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ARE CREDIT RATINGS INFLUENCED BY FINANCIAL FUNDAMENTALS? EVIDENCE FROM BANKING SECTOR OF PAKISTAN

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ABSTRACT

Banking sector is of crucial importance for economic growth and evaluation of financial stability of this sector is considered to be an area of great interest in financial research. One important method of assessing financial performance, stability and measurement of risks in banks is the credit rating system. The aim of current research is to determine influence of 'financial fundamentals' *(FF)* on credit ratings assigned to commercial banks in Pakistan with empirical evidence. Final sample for the study comprised of twenty-four banks from Pakistan. Six-year data have been obtained from financial annual reports of banks from 2012-2017. Techniques used to analyze data were ordered probit model and descriptive statistics. According to findings of ordered probit model, liquidity and profitability significantly and positively impact credit ratings; whereas capital adequacy and efficiency significantly negatively impact credit ratings. It is suggested that banks with intentions of improving their ratings should focus on increasing their profitability and liquidity conditions. Moreover, they should try to minimize operating costs as well as non-performing loan levels, because these are responsible for low ratings and can be destructive for bank reputation.

KEY WORDS

Profitability, Liquidity, Efficiency, Credit ratings, Asset quality, Capital adequacy and Ordered Probit Model.

1. INTRODUCTION

Financial institutions are the building blocks for any economy. Banks constitute the major portion of these financial institutions and financial health of banking system contributes towards the overall progress and economic stability. Banks are tasked with maintaining adequate level of capital formation that is very important for growth of economy. In addition, they provide an authenticate platform to the lenders and borrowers of money for efficient mobilization of resources. Banks also aid in carrying out various activities at national and international levels involving funds such as; facilitating import export, providing funds to organizations and assisting in entrepreneurial activities.

The financial reliability of banks has an immense importance for the economic system because if these banks fail it will damage investors' and depositors' trust in whole financial setup; which then slow down economic growth causing recession. Bank failure was also identified as the main reason behind global economic crises in 2008. After such financial crises, bank credit ratings (CRBs) have gained extensive attractiveness. Hence, financial performance of banks is considered as one of the most important areas of concern not only for researchers but also for regulatory authorities at provincial and federal levels. One of the methods of measuring financial strength, performance and checking risk within banking industry is evaluation of *CR*. *CR* identify and classify banks on the basis of probability of nonfulfillment of their finance related obligations (Karminsky & Khromova, 2016).

Rating agencies use both quantitative and qualitative variables in rating process of institutions. Moody's employ five variables namely: risk positioning, regulatory environment, franchise value, operating environment, and *FF*. Regulatory environment and operating environment represents the prevailing environments in which a bank operates. Risk positioning is the capability of a bank to manage its risk. According to Moody's franchise value is the unity of banking sector standing at given geographical region or business position. Franchise value takes in market share, stability of earnings, geographical diversification and disclosure to event risk (an event reducing franchise value of banks). *FF* comprises of asset quality *(AQ)*, liquidity *(Liq)*, efficiency *(E)*, profitability *(P)* and capital adequacy *(CA)*. After assessment of cited variables, Moody's assign ratings to banks according to scores obtained by banks through evaluation (Öğüt, Doğanay, Ceylan, & Aktaş, 2012).

Researchers have been motivated due to scarcity of studies on effects of *FF* on *CRB* in Pakistan as the research problem was identified after probing into various studies on credit ratings of banking sector firms working around the globe. Present research is designed to empirically examine effect of *FF* on *CR* which is significant in the determination of banking financial strength, by incorporating accounting and financial data in Pakistani context. In this study, researchers are concerned with investigating the link between ratings and different characteristics of banks, like financial fundamentals.

Current study has practical significance as it is conducted particularly for banking sector in Pakistan, and the findings of this research are expected to yield benefits for the improvement of bank ratings and also aid in policy making in Pakistan. The reason why this study focuses only on Pakistani banks is that these banks are carrying on their operations in the same economic and political environment. This research can support scholars in discerning the link of bank ratings with *CA*, *AQ*, *E*, *L* and *P*. The study is also important for potential investors as well as for the society because it provides information about various characteristics of *FF* and *CRB*. This study can be useful for banks and regulators in forecasting the decline or any upgrade in banking financial stability. Findings of this investigation may also direct banks to increase their ratings in order to improve financial strength of studied FFs.

2. LITERATURE REVIEW

Credit Rating Technique in Commercial Banks

Credit rating (CR) is a technique in which credit rating agencies (CRAs) allocate CRs to entities on the basis of analysis of their ability to fulfill their financial commitments. These ratings are the measures of financial credibility of bank, autonomous government body or any organization. Bank credit rating represents the summary of opinions of rating agencies on the overall financial soundness of banks. In this process business risks and financial risks are estimated. External CRs are considered as an absolute measure of risk because CRAs take possibility of all relevant risk factors under consideration. Credit rating is essential for efficient performance of banks due to their effect on capital requirements, collateral calls and bank's capability to better perform in capital market. CRs brings a massive change in sum of investment as it encourages investors to invest through less risky debt instruments. Now credit ratings have gained more importance in order to assess credit risk since amendments in standards of BCBS (Basel Committee on Banking Supervision) for banks (Pagratis & Stringa, 2007). CR provides various benefits such as it helps investors to assess credit risk of organizations, assist them in decision making, reduces expenditures on information gathering and also good ratings of organizations improve their brand image. Therefore, CRs are very important, especially in the investment market. Highly rated companies can avail funds at lower costs because investors are probably willing to provide funds because they believe the funds are safe and the company uses resources efficiently. As a result, funding costs are reduced and performance is improved (Chen, 2012; Opoku Mensah et al., 2017).

The credit rating agencies are specialized in assessment of credit worthiness of banks or any other sovereign entity. CRAs use specific procedures and techniques to select rating scales by means of private and public financial data. Generally identical rating scales are used by CRAs all over the world. Ratings are assigned using alphabetic labels. The Standard & poor's and Fitch use identical ratings that are: AAA, AA, A and BBB, CCC. On the other hand, Moody's uses following labels for ratings: Aaa, Aa, A, Baa (Cantor & Packer, 1994). The main difference between long-term and short-term rating is the scope and duration of the ratings. The long-term ratings[1] are rated AAA to D. AAA represents the highest CR and D represents lowest. Highest scores indicate that the credit worth is high and the organization's default is unlikely, and vice versa. CRAs also update ratings after a specific time period due to changes in the operating environment and economic conditions.

CRAs use different criteria and methodologies to estimate CRBs. Thus, there are possibilities of getting different ratings from different agencies for same banks. Moody's is found less conservative and generally assign higher ratings as compared to others, though S&P is considered more conventional (Karminsky & Khromova, 2016). At times RAs are condemned for assigning inaccurate ratings and their failure in predicting economic crash;

[1] PACRA ratings and their standard rating scales are generally classified as investment grade and speculative grade ratings. Investment grade ratings include AAA, AA, A, and BBB rating types (highest AAA, BBB- lowest investment grade), speculative grade ratings include BB rating categories, B and CCC to C (CCC-C is extreme speculative). The default category includes two classifications: D (default) and SD (selective default).

Enron and Lehman Brothers are few examples, which collapsed despite of being highly rated by CRAs (Pagratis & Stringa, 2007). Public information, typically available in bank financial statements, is used by CRAs to ensure fairness and full disclosure of rating procedure in order to minimize chances of conflicts between evaluated banks and CRAs (Gogas et al., 2014). CRAs also require nonpublic information that describes a company's true creditworthiness in order to assign a specific rating, but some regulations, e.g. *"US Regulation Fair Disclosure"*, made such disclosures prohibited. Yet, CRAs often benefit from some conditional exceptions (Pagratis and Stringa, 2007).

Environments of the country pertaining to finance and politics also have an impact on financial performance of organizations; therefore, they are important determinants of credit ratings of banks. Moody's first assesses the financial/economic environment of countries in which they are located, after that evaluates banks, and lastly the characteristics of the debtor. Earlier research has shown that geographic regions also affect credit ratings. Banks with a strong institutional environment in developed countries generally receive more stable and higher ratings than banks in developing countries (Loon & Haan, 2015; Karminsky & Khromova, 2016; Poghosyan, Werger, & Haan, 2016).

Role of Financial Ratios

Early researches related to CRs used financial ratios for predicting and explaining ratings. One primitive study on ratings to predict bond ratings given by Moody's and Standard & Poor's was conducted by Horrigan (1966). Horrigan used financial ratios as explanatory variables and as a predicted variable he used ratings which were then converted into numerical scale by allocating numbers. Altman and Katz (1976) and Pinches and Mingo (1973, 1975) said that nearly two-third of ratings could be expounded using financial figures. Blume et al. (1998) explained financial ratios as important elements of organizational ratings. Whereas profitability, liquidity, asset quality and cost efficiency are also expected to explain ratings. Poon et al. (1999) conducted revolutionary research on bank rating regarding financial strength. He used bank ratios, risk measures, financial data, and profitability as explanatory variables. Results revealed that loan provisions were the most important significant factor, risk was second important factor and last was the profitability in explaining ratings of financial strength of banks.

In addition to above mentioned primitive studies, great attention has been given to credit ratings by researchers in recent past. Rojas-Suarez (2002) suggested following key indicators commonly used to assess ratings: cost to income ratio, Capitalization ratios, liquidity ratios and return on assets ratio. Tabakis and Vinci (2002) stated that CRs given by CRAs heavily rely on information in the balance sheet. Bissoondoyal-Bheenick (2005) investigated statistical variables related to bank ratings and found that accounting factors explained bank ratings more powerfully. Bhattacharya and Kumar (2006) conducted research by using financial ratios to predict CRs given by Moody's. Pasiouras et al. (2006) determined loan loss provisions, operational set-ups, and capitalizations as main elements in categorization of banks. Boyacıoğlu and Kara's (2007) also conducted a research on Moody's banking financial strength ratings in which the independent variables were twenty bank specific financial ratios grouped by factor analysis. These researches revealed the importance of financial variables in the determination of CRB. CAMEL model is also considered as an important tool for assessing soundness and financial performance of

banks. It was recommended by "Uniform Financial Institution Rating System" (UFIRS) and "US Federal Reserves" in 1979. It is used in banks and financial institutions to evaluate financial performance. Pagratis and Stringa (2007) identified five areas on which CRB are mainly based, these are management quality, asset quality, capital adequacy, liquidity (CAMEL) and earning ability.

Shen, Huang, and Hasan (2012) found that banks with low efficiency (cost-to-income), low AQ ratios and high CA, high Liq ratios and high P were expected to gain high ratings. It was also found that financial ratios influence banks located in low asymmetric information (such as industrial countries or high-income) countries more than those in countries with high asymmetric information (such as middle-income and emerging market). Öğüt et al. (2012) stated that most important factors of bank rating are profitability, efficiency and loan proportions in asset. They found that rating agencies assign high ratings to such banks which make efficient use of their resources, give funds to households and businesses, and generate high net income for stockholders. Karminsky and Khromova (2016) stated that log of total assets, current ratio, ratio of loan loss reserves to gross loans, ratio of equity to liability, dividend payout ratio, cost to income ratio, and interbank ratios are important financial factors which affect CRB. It is also found that macro factors such as trade balance, inflation, and level of GDP per capita have increased their predictive power. Pagratis and Stringa (2007), Shen et al. (2012) and Chen (2012) stated that bank size is significantly related to its CR. The logic behind larger banks to get higher ratings is that they cover major share in economy or market, asset diversification and have many chances to obtain support from the government or any third party in times of crisis. However, larger banks may possibly be riskier than smaller banks as they generally provide high amount of loans to various institutions. It is stated that size of bank is positively associated with its CR (Poghosyan et al., 2016).

Sovereign Ratings and its Relevance

Sovereign rating has gained huge prominence in financial market at international level for being a common method of evaluating risk. This is evaluation of willingness and ability of government to repay debt obligations at its due date (Sehgal et al., 2018). Ferri et al., (2001) stated that CRBs are highly associated with sovereign ratings. CRBs in any emerging market are normally controlled by sovereign "*ceiling*", which means sovereign rating is the highest attainable rating for non-sovereign in its country. Williams et al., (2013) found that raise or reduction in sovereign rating has huge impact on bank ratings. The impact of raise in sovereign rating may differ, depending on national policies relevant to providing financial, business, investment and economic freedom. They revealed that banks which get low ratings as compared to sovereign ratings in their countries are such banks which are improbable to be influenced by differences in sovereign ratings than those banks which are rated high or given same sovereign ratings.

3. METHODOLOGY

Longitudinal panel data is used in research to provide more information about the yearly cross section to assess the dynamics of change. Panel data combines time series data and cross-sectional data to account for changes in two dimensions simultaneously. The

econometric model used in this study incorporates FFs (explained by Moody's) as an independent variable, and CRBs are treated as predicted variable.

3.1. Data Sources

Researchers followed a positivist approach and collected quantitative information using secondary methods of data collection. The frequency of the data is annual and an index of the five elements of FFs is taken for the period 2012-2017. Bank financial statements are used to gather information about FFs. CRBs data is obtained from websites of the most common CRAs operating in Pakistan, namely JCR-VIS and PACRA.

3.2. Sample and Sampling Criteria

Target population of research is banking sector of Pakistan. Cluster sampling technique[2] which is a refined type of probability sampling design is used to collect study sample. Sample formation firstly includes identification of three groups[3] Islamic, public and private banks, and then data is collected from banks within these defined groups. Hence, sample size is comprised of twenty-four banks including four Islamic banks, five public banks and fifteen private sector banks. Names of banks under observation are mentioned in Appendix B.

Econometric Model

Study hypothesized that FFs affect CRBs. Thus, model is specified as below;

$$CR_{it} = \beta_0 + \beta_1 PR_{it} + \beta_2 ER_{it} + \beta_3 LR_{it} + \beta_4 CAR_{it} + \beta_5 AQR_{it} + \varepsilon_{it}$$

Ratings are given in alphabetical letters by rating agencies. For the purpose of conducting econometric analysis numerical values are used instead of alphabetical letters. Conversion of alphabetical letters into numerical values are made in a manner that lowest value shows lowest rating and highest value depicts highest rating. Summary of numerical ratings and long term-letter ratings is given in Table A1.

3.4 Estimation Strategy

OPM is suitable method for this study due to specification of data and the reason that outcome variable is discrete and ordinal in nature. Since traditional method of least square cannot be applied, ordered probit model has been incorporated to check the link between independent variable and ordinal[4] dependent variable. This model also notifies differences between various categories of outcome variable. Hence, ordered probit model is the most appropriate econometric methodology to specify the model for credit ratings of banks. First

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[2] With this technique, groups with dissimilar characteristics are identified first, and then specific groups are selected. After selecting a group, you must investigate all participants in each selected group.

[3] The selection of these three types of banks is intended to generalize the results across the banking sector. Researchers have excluded microfinance banks, financial development institutions and specialized banks because these banks limit their operations to certain levels that can negatively impact results.

[4] Ordinal variables are categorized and ordered variables such as “bad”, “good” and “excellent”, which may indicate student grades.

of all, descriptive statistics is performed to state properties of studied variables. After that correlation analysis is conducted to determine the magnitude and direction of association between variables. Finally, each variable is implied in OPM for data analysis. Post estimation tests i.e. multicollinearity test for checking model soundness and link test to assess model specification are also conducted.

3.5 Variables Description and Definition

3.5.1 Bank Credit Ratings

CRBs are main variable of study and CRs allocated by JCR-VIS and PACRA (popular CRAs in Pakistan) are used in research.

3.5.2 Profitability (P)

It is a major financial variable in literature for the determination of CRBs. In this study return on assets is taken as proxy for P. It is calculated in terms of ratio of net income to total assets of a bank. ROA explains ability of banks to make efficient use of their resources in accomplishing set goals (Opoku Mensah et al., 2017).

3.5.3 Efficiency (E)

Ratio of cost to income is used in measuring operational efficiency of banks similar to Shehzad et al., (2010) and Poghosyan et al., (2016). It represents cost of bank in relation to income. This ratio is calculated by dividing bank operating costs to its operating incomes.

3.5.4 Liquidity (L)

It is measured by calculating ratio of liquid assets to borrowings and deposits (Karminsky & Khromova, 2016). Liquidity explains either banks are able to fulfill their short-term financial obligations or not. Liquidity risk represents the state in which banks are unable to meet their obligations when become due and eventually fail to pay back.

3.5.5 Capital Adequacy (CA)

It is measured by calculating CAR of a bank in correspondence with Shen et al. (2012). CAR evaluates capital requirements of bank according to risk it faced. It indicates that banks have adequate amount of resources to meet their potential risks. CAR is determined by taking ratio of Tier 1 and Tier 2 capital to its total risk weighted assets.

3.5.6 Asset Quality (AQ)

NPL ratio is used to measure AQ in this study as in Ishaq et al., (2016). It has been calculated by dividing non-performing loans by total amount of loans in the bank portfolio. Investors may draw on NPL ratio for deciding where to commit funds. They consider lower NPL ratio as less risky investment opportunity in comparison with higher ratio. Hence, financial experts employed NPL ratio for the comparison of loan performance of one bank with other banks (Poghosyan et al., 2016).

4. EMPIRICAL RESULTS AND ANALYSIS

4.1 Descriptive Statistics

Table 1 shows the descriptive statistics[5] of variables used to study the effect of FFs on CRBs[6] for the period of 2012–2017.

Table 1
Descriptive Statistics

Variables	Mean	Std. Deviation	Minimum	Maximum
P	0.84	0.92	-2.65	2.91
E	69.14	29.88	33.34	265.75
L	55.27	14.13	18.4	83
CA	16.47	7.61	4.25	53.86
AQ	0.74	6.98	0	41.57

Results report variation in CRs as most of the banks are assigned good or satisfactory ratings, while some received unsatisfactory ratings. BBB+ is the lowest CR a bank gets and it might be any operational or financial flaw in that bank. All those banks which got highest rating AAA depict their high credit quality and their strong ability of meeting financial obligations on time. The results of descriptive statistics and bar charts show that on the whole banks are performing good.

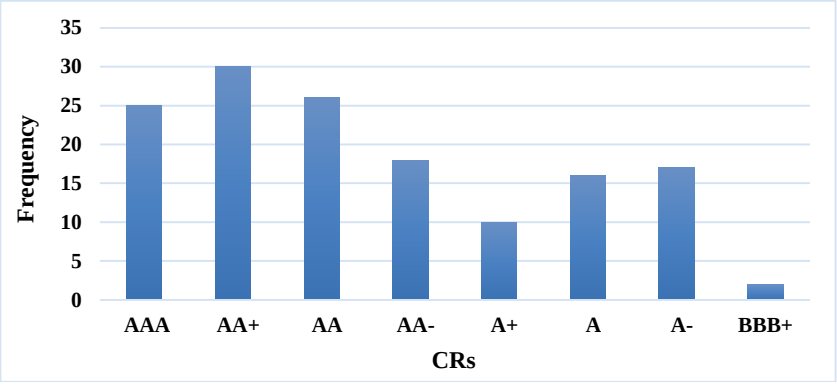

Figure 4.1: Bar Graph Showing Frequency of CRs

4.2 Correlation Analysis[7]

To check link between CRBs and FFs, Spearmen rank correlation analysis is used as the dependent variable is categorical.

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[5] Descriptive analysis is used to statistically verify behavior of large set of data by summarizing it accurately and precisely. It shows information regarding mean, standard deviation, minimum and maximum values.

[6] As predicted variable is categorical, hence it is presented in bar chart.

[7] Correlation is a statistical technique that shows relevance between the evaluated variables. It is measured by the annotated correlation coefficient "r" between -1 and +1.

Table 2
Correlation Matrix

	1	2	3	4	5	6
CRs	1	-	-	-	-	-
P	0.72**	1	-	-	-	-
E	-0.78**	-0.87**	1	-	-	-
L	0.51**	0.65**	-0.65**	1	-	-
CA	0.22**	0.43**	-0.40**	0.68**	1	-
AQ	-0.06	-0.25**	0.11	-0.08	-0.18*	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.3 Ordered Probit Model

Table 3 shows the results for the ordered probit model. A probability value of 0.000 indicates that the model is significant. In short, FFs have a major impact on a CRBs. In an OPM[8], when outcome variable got n categories, cutoff values for model will be n-1. For analysis in the current sample, result variables consist of 20 categories. However, the ordered probit model represents 7 cutoff values because the data is only acquired for 8 categories.

Table 3
Findings in OPM

	(CR)	(Coefficients)	(Standard Error)	(z)	(P>z)	(95% Confidence Intervals)
P	76.10	18.01	4.22	0.000	40.79	111.41
E	-1.65	.563	-2.94	0.003	-2.76	-.553
L	3.46	.973	3.56	0.000	1.55	5.374
CA	-6.83	1.52	-4.49	0.000	-9.82	-3.850
AQ	1.82	1.40	1.30	0.194	-.92	4.567
/cut1	-3.735	.983			-5.663	-1.807
/cut2	-1.397	.743			-2.854	.059
/cut3	-.647	.733			-2.084	.789
/cut4	-.304	.728			-1.732	1.123
/cut5	.283	.717			-1.122	1.690
/cut6	1.088	.719			-.321	2.497
/cut7	2.124	.741			.671	3.577
LR chi2 (5)	= 140.38				Probability > chi2 = 0.0000	
Log likelihood	= -209.28071				Pseudo R^2	= 0.2512

Pseudo R^2 is 0.2512 which is calculated as;

- McFadden R^2 (aka pseudo R^2) is

  Pseudo R^2 = Model L^2/ DEV_0 = 140.38/558.92 = 0.2512

[8] The CRB is an ordinal variable because it has 20 categories and is ordered. That is, one category is better than the other.

(Remember, $DEV_0 = -2 * LL_0 = -2 * -279.461 = 558.92$)

The interpretation of the OPM explains meaning and sign of coefficients, it does not interpret magnitude. The p-value for each variable is less than 0.01. It shows that variables are significant at the 99% significance level, except for AQ, because the p-value is greater than 0.1. This indicates that the CRB is not affected by AQ. The results show that P has a large and positive effect on CRB. At the same time, the return factor suggests that higher returns are likely to give banks higher CR. These results are in line with those of Shen et al. (2012) and Schutt et al., (2012). Poon et al., (1999) also argued that P ratio is considered as a significant variable to explain the financial strength associated with a bank's credit score.

Efficiency has significant impact on a bank's rating, but its negative coefficient indicates the opposite that is the higher the bank's efficiency ratio (cost / income), the lower rating will be assigned to that bank most probably. Rojas-Suárez (2002), Ogut et al., (2012), Karminsky and Khromova (2016) also found evidence supporting the hypothesis that low-efficiency banks receive high CRs more possibly.

Liquidity has a significant positive impact on a CRB. That positive ratio indicates that the higher the liquidity ratio, the higher the P that a bank will get a high CR. Shen et al. (2012), & Karminsky and Khromova (2016), reported the same results. They found that banks with better L positions can receive better CRs.

CA is found statistically significant and has an inverse link with CRBs. Coefficient of CA indicates that banks with high ratio of CA have more chances of receiving low CRs. The reason behind these findings may be that high level of CA generate idle funds which yield no profit; as such funds are just an excessive investment for protection from expected risks. Hence, lower rating due to lower P. However, Altman and Katz (1976) and Pinches and Mingo (1973, 1975) stated that usually CA was not the major reason behind poor performance of banks. Though CA is important but is not the prime determinant of CR, therefore not much important in determination of CR. Contrary to these findings, Pagratis and Stringa, (2007) and Chen (2012) found that high ratio of CA enhances the P of banks to get high CRs, tier 1capital substantially influence CRBs.

AQ is found statistically insignificant because its P value is 0.194 that is above 0.05 even at 10% level of significance. Hence, no impact on ratings is reported in findings and failed to reject H_{5_0}. The reason may be the hesitation of banks to disclose actual figure of non-performing loans due to the damage it can cause to their goodwill. Research conducted by Pagratis and Stringa (2007) found that the main factor for banks in improving ratings is improving their credit risk management.

Findings depict seven cut values (parameters) in ordered probit model. Which means eight categories would be there for CRBs. Consequently, following threshold parameters (-3.74, -1.40, -.65, -.30, .28, 1.088 and 2.12) represent 8 values possible for CRBs (M = eight), given as:

CR_i = BBB+ if CR_i^* is ≤ -3.74
CR_i = A- if $-3.74 \leq CR_i^* \leq -1.40$
CR_i = A if $-1.40 \leq CR_i^* \leq -.65$
CR_i = A+ if $-.65 \leq CR_i^* \leq -.30$

CR_i = AA- if $-.30 \leq CR_i^* \leq .28$
CR_i = AA if $.28 \leq CR_i^* \leq 1.088$
CR_i = AA+ if $1.088 \leq CR_i^* \leq 2.12$
CR_i = AAA if $CR_i^* \geq 2.12$

Table 4
Findings of Ordered Probit Model

	Proposed Hypotheses	**Status**
H_1	P has no effect on CRB.	Not Supported
H_2	E has no effect on CRB.	Not Supported
H_3	L has no effect on CRB.	Not Supported
H_4	CA has no effect on CRB.	Not Supported
H_5	AQ has no effect on CRB.	Supported

Ordered Probit Model (OPM) with Marginal Effect

Because the parameters of the order model (ordered probit / ordered logit) are hard to infer, using marginal effect[9] make findings easier to understand. The ordered probit model contains as many marginal effects as there are dependent variable categories. In this study, there are 8 categories of dependent variables, so each independent variable has 8 marginal effects.

Marginal effects for categories of CRB are shown in Appendix B (Table B1-B8). Findings presented in Table A1 indicate that an increase of one unit in P of banks will increase their probability of getting AAA rating by 789%. If efficiency of banks shows an increment of one unit then their likelihood of receiving AAA rating will decrease by 17%. On the other hand, an increment of one unit in L of banks will increase their chances of receiving AAA rating by 36%. Whereas, an addition of one unit in CA of banks will reduces their possibility of getting AAA rating by 70%. Since AQ is statistically insignificant thus shows no impact. Likewise, results of marginal effects for each type of CRBs are interpreted.

Marginal outcome for same explanatory variable compute zero. If they are more probable for some categories, then there are also some less probabilities for other categories; such as in case of efficiency marginal effects are reported as -17, -38, -8, 16, 13, 23 and 1 = 0.

4.5 Predict Probabilities for Each Outcome

Table C shows linear prediction[10] and predicted probabilities[11] for every observation. End results of z value and predicted probability are almost same. Observation of first bank

[9] "Marginal effect shows variation in probability when there is an increase of one unit in independent variable. For continuous variables this represents the instantaneous change given that the unit may be very small. For binary variables, the change is from 0 to 1, so one unit as it is usually thought".

[10] Linear prediction is best estimate for CRB * value. This means which category will be CRB * value.

[11] Probability for particular bank to falls in certain category.

shows that chance of receiving BBB+ is just one percent, and possibility of receiving A and A- is 26% and 52% respectively, however possibility of achieving AA- and A+ rating is 8% for each. Whereas likelihood of receiving AA rating is only three percent and finally possibility of obtaining AAA and AA+ is below one percent for each. Predicted probabilities concluded that first bank got highest possibility of receiving A- rating, and similar results are found for linear prediction in z column i.e. -1.4 lies in A-slot. Likewise, predicted possibilities of other banks are interpreted.

Table 5 presents summarized predicted probabilities. Probability mean shows that about two percent banks will get BBB+, nearly twelve percent banks will receive A-, almost ten percent banks would get A, almost six percent banks will get A+, nearly twelve percent banks would achieve AA-, nearly nineteen percent banks will get AA, about twenty two percent banks will get AA+ and almost sixteen percent banks will get AAA.

Table 5
Predicted Probabilities

Variables	Mean	S. D	Minimum	Maximum
Pr (BBB+)	.016	.085	2.17e-11	.741
Pr (A-)	.119	.194	.0000105	.756
Pr (A)	.102	.101	.0002187	.292
Pr (A+)	.061	.046	.0000707	.135
Pr (AA-)	.124	.076	.000021	.231
Pr (AA)	.191	.1031	.50e-06	.312
Pr (AA+)	.217	.142	2.22e-08	.395
Pr (AAA)	.166	.206	3.79e-11	.767

4.6 Diagnostic Tests

Specification of Model: Link test[12] is applied to verify model specification. Results indicate insignificance of hat square; failed to reject H_0. Hence, model is accurately specified.

H_0: Correct specification of model is achieved.

H_A: Correct specification of model is not achieved.

Variance Inflation Factor Test:

The VIF[13] test checks the multicollinearity between the tested variables. The results in Table B9 gives no indication for presence of multicollinearity, as test values for variables and their average are less than 5.

[12] Another link test estimation regression equation is dependent on hat and hat square. It creates two variables from error and then regress on the explained variable. When the hat square of the outcome variable is significant, it means model specification is not correct. It suggests part of an error explains predicted variable. It might be due to omission of important variables or presence of irrelevant variables in model.

[13] VIF stands for variance inflation factor, which measures association of independent variables. When variables are linked, changing one variable also changes another variable.

5. CONCLUSION

An important function of CRAs is to measure financial credibility of banks. Indicators of financial performance of banks are determined in context of banking capacity to fulfill financial obligations as well as their effectiveness in managing risk. The carried research may help CEOs to identify elements responsible for deterioration in financial strength of banks in order to take corrective actions. It can also aid policymakers in identification of determinants which can improve credit ratings, because improved credit ratings can be used by banking industry to position themselves high in financial market and to attract potential investors. CRAs may also get help from the findings in identification of effective indicators to be focused on while carrying out evaluation process.

This study has developed substantial understanding about factors affecting CRBs such as E, P, AQ, CA and Liq. for bank managers and investors. In Pakistan, deficiencies exist in regulatory and accounting framework. The research may be helpful in formulating appropriate policies regarding future improvements in banking sector. It is better for banks to enhance their capability in order to make optimum use of their capital. In this way operating costs will go down in relation to their income, hence an increase in profitability.

Banks must try to improve their liquidity condition by improving their ability of fulfilling short-term obligations in time. Maintaining an adequate level of resources is also advised to banks to meet potential risks. Moreover, Banks should follow accounting systems and standards specified by IAS and IFRS which will minimize the reasons behind non-performing loans because to some extent bank's mismanagement is responsible for such loans. To decrease the probability of NPLs, banks should properly inspect credit worthiness of borrowers and follow proficient loan approval procedures. Banks are further advised to emphasize on collateral backed loans to avoid default risk. Banks are also suggested to use those softwares that aid in risk detection and preventing other relevant obstacles. Therefore, it is concluded that these recommendations are useful in improving reputation and credit rating of banks.

It is also important to state the delimitations of study. One of the delimitations is that there are many other substitutes for measuring FFs, but the study is rationally limited to a few suitable substitutes. Also the sample size is kept small involving only Islamic, public and private banks; this may impact research findings. However, future research can be conducted on a large scale using other factors such as regulatory environment, franchise value, risk positioning and operating environment to enhance research value and contribute to existing body of knowledge.

Moreover, it will be worth studying to check the effect of these FFs on microfinance banks, development finance institutions or non-banking financial institutes. Macroeconomic factors are also important to see the impact on CRBs. It is also recommended to analyze the influence of sovereign ratings on the CRBs or other sectors. The impact of corporate governance on the bank rating can also be reviewed in future studies. Future researchers will be able to use different types of measures for each item of financial foundation. Instead of the risk-weighted CA, the total capital ratio can also be used to measure CA. Potential researchers may increase the frequency of data and time period to acquire more research insights.

APPENDIX A

Table A1
Synopsis of Long Term-Letter Ratings and Numerical Ratings

Credit Quality	PACRA & JCR-VIS	Numerical
Highest capacity to meet financial obligation	AAA	20
Very strong payment capacity	AA+	19
	AA	18
	AA-	17
Strong capacity	A+	16
	A	15
	A-	14
Adequate capacity	BBB+	13
	BBB	12
	BBB-	11
Less vulnerable	BB+	10
	BB	9
	BB-	8
More vulnerable	B+	7
	B	6
	B-	5
An obligor is currently vulnerable	CCC	4
Currently highly- vulnerable	CC	3
Currently highly- vulnerable to nonpayment	C	2
An obligor has failed to pay	D	1

Table A2
Operationalization of Variables

Variables	Measurement	Formula	Sources
Profitability	Return on Assets	Profit After Tax / Total Assets	Opoku Mensah et al. (2017); Shen et al. (2012)
Efficiency	Cost to Income Ratio	Operating Expenses / Operating Income	Poghosyan et al., (2016); Shen et al., (2012); Shehzad et al. (2010)
Liquidity	Liquidity Ratio	Liquid Assets / Deposits & Borrowings	Karminsky & Khromova (2016); Shen et al. (2012)
Capital Adequacy	Capital Adequacy Ratio	Tier1 cap. + Tier2 cap. / Risk Weighted Assets	Shen et al. (2012)
Asset Quality	NPL Ratio	Non-Performing Loans / Total Amount of Loans	Ishaq et al., (2016); Poghosyan et al. (2016)

APPENDIX B

Table B1
Marginal Effect of AAA Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	7.896931	2.66798	2.96	0.003	2.6678	13.1261	.00847
Efficiency	-.1720682	.06916	-2.49	0.013	-.307611	-.036525	.691497
Liquidity	.3597418	.13074	2.75	0.006	.103492	.615991	.552752
Cap Adequacy	-.7093258	.22669	-3.13	0.002	-1.15364	-.265014	.164793
Asset quality	.1889799	.1518	1.24	0.213	-.108543	.486503	.107469

Table B2
Marginal Effect of AA+ Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	17.38922	4.93924	3.52	0.000	7.70848	27.07	.00847
Efficiency	-.3788982	.13818	-2.74	0.006	-.649724	-.108072	.691497
Liquidity	.7921596	.25487	3.11	0.002	.292614	1.29171	.552752
Cap Adequacy	-1.561952	.41344	-3.78	0.000	-2.37228	-.751621	.164793
Asset quality	.4161381	.33059	1.26	0.208	-.231802	1.06408	.107469

Table B3
Marginal Effect of AA Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	4.4771	2.77724	1.61	0.107	-.966188	9.92039	.00847
Efficiency	-.0975527	.06901	-1.41	0.157	-.232806	.037701	.691497
Liquidity	.2039526	.13006	1.57	0.117	-.050962	.458867	.552752
Cap Adequacy	-.4021464	.25585	-1.57	0.116	-.903602	.099309	.164793
Asset quality	.1071406	.09885	1.08	0.278	-.086594	.300875	.107469

Table B4
Marginal Effect of AA– Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	-7.504394	2.81903	-2.66	0.008	-13.0296	-1.9792	.00847
Efficiency	.1635151	.07648	2.14	0.033	.013611	.313419	.691497
Liquidity	-.3418599	.14458	-2.36	0.018	-.625234	-.058485	.552752
Cap Adequacy	.6740669	.25577	2.64	0.008	.172773	1.17536	.164793
Asset quality	-.1795862	.15129	-1.19	0.235	-.476112	.11694	.107469

Table B5
Marginal Effect A+ Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	-6.241203	2.4268	-2.57	0.010	-10.9976	-1.48476	.00847
Efficiency	.1359912	.06294	2.16	0.031	.012637	.259345	.691497
Liquidity	-.2843157	.11499	-2.47	0.013	-.509692	-.058939	.552752
Cap Adequacy	.5606034	.20812	2.69	0.007	.15269	.968517	.164793
Asset quality	-.149357	.1241	-1.20	0.229	-.392584	.09387	.107469

Table B6
Marginal Effect of A Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	-10.84102	3.5213	-3.08	0.002	-17.7426	-3.93939	.00847
Efficiency	.2362176	.09372	2.52	0.012	.052534	.419902	.691497
Liquidity	-.4938584	.172	-2.87	0.004	-.830981	-.156736	.552752
Cap Adequacy	.9737722	.30037	3.24	0.001	.385052	1.56249	.164793
Asset quality	-.2594342	.20311	-1.28	0.201	-.657513	.138645	.107469

Table B7
Marginal Effect of A– Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	-5.172501	2.12184	-2.44	0.015	-9.33123	-1.01378	.00847
Efficiency	.1127049	.05276	2.14	0.033	.00929	.21612	.691497
Liquidity	-.2356314	.10227	-2.30	0.021	-.436077	-.035186	.552752
Cap Adequacy	.4646094	.1889	2.46	0.014	.094379	.834839	.164793
Asset quality	-.1237821	.10307	-1.200	.230	-.325794	.078229	.107469

Table B8
Marginal Effect of BBB+ Rating after Oprobit

Variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
Profitability	-.0041406	.00924	-0.45	0.654	-.022253	.013972	.00847
Efficiency	.0000902	.0002	0.45	0.651	-.000301	.000481	.691497
Liquidity	-.0001886	.00043	-0.44	0.661	-.001032	.000654	.552752
Cap Adequacy	.0003719	.00082	0.45	0.651	-.001239	.001983	.164793
Asset quality	-.0000991	.00025	-0.40	0.686	-.00058	.000382	.107469

Table B9
Results of Multicollinearity

Variables	VIF	1/VIF
Profitability	2.93	0.341227
Efficiency	3.02	0.330979
Liquidity	2.22	0.450327
Capital Adequacy	1.43	0.701535
Asset quality	1.19	0.841235
Mean VIF	**2.16**	-

Table B10
Results of Link Test of Model Specification

	Credit Ratings	Coefficients	Std. Error	z	P>z	[95% Conf. Interval]
_hat	.9993826	.0919343	10.87	0.000	.8191946	1.179571
_hatsq	.0721758	.0388874	1.86	0.063	-.004042	.1483937
/cut1	-3.221499	.4849934			-4.172069	-2.270929
/cut2	-1.283228	.1900632			-1.655745	-.9107107
/cut3	-.5585581	.1511905			-.8548859	-.2622302
/cut4	-.2179707	.1449593			-.5020857	.0661443
/cut5	.374239	.1456482			.0887738	.6597042
/cut6	1.208652	.1690471			.8773255	1.539978
/cut7	2.310792	.2255385			1.868745	2.75284

LR chi2(2) = 143.69 Prob > chi2 = 0.0000
Loglikelihood = -207.62462 Pseudo R2 = 0.2571

Table B11
List of Commercial Banks of Pakistan

S#	Banks of Pakistan
1	First Women Bank Limited
2	National Bank of Pakistan
3	Sindh Bank Limited
4	The Bank of Khyber
5	The Bank of Punjab
6	Allied Bank Limited
7	Askari Bank Limited
8	Bank Alfalah Limited
9	Bank Al-Habib Limited
10	Faysal Bank Limited
11	Habib Bank Limited
12	Habib Metropolitan Bank Limited
13	JS Bank Limited
14	MCB Bank Limited
15	Samba Bank Limited
16	Silk Bank Limited
17	Soneri Bank Limited
18	Standard Chartered Bank Limited
19	Summit Bank Limited
20	United Bank Limited
21	AL Baraka Bank (Pakistan) Limited
22	Bank Islami Pakistan Limited
23	Dubai Islamic Bank Pakistan Limited
24	Meezan Bank Limited

Source: Compiled by researchers using the website of Central Bank of Pakistan (www.sbp.org.pk)

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