CHAPTER -6

Chapter 6

DETERMINANTS OF CREDIT RISK AND THEIR IMPACT ON GROWTH OF BANKS

6.1 Introduction

One of the core objectives of the bank has always been disbursement of loans and advances. According to Suresh & Paul (2011), banks grant credit to produce profits and in this process, they assume and accept risks. Basel Accord has classified risks into three categories – Credit risk, Market risk and Operational risk, out of the three, the most prominent risk is credit risk constituting 90-95% of risk segment of Banks. Basel Committee on Banking Supervision (September, 2000) has defined Credit Risk as "the probability that a bank borrower or counter party will fail to meet its obligations in accordance with agreed terms". Thus efficient credit risk management has been a key element in overall risk management of any organisation. Effective credit risk management is also pertinent towards long term success of any banking organisation. Hence credit risk management should be oriented towards maximisation of risk-adjusted rate of return by keeping the exposure of credit risk contained below the tolerable parameters.

Thus a bank should manage properly the below mentioned risks:

- The risk involved in individual credits or transactions should be taken care of.

- The significant risk for a bank i.e., the credit risk inherent in the entire portfolio needs to be efficiently evaluated and controlled.
- Also, the relationship that exists between credit risks and other risks should be managed appropriately.

The aim of this chapter is to analyse the determinants of credit risk of Indian banking sector keeping in view of the Objective 3 of the study as mentioned below-

Objective3:-

- To assess the credit risk of the banks over time and the impact of the risk on growth of Indian banking sector.

6.2 Approaches of Credit Risk Assessment

Mu (2007) described credit risk assessment as commercial banks' ability to predict the loss caused by borrower's unexpected default. Basically, these approaches can clubbed into two groups, viz., Traditional approach and Western Approach.

Traditional approach encompasses the generally practiced measures such as expert system, usage of credit rating and credit scoring of borrowers. This approach is largely followed in banks and financial institutions for assessment of the credit risk of borrowers. Other approach, i.e., the mainstream Western approach includes modelling the probability of default risk based on historical data. Generally, there are three types of information relevant to the default probability: financial statements, market prices of the firm's debt and equity, and the subjective perception of the firm's risk. Brown and Wang (2002) have mostly classified credit risk modelling into structural models and reduced-form models. Structural models

basically use information obtained from equity market and accounting information to weigh credit risk. On the other hand reduced-form model use the rating and other information provided by credit risk agencies like Standard & Poor's and Moody's. Crosbie and Bohn (2003) have developed the following three key elements as determinant factors of default probabilities: Value of Assets, the market value of the firm's assets; Asset Risk, the "uncertainty" or risk attached to the asset value; and Leverage, the extent of the firm's contractual liabilities. Several large banks of USA banks have introduced more structured or formal systems for approving loans, portfolio monitoring and management reporting, analysis of the adequacy of loan loss reserves or capital, and profitability and loan pricing analysis (Treacy& Carey, 2000).

6.3 Traditional System for Assessing Credit Risk

Financial institutions must determine the credit worthiness of its borrowers in order to reduce the composition of credit risk in its loan portfolio. Traditionally the measures like expert system, credit rating and credit score are exercised for assessing credit risk of a borrower or counter party and to stay afloat.

a. Expert System

The Expert system is the most used traditional method in assessing credit risk. When commercial banks have a loan application concerning a particular project, banks might organize a committee composed by experts to make a decision based on qualitative and quantitative information. This means the experts' expertise and subjective judgement play an important role in the decision-making process. The most popular expert system is the "five Cs" system singled out by Sinkey (2002),

quoted in Heffernan (2005). The experts analyze the five factors and make a decision based on the subjective balance between the five Cs.

According to Mu (2007):

> The five Cs are Character, Cash flow, Capital, Collateral (or security) and Conditions. Character concerns the borrower's personal nature, reputation, knowledge, social status and credit record etc. It is usually used to measure borrower's willingness to repay. For example, the history of an enterprise is regarded as a signal whether it is a good borrower.
>
> Cash flow indicates the borrower's liquidity. A liquidity problem is a common cause for default. Usually banks require borrowers to submit the financial reports and frequent cash flow always means good liquidity. Capital means the assets or capital the borrower has. This term directly relates to the amount of the loan. A leverage of debt to capital is a good index to show the probability of bankruptcy or default. Usually higher leverage means higher default possibility. Collateral is a security or guarantee pledged for the repayment of a loan if one cannot procure enough funds to repay. The value of collateral is closely determined by the liquidity and stability of collateral. Real estate and share certificates are the favourable collateral. Conditions are also known as Cycle Conditions, which indicate the current macroeconomic status of the economy. If the banks believe the economy is in the upturn, it would be easier for a borrower to obtain loans. If it is in the event of a downturn, banks' valuation of borrower's collateral would decrease and things would be difficult for the borrower.

b. Credit Rating:

Credit rating is one of the three methods of traditional approach. Credit rating is developed for assessment of credit worthiness of an individual or corporation. The rating is given upon proper analysis of financial history as well as based on current assets and liabilities. This credit rating score is very pertinent for a lender or an investor as the rating itself indicates the probability that the subject under consideration is capable of paying back the loan or not. Thus credit rating is by and large a useful method for assessing credit worthiness of a loan applicant and is widely practiced by banking and financial institutions across the globe.

As of now, two kinds of credit rating is usually available: external ratings published by the credit rating agencies, such as Moody's, S&P, etc., and internal ratings calculated and used by banks based on their own assessment criteria.

The Office of the Comptroller of the Currency (OCC) of USA was the pioneer in developing the initial credit rating system. It developed five categories of loans with respect to different possibility of default. After this system was put in place, banking institutions have further developed these five categories laid down by OCC into more comprehensive categories based on their own requirement. Presently in USA, around 60% of bank corporations and the top 50 banks have developed internal ratings which have 9 to 10 categories (Li et al., 2003). Thus the development of internal and external ratings, have helped banks to increasingly map their internal risk ratings to public ratings.

c. Credit Score

The underlying concept behind this method of credit assessment is largely based on the available previous systems i.e., the basic factors which determine the probability of default (as opposed to repayment) needs to be identified before hand, and then these factors should be combined or weighted to formulate a quantitative score. In certain cases, the score is interpreted as a probability of default; while in others, the score can be used as a classification system. Thus a potential borrower is categorised either as a good or a bad borrower, which is done based on a credit score or a cut off point. For example, Altman's (1968) Z-score model is a classificatory model for corporate borrowers using linear discrimination analysis and based on a matched sample (by year, size and industry) of failed and solvent firms (Mu, 2007).

6.4 Some Popular Credit Risk Models used for Credit Risk Measurement

A.1. Basic Model

Measuring or assessing credit risk indicates the predicting capacity of commercial banks towards the loss which may arise due to unanticipated default by a borrower. One of the approaches of assessing credit risk is the mainstream Western approach which tries to model the probability of default risk based on historical data. Assessment of the impact of non-performing asset (NPA) write offs on the banks profits is treated as one of easiest method of approximating credit risk. This method of estimating credit risk involves dividing the 'profit before taxes' (PBT)

by the NPAs. Here, profit before taxes (PBT) is more relevant since losses written off typically enjoy tax shields.

This concept can be presented using a different method which is calculated from the net income of the bank and treat both the net income and the NPAs as a proportion of average total assets of the bank.

Accordingly, this simple measure of credit risk as mentioned by Suresh and Paul (2011) can be presented in the following forms:

i. PBT/TA

NPA/TA

or

ii. (PAT/[1-t])/TA

NPA/TA

or simply

iii. PBT/NPA

The values obtained by using these measures can be interpreted as below-

If after using the aforesaid measure, the result obtained is say, 0.7, it simply means that if 70 percent of the NPAs turn into 'loss assets' and are written off, the bank's Profit Before Tax (PBT) would be eaten away completely and due to this reason, the resultant proportion is also called the 'margin of safety' (Suresh and Paul, 2011).

A.2. Modelling Credit Risk

Over the years, financial institutions across the nations have usually tried to reduce the occurrence of credit risk basically by loan-by-loan analysis. In the early years of 1960s it was attempted to prepare a better and more analytic framework for assessing credit risk. Thus, the first 'Credit Scoring' models were developed which aimed at assisting credit decisions for consumer loans. During the initial days, the financial institutions especially the lending institutions basically categorised the borrowers on the basis of their default potential which was estimated using ordinal ranking. With the passage of time, especially during mid of 1980's, RAROC approach was being introduced as a performance measure coupled with a significant development of attaching a Probability of Default (PD) with each credit score. This enables estimation of expected losses (EL) in case of various financial institutions.

The available procedures of calculating Probability of Default (PD) can be categorised into two broad groups.

a. **Empirical**: The empirical models try to identify the characteristics of defaulting counter parties. They use historical default rates attached with 'each score' for this purpose. Although, conventionally models like discriminant analysis (e.g., Altman's Z Scores) is used for the purpose of defining such scores, but of late Logit or Probit Regressions are also being used for enumerating these scores.

b. **Market- based (also known as structural or reduced- form) models**: The market-based models tries to deduce the likelihood of default based on counter

party market data (eg., bond or credit default swap (CDS) spreads and volatility of equity market value).

According to Suresh and Paul (2011), various commercial credit value- at- risk models have been devised during the last 10-15 years (eg., Credit Matrics, KMV and Credit Risk+) that use credit risk inputs (credit data, market data etc) for deriving a loss distribution, with the assumption that correlations across borrowers arise due to common dependence on a set of 'systematic risk factors' (typically, variables representing the state of the economy). Banks that generally embrace better technologies and sophisticated advancements basically use these models for active portfolio- level credit management (particularly, for large corporate loans). It tries to identify risk concentrations and opportunities available for diversification using credit derivatives and debt instruments and thus tries to infer credit risk.

Following table represents the popular models along with the approach used.

Table 6.1- Industry sponsored Credit Value at Risk (VAR) Models

Approach	**Sponsor**	**Model**
Credit mitigation approach	JP Morgan Mc Kinsey	Credit Metrics Credit Portfolio
Option Pricing approach	KMV Corporation	KMV(Keolhofer/McQuown/ Vasicek)
Actuarial approach	CSFB (Credit Suisse first Boston)	CreditRisk+
Reduced form approach		Jarrow/Turnbull Duffie /Singleton

Source- Suresh & Paul (2011)

In order to know the difference among each of the approaches the following table is formulated.

Table 6.2 Comparison of Credit Risk Models On Various Parameters

	Credit Migration Approach		Contingent claim approach	Actuarial approach	Reduced-form approach
	Credit Metrics	Credit Portfolio	KMV	Credit risk$^+$	Kamakura
Software Definition of risk	ΔMarket value	Δ Market value	Market value	Default Losses	Default Losses
Credit events	Downgrade/ default	Downgrade/ default	Δ continuous default probabilities (EDFs)	ΔActuarial default rate	Δ Default intensity
Risk drivers	Equity ratios	Macro factors	Asset values	Expected default rates	Hazard rate
Transition Probabilities	Constant	Driven by macro factors	Driven by **o** Individual term structure of EDF **o** Asset value Process	N/A	N/A
Correlation of credit events	Standard multivariate normal distribution (equity factor model)	Conditional default probabilities function of macro factors	Standard multivariate normal asset returns(asset factor model)	Conditional default probabilities function of common risk factors	Conditional default probabilities function of macro factors
Recovery rates	Random (beta distribution)	Random (empirical distribution)	Random (beta distribution)	Loss given default deterministic	Loss given default deterministic
Interest rates	Constant	Constant	Constant	Constant	Stochastic
Numerical approach	Simulation/Analytic econometric	Simulation econometric	Analytic/ Simulation econometric	Analytic	Tree based/ Simulation econometric

Source: BIS working paper, 2005

6.5Assessing the Credit Risk of Indian Banks

Before assessing the credit risk of the banks, it is important to know the Capital to Risk Weighted Assets Ratio, which is treated as an important indicator of financial

soundness. If we mull over this ratio of banks across the major economies of the world, then we get the picture, presented below –

Table 6.3- CRAR of Major Economies

Country	CRAR
Germany	17.9
Japan	14.2
UK	15.7
USA	15.3
India	13.6
Russia	13.7
China	12.9
South Africa	15.8
Brazil	16.7

Source- IMF Financial soundness indicator, 2012-13

It reveals Capital to Risk Weighted Assets Ratio of India (13.6) is although better than China (12.9), almost near to Russia (13.7) but is lagging behind other developed economies as well as other BRICS nations like Brazil (16.7) and South Africa (15.8). This suggests the need for improvement in the ratio of India.

Further, an attempt is also made to analyse the preparedness of Indian banks against credit risk in terms of maintaining CRAR ratio. Thus, CRAR Ratio (Capital to Risk weighted Assets Ratio) of each of the 14 banks is considered with regard to the specified period.

Table 6.4. - CRAR Ratio of Banks

As on March	CRAR Ratio										
	SBI [1]	BOB[2]	OBC[3]	CORPORATION BANK[4]	CANARA[5]	UNION[6]	BOI[7]	SYNDICATE[8]	ALLAHABAD BANK[9]	IOB[10]	PNB[11]
2003	13.5	12.65	14.04	18.5	12.5	12.41	12.02	11.03	11.15	11.3	12.02
2004	13.53	13.91	14.47	20.11	12.66	12.32	13.01	11.49	12.52	12.49	13.1
2005	12.45	12.61	9.21	16.23	12.78	12.09	11.52	10.7	12.53	14.21	14.78
2006	11.88	13.65	11.04	13.92	11.22	11.41	10.75	11.73	13.37	13.04	11.95
2007	12.34	11.8	12.51	12.76	13.5	12.8	11.75	11.74	12.52	13.27	12.29
2008	13.54	12.91	12.12	12.09	13.25	12.51	12.04	11.22	11.99	11.93	12.96
2009	12.97	12.88	12	13.66	14.1	12.01	13.21	11.37	13.11	12.7	12.59
2010	12	12.84	10.83	15	13.43	12.51	12.63	11.2	13.62	14.26	12.97
2011	10.69	13.02	12.3	12.9	0	0	11.42	11.2	12.96	13.28	11.76
2012	12.05	12.95	11.01	11.94	0	0	11.57	10.81	12.83	11.95	11.59
2013	11.22	13.3	12.04	11.38	12.4	0	11.02	11.41	11.03	10.74	12.72
2014	12.96	12.87	11.01	12.21	11.14	11.89	10.76	12.01	10.26	10.78	12.28
CV	6.802768857	3.7662807	11.071271	17.845932	43.617297	55.5836	6.3533862	3.123663	7.6633576	8.7883416	6.2195022
	1	2	3	4	5	6	7	8	9	10	11
CAGR	-0.003704213	0.0015687	-0.0218582	-0.0370696	-0.0104169	-0.0038838	-0.0100164	0.0077683	-0.0075339	-0.0042736	0.0019473

Source- Researcher's own calculation based on data available in DBIE database

Contd. **Table 6.4.1 –CRAR Ratio**

As On March	CRAR Ratio		
	HDFC	ICICI	AXIS
2003	11.12	11.1	10.9
2004	11.66	10.36	11.21
2005	12.16	11.78	12.66
2006	11.41	13.35	11.08
2007	13.08	11.69	11.57
2008	13.6	13.97	13.73
2009	15.09	15.92	13.69
2010	16.45	19.14	15.8
2011	15.32	17.63	12.65
2012	15.71	16.26	13.66
2013	15.94	16.9	17
2014	16.07	17.7	16.07
CV	13.285239	18.719277	14.250693
CAGR	0.0340401	0.0433325	0.0359202

Source- Researcher's Calculation Based on data collected from DBIE-RBI

This table indicates, among all banks private sector banks are performing better in terms of maintaining CRAR ratio. Out of Public Sector banks, except Bank of Baroda, Syndicate bank and Punjab National Bank, rest all the banks are having

negative CAGR of Capital Adequacy, thereby indicating the need to improve CRAR of public sector banks. Also the coefficient of variation is high in case of CANARA bank and Union bank, suggesting the need for betterment in terms of CRAR of both the banks.

The values of CRAR indicate private sector banks are maintaining higher Capital to risk weighted ratio compared to their public sector counterparts. The public sector banks are conforming to the minimum capital requirement stipulated by RBI in line with Basel norms. The major players like SBI, Bank of Baroda and Punjab National Bank are maintaining a reasonably higher amount of CRAR ratio to remain protected against shock, but the banks like Allahabad bank, Indian Overseas Bank and Bank of India are still having huge scope of improvement as far as risk buffering is concerned and they have to work on improving CRAR ratio in a consistent Manner.

In order to calculate the credit risk scores of each individual banks, the model specified in chapter 4, is used and the credit risk scores were calculated.

Table 6.5- Credit Risk Scores of the Banks

Name of Banks	Credit Risk Score
SBI AND ITS ASSOCIATES	3.5
BANK OF BARODA	3.2
ORIENTAL BANK OF COMMERCE	3.7
CORPORATION BANK	2.0
CANARA BANK	1.9
UNION BANK	3.2
BANK OF INDIA	2.8
SYNDICATE BANK	3.2
ALLAHABAD BANK	3.6
INDIAN OVERSEAS BANK	3.4
PUNJAB NATONAL BANK	3.9
AXIS BANK	1.2
HDFC BANK	1.4
ICICI BANK	3.2

Source- Researcher's own Calculation

Out of the 14 banks under study, nationalised banks are having more or less nearing score as the NPA level of all these banks are quite high compared to the private players. Thus the highest credit risk score (3.9) is observed in case of Punjab National Bank, followed by Oriental bank of Commerce (3.7) and Allahabad Bank (3.6) whereas lowest credit score is observed in case of CANARA Bank(1.9). Banks like SBI (3.5), Indian Overseas bank (3.4), Syndicate Bank (3.2), Bank of Baroda (3.2), Union Bank (3.2) are also showing higher scores of credit risk. In the category of private sector banks, ICICI bank is having the highest credit risk score(3.2), due to accumulation of more toxic assets. These scores indicate the need for taming the unbridled growth of credit risk in public sector banks of India.

Table 6.6- Credit Risk Scores of the Banks During 2002-03to 2013-14

Year	Credit Risk
2003	6.43
2004	5.6
2005	4.2
2006	2.8
2007	1.9
2008	1.6
2009	1.5
2010	1.7
2011	1.6
2012	1.8
2013	2
2014	2
CAGR(%)	-0.101

Source- Researcher's own Calculation

The aforesaid table reveals lowering of credit risk over the years during 2003 to 2009. Post recession, in the year 2010, again the credit risk started increasing and continued to increase till 2014, depicting the vulnerability of the banking sector.

However, the CAGR of 2003-2014 period, indicates a negative growth rate of -10%.

6.6 Impact of Credit Risk

Credit risk is assumed to have some impact on the growth of the Banks.

Now for identifying the impact of credit risk, following methodology is adopted.

Multiple regression analysis approach is employed in determining the impact of underlying factors on credit risk. The following equation is used in this case-

$$y_t = a + \sum_{i=1}^{7} \beta_i x_{i,t} + u_i$$

whereas, $y_{t=}$ dependent variable in time *t*, a=constant, $x_{i,t}$is the explanatory variable of i^{th} component in time t, x_1 , x_2, ….,x_7 denotes the variables identified. Taking ROE as dependent variable, and the following independent variables

a= intercept

X_1 = GNPATA (GNPA TO TOTAL ASSETS)

X_2 = OETA (OTHER EXPENSE TO TOTAL ASSETS)

X_3 = CRAR (CAPITAL TO RISK WEIGHTED ASSETS RATIO)

X_4 = TLTD (TOTAL LOANS TO TIME DEPOSITS)

X_5 =RGR (REAL GDP GROWTH RATE)

X_6 = INFLAR (RATE OF INFLATION)

X_7= RIR (REAL INTEREST RATE)

u_i = RESIDUAL OF REGRESSION

Analysis & Findings-

The regression equation obtained is

y_t =-41.410+ 243.752 X_1-905.356 X_2 +2.221 X_3 +23.079 X_4+1.049 X_5 +.551 X_6 + .309 X_7

Model Summary

Model	R	R Square	Adjusted R Square		Std. Error of the Estimate	
1	.980(a)	.960	.868		1.2539369	
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	114.100	7	16.300	10.367	.040
	Residual	4.717	3	1.572		
	Total	118.817	10			

As R^2 measures the strength of regression, here we can say that the independent variables can explain 96% of the dependent variable that is ROE which measures the growth of banking sector. Also, sig. in ANOVA table is the P value, if the p value is less than 0.05, regression is significant at 95% level. In this case, P value is .040<.05, so we can conclude that our regression is significant at 95% confidence interval. Also the regression equation is tested and expected values noted down.

Similarly, the regression coefficients (as found in ANOVA table 6.7) GNPA to Total Assets Ratio, Rate of Inflation, Real GDP Growth Rate have turned out to be statistically significant which indicates that Growth of Indian banking Sector has been affected by credit risk along with the stated macro economic factors.

Thus we can derive that credit risk is having underlying impact on the growth of the banking sector.

6.7 Chapter Findings

- Among all banks studied, private sector banks are performing better in terms of maintaining CRAR ratio.

- The major players like SBI, Bank of Baroda and Punjab National Bank are maintaining a reasonably higher amount of CRAR ratio to remain protected against shock, but the banks like Allahabad bank, Indian Overseas Bank and Bank of India are still having huge scope of improvement as far as risk buffering is concerned and they have to work on improving CRAR ratio in a consistent Manner.

- Out of Public Sector banks, except Bank of Baroda, Syndicate bank and Punjab National Bank, rest all the banks are having negative CAGR of Capital Adequacy, thereby indicating the need to improve CRAR of public sector banks. Also the coefficient of variation is high in case of CANARA bank and Union bank, suggesting the need for betterment in terms of CRAR of both the banks.

- Out of the 14 banks under study, nationalised banks are having more or less nearing score as the NPA level of all these banks are quite high compared to the private players. Thus the highest credit risk score (3.9) is observed in case of Punjab National Bank, followed by Oriental bank of Commerce (3.7) and Allahabad Bank (3.6) whereas lowest credit score is observed in case of CANARA Bank(1.9).

- Banks like SBI (3.5), Indian Overseas bank (3.4), Syndicate Bank (3.2), Bank of Baroda (3.2), Union Bank (3.2) are also showing higher scores of credit risk.

- In the category of private sector banks, ICICI bank is having the highest credit risk score (3.2), due to accumulation of more toxic assets. These

scores indicate the need for taming the unbridled growth of credit risk in public sector banks of India.

- It is observed that credit risk over the years decelerated during 2003 to 2009 period. Post recession, in the year 2010, again the credit risk started increasing and continued to increase till 2014, depicting the vulnerability of the banking sector. However, the CAGR of 2003-2014 period, indicates a negative growth rate of -10%.
- Growth of Indian banking Sector has been affected by credit risk along with the stated macro economic factors like Rate of Inflation, Real GDP Growth Rate.