefficiency is greater than 0.70 or less than -0.70, it can be interpreted as variables having multicollinearity problem. The solution to the multicollinearity problem is to drop one of the collinear variables. According to the correlation table (Table 2 below), the variables that indicate more than 0.70, with a high probability value were dropped to avoid autocorrelation and multicollinearity problem.

4.3 Augmented Dickey-Fuller Unit Root Test

Most time series data are often presumed to be non-stationary and thus it is necessary to perform a pretest to ensure there is a stationary cointegrating relationship among variables to avoid the problem of spurious regression.

Table 3

Augmented Dickey-Fuller (ADF) Unit Root Test							
Variables	***Levels (Intercept Only)***				***First Difference (Intercept Only)***		
	Sig.level(%)	t-statistics	Prob.*		Sig.level (%)	t-statistic	Prob.*
ADF test statistics	-	-9.217496	0				
CR1	1	-3.4562					
	5	-2.87281					
	10	-2.57285					
ADF test statistics	-	-2.851286	0.0691			-7.1328	0
CR2	1	-3.808546			1	-3.8315	
	5	-3.020686			5	-3.03	
	10	-2.650413			10	-2.6552	
ADF test statistics	-	-20.7234	0				
Management	1	-3.45529					
	5	-2.87241					
	10	-2.57264					
ADF test statistics	-	-6.571026	0				
GDPPC	1	-3.455193					
	5	-2.87237					
	10	-2.572615					
ADF test statistics	-	-5.008901	0				
Bank Reserve	1	-3.808546					
	5	-3.020686					
	10	-2.650413					
ADF test statistics	-	-2.695108	0.093			-4.7707	0.002
CPI	1	-3.455887			1	-3.9204	
	5	-2.872675			5	-3.0656	
	10	-2.572778			10	-2.6735	
ADF test statistics	-	-1.165025	0.668			-4.3285	0.0035
Tbill	1	-3.808546			1	-3.8315	
	5	-3.020686			5	-3.03	
	10	-2.650413			10	-2.6552	
ADF test statistics	-	-1.609641	0.46			-3.7557	0.0117
Discount Rate	1	-3.808546			1	-3.8315	
	5	-3.020686			5	-3.03	
	10	-2.650413			10	-2.6552	
ADF test statistics	-	-1.545543	0.4907			-3.9875	0.0072
Fin. Sec. Devt. 1	1	-3.808546			1	-3.8315	
	5	-3.020686			5	-3.03	
	10	-2.650413			10	-2.6552	
ADF test statistics	-	-1.93813	0.3095			-3.8115	0.0104
Fin. Sec. Devt.2	1	-3.808546			1	-3.8315	
	5	-3.020686			5	-3.03	
	10	-2.650413			10	-2.6552	
*MacKinnon (1996) one-sided p-values.							

Before proceeding with the OLS estimations, it is necessary to examine the time series properties of the variables by employing unit root tests. The Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979; 1981) unit root tests is being done in this study in order to check whether the time series are stationary or not. Table 3 presents the ADF unit root tests results. The optimal lag lengths for the ADF test were chosen. Lag five was the most efficient lag to be chosen based on the lag order selection criterion. ADF test indicates that CR1, Management and GDPPC, are stationary at levels with the remaining variables being stationary at first difference.

4.4: Regression Analysis for Credit Risk One (CR1)

Table 4a indicates that three variables namely Management, Government borrowing and Financial Sector Development (FSD 2 defined as the ratio of total asset to GDP) significantly influence Credit Risk (CR 1 defined as the ratio of loan loss provision to total asset). A p-value (prob.) less that 5% means the variable significantly influences the dependent variable at the 5% level. The negative sign against the coefficient of government borrowing and financial sector development suggest a negative relationship to credit risk. This means that whenever there is innovation and development in the financial sector, credit risk reduced and also an increase in government borrowing reduces credit risk and vice versa.

Table 4a: Regression Analysis for Credit Risk One (CR1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.213950	2.212671	2.356406	0.0325
MANAGEMENT	0.161761	0.046314	3.492677	0.0033
GOVT BORROWING	-0.000210	6.67E-05	-3.179302	0.0062
DISCOUNT RATE	0.011703	0.035079	0.333619	0.7433
FIN. SEC. DEVT.1	77.19347	71.99158	1.072257	0.3006
FIN. SEC. DEVT. 2	-1.858250	0.771118	-2.409807	0.0293
R-squared	0.587614	Mean dependent var		5.066190
Adjusted R-squared	0.450152	S.D. dependent var		1.376345
S.E. of regression	1.020583	Akaike info criterion		3.113582
Sum squared resid	15.62385	Schwarz criterion		3.412017
Log likelihood	-26.6926	Hannan-Quinn criter.		3.178350
F-statistic	4.274742	Durbin-Watson stat		2.836373
Prob(F-statistic)	0.012876			

Table 4b: Model Diagnostic Tests

Serial Correlation	F(2,11)=0.9537[0.47575]
Heteroskedasticity	F(7,13)=0.9537[0.147575]
Normality	X2 (2)=0.230666[0.891069]

The fundamental regression statistics show that R^2 (58.76%) is high implying that overall goodness of fit of the model is satisfactory. It also means that about 58% of credit risk variation is explained by the model. Further, the Durbin Watson Statistic (2.8) shows that there is no autocorrelation in the residuals. The F-statistic of 2.836373 with it corresponding p-value [0.012876] suggests that the five independent variables jointly impact credit risk. The diagnostic test statistics reported in Table 4b indicates that the model passes serial correlation and heteroscedasticity and normalilty test at the 5%, meaning a good model. The cumulative sum (CUSUM) plots in Figure 1 from a recursive estimation of the model indicate stability in the dependent variable over the sample period.

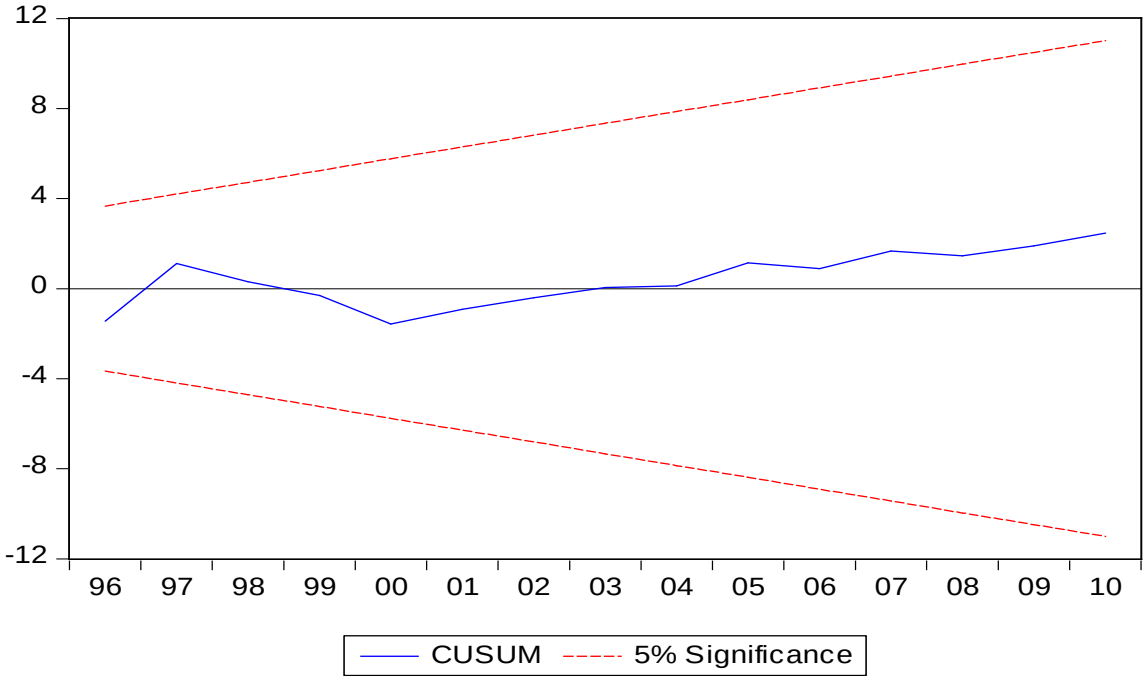

Figure 1: Stability Test for the Credit Risk Model 1

4.5: Regression Analysis for Credit Risk two (CR2)

Table 5a indicates that two variables namely Management, GDPPC significantly influence Credit Risk (CR 2 defined as the net interest income to total asset) at the 5% significant level.

The fundamental regression statistics show that R^2 (46.97%) is on average implying that overall goodness

Table 5a: Regression Analysis for Credit Risk Two (CR2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.028480	0.481209	-0.059179	0.9535
MANAGEMENT	0.210628	0.077482	2.718405	0.0152
CPI	-0.012180	0.010430	-1.167841	0.2600
GDPPC	0.000864	0.000273	3.162370	0.0060
TBILL	0.015214	0.013570	1.121187	0.2788
R-squared	0.469718	Mean dependent var		1.714170
Adjusted R-squared	0.337147	S.D. dependent var		0.505438
S.E. of regression	0.411506	Akaike info criterion		1.266271
Sum squared resid	2.709396	Schwarz criterion		1.514967
Log likelihood	-8.295840	Hannan-Quinn criter.		1.320244
F-statistic	3.543156	Durbin-Watson stat		2.567457
Prob(F-statistic)	0.029748			

Table 5b: Model Diagnostic Tests

Serial Correlation	F(5,11)=1.680351 [0.2196]
Heteroskedasticity	F(5,10)=0.473466 [0.7883]
Normality	X2 (2)=1.906345[0.385516]

of fit of the model is satisfactory. It also means that about 46% of credit risk variation is explained by Management and GDPPC. Further, the Durbin Watson Statistic (2.6) shows that there is no autocorrelation in the residuals. The F-statistic of 3.543156 with it corresponding p-value [0.029748] suggests that the four independent variables jointly impact credit risk in the long run. The diagnostic test statistics reported in Table 5b indicates that the model passes serial correlation and heteroscedasticity and normalilty test at the 5%, meaning a good model. The cumulative sum (CUSUM) plots in Figure 2 from a recursive estimation of the model indicate stability in the dependent variable over the sample period.

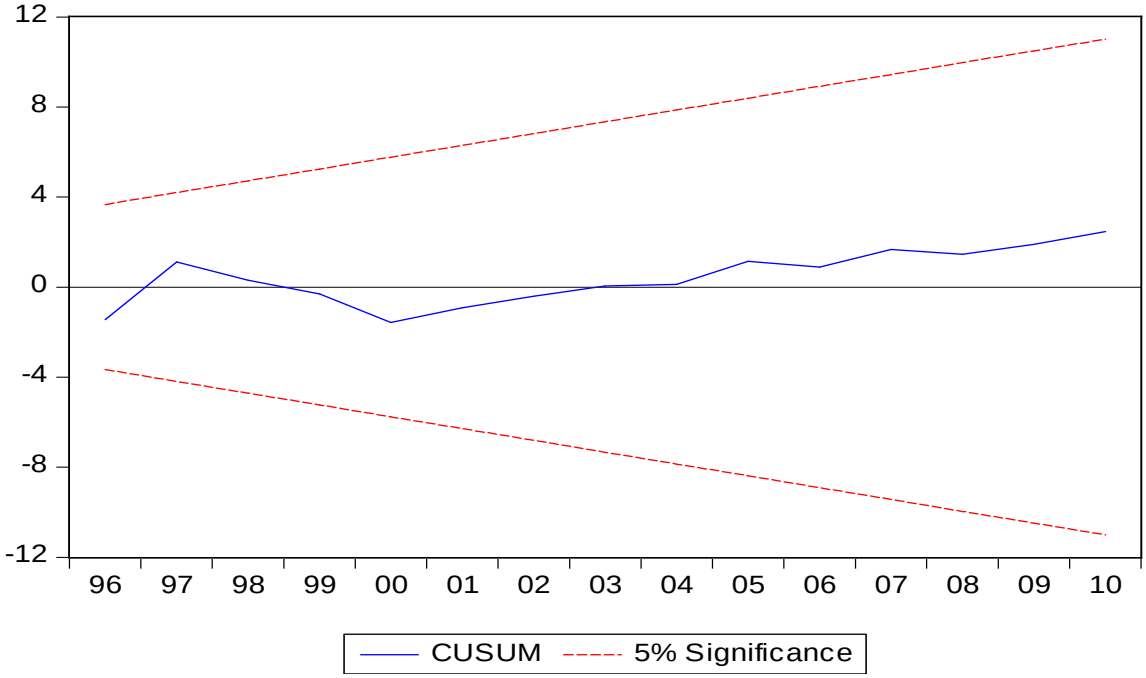

Figure 2: Stability Test for the Credit Risk Model 2

Conclusions and Recommendations

This paper undertook to investigate the effect of bank-specific, industry-specific and macroeconomic determinants of credit risk of commercial banks in Ghana. A unique feature of this study is the emphasis on macroeconomic factors such as Government borrowing, Government securities, the required reserve, the bank discount rate, the Treasury bill rate and the inflation rate which are known to influence credit risk.

This study involved the following three stages: (1) a brief description of the banking system of Ghana, (2) a discussion of the determinants of bank credit risk; 3) the empirical model, and (4) the discussion of empirical findings.

It has been found that there is no significant relationship between bank ownership, FSD1, Government securities, Treasury bill rate, the discount rate and the GDPPC on one hand and CR1, while management inefficiency, Government borrowing and FSD2 have significant relationship with the CR1. While management efficiency has a positive relationship Government borrowing and FSD2 have a negative relationship. An increase in management inefficiency is supposed to lead to a higher CR1. An increase in Government borrowing and an improvement in the FSD2 (bank assets/GDP) is supposed to lead to a decline in CR1.

Again the regression analysis reveals a positive relationship between management inefficiency and GDPPC on one hand and CR2. This suggests that as each of the two increases, CR2 also increases. Management inefficiency means a higher operating cost as a ratio of operating income. This means that for CR2 measured by net interest income/total asset ratio to go up then the operating cost must increase. A positive relationship means that an increase in the GDPPC would lead to an increase on CR2. A higher GDPPC suggests increase in the income level of the individuals, leading to the ability to take more loans and for that matter an increase in net interest income for banks. It also means an improvement in the ability to repay loans and thus more net interest income.

That the required reserve, Treasury bill rate and the discount rate do not influence credit risk means that these variables are not good policy instruments to be used to influence the performance of banks. Again changes in the rate of inflation do not result in the worsening or improvement in bank performance by way of credit risk

management.

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