RESEARCH ARTICLE

CREDIT RISK AND COMMERCIAL BANK PROFITABILITY IN RWANDA.

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Manuscript Info	*Abstract*
	This study carried out an empirical analysis on credit risk and commercial bank profitability in the Republic of Rwanda over the period 2006-2015 quarterly basis, this study investigates the co-integration and causal relationship between the credit risk indicators that is non performing loans (NPL) Loan loss provision (LLP) and Capital adequacy ratio (CAR) together with macro-economic variables such as inflation,(CPI),gross domestic product (GDP) and interest rate as a moderate variable to the commercial bank profitability/performance measured by ROA (return on asset), ROE (return on equity) and NPM (net profit margin).The analysis employs Augmented Dickey Fuller (ADF) test, Johansen's co integration test, Granger causality test and other tests over the study period, the relationship between the variables under study are examined, the results have found evidence that the variables are co-integrated. In addition to this, our findings show that credit risk indicators, macro economic variables used in this study are negatively and positively related to the banking performance measured by its selected indicators to one way or otherwise based on the magnitudes estimated in the study. However this study revealed that an increased exposure to credit risk reduces bank profitability, therefore, the banks should adopt an aggressive deposit mobilization to increase credit availability and develop a reliable credit risk management strategy with adequate punishment for loan payment defaults.

Introduction:-

The role of banks is like blood arteries of human body in developing economies as it accounts for more than 90 percent of their financial assets (ADB, 2013) due to less borrowers' access to capital market. (Noman, 2015) Therefore, efficient intermediation of banks is vital for developing economies in order to achieve high economic growth, while ruin of them leads to economic crisis. However, intermediation function of banks gives rise to different types of risks with different magnitudes and level of causes on bank performance such as credit risk, liquidity risk, market risk, operational risk. Among the others Credit risk is found most important type of banking risk. (Sajeda Pervin, 2015)

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When a seller transfers his wealth to a buyer who has agreed to pay later, there is a clear implication of trust that payment will be made at agreed date. Major causes of serious banking problems are directly related to lax credit standards for borrowers. Poor portfolio assessment or lack of attention to changes in economic circumstances, common in emerging economies (Jahan, 2014) Banks as financial institutions extend credit to their customers in form of loans, overdrafts, off balance sheet activities (i.e., letter of credit (LC) guarantees), and credit card facilities. Banks grant credit to enhance their revenues streams, maintain a competitive edge, to act as its bargaining power in the industry, as the industry practice as well as to enhance the relationship with their customers.

Lending is one of the main factors of Asset side of balance sheet of a bank. So, profitability of the bank is greatly involved with the lending procedure to borrowers. A profitable banking sector is better able to withstand negative shocks and contribute to the stability of the financial system. The profitability of a financial institution is affected by numerous factors. These factors include elements internal to each financial institution and several important external forces shaping earnings performance. Credit risk is the primary financial risk in the banking system and exists in virtually all income-producing activities. How a bank selects and manages its credit risk is critically important to its performance over time; indeed, capital depletion through loan losses has been the proximate cause of most institution failures.

Banks invest in debt of those customers. The price of debt sold might be lower than the price as the bank bought debt. This makes a net loss of banks. However, the loss from the default of the bank does not have to be great it depends on the percent of recover from obligor and total exposure of banks. And a good risk management tries to avoid high exposure on risk.

Although the regulations have been evolutionarily developed, the three Basel Accords all have placed explicitly the onus on banks to adopt sound internal credit risk management practices to assess their capital adequacy. (Fan Li, 2014)

Background of the study:-
The stream of bank failures experienced in the USA during the great depression of the 1940s prompted considerable attention to bank performance. The attention has grown ever since then (Heffernan, 2005). The recent global financial crisis of 2007/2009 also demonstrated the importance of bank performance both in national and international economies and the need to keep it under surveillance at all times. (T.G.Arun, 2004)Argued that the importance of banks is more pronounced in developing countries because financial markets are usually underdeveloped, and banks are typically the only major source of finance for the majority of firms and are usually the main depository of economic savings. (Hoffmann, 2011)

The development of the financial sector before the genocide of 1994 was slow. At the time, only 3 commercial banks and 2 specialized banks operated with a total of less than 20 branches in the country, and one microfinance (UBPR) with around 146 branches. The war and the genocide affected heavily the banking sector which led to the closure of the Central bank for 4 months. The former government left the country in 1994 for the DRC, after committing the genocide, with two-thirds of the national monetary base in addition to US $7 million in cash which was taken from the UBPR. Consequently, it took two years for this bank to reopen, in 1996.

Moreover, almost both physical and human capital of all banks was destroyed during the genocide. The post genocide period was marked by increase in number of banks, where in 2002 there were 6 commercial banks with 28 branches, 2 specialized banks and 1 union of financial institutions (UBPR) with 148 branches (NBR, 2004). In 2007, commercial banks operated only 38 branches, making only 7 % of all branches of financial institutions and by the end of 2008, 8 commercial banks, and due to increase of foreign banks by 2014 the number increased to 11(BNR REPORT 2014)

The Rwanda financial sector is largely dominated by banking sector which hold around 66.9 percent of the total financial sector assets. The pension sub-sector comes second, with 17.1 percent of the total financial sector assets. Insurance institutions hold 9.7 percent of the total financial sector's assets. Microfinance institutions account for 6.3 percent of total financial sector assets. The National Bank of Rwanda (BNR) is the sole regulator of the above mentioned financial sector sub-sectors. Other integral components of the financial sector in Rwanda are: forex bureaus; capital market and; payment system.

Between 2007 and 2010, Rwanda's banking sector faced dramatic turbulence. "The banking sector at the end of 2008 was suffering from high levels of Non-Performing Loans, lack of liquidity [lack of cash], poor infrastructure, high operating losses and bad controls," said the Managing Director of Rwanda Commercial Bank (BCR) Anand Sanjeev. Domestic credit also went down significantly, as banks lacked cash to lend out, leaving the economy to contract below 7%. Banks, according to Anand, also held back on large extensions of credit and focused internally to fix the internal shocks, which eventually helped to lay foundation for an improvement in performance. In 2010, when the economy regained strength, the banking sector

Between June 2014 and June 2015, the number of banks increased from 14 in June 2014 to 17 in June 2015**.** Three banks: AB Bank, Crane Bank and BRD commercial joined the Rwandan banking industry. In total, the Current Rwandan banking system is composed of 11 commercial banks, 4 microfinance banks, 1 development bank and 1 cooperative bank. Microfinance's sub-sector constitutes 13 limited companies, 64 SACCOs and 416 UMURENGE SACCOs. There are also 88 foreign exchange bureaus. Non-Bank Financial Institutions include: 10 private insurers, 2 public insurers, 8 loss adjusters, 6 brokers, 155 insurance agents and 1 public pension fund and 54 private funds. (BNR REPORT ON FINANCIAL STABILITY)

Rwandan banking system is more privately and domestically owned. As of June 2015, close to 61 percent of banking assets were domestically owned. Foreign assets were 39 percent. Private ownership stood at 55 percent of the total banking system assets. Three of the foreign banks are subsidiaries of Kenyan big banks which were ranked among top 100 banks by return on assets in Africa

The development of the financial sector in Rwanda is essential in financing development, for many reasons but specifically, the financial sector contributes to economic growth and government revenues and supports the mobilization of domestic savings, especially through improving access to finance in the medium to long-term. Second, the financial sector facilitates domestic and foreign debt financing and investments and access to international capital markets.

Problem statement:-
Banks in Rwanda regardless whether they are owned by government or private shareholders, are exposed to five types of core risks through their operation, which are credit risk, asset/liability risk, foreign exchange risk, internal control & compliance risk, and money laundering risk. Among these, credit risk is one of the most destructive risks for banks.

Lending represents the heart of the banking industry, loans are the dominant asset and represent 50-75 percent to total amount at most banks, generate the largest share of operating income, but represent the banks greater risk exposure. The more credit of a particular is in risk, the more probability of a bank to be bankrupt. (Westhuizen, 2014)

Banking sector in Rwanda are facing a lot of problems like considering a recapitalization to shore up its profitability levels, which are rattled by high operating costs, credit risk and fluctuations of interest rate among others, which are sabotaging the bank's profitability. (Maurice Toroitich)

Despite the decline in nonperforming loan ratio in Commercial banks from 7.2 in 2013 to 5.9 in 2015 it is still above the central bank cap or rate of 5% and its movements are almost completely random, followed by an increase of NPLR in Microfinance banks from 7.6 2014 to 7.9 in 2015. This is also followed by a high level of loan loss provisions which banks draw from their profits to cover such NPL ratio to be low , without clear implications on credit risk management, banks may expect future loss of profits (Source: BNR, Financial Stability Directorate.

With globalization of banking sector banks have to be competitive, profitability affects competitiveness, profitability also depends on the level of credit risk and how credit risk is managed and there are internal and external/macro-economic factors that affect profitability which this study intends to examine through looking to its relationship and magnitudes of such relationship in Rwandan commercial banks and overall banking sector.

Though, there are a number of studies that were conducted at a global level to examine the Relationship of the above scenario, most of the studies were made with reference to developed countries especially in, Europe and USA. This

means, they do not explain the issues for emerging market particularly for Rwandan case. This work intends to fill this gap specifically, to analyze relationship between credit risk and commercial bank profitability in Rwanda. Particularly to the knowledge of the researchers in Rwanda there are very few study done so far on this issue.

Objective of the research:-
General objective:-
The overall objective of the research is to study the relationship between credit risk and commercial bank profitability in Rwanda.

Specific objectives:-
To evaluate the relationship between credit risk and net profit margin in commercial banks of Rwanda
To assess the relationship between credit risk and the return on equity in Rwandan commercial banks
To examine the relationship between credit risk and return on asset in Rwandan commercial banks
To assess the relationship between external/macro-economic factors, moderating factor on commercial banks profitability in Rwanda.

Hypothesis:-
Ho 1. There is no statistically significant relationship between credit risk measured by NPLR, RLLP and CAR and net profit margin in Rwandan commercial banks.
Ho 2. There is no statistically significant relationship between credit risk measured by NPLR, RLLP and CAR and return on asset in commercial banks of Rwanda.
Ho 3. There is no statistically significant relationship between credit risk measured by NPLR, RLLP and CAR and return on equity in Rwandan commercial banks.
Ho 4. There is no statistically significant relationship between credit risk measured by NPLR, RLLP and CAR and external/macro-economic factors, moderating factor on commercial bank profitability in Rwanda.

Literature review:-
Introduction:-
This chapter deals with various concepts in regards to the relationship between credit risk and banking profitability, in addition the researcher discussed various empirical studies, thoughts and ideas from different sources and was linked together to formulate a meaningful and magnificent material. Theories about credit risk management and financial performance was utilized in this chapter and finally, the summary of the literature review was drawn.

One of the most pioneer paper in banking profitability, (Haslem, 1968) identifies that bank management, time, location and size influence on bank's profitability. It remains a great interest among the researchers to investigate the effect of credit risk on profitability. For example, (Matthew Osborne, 1980) finds a strong positive relationship between capital adequacy ratio and profitability of US banks during 1980s however; he considered the relationship should be negative under certain situations. In another study (Rachdi, 2013) also found the similar result for UK commercial banks during 2000-2005.

Risk and interest rate risk are intrinsically related to each other and not separable. (Mathias Drehmann, 2009)Increasing amount of non-performing loans in the credit portfolio is inimical to banks in achieving their objectives. Non-performing loan is the percentage of loan values that are not serviced for three months and above. (KOLAPO, 2012)

The issue of credit risk has gained increasing attentions in the last few decades. Amounts of bad loans are alarmingly increasing in not only the developing and under developed countries but also in developed countries. Banks' lending policy could have crucial influence on non-performing loans. A default is not entirely an irrational decision. Rather a defaulter takes into account probabilistic assessment of various costs and benefits of his decision. Lazy banking' critically reflects on banks' investment portfolio and lending policy. (Sinkey, 1991)

A bank exists not only to accept deposits but also to grant credit facilities, therefore inevitably exposed to credit risk. Credit risk is by far the most significant risk faced by banks and the success of their business depends on accurate measurement and efficient management of this risk to a greater extent than any other risks. (Giesecke, 2004)

According to Chen and Pan (2012), credit risk is the degree of value fluctuations in debt instruments and derivatives due to changes in the underlying credit quality of borrowers and counterparties. Coyle (2000) defines credit risk as losses from the refusal or inability of credit customers to pay what is owed in full and on time.

In the same vein, Naomi (2011) argued that credit risk represents the potential variation in the net income from non-payment or delayed payment of credit facility granted to customers. The Global Risk Management Group 1999 in its report conceded that credit risk is the possibility that bank borrower will fail to meet obligation in accordance with the agreed terms. It added that, the effective management of credit risk is a critical component of a comprehensive approach to risk management and essential to the long-term success of any banking organization. Lending involves the creation and management of risk assets, and it is an important task of bank management.

The main source of credit risk include, limited institutional capacity, inappropriate credit policies, volatile interest rates, poor management, inappropriate laws, low capital and liquidity levels, direct lending, massive licensing of banks, poor loan underwriting, laxity in credit assessment, poor lending practices, government interference and inadequate supervision by the central bank (Harrison Owusu, 2009) An increase in bank credit risk gradually leads to liquidity and solvency problems.

During the years 2000 to 2005, there was an increase in ROA and a decrease in ROE for banks in the United States. According to the results of a survey made to bank senior managers, the three risk factors that most contributed to the financial crisis were inappropriate risk governance, weak risk culture, and ineffective incentive and remuneration policies. Risk governance is necessary for limiting excessive risk taking, while banks should develop a strong risk culture through the encouragement of an assessment, measurement, and mitigation mindset of bank employees, at all levels, in the organizational hierarchy. (Berríos, 2013)

In addition, incentive and remuneration policies should reward managers with strong performance, based on attainment of long term goals and bank shareholder wealth maximization. If proper behavior is rewarded, it will be in the managers' best interest to not make decisions causing bank risk to rise to intolerable levels, resulting in decreased share values when lacking high enough returns. Diminished shareholder value would be an adverse effect of the separation of ownership (shareholders) and control (managers) that give rise to agency problems. (Eddy Junarsin, 2009)

Determinants of Financial Performance:-
The financial performance of banks is expressed in terms of profitability and the profitability has no meaning except in the sense of an increase of net asset. Profitability is a company's ability to earn a reasonable profit on the owner's investment. Most organizations exist is to earn profit and profitability ratios show a company's overall efficiency and performance. We can divide profitability ratios into parts: Profit margin and returns. Ratios that show margins represent the firm's ability to translate sakes dollars into profits at various stages of measurement. Ratios that show returns represent the firm's ability to measure the overall efficiency of the firm in generating returns for its shareholders. (MAGNIFIQUE, 2001)

The Internal Determinants:-
Internal determinants of bank performance can be defined as factors that are influenced by a bank's management decisions. Such management effects will definitely affect the operating results of banks. Although a quality management leads to a good bank performance, it is difficult, if not impossible, to assess management quality directly. In fact, it is implicitly assumed that such a quality will be reflected in the operating performance.

External Determinants of Bank Performance:-
External determinants of bank profitability are factors that are beyond the control of a bank's management. They represent events outside the influence of the bank the two major components of the external determinants are sector specific and macroeconomic factors. (Lelissa., 2014)

Macro-Economic Related Variables:-
There is wide variety of literature support the impact of the macroeconomic factors impact on bank performance. The macroeconomic policy stability, Gross Domestic Product, Inflation, Interest Rate and Political instability are also other macroeconomic variables that affect the performances of banks.

Profit Measures of Banks:-
In most research papers relating to this study the profitability is measured in the form of ratios which are normally reported by commercial banks in their annual reports (Bentum, 2012) claims that the use profitability ratios are not influence by changes in price levels. And it is said to be the most appropriate way of measuring profitability as one make use of time series analysis. This is because the real value of profits cannot be affected by the varying inflation rates for one to realize how well a bank is performing it is much more useful to consider return on assets (ROA) and return on equity ROE.

Bank Credits/Credit Facilities:-
Traditionally, bank lending could in broad term be categorized into two: overdraft and loan but according to (Okoye, 2013) he described credit facilities as the types of loans portfolio that are available to customers in the banking industry especially in commercial banks. He further classified these credit facilities into four major categories; short term credit, Medium term credit, Long term credit, Secured and unsecured credits.

Short Term Credit:-
This type of credit facility is due for repayment after one year. It is used to meet working capital requirement i.e expansion of current business operation. Examples are: Commercial credits, Overdraft, and Demand/call credit.

Medium Term Credit:-
(Okoye, 2013), described medium term credit as bank credit whose maturity is over one year, but not more than five years. It is required to finance or acquire capital assets which yield a commensurate return within the credit period. Examples are: Consumption credit and Letter of Credit.

Long Term Credit
This is a credit facility that is used to finance the expansion of fixed assets. It is usually a large sum of money which is due for repayment after five years of grant. Examples are; Industrial Credit, Equipment leasing credit, Stock, replacement credit.

Secured and Unsecured Credits
Banks grant credits against the securities of tangible pledges by the borrower in favor of the lending bank. The assets so pledge are known as collateral securities.

Factors Responsible for Credit Risk:-
According to (Gyamerah, 2015)some of the important factors which cause credit risk and have adverse impact on credit quality highlighted in various studies conducted by expert communities/groups are: Deficiencies in appraisal of loan proposals and in the assessment of credit worthiness of financial strength of borrowers, Inadequately defined lending policies and procedures High prudential exposure limits for individuals and group of borrowers, Absence of credit concentration limits for various industries/business segments, Inadequate values of collaterals obtained by the banks to secure the loan facilities, Liberal loan sanctioning powers for bank executives without checks and balance, Lack of knowledge and skills of officials processing loan proposals, Lack of information on functioning of various industries and performance of economy, Lack of proper coordination between various departments of banks looking into credit functions, Lack of well defined organizational structure and clarity with respect to responsibilities, authorities and communication channels, Lack of proper system of credit risk rating, quantifying and managing across geographical and product lines, Lack of reliability of data being used for managing credit and risks associated with lending.

Theoretical Review:-
The theoretical review aims at giving the meaning of a word in terms of theories of a specific discipline. It contributes to a better understanding of the concept and help in assuming both knowledge and acceptance of theories that relate to profitability and credit risk.

Credit Market Theory:-
A model of the neoclassical credit market postulates that the terms of credits clear the market, if collateral and other restrictions (covenants) remain constant, the interest rate is the only price mechanism. With an increasing demand for credit and a given customer supply, the interest rate rises, and vice versa. It is thus believed that the higher the failure risks of the borrower, the higher the interest premium.

Modern Portfolio Theory Model:-
Modern portfolio theory was largely defined by the work of Markowitz (born in 1927) in a series of articles published in the late 1950s. The theory was extended and refined by Sharpe (1934), Litner (1916 1983), Tobin (1918), and others in the subsequent decades.

MPT is a theory of finance which attempts to maximize portfolio expected return for a given amount of portfolio risk, or equivalently minimize risk for a given level of expected return, by carefully choosing the proportions of various assets. Modern Portfolio theory was introduced by Harry Markowitz in his paper "Portfolio Selection," which appeared in the 1952 Journal of Finance. The portfolio theory integrates the process of efficient portfolio formation to the pricing of individual assets. It explains that some sources of risk associated with individual assets can be eliminated or diversified away, by holding a proper combination of assets (Bodie et al, 1999).

Theory of Multiple-Lending:-
It is found in literature that banks should be less inclined to share lending (loan syndication) in the presence of well-developed equity markets. Both outside equity and mergers and acquisitions increase banks" lending capacities, thus reducing their need of greater diversification and monitoring through share lending. (DR. Victor okoye and 2eze, 2013)

Arbitrage Pricing Theory:-
The arbitrage pricing model (APT) on the other hand approaches pricing from a different aspect. It is rarely successful to analyze portfolio risks by assessing the weighted sum of its components. Equity portfolios are far more diverse and enormously large for separate component assessment, and the correlation existing between the elements would make a calculation as such untrue.

Profitability theory:-
Theories about the bank's profitability began in the early 1980s, applied using two models of industrial organization. The theories are theory of market power (MP) and theory of efficiency structure (ES) and added portfolio balance theory (Vincent Okoth Ongore, 2013) Application of the hypothetical market power in the banking industry stated that the profitability of a bank is affected by the structure of the industrial market.

There are two approaches in the theory of market power, namely the structure conduct performance (SCP) and the relative market power (RMP). Structure conduct performance approach suggests that the level of concentration in the banking industry has the potential to make bank market forces so as to raise its profitability. Banks that have a high concentration in the market will gain abnormal profit because of its ability in determining the interest rate is lower and provide a level higher loan interest as a result of collusion or monopoly, as compared to companies operating with small market concentration, irrespective of efficiency hypothesis structure conduct performance or collusion postulates that market structure affects the behavior or attitude of the company through pricing policy and investment, and ultimately affect the profitability (Themba Mamba Shipho, 2011)

Market power theory:-
Assumes that bank profitability is a function of external market factors, while the theoretical efficiency and balance portfolio structure assumes that the bank's profitability is influenced by internal efficiency and management policies, thus, bank profitability is a function of internal and external variables. In the study (GITONGA, 2009) internal variables that affect bank performance (profitability) is characteristic of individual banks determined by the decisions of the board of directors and internal management, while external variables is widely sectors in the economy which may affect the sustainability of the bank.
Balance sheet structure could also influence banks" profitability; in this context, the equity-to-asset ratio is an important balance sheet ratio that received much attention. For this ratio, theoretical explanations assume different signs of the relationship with profitability. According to the Modigliani-Miller theorem there exists no relationship between the capital structure (debt or equity financing) and the market value of a bank (Modigliani and Miller, 1958). In this context, there do not exist a relationship between the equity-to-asset ratio and funding costs or profitability. Nevertheless, as this chapter already mentioned the agency problem, information asymmetry and transaction costs distort Money Market's perfect market. Thus, when the perfect market does not hold there could be a possible explanations for a negative relationship capital structure and profitability.

Financing theory:-
Suggest that increasing risks, by increasing leverage and thus lowering the equity-to-asset ratio (increasing leverage), leads to a higher expected return as entities will only take on more risks when expected returns will increase; otherwise, increasing risks have no benefits. This theoretical explanation is known as the risk-return trade off.

Empirical review:-
Several latest researchers have also dug into this study and other related topics, (Josiah Aduda, 2011)have found the positive relationship between credit risk management and profitability of commercial banks in Sweden. (Olawale Femi Kayode, 2015) Showed that credit risk management is positively related to profitability of banks in Nigeria, (KOLAPO T. F., 2012) assessed the effect of credit risk management on the profitability of commercial banks in Kenya and found that banks' profitability is not affected by credit risk management.

When it comes to both credit risk and liquidity risk, (Ruziqa, 2013)has tested the impact of credit risk and liquidity risk on the financial performance of conventional banks in Indonesia. The results illustrated that credit risk was negatively related to profitability while liquidity risk demonstrated a positive effect.

(Muhammad Nawaz, 2012), examined the relationship between credit risk and performance of Nigerian Banks, the study used descriptive statistics and found a significant impact on the profitability of the banking industry.

Khalid (2012) examined the impact of nonperforming loans on the profitability of private banks in India using Return on Asset as profitability variable for the period 2006 – 2011, operating performance of the sample banks is estimated with the help of financial ratios. Multiple regression models were employed to examine if banks nonperforming, credit risk loans and operating performance are positively correlated and found that the bulk of the profits of commercial banks are not influenced by the amount of credit and non performing loans (Shahid Munir, 2012) investigated the relationship between bank performance and credit risk management. It could be inferred from their findings that return on equity (ROE) and return on assets (ROA) both measuring profitability were inversely related to the ratio of non-performing loan to total loan of financial institutions thereby leading to a decline in profitability.

In their study 'Credit Risk management and Profitability in Commercial Banks in Sweden' (Selvaraj, 2015) highlighted that credit risk management has effect on performance of the banking institutions specifically on the profitability, the analysis further indicated that the impact of credit risk management on the financial performance is not the same on all (4) commercial banks sampled. Further the results of the study were limited to banks sampled and were not generalized for all the commercial banks in Sweden. The researchers used regression model to do the empirical analysis.

In Costa-**Rica,** (OKE, 2012)**,** applied regression analysis to study the presence of credit risk on bank performance, they discovered that performance improvements led to regulatory changes and that credit risk accounts for differences in bank performance, while non-performing loans inversely affect efficiency and return on assets (*ROA*) and the capital adequacy ratio (*CAR*) has a positive influence on the net interest margin.

In another recent study conducted in (Bhattarai, 2015)assessed the effect of CRM on the financial performance of Nepalese banks using regression analysis. The study establishes that all credit risk factors have an inverse influence on the financial performance of banks; conversely, the *DR* exerts a major impact on bank performance. The study proposes banks to create and develop policies with the aim of not only reducing the exposure of the banks to credit risk but also improving profitability.

The Ghanaian study of (Kurawa, 2011)utilized regression analysis in an attempt to reveal the connection between credit risk and profitability of selected banks and established that credit risk components (non-performing loan rate, net charge-off rate, and the pre-provision profit as a percentage of net total loans and advances) have a positive and significant relationship with bank profitability. This shows that banks in Ghana enjoy high profitability regardless of high credit risk, an opposing view to other views expressed in many studies that credit risk indicators are negatively related to profitability

(Garr, 2013) , identify poor asset quality, as indicated by the high levels of nonperforming loans (NPLs) to be responsible for the low profitability. The negative effect of non-performing loans on bank profitability has been collaborated by (Garr, Determinants of Credit Risk in the Banking Industry of Ghana, 2013)in their research on Ghana. (M. Kabir Hassan, 2001), Also concludes that large loans to asset ratios lead to higher profitability

(Athanasoglou, 2006). Show that countries with high inflation have underdeveloped financial systems and that banks with higher inflation rates are positively associated with net interest margins. 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.

(Sabo, 2007), uses panel data to explore GDP growth rate and inflation expectations in determining bank profitability and interest spreads in Brazil. The speed of GDP growth impact credit quality of the banking sector negatively especially in periods of recession marked by decline in banks return, (BENDOB, 2015) finds macroeconomics variables have no effect in determining profitability of commercial banks in Tunisia. Khrawish (2011) finding shows GDP and inflation rate to impact negatively the financial performance of commercial banks in Jordan.

In another study conducted in Taiwan, Chen and Pan (2012) assessed the credit risk efficiency of banks for the period of four years (2005-2008). The study employs financial ratio to measure the credit risk and evaluate using Data Envelopment Analysis (DEA). The credit risk measures were credit risk technical efficiency, credit risk allocation efficiency, and credit risk cost efficiency. The findings suggest that only one bank is competent in all forms of efficiencies over the assessment periods.

The critiques of the existing literature relevant to the study:-
Different findings of the studies above, Kithiniji (2010) investigated the effect of credit risk management on the profitability of commercial banks in Kenya from 2004 to 2008 period, and found that the immensity of the profits of commercial banks are not influenced by the amount of credit and non-performing loans. His interesting but quite surprising results show that credit risk indicators have no relationship with bank profitability.

One of the most pioneer paper in banking profitability, Haslem (1968) identifies that bank management, time, location and size influence on bank's profitability. Berger (1995) surprisingly finds a strong positive relationship between capital adequacy ratio and profitability of US banks during 1980s; however, he considered the relationship should be negative under certain situations. . It remains a great interest among the researchers to investigate the effect of credit risk on profitability.

Overall, the existing literature provides a rather complete account of the effect of credit risk on bank performance especially profitability, but the empirical results diverge significantly. Also, the time dimension of the panels used in most of the empirical studies is too small to appropriately capture the effect of volatility of credit risk on bank profitability.

Finally, literature relating the effect of credit risk on the Rwandan banking sector profitability specifically commercial banks is very few. Therefore, more studies are needed to address the above issues adequately, in order to allow a better imminent into the effect of credit risk on commercial bank profitability, especially in Rwanda.

Research Gap:-
These kinds of researches show that no exact final conclusion could be drawn until now and thus make this area worth studying to the interested researcher.

None of the above findings really captured the co integration approach to test the relationship between credit risk and commercial bank profitability which this study intends to examine in Rwanda since descriptive statistics was the major use of many researchers.

As we have described before, banks' strength plays an important role in the stability and growth of economy. And the stability of banks depends on the profitability and capital adequacy (Tabari et al., 2013, p.1624). A thorough

study of previous research relating the profitability of banks has made us aware of the lacking conclusion of relationship between credit risk and profitability of banks.

The contradiction of the researchers like that of Kithinji (2010) and Musyoki and Kadubo (2011) where these two people found that, credit risk is the best predictor of financial performance and Kithinji (2010) found that the bulk of the profits of commercial banks are not influenced by the amount of credit and non performing loans. The implication is that other variables apart from credit and non performing loans impact on banks' profit. So it is my turn to use different techniques of co integration approach to provide my contribution.

Though, there are a number of studies that are conducted at a global level to examine the Relationship of the above scenario, most of the studies were made with reference to developed countries especially in, Europe and USA. This means, they do not explain the issues for emerging market particularly for Rwandan case. This means, they do not explain the issues for emerging market particularly for Rwandan case. This work intends to fill this gap specifically, to analyze relationship between credit risk and commercial bank profitability in Rwanda.

The contribution of this research is also to supply the foundation for other researchers who wish to dig into further study of such area, from a practical perspective; the information provided in this research offered a guideline for bank managers, investors and bank supervisors.

Methodology:-
Research design is the structure and plan of investigation undertaken to obtain answers to research questions. According to (Robson, 2002) the overall scheme or program of research is the plan. (According to (Leedy, 1989) the study design should include an outline of what the researcher has done from writing hypothesis and their operational implications to the final analysis of the data.

Research Design:-
Basing on the main objectives of this research which is to study on credit risk and banking profitability in Rwanda used a Quantitative research design consisted of employing an econometric model to study the long term as well as the short term relationships between the variables of interest this gives the readers a comfortary answer addressed to the research question. In other words, it is used for testing hypothesis (Hair et al., 2011, p.149). The plan is the overall program of the research and includes an outline of what the investigator did from writing the hypothesis and their operational implications for the final analysis of data.

Data Collection:-
Secondary data:-
This study used the previous works from related articles including published Financial Reports from commercial banks in Rwanda and quantified data to those Banks available in the National Bank of Rwanda (BNR) that is annual reports on their performance.

Conceptual frame work:-
The conceptual framework is developed from the review of literature discussed above and presented in the following diagram (figure 3). It shows the relationship between the dependent variables profitability measures (NPM, ROA, and ROE) and explanatory (credit risk indicators and macroeconomic variables). It also revealed the moderating role of control identity.

Figure 3.4.1:- Diagram showing relationships between variables.
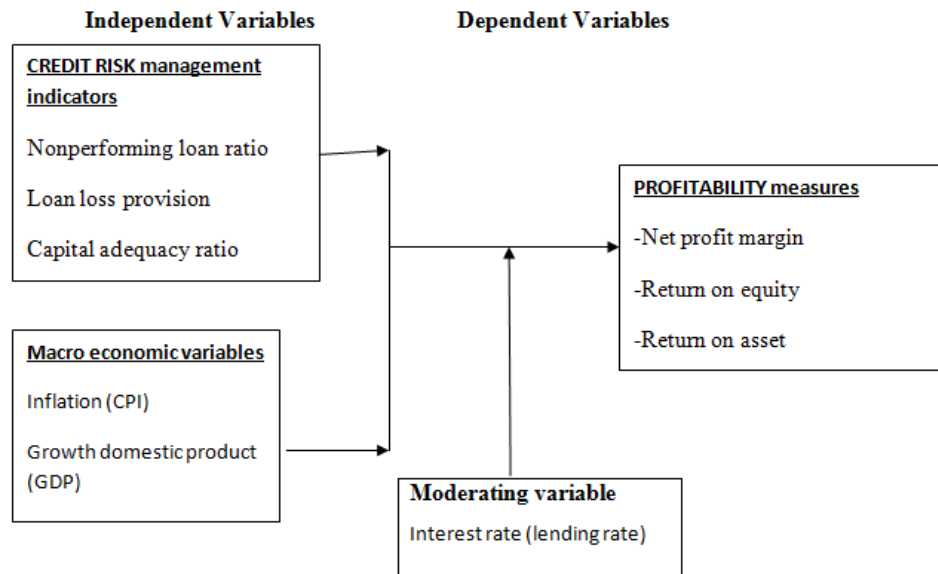
Model specification:-

An economic model is a representation of the basic features of an economic phenomenon; it is an abstraction of the real world (Fonta et al, 2009). The specification of a model is based on the available information relevant to the study in question. In order to analyze the credit risk and commercial bank profitability in Rwanda we first have the functional form of these models specified as follows:

Profitability =f (credit risk) +other variables
However the bank's Profitability $B\pi t$ is measured using three indicators that are ROE (Return on equity), NPM (Net profit margin) and ROA (Return on asset).And credit risk CRt is measured using also three important indicators that are NPLR (Nonperforming loan ratio), RLLP (Ratio of loan loss provision) and CAR (Capital adequacy ratio). Given that the study is aimed at establishing the relationship between every each dependent variable against independent variables the researcher used econometric models expressed functionally as follows:

Model I:-
$\text{NPM} = f(NPLR_t, RLLP_t, CAR_t, CPI_t, GDP_t, IR_t) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots_I$

Model II:-
$\text{ROA} = f(NPLR_t, RLLP_t, CAR_t, CPI_t, GDP_t, IR_t) \ldots \ldots \ldots \ldots \ldots \ldots \ldots_{II}$

Model III:-
$\text{ROE} = f(NPLR_t, RLLP_t, CAR_t, CPI_t, GDP_t, IR_t) \ldots \ldots \ldots \ldots \ldots \ldots \ldots_{III}$
However models (i), (ii) and (iii) above are exact or deterministic in nature. In order to allow for the inexact relationship among the variables as in the case of most economic time series variables, stochastic error term "µt" is added to form good econometric models.

Econometrically the regression models can be specified as:
Model I:-
$\text{NPM}_t = \alpha o + \alpha_1 NPLR_t + \alpha_2 RLLP_t + \alpha_3 CAR_t + a_4 CPI_t + a_5 GDP_t + a_6 IR_t + \mu t$

Model II:-
$_{ROAt} = ao + \alpha_1 NPLR_t + \alpha_2 RLLP_t + \alpha_3 CAR_t + a_4 CPI_t + a_5 GDP_t + a_6 IR_t + \mu t$

Model III:-

$$ROE_t = ao + \alpha_1 NPLR_t + \alpha_2 RLLP_t + \alpha_3 CAR_t + a_4 CPI_t + a_5 GDP_t + a_6 IR_t + \mu t$$

Where:
NPM_t = Net profit margin at time t
ROE_t = Return on equity at time t
ROA_t = Return on asset at time t
$NPLR_t$ = Non performing loan ratio at time t
$RLLP_t$ = Ratio of loan loss provision at time t
CAR_t = Capital adequacy ratio at time t
CPI_t = Consumer price index (inflation) at time t
GDP_t = Gross domestic product at time t
IR_t = interest rate at time t
T = Periods of Observations of the Variables

Where $\alpha1……..a6$ are coefficient values of six independent variables, or exogenous regressors αo is the intercept term or a white noise, mean zero sequence.

Model assumptions:-
The following diagnostic tests were conceded to make certain that the data suits the fundamental assumptions of classical linear regression model:

Normality:-
To check for normality, descriptive statistics were used. To determine if a data set is well-modeled by a normal distribution.

Serial correlation:- To test for autocorrelation in the errors in a regression models.
Heteroscedasticity: -To avoid the problem of heteroscedasticity of disturbance terms.

Data analysis:-
This study employed co integration approach or methodology, where useful tests of co integration were used like unit root tests, Johansen co integration test, Granger causality test, vector error correction estimates, where we looked for a long/short run relationship using co integration approach developed by Pedroni (1999). This approach is a significant improvement over conventional tests applied in a time series data.

Data Measurements:-
This section presents the measurements that were used to operationalise the study variables

Expected Sign:-
Expected sign is a statistical technique which shows the relationship between two variables. The positive expected sign means that one variable increase, the other variable will also increase while negative expected sign means that when one variable increase, the other variable will be decrease.

Table 3.1:- Summary of explanatory variables and their expected effect on the dependent variables.

Independent variables	Proxies and Definition	Expected effect
Non- performing loan Ratio (NPLR)	The percentage of nonperforming loans over Total Loan	Negative
Capital adequacy (CAR)	The proportion of a bank's own equity in relation to its risk exposure	Positive
Loan loss provision(LLP)	A contra income account that enables banks to recognize in their profit and loss statements.	Positive
Interest rate (IR)	Interest rate on annual average loans/Lending rate.	Positive
Gross Domestic Product (GDP)	Growth rate of real gross domestic product	Positive

Inflation(CPI)	Higher inflation can make debt servicing easier by reducing the real value of outstanding loans. However, it can also weaken borrowers' ability to service debt by reducing their real income	Negative/Positive
Dependent variables	**Measurement**	
ROA	Total income to its total asset	
ROE	Net Income after Taxes divided by Total Equity Capital	
NPM	It is the percentage of revenue left after all expenses have been deducted from sales.	

Empirical Analysis and Results:-
This section presents the results of the unit root, co integration test, vector error correction, Granger causality tests, impulse responses and variance decomposition conducted

Table 4.2:- Descriptive Statistics.

Statistics	LNPM	ROA	ROE	NPLR	RLLP	CAR	IR	LRGDP	CPI
Mean	9.056511	1.782500	13.02500	8.622500	5.192500	19.9525 0	16.7175 0	6.822384	6.690000
Median	9.014652	2.200000	11.55000	7.250000	3.950000	20.8500 0	16.8000 0	6.812861	5.750000
Maximum	10.66992	2.900000	32.40000	14.30000	14.40000	24.1000 0	17.5000 0	7.175490	22.20000
Minimum	5.867883	-2.800000	-16.50000	5.700000	0.800000	13.4000 0	15.5000 0	6.378426	0.200000
Std. Dev.	0.971501	1.204242	8.978314	2.822664	3.737982	2.84009 6	0.56016 8	0.214842	5.058570
Jarque-Bera	6.987416	141.0551	7.759445	5.150045	5.949186	6.41000 2	2.22850 6	1.949240	18.30620
Probability	0.030388	0.000000	0.020657	0.076152	0.051068	0.08055 9	0.32816 0	0.377336	0.060106
Sum	362.2605	71.30000	521.0000	344.9000	207.7000	798.100 0	668.700 0	272.8953	267.6000
Sum Sq. Dev.	36.80876	56.55775	3143.795	310.7298	544.9277	314.579 7	12.2377 5	1.800134	997.9760
Observations	40	40	40	40	40	40	40	40	40

Source: Researcher's compilation from E-views 8 results.

Table 4.1 shows the descriptive statistics of the variables. The results indicate that the mean values are for ratio of non-performing loans (NPLR) 8.6; for ratio of loan loss provision (RLLP) 5.19, capital adequacy ratio (CAR) is 19.9,interest rate(IR) is 16.7,real gross domestic product(LRGDP) 6.8, and inflation (CPI) . The mean value of net profit margin is 9.0, for return on assets (ROA) is 1.7, for return on equity (ROE) is 13.0 respectively. Therefore Jarque-Bera statistics indicates that all explanatory variables are normally distributed at the 5% level of significance. And considering the standard deviation of the above variables it indicates that the data are clustered around the mean and thus more reliable. It also indicates that all the explanatory variables have an influence on commercial bank profitability in Rwanda as indicated
by their positive mean values and their standard deviation.

Unit root tests:-
The established standard procedure for co integration analysis is to start with unit root tests on the time series data being analyzed. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test are used to test for the presence of unit roots and establish the order of integration of the variables in the model.

Table 4.3:- Unit Root Test

VARIABLES	ADF Test			PP Test		
	LEVEL	1st difference	I(d)	Level	1st difference	I(d)
LNPM	-0.093616	-3.064978*	I(1)	-0.432172	-1.394567**	I(1)
ROA	-0.443235	-2.840270**	I(1)	-0.443235	-0.889640**	I(1)
ROE	-0.421552	-1.290450**	I(1)	-0.421552	-1.290450**	I(1)
NPLR	-0.072758	-0.763649*	I(1)	-0.072758	-0.763649*	I(1)
RLLP	-0.099604	-1.211638*	I(1)	-0.089826	-1.211638*	I(1)
CAR	-0.213107	-1.572046*	I(1)	-0.213107	-1.572046*	I(1)
IR	-0.229350	-1.813408*	I(1)	-0.229350	-1.238424*	I(1)
LRGDP	-0.022755	-2.627492*	I(1)	-0.036904	-1.018565*	I(1)
CPI	-0.203065	-0.791286*	I(1)	-0.120028	-0.953358*	I(1)

Source: author's compilation and values obtained from Eviews: Note: *(**) denote significant at 1% and 5% level of significance respectively.

At the first instance the results of the ADF and PP unit root tests, the null hypothesis of the test is that there is a unit root against the alternative one that there is no unit root in the variables.

The presence of non-stationary variables might lead to spurious regressions and nonobjective policy implications. Augmented Dickey Fuller (ADF) tests are used for this purpose in conjunction with the critical values, which allows for calculation of critical values for any number of regressors.

The ADF and PP statistics for NPM, ROA, ROE, CAR, IR, RGDP and CPI are all insignificant at 5% level of significance, which leads to non-rejection of the null hypothesis that there is a unit root problem in the variables. According to ADF and PP test, it is obvious that the variables are non-stationary.

However, differencing has the effect of making the variable stationary. Table1 above summarizes the results of unit root tests for first difference variables.
The ADF and PP test statistics for the first difference variables are all significant at 5% level of significance, which leads to rejection of the null hypothesis that there is a unit root problem in the variables. Based on ADF and PP test, it is apparent that the first differences variables are stationary, which implies that the variables are integrated of order one, I (1). Therefore we can conclude that all series involved in the estimation procedure are regarded as I(1), and it is suitable to make co integration test

Testing for Co integration:-
Having established the stationarity of the study variables, it is also important to establish the stationarity of the linear combinations of the variables as to whether there could be a long-run or equilibrium relationship between the dependent variables and the independent variables (that is, whether they are co-integrated). We, therefore, tested for co-integration to establish long-run stationary or stable relationship using the Johansen Co-integration test.

The results for the Johansen co integration test based on trace and maximum Eigen values test statistics are presented in tables below,

Table 4.4:- The Johansen co-integration test based on trace and maximal Eigen value – NPM.

Hypothesized	Trace statistics	0.05 critical value	P-value	Maximum Eigen Statistic	0.05 critical value	P-value
None *	171.2073*	125.6154	0.0000	63.65441*	46.23142	0.0003
At most 1 *	107.5529*	95.75366	0.0060	45.36207*	40.07757	0.0116
At most 2	62.19079	69.81889	0.1743	29.40109	33.87687	0.1561

At most 3	32.78971	47.85613	0.5685	20.95447	27.58434	0.2790
At most 4	11.83524	29.79707	0.9374	5.344536	21.13162	0.9927
At most 5	6.490703	15.49471	0.6375	4.217136	14.26460	0.8358
At most 6	2.273567	3.841466	0.1316	2.273567	3.841466	0.1316

Trace test indicates 2 co integrating eqn(s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values.

Table 4. 5:- The Johansen co-integration test based on trace and maximal Eigen value – ROA.

Hypothesized	Trace statistics	0.05 critical value	P-value	Maximum Eigen Statistic	0.05 critical value	P-value
None *	176.1575	125.6154	0.0000	63.70737	46.23142	0.0003
At most 1 *	112.4502	95.75366	0.0022	47.87167	40.07757	0.0055
At most 2	64.57848	69.81889	0.1220	32.64294	33.87687	0.0696
At most 3	31.93555	47.85613	0.6157	18.02656	27.58434	0.4929
At most 4	13.90899	29.79707	0.8457	7.104414	21.13162	0.9497
At most 5	6.804573	15.49471	0.6005	4.464033	14.26460	0.8074
At most 6	2.340540	3.841466	0.1260	2.340540	3.841466	0.1260

Trace test indicates 2 co integrating eqn(s) at the 0.05 level:* denotes rejection of the hypothesis at the 0.05 level. ** MacKinnon-Haug-Michelis (1999) p-values.

Table 4.6:- The Johansen co-integration test based on trace and maximal Eigen value – ROE.

Hypothesized	Trace statistics	0.05 critical value	P-value	Maximum Eigen Statistic	0.05 critical value	P-value
None *	168.4844	125.6154	0.0000	60.19890	46.23142	0.0009
At most 1 *	108.2855	95.75366	0.0052	41.24548	40.07757	0.0368
At most 2	67.03999	69.81889	0.0816	32.07384	33.87687	0.0808
At most 3	34.96615	47.85613	0.4498	20.25444	27.58434	0.3238
At most 4	14.71171	29.79707	0.7984	7.595876	21.13162	0.9267
At most 5	7.115834	15.49471	0.5642	4.936404	14.26460	0.7499
At most 6	2.179430	3.841466	0.1399	2.179430	3.841466	0.1399

Trace test indicates 2 co integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level ** MacKinnon-Haug-Michelis (1999) p-values

From all the tables above indicating Johansen co-integration test based on trace and maximal Eigen value in all dependent variables that is NPM, ROA, ROE, both the trace test and the Max-Eigen test statistics indicate the presence of at least two co-integrating equations at 5% level of significance. This implies that commercial banks performance and the independent variables are co-integrated., it further shows that there is a long-run relationship between commercial bank profitability variables and credit risk variables both internal and external variables. Thus we reject the hypothesis of no co-integration and proceed with the investigation of the co-integrating relationship.

Normalized co integrating relationship:-
The result of the normalized co integrating vectors as shown in table below indicates a long run relationship between commercial bank profitability measures and credit risk measures as the explanatory variables. The results in the table are explained with respect to the signs and magnitude of the variables in the normalized co integration results.

Table 4.7:- Long-run Dynamics: Normalized Co integration coefficients NPM.

LNPM	NPLR	RLLP	CAR	IR	LRGDP	CPI
1.000000	0.132768	0.235544	-0.198870	-8.250365	13.16919	-0.528515
(SE)	(0.09926)	(0.27710)	(0.23490)	(0.97149)	(4.08827)	(0.05673)
[t-stat]	[6.3748]	[0.8500]	[-0.8466]	[-8.4924]	[-3.2212]	[-9.3163]

Source: Author's estimation

Evidence from the estimated relationship in the long-run, lagged period suggests a significant positive relationship between NPM (net profit margin) and two credit risk ratios that is non performing loan ratio, ratio of loan loss provision, and real gross domestic product as external factor.

Surprisingly, NPL is positive and statistically significant this finding is remarkable because, theoretically NPL is expected to have an inverse relationship with a bank's net profit margin. Our result however, shows a positive association between non-performing loans and net profit margin of commercial banks. The positive relationship between non-performing loans and commercial bank profitability indicates that, even though there is huge loan default, non-performing loans are increasing proportionately to profitability. This implies that, banks do not have effective institutional measures to deal with credit risk management, what the banks do is that they shift the cost on loan default to other customers in the form of higher interest rate on loans.

Crockett (2003) argues that initially NPLs may not seem to have a serious negative effect, banks remain liquid and depositors retain their confidence in the system over time, however, the size of the problem grows, especially if banks are allowed to accrue interest on their non-performing loans.

There is also an assumption that in long run recovery departments might have done their job better that is minimizing collections costs and time to collect, increasing, improving recovery rates and reduce bad debt write-offs, improving staff productivity and focus collections resources protecting future revenue streams and reduce churn With respect to Gross domestic product (RGDP), a positive relationship between bank net profit margin and level of economic activities as expected during upswings as demand for lending increases. For the case of loan loss provision is explicitly intended to smooth bank profits over the business cycle in long run, Fernández and Saurina (2001). Because of the loan loss provision, cash flow remains available. The loan loss provision ensures that banks will have sufficient funds to provide services to its depositors.

Then the negativity of the remaining three explanatory variables that is capital adequacy ratio, interest rate, and inflation the result of the co integrating relationship provides no significant evident in support of a long run relationship between net profit margin, capital adequacy ratio, interest rate and inflation and, hence may not be reliable for efficient policy implementation.

Table 4. 8:- Long-run Dynamics: Normalized Co integration coefficients ROA.

ROA	NPLR	RLLP	CAR	IR	LRGDP	CPI
1.000000	-0.610808	0.246270	0.788918	12.87067	-24.57082	0.560449
(SE)	(0.14664)	(0.40252)	(0.34133)	(1.38178)	(5.89194)	(0.08302)
[t-stat]	[-4.1653]	[0.6118]	[2.3113]	[9.3145]	[-4.1702]	[6.7507]

Source: Author's estimation.

The relationship represented by the co integrating equation shows that in the long-run, lagged period of return on asset, ratio of loan loss provision, capital adequacy ratio, interest rate (lending rate) as a moderating factor and inflation (CPI) exert positive influences on return on asset while non performing loan ratio, real gross domestic product and inflation impact return on asset negatively in long run.

Table 4. 9:- Long-run Dynamics: Normalized Co integration coefficients ROE.

ROE	NPLR	RLLP	CAR	IR	LRGDP	CPI
1.000000	-19.83894	-15.84064	3.643514	360.2679	-797.3227	16.69373
(SE)	(4.33566)	(12.3288)	(10.3957)	(41.8429)	(176.837)	(2.53981)
[t-stat]	[-4.5757]	[1.2848]	[0.3504]	[8.6100]	[-4.5088]	[6.5728]

Source: Author's estimation

The relationship represented by the co integrating equation shows that in the long-run, lagged period of return on equity, capital adequacy ratio, interest rate(lending rate) and inflation(CPI) exert positive influences on return on equity while non performing loan ratio, ratio of loan loss provision and real gross domestic product impact return on equity negatively.

From the above estimation of two tables of ROA and ROE long run Normalized Co integration coefficients suggests that non performing loan impact these two dependent variables negatively as expected.

Relationship between nonperforming loan ratio, return on asset, and return on equity is found negative and significant indicating that high non performing loan reduces the commercial banks profitability and sound credit risk management is a precondition for ensuring the assets and equity of the banking sector. This is consistent with Kolapo et al. (2012) and Ruziqa (2013) argued that, improving the profitability indicators sound credit risk management is essential.

Loan loss provision is positive in long run over return on assets (ROA) confirming previous results for the US market supportive of an income smoothing pattern (Greenawalt and Sinkey 1988). while the return on equity(ROE) has a negative sign long run implying that provisions tend to decrease as a share of total equity when the increase of new lending and the decrease of monitoring tend to reinforce the risk exposure of banks portfolios and hence affect return on equity negatively.

The result indicates a positive relationship between return on asset, return on equity with capital adequacy ratio which implies that banks with good capital adequacy ratio have a good profitability because a bank with a strong capital adequacy is also able to absorb possible loan losses and thus avoids bank 'run', insolvency and failure in long run.

In long run a positive influence is estimated between return on asset, return on equity and inflation as external factor this is consistent with recent studies (Alexiou and Sofoklis, 2009) confirm a positive relationship between inflation and commercial bank profitability. The extent to which inflation impacts bank profitability depends on whether the extent of inflation is fully anticipated, if the inflation rate is fully anticipated by the bank's management, the bank can adjust interest rates appropriately to increase revenues faster than costs, especially when inflation affects both salaries and the other operating costs of the bank which should have a positive impact on profitability in long run as shown in the estimation.

A long run negative relationship between return on asset, return on equity and real gross domestic product was estimated which is consistent with arling, Jacobson, Linde and Roszbach (2007), Bonfim (2009), IMF (2000), Jimenez and Saurina (2006).This happens during downswings when demand for credit facilities is expected to slow down. Consequently negative relationship between RGDP and commercial bank profitability measures that is return on asset, return on equity was estimated.

A positive impact of interest rate, return on asset, and return on equity was also found. The results also concur with those of Khan (2014) who found that in Pakistan there was strong and positive correlation between interest rate and commercial banks' profitability meaning that if the value of interest rate is increased/decreased then as result, value of bank profitability also increased/decreased.

Vector error correction (VECM) model:-
Without withstanding on the evidence that Johansen co integration portrays the presence of the co integrating vectors, it does not necessarily reveal the nature of the adjustment process in the system. This is achieved by the analysis of the result of VECM shown in the tables below.

Having determined the variables as integrated of order I(1) i.e. they are non-stationary at their levels but stationary after differencing once and once again having approved the existence of co-integration test, we can, then, formulate an error correction model. If a set of variables are found to have one or more co integrating vectors then a suitable estimation technique is a VECM (Vector Error Correction Model) which adjusts to both short run changes in variables and deviations from equilibrium.

Hypothesis 1:- There is no statistically significant relationship between credit risk measured by NPLR, RLLP and CAR and net profit margin in Rwandan commercial banks.

Table 4. 10:- Short-run dynamics: Vector error correction model coefficients on NPM.

Regressor	Coefficients	T-statistics	Standard errors	p- values
ECM (-)	-0.813384	-3.48462	0.23342	**0.0022**
D(NPLR(-1))	0.099539	0.19009	0.52364	**0.4008**
D(RLLP(-1))	0.629837	2.14085	0.29420	**0.00062**
D(CAR(-1))	-0.044761	-0.05568	0.80391	**0.6698**

D(IR(-1))	-0.295583	-2.18041	0.13556	**0.0003**
D(LRGDP(-1))	0.001716	0.19893	0.00863	**0.1441**
D(CPI(-1))	0.518062	0.56267	0.92072	**0.1055**

R-squared = 0.823216
Adjusted R-squared = 0.696942
F-statistic = 6.519287
Prob (F-statistic) = 0.00064

Source: Authors' computation from E-Views

The Error Correction results in Table 4.2.9 on the impact of credit risk indicators on net profit margin is that non performing loans(NPLR), ratio of loan loss provision(RLLP) ,capital adequacy ratio (CAR), as internal bank factors and external /macro-economic factors that is), real gross domestic products (RGDP) ,inflation (CPI) and interest rate (IR) as a moderate variable show that R-squared is 0.82 while adjusted R-squared is 0.69 indicating that 69 percent of changes in net profit margin are attributable to the combined effect of all explanatory variables in short run.

Also, from the table, we see that the ratio of loan loss provision (RLLP) has a t-statistic of 2.14085 with a probability value of 0.00062 which is statistically significant indicating that it has a significant relationship with net profit margin. The interest rate (IR) shows a similar relationship with net profit margin with a t-statistic of -2.18041 and a probability value of 0.0003.

Overall, the results show that the F-statistic is 6.5 with a probability value of 0.00064 indicating that the combined impact of the independent variables on commercial bank profitability represented by net profit margin is statistically significant in short run. We therefore reject the null hypothesis, and conclude that the credit risk indicators have significant impact on net profit margin in Rwandan commercial bank in short run.

Furthermore, the Error Correction Co-efficient of -0.813384 is appropriately signed, being negative and also significant at 5% level of significance. The co-efficient shows that the speed of adjustment of the model is approximately 81.3 percent quarterly due to any deviation from equilibrium

Table 4. 11:- Short-run dynamics: Vector error correction model coefficients on ROA.

Regressor	Coefficients	T-statistics	Standard errors	p- values
ECM (-1)	-0.284001	0.26775	0.21277	0.0079
D(NPLR(-1))	-0.047683	-0.23314	0.20453	0.3738
D(RLLP(-1))	0.460757	4.83652	0.09527	0.8043
D(CAR(-1))	0.14039	0.44487	0.31558	0.3455
D(IR(-1))	0.074125	1.27274	0.05824	0.7875
D(LRGDP(-1)	-0.008243	-2.19813	0.00375	0.8580
D(CPI(-1))	-0.089063	-0.24555	0.36272	0.4861

R-squared = 0.788494
Adjusted R-squared = 0.623132
F-statistic = 1.337013
Prob (F-statistic) = 0.026448

Hypothesis 2:- There is no statistically significant relationship between credit risk measured by NPLR, RLLP and CAR and return on asset in commercial banks of Rwanda.

The Error Correction results in Table 4.2.10 on the impact of credit risk indicators on return on assets (ROA) reveal that none of the independent variables is statistically significant in the current period. The overall result reveals that R-squared is 0.78 (with adjusted R-squared of 0.62) indicating that 62 percent of the variations in return on assets could be explained by the combined effect of changes in the return on assets itself, management of nonperforming loans(NPLR), ratio of loan loss provision(RLLP) ,capital adequacy ratio (CAR), as internal bank factors and external factors that is real gross domestic products (RGDP) , inflation (CPI) and interest rate (IR), as a moderate variable do their job better in short run.

F-statistic is 1.337013 with a probability value of 0.00264 indicating that the combined effect of return on assets itself, management of nonperforming loans (NPLR), ratio of loan loss provision (RLLP), capital adequacy ratio (CAR), as internal bank factors and external/macro-economic factors that is real gross domestic products (RGDP), inflation (CPI) and interest rate (IR) as a moderate variable respectively, have significant impact on commercial bank performance represented by return on assets at 5 percent. Consequently, we reject the null hypothesis and conclude that the management of credit risk has a significant impact on return on asset in quarterly basis and accept a long run relationship between return on assets and credit risk indicators under study. It also implies that the profitability measures are adjusting to deviations in the long run equilibrium relationship.

Furthermore, the Error Correction Co-efficient of -.284001 is appropriately signed, being negative and also significant at 5% level of significance. The co-efficient shows that the speed of adjustment of the model is approximately 28.4 percent quarterly due to any deviation from equilibrium.

Table 4. 12:- Short-run dynamics: Vector error correction model coefficients on ROE.

Regressor	Coefficients	T-statistics	Standard errors	p-values
ECM (-1)	-0.914439	0.71266	0.16058	0.0483
D(NPLR(-1))	-0.019180	-0.63844	0.03004	0.0411
D(RLLP(-1))	0.062999	4.98086	0.01265	0.0067
D(CAR(-1))	0.015218	0.34033	0.04472	0.5910
D(IR(-1))	0.012047	1.53199	0.00786	0.6516
D(LRGDP(-1)	-0.001369	-2.81537	0.00049	0.0447
D(CPI(-1))	-0.022517	-0.43186	0.05214	0.2986
R-squared = 0.871651				
Adjusted R-squared = 0.837117				
F-statistic = 4.863761				
Prob (F-statistic) = 0.013509				

Hypothesis 3:-
Ho 3. There is no statistically significant relationship between credit risk measured by NPLR, RLLP and CAR and return on equity in Rwandan commercial banks.

The Error Correction results in Table 4.2.11 on the impact of credit risk indicators on return on equity (ROE) reveal that at least three independent variables, non performing loans (NPLR), ratio of loan loss provision (RLLP), capital adequacy ratio (CAR), respectively, have a significant impact on return on equity in short run, shown by the table above, we see that the non performing loan ratio has a t-statistics of -0.63844 with a probability value of 0.0411, loan loss provision (RLLP) has a t-statistic of 4.98086 with a probability value of 0.0067, capital adequacy ratio (CAR) has also a t-statistic of 0.34033 with a probability value of 0.5910 which indicates a statistically significant relationship with return on equity and credit risk indicators.

F-statistic is 4.863761 with a probability value of 0.013509 indicating that the combined impact of the independent variables on commercial bank profitability represented by return on equity is statistically significant. We therefore reject the null hypothesis, and conclude that the credit risk indicators have significant impact on return on equity in Rwandan commercial bank in short run.
Additionally, the Error Correction Co-efficient of -0.914439 is appropriately signed, being negative and also significant at 5% level of significance. The co-efficient shows that the speed of adjustment of the model is approximately 91.4 percent quarterly due to any deviation from equilibrium.

Granger causality:-
Pair-wise Granger Causality Test Results:-
The purpose of the pair-wise granger causality test is to ascertain the direction of causality between each of the independent variables and the dependent variables. This is also to determine whether a specific variable or group of variables play any significant role in the determination of other variables in the Vector Error Correction (VECM). It tests whether an endogenous variable can be treated as exogenous and was done by examining the statistical

significance of the lagged error correction terms by applying separate t-tests on the adjustment coefficients. Prior expectation is that the independent variables should cause changes in the dependent variable both on the short-run and on the long-run. But in reality, the relationship could be the other way round.

Table 4 13 Pairwise Granger Causality Tests on NPM

Pairwise Granger Causality Tests			
Date: 06/05/16 Time: 22:34			
Sample: 2006Q1 2015Q4			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
NPLR does not Granger Cause LNPM	38	2.24619	0.1217
LNPM does not Granger Cause NPLR		1.29125	0.2885
RLLP does not Granger Cause LNPM	38	3.17985	0.0546
LNPM does not Granger Cause RLLP		1.63814	0.2098
CAR does not Granger Cause LNPM	38	0.72848	0.4902
LNPM does not Granger Cause CAR		0.56165	0.5756
IR does not Granger Cause LNPM	38	3.53950	0.0405
LNPM does not Granger Cause IR		1.68746	0.2006
LRGDP does not Granger Cause LNPM	38	3.59744	0.0386
LNPM does not Granger Cause LRGDP		4.59221	0.0174
CPI does not Granger Cause LNPM	38	2.29591	0.1165
LNPM does not Granger Cause CPI		0.81649	0.4507

Source: Authors' computation from E-views

Table 4.14:- Pairwise Granger Causality Tests on ROA.

Pairwise Granger Causality Tests			
Date: 06/05/16 Time: 22:44			
Sample: 2006Q1 2015Q4			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
NPLR does not Granger Cause ROA	38	2.17642	0.1295
ROA does not Granger Cause NPLR		3.87689	0.0307
RLLP does not Granger Cause ROA	38	0.87303	0.4271
ROA does not Granger Cause RLLP		0.03542	0.9652
CAR does not Granger Cause ROA	38	0.62566	0.5411
ROA does not Granger Cause CAR		0.69772	0.5049
IR does not Granger Cause ROA	38	0.56018	0.5764
ROA does not Granger Cause IR		0.10170	0.9036
LRGDP does not Granger Cause ROA	38	1.02506	0.3699
ROA does not Granger Cause LRGDP		0.18052	0.8357
CPI does not Granger Cause ROA	38	0.76791	0.4721
ROA does not Granger Cause CPI		9.23476	0.0007

Source: Authors' computation from E-views 8

Table 4.15:- Pairwise Granger Causality Tests on ROE.

Pairwise Granger Causality Tests			
Date: 06/05/16 Time: 22:55			
Sample: 2006Q1 2015Q4			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
NPLR does not Granger Cause ROE	38	5.21605	0.0108
ROE does not Granger Cause NPLR		2.42258	0.1043
RLLP does not Granger Cause ROE	38	3.03029	0.0619

ROE does not Granger Cause RLLP		0.65455	0.5263
CAR does not Granger Cause ROE	38	3.41243	0.0450
ROE does not Granger Cause CAR		0.85312	0.4353
IR does not Granger Cause ROE	38	0.18253	0.8340
ROE does not Granger Cause IR		0.41530	0.6635
LRGDP does not Granger Cause ROE	38	0.30897	0.7363
ROE does not Granger Cause LRGDP		0.04912	0.9521
CPI does not Granger Cause ROE	38	2.73257	0.0798
ROE does not Granger Cause CPI		2.31193	0.1149

Source: Authors' computation from E-views 8

The Granger causality test results in all Tables representing relationship between dependent variables and explanatory variables reveal the direction of causality between the various variables representing commercial bank profitability measures (NPM, ROA, and ROE) with credit risk indicators, macro-economic variables, the results above indicate that there is a unidirectional granger causality relationship running from all variables under study.

Diagnostic tests:-
This section examines the statistical properties of the estimated model after presenting the results from the empirical analysis. The estimated model was tested for serial correlation, autoregressive conditional heteroscedasticity, normality and stability. The results are presented in the tables below

Table 4. 16:- Diagnostic tests net profit margin (NPM).

Test	F-statistics	P-value
1. Normality Jarque-Bera statistic	6.987416	0.030388
2. Serial correlation Breusch-Godfrey serial correlation LM test	0.051758	0.999911
3.Autoregressiveconditional heteroscedasticity ARCH LM test	0.24246	0.6253
4.Heteroscedasticity White heteroscedasticity	0.478964	0.9452

Table 4. 17:- Diagnostic tests return on assets (ROA).

Test	F-statistics	P-value
1. Normality Jarque-Bera statistic	6.313525	0.42563
2. Serial correlation Breusch-Godfrey serial correlation LM test	0.459134	0.875061
3.Autoregressiveconditional heteroscedasticity ARCH LM test	2.916501	0.037069
4.Heteroscedasticity White heteroscedasticity	2.727626	0.0290

Table 4.18:- Diagnostic tests return on equity (ROE)

Test	F-statistics	P-value
1. Normality Jarque-Bera statistic	0.361477	0.3127
2. Serial correlation Breusch-Godfrey serial correlation LM test	0.277714	0.7594
3.Autoregressiveconditional heteroscedasticity ARCH LM test	0.283168	0.5978
4.Heteroscedasticity White heteroscedasticity	3.553663	0.0624

The diagnostics test in all above three tables indicates that the residuals are normally distributed, homoscedastic and serially uncorrelated and the parameters appear to be stable due to the fact that all the p values are statistically significant at 5% level.

Impulse Response Functions:-
Impulse response function (IRF) depicts the dynamic property of the model. It helps to test for response of the dependent variables to unit shock of the independent variables. The results for the IRF show how each measure of commercial bank profitability respond to the shocks. Figure 1 shows the response of net profit margin to shocks in all credit risk measures, macro economic variables and moderate factor. Figure 2, 3 shows the response of return on asset, return on equity to such shocks brought by credit risk indicators. Figure 1 the results show that apart from real gross domestic product, other variables revealed to be insignificant but with a probability that after some increased periods most of the variables will have a negative impact to the shocks especially CAR, NPLR and IR.

To sum up, the response of NPL to shocks in either ROA or ROE there is uniformity in that there is a negative relationship between NPL in both cases as supported by Salas and Saurina (2002) study. However for the case of ROA shocks become normalized at quarter five and quarter two for the case of ROE respectively which implies that NPLR has a significantly impact to the shocks within these two profitability variables, ROA and ROE.

For the case of CAR and RLLP were normalized from the equilibrium and finally provides a normal trend for a long period.

Nevertheless almost of credit risk indicators provide a significant impact to the shocks in profitability measures in short run shown by blue lines as the best interpreter of impulse responses using vector error correction estimates (VEC)

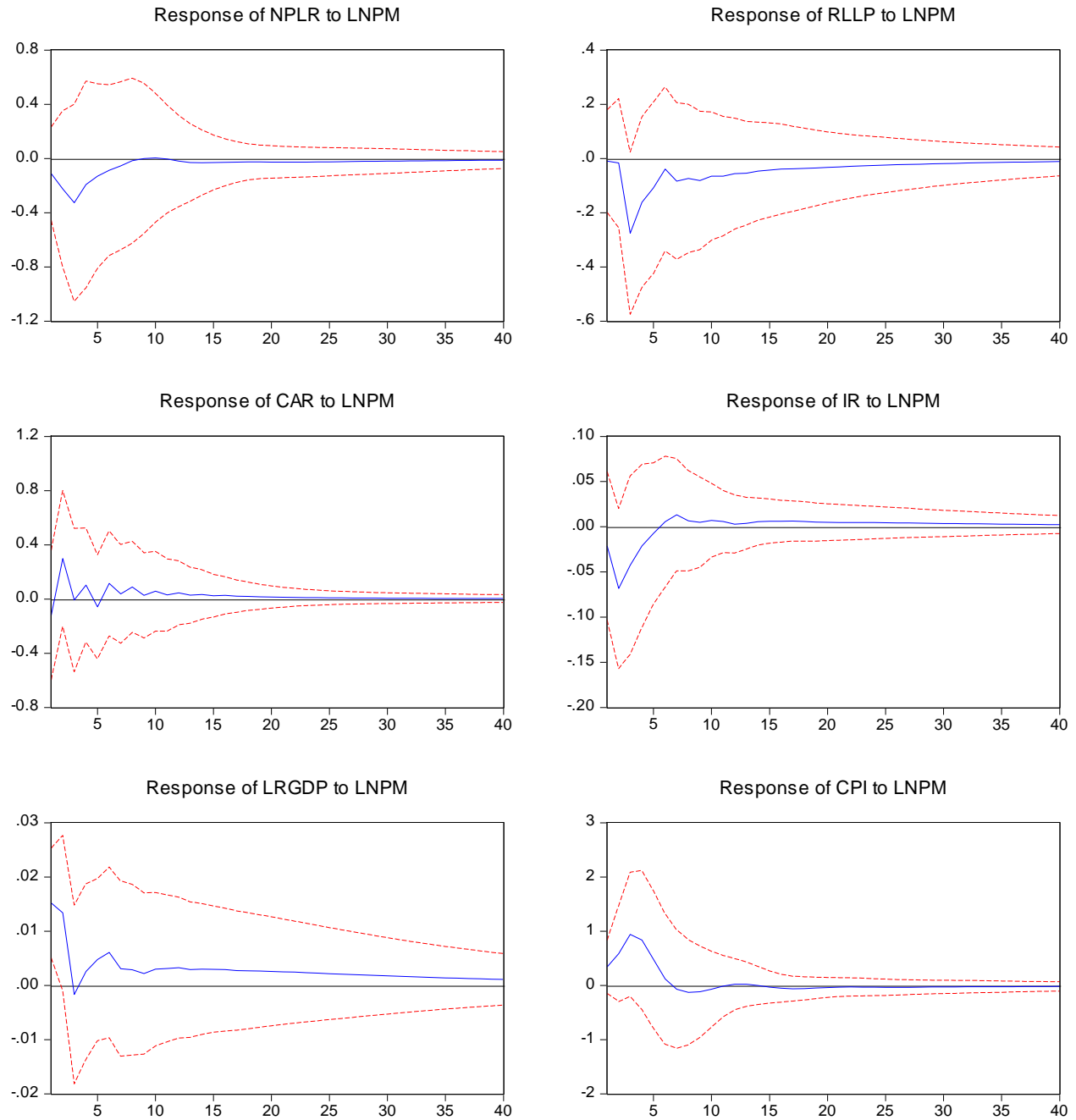**Figure 4. 1:-** Impulse response function between NPM and explanatory variables.

Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure 4.2:- Impulse response function between ROA and explanatory variables.
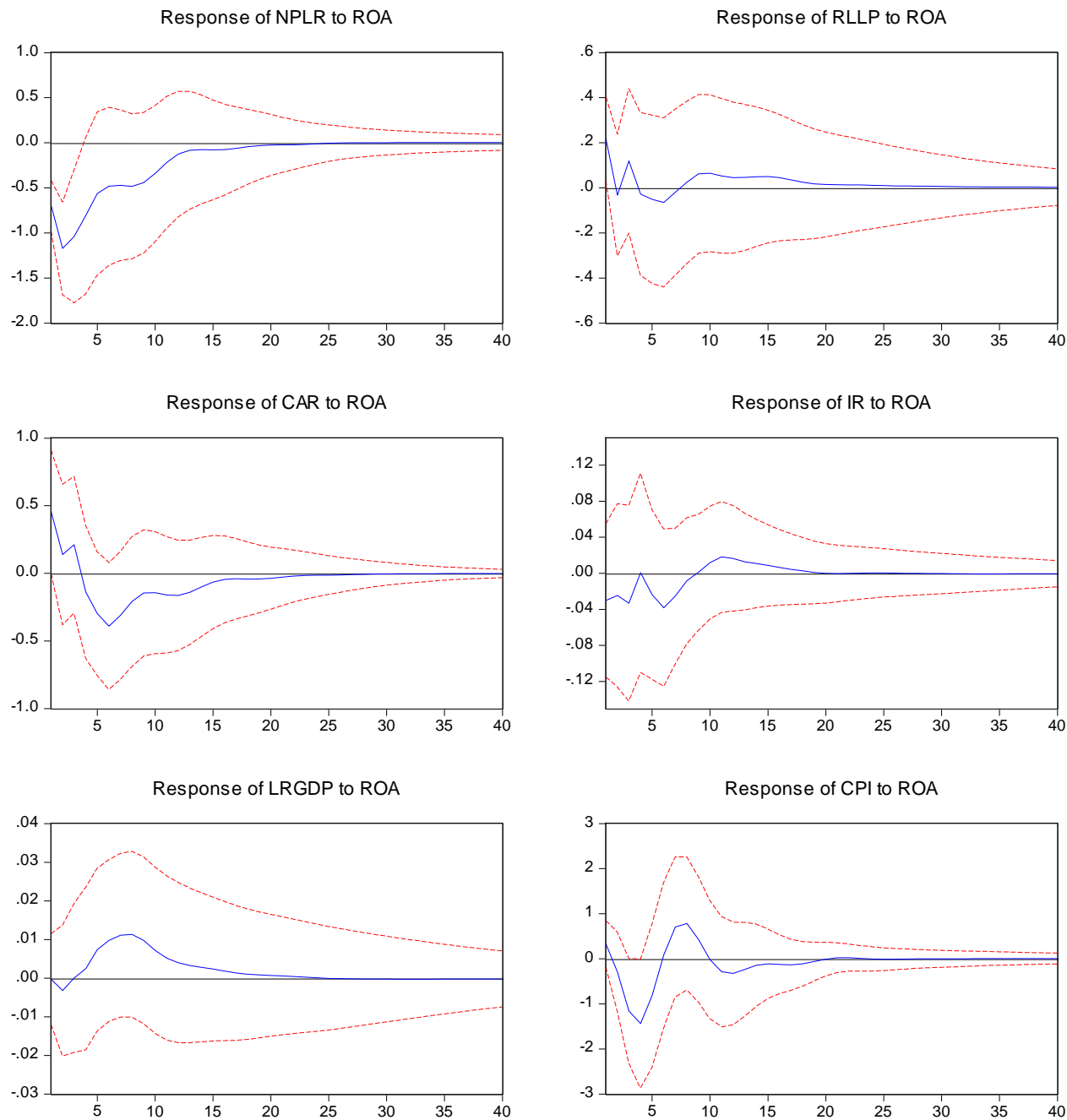Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure 4.3:- Impulse response function between ROE and explanatory variables.
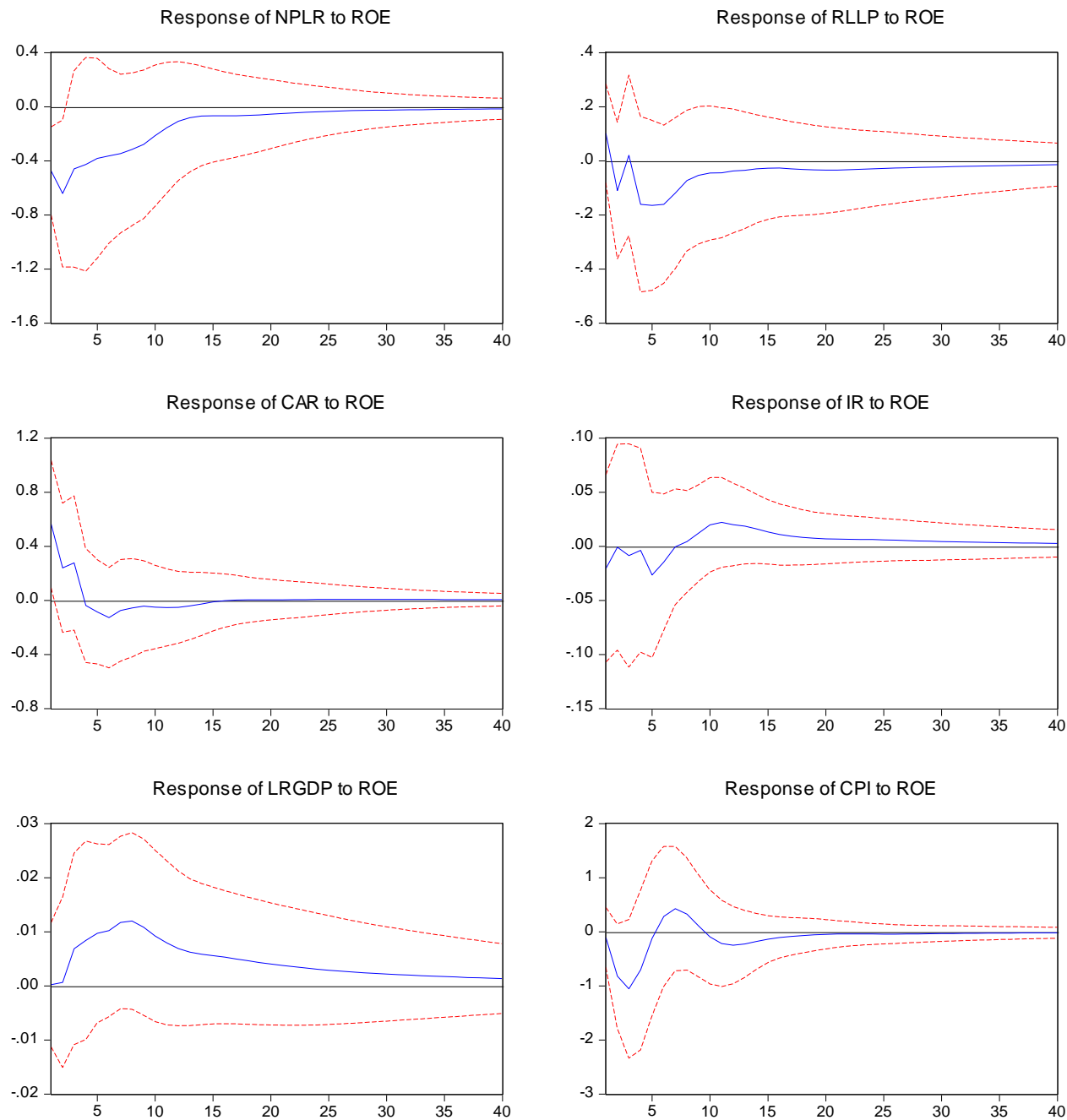Response to Cholesky One S.D. Innovations ± 2 S.E.

Table 19:- Variance Decomposition of NPM.

Variance Decomposition of LNPM:							
Period	S.E.	LNPM	NPLR	RLLP	CAR	IR	LRGDP	CPI
1	0.594156	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.669971	80.57027	0.092807	12.54768	0.298102	1.647777	2.424541	2.418819
3	0.745805	65.27914	1.167393	16.94896	0.242427	10.42446	3.450757	2.486864
4	0.771164	61.06111	1.908387	16.53115	2.282648	11.55587	4.161588	2.499249
5	0.816933	56.15884	8.732429	14.73109	2.855632	11.51586	3.773872	2.232263
6	0.863714	50.42500	15.00674	14.47974	3.540094	11.10441	3.382116	2.061905
7	0.881933	48.50577	17.17507	13.99535	3.726180	10.68440	3.620897	2.292326
8	0.895848	47.01790	18.99466	13.57104	3.906872	10.47438	3.807862	2.227277
9	0.908480	45.72645	20.66463	13.21367	3.867443	10.59988	3.758015	2.169910
10	0.915102	45.07607	21.42736	13.07413	3.882431	10.56379	3.837582	2.138637
11	0.917957	44.85542	21.53143	13.01256	3.921889	10.51059	4.041494	2.126610
12	0.919982	44.67494	21.51303	12.96373	4.029671	10.49400	4.205158	2.119470

Source: author's compilation and values obtained from Eviews

Table 4. 20:- Variance Decomposition of ROA.

Variance Decomposition of ROA:							
Period	S.E.	ROA	NPLR	RLLP	CAR	IR	LRGDP	CPI
1	0.968301	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	1.282935	86.00190	4.204357	1.527893	7.790454	0.014306	0.199464	0.261627
3	1.344921	79.04419	4.326155	1.965887	13.00379	0.267499	1.144524	0.247952
4	1.373877	78.76969	4.663813	1.898865	12.54178	0.564956	1.113952	0.446945
5	1.405408	77.75143	4.502169	1.836749	13.36464	0.754504	1.343136	0.447375
6	1.428682	75.24092	4.360890	2.170874	15.50366	0.734861	1.354269	0.634524
7	1.448885	75.12728	4.251683	2.152364	15.56750	0.717337	1.334915	0.848927
8	1.471980	75.29638	4.326397	2.142951	15.13969	0.795910	1.345518	0.953160
9	1.483091	74.78087	4.346445	2.226872	15.41860	0.824100	1.400408	1.002700
10	1.485357	74.56907	4.345858	2.222434	15.56995	0.834708	1.449530	1.008445
11	1.487856	74.61832	4.333558	2.225040	15.51777	0.845555	1.453703	1.006049
12	1.490606	74.53902	4.326780	2.260105	15.57647	0.845630	1.449565	1.002428

Source: author's compilation and values obtained from Eviews

Table 4. 21:- Variance Decomposition of ROE.

Variance Decomposition of ROE:							
Period	S.E.	ROE	NPLR	RLLP	CAR	IR	LRGDP	CPI
1	4.978271	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	7.232906	57.24234	36.86611	2.563789	1.889173	0.445850	0.451147	0.541587
3	8.353682	42.98002	28.63717	6.907626	18.87435	0.343344	1.196763	1.060726
4	8.547810	41.26289	29.41660	7.148053	18.59933	1.133010	1.146369	1.293745
5	8.629969	40.50298	28.97862	7.832191	18.61473	1.284084	1.179038	1.608346
6	8.772576	39.71834	29.29700	7.580078	18.72177	1.265034	1.141193	2.276585
7	8.956599	38.76147	30.14046	7.796490	17.96872	1.872291	1.101473	2.359096
8	9.194440	37.19215	31.69204	8.112373	17.11906	2.494276	1.121559	2.268537

9	9.309756	36.36402	32.01225	8.467444	17.22226	2.609137	1.104633	2.220255
10	9.353529	36.03260	32.21221	8.515910	17.31005	2.626678	1.094878	2.207676
11	9.376264	35.86434	32.19585	8.553368	17.44100	2.631265	1.091191	2.222982
12	9.381144	35.83114	32.21583	8.551915	17.45101	2.628675	1.090916	2.230506

Source: author's compilation and values obtained from Eviews

Forecast error variance decomposition:-
Table 4.19-21 shows the results of the forecast error variance decomposition over the horizon of 12 quarters. The forecast error variance decomposition for NPM is mostly attributed to itself in the first quarter where it suggests that in the short run, shock to Net profit margin account for 100% variations of fluctuations in NPM (own shock) and 0% from other variables in that quarter. Indicating that net profit margin is to at larger extent influenced by its own innovations beyond explanatory variables. However, after 6 quarters the variable NPLR and after 2 quarters variables RLLP and IR significantly contributed to the fluctuations in NPM. Their contribution has been increasing as the horizon increase.

Meanwhile, the fluctuations in ROA are mainly attributed to itself to 100% but CAR, NPLR taking a prominent share in the fluctuations as from the beginning of the 2 quarters. The forecast error variance decomposition in ROE are largely due to itself in the first quarter accounts 100% but after 1 quarter the variable NPLR and after 2 quarters variables RLLP,CAR contributed significantly to the fluctuations in ROE as the horizon extend. However other results of explanatory variables to dependent variables to a smaller extent do not tally whose results suggested insignificant influence of credit risks shock to profitability measures in Rwanda.

Summary, Conclusions & Recommendations:-
In this study, we have analyzed the impact of credit risk indicators on the profitability of Rwandan commercial banks, to achieve the objectives of the study; we formulated four hypotheses to test the relationship between each of the credit risk indicators, macro economic variables and moderate factor used in this study on each of the three profitability indicators. Three models were therefore formulated to test such relationship of explanatory variables against each of the three performance indicators, namely, net profit margin (NPM), return on asset (ROA), and return on equity (ROE). Credit risk indicators are non performing loans (NPLR), ratio of loan loss provision (RLLP), capital adequacy ratio (CAR), as internal bank factors and external (macro-economic) factors that is real gross domestic products (RGDP), inflation (CPI) and interest rate (IR) as a moderate factor, the essence is to ascertain whether the credit risk indicators impact significantly on each or all of the three performance indicators in the one way or otherwise.

The results show that using the above mentioned explanatory variables representing the credit risk indicators both internal and external factors, there is a short and long run significant impact on all the three profitability indicators used in this study.

Felix and Claudine (2008) investigated the relationship between commercial bank performance and credit risk management and concluded that return on equity (ROE) and return on assets (ROA) both measuring profitability were inversely related to the ratio of non-performing loans to total loans of financial institutions thereby leading to a decline in profitability.

Conclusion:-
Credit creation is the prime operation of the banks, but, it expose to credit risk for the bank due to the failure of the borrowers to fulfill the promise with the banks. Moreover, banks need to identify and manage the credit risk sensibly because it may affect profitability and lead a bank to the banking crisis and economy to systematic crisis as whole.

This study has investigated the relationship between commercial bank profitability and credit risk in Rwanda. We adopted co integration approach to analyze time series quarterly data from 2006 to 2015. Our results provide evidence of a great collision of credit risk indicators on profit persistence in the Rwandan commercial banks as well as banking sector in general. We established a significantly negative/positive relationship between credit risk indicators, macro-economic variables, moderate factor and commercial bank profitability. However the impact of all above explanatory variables varies differently in magnitude and signs as demonstrated in all graphs in this study. This implies that bank increased exposure to credit risk reduces profits, however we report that there is no significant granger causality relationship between the various credit risk indicators and the various measures of

commercial bank profitability except for a uni-directional granger causality relationship to all above variables under study which reflects a cause and effect relationship.

The estimated results suggest that the profitability of commercial bank in Rwanda is influenced not only by factors related to their management decisions, internal factors, but also to changes in the external macroeconomic environment that is inflation, real gross domestic product and interest rate as a moderate variable estimated in the results. The type of explanation for the level of profitability would determine possible policy implications and ought to be taken seriously, Since very little empirical work has been undertaken investigating the behaviors in banking sector in relation to the profitability and credit risk in Rwanda, an empirical investigation like, the one conducted above may yield insights that could be of interest to academics, bankers, and policy makers.
Based on the foregoing, we conclude that there is a significant relationship between various internal and external bank variables (explanatory variables) employed in this study on the profitability of commercial banks in Rwanda and overall performance of Rwandan economy.

Recommendations:-
Based on the findings and conclusions of the study the following recommendations are given.

The bank management need to be careful in setting up a credit policy that will not negatively affects profitability and also they need to know how credit policy affects the operation of their banks to ensure sensible utilization of credit and maximization of profit.

The results depart several implications for investors and banking firms, screening evidence about what sabotages or drives banks‟ profitability will help businesses to realize which economic and financial factors are critical to track and analyze in order to attain operational success. Importantly, if banking firms know which factors are likely to boost performance, then this should create increased competition in the marketplace. Economically, this would aid in keeping the economy of a particular country to grow and create jobs.

The implications of these findings for public policy include further education about personal finance in regards to investment analysis. With a debt driven economy, the need to save and pledge potential financial security is becoming ever more obvious. A society that understands financial measurements and their implications, banks operating performance is more capable of making good decisions that can help drive individual wealth and growth which will ultimately.

Individuals or investors can use the familiarity derived from the findings of this study and personally start taking care of their retirement through equity investing, by recognizing the drivers of ROA, ROE and NPM. This can also help new investors to analyze financial statements and make informed equity investment decisions.

The bank should give more attention and utilization on the bank specific factors than both the industry and macroeconomic factors as those external factors on banking sector performance since there are not controlled directly.

Finally, the ability to maximize risk adjusted returns on any investment especially in banking sector and sustaining stable and competitive returns is an important element in ensuring the competitiveness of the Rwandan banking sector. Thus, from the regulatory perspective, the performance of the banks will be based on their efficiency and profitability.

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Appendix:-
Appendix 2:- Stationarity tests.
2.1 Net profit margin at first difference

Null Hypothesis: D(LNPM) has a unit root				
Exogenous: Constant				
Lag Length: 6 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.021558	0.0040
Test critical values:	1% level		-3.653730	
	5% level		-2.957110	
	10% level		-2.617434	

Appendix 3:- Co integration results.
Results on net profit margin

Date: 06/06/16 Time: 11:32				
Sample (adjusted): 2006Q3 2015Q4				
Included observations: 38 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LNPM NPLR RLLP CAR IR LRGDP CPI				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.812714	171.2073	125.6154	0.0000
At most 1 *	0.696914	107.5529	95.75366	0.0060
At most 2	0.538703	62.19079	69.81889	0.1743
At most 3	0.423877	32.78971	47.85613	0.5685
At most 4	0.131203	11.83524	29.79707	0.9374
At most 5	0.105041	6.490703	15.49471	0.6375
At most 6	0.058076	2.273567	3.841466	0.1316
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**

None *	0.812714	63.65441	46.23142	0.0003
At most 1 *	0.696914	45.36207	40.07757	0.0116
At most 2	0.538703	29.40109	33.87687	0.1561
At most 3	0.423877	20.95447	27.58434	0.2790
At most 4	0.131203	5.344536	21.13162	0.9927
At most 5	0.105041	4.217136	14.26460	0.8358
At most 6	0.058076	2.273567	3.841466	0.1316
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
LNPM	NPLR	RLLP	CAR	IR
-0.613876	-0.388441	-0.144595	0.122081	5.064703
2.083586	0.131616	0.598510	0.508182	2.957292
-1.775814	-0.451224	1.411878	1.462413	1.802787
-0.547913	-0.086614	-0.764719	-0.337018	0.617679
-0.059593	0.205759	0.350087	0.491967	-2.310346
-0.977698	0.307679	0.174836	-0.131124	0.797497
-0.647081	0.198703	0.877714	-0.069467	-0.887445
Unrestricted Adjustment Coefficients (alpha):				
D(LNPM)	-0.195823	-0.214726	0.282043	0.232955
D(NPLR)	-0.074482	-0.308998	-0.007097	0.034777
D(RLLP)	0.375635	-0.200175	-0.230319	0.159588
D(CAR)	-0.072954	-0.000866	-0.416121	-0.445133
D(IR)	-0.147414	-0.160344	-4.07E-05	-0.048193
D(LRGDP)	-0.004105	-0.007229	0.008190	0.004751
D(CPI)	-0.721694	0.741544	-0.140703	0.793719
1 Cointegrating Equation(s):		Log likelihood	-141.5133	
Normalized cointegrating coefficients (standard error in parentheses)				
LNPM	NPLR	RLLP	CAR	IR
1.000000	0.132768	0.235544	-0.198870	-8.250365
	(0.09926)	(0.27710)	(0.23490)	(0.97149)

Appendix 4:- Vector Error Correction Estimates.

Error Correction:	D(LNPM)	D(NPLR)	D(RLLP)	D(CAR)	D(IR)	D(LRGDP)	D(CPI)
CointEq1	-0.813384	0.099539	0.629837	-0.044761	-0.295583	0.001716	0.518062
	(0.23342)	(0.52364)	(0.29420)	(0.80391)	(0.13556)	(0.00863)	(0.92072)
	[-3.48462]	[0.19009]	[2.14085]	[-0.05568]	[-2.18041]	[0.19893]	[0.56267]

Vector error correction model coefficients on NPM.

4.2 Vector error correction model coefficients on return on asset

Error Correction:	D(ROA)	D(NPLR)	D(RLLP)	D(CAR)	D(IR)	D(LRGDP)	D(CPI)
CointEq1	-0.284001	-0.047683	0.460757	0.140390	0.074125	-0.008243	-0.089063
	(0.21277)	(0.20453)	(0.09527)	(0.31558)	(0.05824)	(0.00375)	(0.36272)
	[0.26775]	[-0.23314]	[4.83652]	[0.44487]	[1.27274]	[-2.19813]	[-0.24555]

4.3 Vector error correction model coefficients on return on equity

Error Correction:	D(ROE)	D(NPLR)	D(RLLP)	D(CAR)	D(IR)	D(LRGDP)	D(CPI)
CointEq1	-0.114439	-0.019180	0.062999	0.015218	0.012047	-0.001369	-0.022517
	(0.16058)	(0.03004)	(0.01265)	(0.04472)	(0.00786)	(0.00049)	(0.05214)

[0.71266]	[-0.63844]	[4.98086]	[0.34033]	[1.53199]	[-2.81537]	[-0.43186]

Appendix 5:- Grange causality results.

Pairwise Granger Causality Tests			
Date: 06/05/16 Time: 22:34			
Sample: 2006Q1 2015Q4			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
NPLR does not Granger Cause LNPM	38	2.24619	0.1217
LNPM does not Granger Cause NPLR		1.29125	0.2885
RLLP does not Granger Cause LNPM	38	3.17985	0.0546
LNPM does not Granger Cause RLLP		1.63814	0.2098
CAR does not Granger Cause LNPM	38	0.72848	0.4902
LNPM does not Granger Cause CAR		0.56165	0.5756
IR does not Granger Cause LNPM	38	3.53950	0.0405
LNPM does not Granger Cause IR		1.68746	0.2006
LRGDP does not Granger Cause LNPM	38	3.59744	0.0386
LNPM does not Granger Cause LRGDP		4.59221	0.0174
CPI does not Granger Cause LNPM	38	2.29591	0.1165
LNPM does not Granger Cause CPI		0.81649	0.4507

Appendix 6:- Diagnostic tests.

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.207032	Prob. F(2,31)	0.8141
Obs*R-squared	0.527235	Prob. Chi-Square(2)	0.7683

Heteroskedasticity Test: ARCH			
F-statistic	0.242486	Prob. F(1,37)	0.6253
Obs*R-squared	0.253929	Prob. Chi-Square(1)	0.6143

Heteroskedasticity Test: White			
F-statistic	0.478964	Prob. F(27,12)	0.9452
Obs*R-squared	20.74766	Prob. Chi-Square(27)	0.7980
Scaled explained SS	73.03827	Prob. Chi-Square(27)	0.0000