

# Short-term Challenges and Long-term Implications of Credit Risk Scoring and Rating Models in Indian Banking

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## Abstract

*This paper illustrates the credit scoring and rating models developed by Indian banks. Risk management plays a crucial role in a bank's credit management. India has yet to realise the power of the credit derivative market of late, Reserve Bank of India has come out with a draft proposal in this regard which has recognized that banks are dominant players in the loan market are substantially exposed to credit risk. The market has not yet provided adequate protection against the credit risk to commercial banks. While bankers realize that for better credit-management, they are skeptical about the practicality of extending a new credit-consciousness to the vast base of employees spread across the country. The conclusion of this paper indicates the important innovations with significant potential for enhancing a bank's risk management.*

**Key words:** Risk-modeling, credit-scoring, credit-risk, credit-consciousness, innovations.

## INTRODUCTION

*“Risk is a choice rather than a fate. The actions we dare to take, which depend on how free we are to make choices, are what the story of risk is all about. And that story helps define what it means to be a human being”-Against the Gods, Remarkable Story of Risk, Peter L Bernstein.*

Credit risk is the possibility that a borrower will fail to service or repay a debt on time. The degree of risk is reflected in the borrower's credit rating, which defines the premium over the riskless borrowing rate it pays for funds and ultimately the market price of its debt. Credit risk has two variables i.e., market risk and firm-specific risk. It allow users to isolate, price and trade firm-specific credit risk by unbundling a debt instrument or a

basket of instruments into its component parts and transferring each risk to those best suited or most interested in managing it. There are various traditional mechanisms to reduce credit risk including refusal to make a loan, insurance products, guarantees and letters of credit, but these mechanisms are less effective during periods of economic downturn when risks that normally offset each other simultaneously default and financial institutions suffer substantial loan losses.

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The use of credit scoring is the quantitative and statistical techniques to assess the credit risks involved in lending to consumers has been one of the most successful if unsung applications of mathematics in business for the last fifty years. Now with lenders changing their objectives from minimising defaults to maximising profits, the saturation of the consumer credit market allowing borrowers to be more discriminating in their choice of which loans, mortgages and credit cards to use, and the Basel Accord banking regulations raising the profile of credit scoring within banks there are a number of challenges that require new models that use credit scores as inputs and extensions of the ideas in credit scoring. Tremendous growth in the credit industry has spurred the need for credit scoring and its applications. It would seem that credit scoring has become a separate branch of computational finance, and given its importance and use throughout the credit industry. The goal of credit scoring is of course to distinguish between “bad” and “good” credit customers. A “good” credit customer is one whose performance over time is deemed acceptable by the lending institution while a “bad” credit customer has performance deemed unacceptable.

### **THE REAL RISKS OF CREDIT DERIVATIVES**

A derivative is a bilateral agreement that shifts risk from one party to another; its value is derived from the value of an underlying price, rate, index, or financial instrument. Credit derivatives arose in response to demand by financial

institutions, mainly banks, for a means of hedging and diversifying credit risks similar to those already used for interest rate and currency risks. But credit derivatives also have grown in response to demands for low-cost means of taking on credit exposure. The result has been that credit has gradually changed from an illiquid risk that was not considered suitable for trading to a risk that can be traded much the same as others.

Credit derivatives are a relatively recent financial innovation that effectively shifts credit risk, or the risk of default, from one party to another. The vast majority of credit derivatives are actually known as credit default swaps. Credit constraints are a significant barrier to economic efficiency and welfare in India. The modern development of liquid and transparent securities markets makes it possible for individual to easily obtain loans by pledging high quality collateral (*Shah, 2000*). There is tremendous scope for the credit markets in India to develop. Introduction of new asset classes and expansion of investor base will lead to more trading and increasing liquidity. Some of the new participants in the booming market for credit derivatives may underestimate the risk they're taking on. The market is so opaque that regulators and participants alike are unsure which party actually ends up holding the bag in the event of default on loans by commercial banks and on big lease contracts.

### **THE TAKE-AWAY**

A financial institution that jumps into this market needs to beef

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up its risk-management capabilities by gaining a better understanding of credit risks and derivatives as well as their impact on capital allocations. Industrial corporate are exposed to credit risk in a variety of ways, including customer accounts receivable, longer-term supply contracts, loans to customers and vendors, and counterparty exposures. Credit derivatives, moreover, would allow corporate users to avoid a number of drawbacks associated with other methods for managing credit risk, including credit insurance, factoring, and surety bonds or securitization. But, as both surveys and interviews with credit derivatives dealers suggest, corporate direct use of credit derivatives has been very limited, accounting for less than 5% of the credit protection purchased using credit derivatives.



As the surveys and interviews also indicate, there are a number of reasons why corporate may be reluctant to use credit derivatives: (1) Unlike the cases of interest rate or currency risk, credit risk management is typically the purview of business units rather than the corporate treasury, and the business units tend to have considerably less experience with derivatives, (2) The protection provided by a credit derivative is unlikely to provide a perfect match

for the loss that would be suffered by a corporate in the event of a default, (3) The liquidity in credit derivatives tends to be greatest in maturities that are much longer than those of most corporate credit exposures, (4) It is harder for a corporate to determine how much protection to buy than for a financial, (5) While the existing credit derivative documentation (which is based on loans or bonds) works well for banks and investors, it is less satisfactory for the credit risk faced by corporate, which is often based on payment, (6) While accounting standards require that credit derivatives be marked to market, the inability of corporate to mark to market their underlying exposure being hedged leads to unwanted volatility of earnings.

**Settlement of a CDS in case of Default**

<b>Physical Settlement</b>	<b>Cash Settlement</b>
Most common form of settlement	Much less common in the market, but sometimes used for specific reasons
Protection owner delivers the obligation in return for par.	Generally, settlement amount is (Par recovery)
Must be a "Deliverable Obligation" (an Obligation with certain characteristics)	Recovery is valued in the market by asking dealers for firm all-in bid prices for the Reference

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	Obligation or Deliverable Obligation
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### TYPICAL TRADES INVOLVING CDS

1. Portfolio hedging and/or yield enhancement
2. Position ahead of prospect of default (timing and recovery)
3. Play widening/tightening of spreads
4. Play steepening/flattening of curves
5. Play the bond/CDS basis
6. Play senior/subordinated basis
7. View on capital structure, i.e., credit vs. equity
8. Macro views, i.e., investment grade vs. high yield names or portfolios
9. Views on credit volatility
10. Leveraged Credit Linked Notes

### TYPES OF CREDIT DERIVATIVES

*“In my view, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal.”*

**Warren Buffett, Chairman and CEO, Berkshire Hathaway, 2002**

The product menu in the credit derivatives market is changing every day, but there are four major instruments that make up the bulk of the trading volume today: Total Return Swaps, Credit Default Swaps, Credit Spread Options and Credit Linked Notes. Terminology varies among market

participants, sometimes based on geography. For example, Credit Default Swaps are sometimes called credit swaps so it is difficult to maintain a consistent lexicon when discussing this developing market. Traders and marketing staff are careful to provide detailed descriptions of a transaction-specific payoff profile so it is of more value to understand under what circumstances one will receive a payment, or be required to make one, than it is to know a list of product names.

### CREDIT DERIVATIVES USED BY COMMERCIAL BANKS:

The credit risk management practices involve monitoring and constant follow-up on loan accounts. But cyclically, banks have the problem of having to manage funds and risk concurrently. Credit derivatives seek to transfer the returns and risk of an asset portfolio without transferring the ownership per se. They are, therefore, off-balance sheet items. The basic idea is to transfer the risk underlying an asset and trade it separately. The success of these instruments will depend on a continuing market for various risk-denominated securities and a market that follows at least the semi-strong efficient market hypothesis. The fear of misuse and the whole question of recourse and timing thereof have slowed down the process of their acceptance in India. The present set of rules does not permit commercial banks absolute freedom in using credit derivatives as buyers and sellers. Only plain instruments of the plain vanilla type are permitted to use credit derivatives, and that too they cannot have a trading intent, except

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to a limited extent. The deals should be on the basis of market rates and free availability of information. A full gamut of systems and procedures must be in place before any bank can embark upon this activity.

### **CREDIT DERIVATIVES USED BY INVESTMENT BANKERS**

Credit derivatives have emerged as a significant area in global derivatives and risk management practice. These instruments have begun to revolutionize the management of credit risk in banking and capital markets. These changes impinge upon the nature of the institutions, operations and instruments that constitute the sector. Institutional changes include: a rapid increase in the number of new private sector banks; a process of consolidation of banks that thus far has principally affected the private banking sector but is now being consciously promoted in the public sector as well; privatisation of equity in public sector banks; mergers of banks and other financial institutions, particularly development banking institutions; and the creation of universal banks that are in the nature of financial supermarkets, offering customers a range of products from across the financial sector such as debt products, investment opportunities in equity, debt and commodity markets and insurance products of different kinds. The most crucial change has been an increasing reluctance of banks to play their traditional role as agents who carry risks in return for a margin defined broadly by the spread between

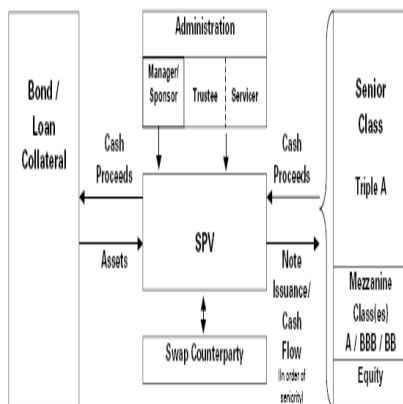
deposit and lending rates. Traditionally, banks accepted small deposits that highly liquid investments protected against capital and income risk. They in turn made large investments in highly illiquid assets characterised by a significant degree of capital and income risk. This made banks crucial intermediaries for facilitating the conversion of savings into investment.

### **CREDIT RISK MODELING**

A credit derivative is a privately negotiated, off balance sheet agreement that explicitly transfers credit risk from one party to another. The buyer of credit derivative protection need not own the defaulted asset in order to receive compensation on a credit derivative and the buyer of protection need not suffer an actual loss to receive compensation. There are various types of contracts such as credit default swap, single name, portfolio and index, synthetic securitization i.e. total return swap and credit spread option. For example, a bank concerned that one of its customers may not be able to repay a loan can protect itself against loss by transferring the credit risk to another party while keeping the loan on its books. This mechanism can be used for any debt instrument or a basket of instruments for which an objective default price can be determined. In this process, buyers and sellers of the credit risk can achieve various objectives, including reduction of risk concentrations in their portfolios, and access to a portfolio without actually making the loans. Credit derivatives offer a flexible

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way of managing credit risk and provide opportunities to enhance yields by purchasing credit synthetically. Credit derivatives cannot eliminate all credit risk because inherent in the transfer of a loan exposure to Company A, is the introduction of a new exposure to Company B because of the use of a derivative with Company B. Generally, AAA-rated Special Purpose Corporations or Vehicles (SPCs or SPVs) are created to enter into such transactions to reduce the new exposure. A simple cash-flow collateralized debt obligation (CDO) is shown below:



Credit derivatives, in their simplest form, are bilateral contracts between a buyer and seller under which the seller sells protection against certain pre-agreed events occurring in relation to a third party (usually a corporate or sovereign) known as a reference entity. These events are called credit events and they relate to the creditworthiness of the reference entity. The reference entity will not (except in certain very limited circumstances) be a party to the credit derivatives contract, and will usually be unaware of the contract's existence.

It is admittedly, a complex subject and at the operative level of banks as well as central banks there will be difficulty in understanding these models. It hardly needs emphasizing that it is not sufficient for banks to have a couple of whiz kids who would undertake the preparation of banks specific models. Meaningful credit risk modeling will require a lot more awareness of these concepts both in banks and in the central bank. Merely because the Basle Committee sees difficulties in incorporating credit risk models into capital adequacy requirements, within the time-scale envisaged for amending the capital accord should not lull us in India into complacency. Sooner or later these models would be refined to make them operational and we in India would do well to get acquainted with issues relating to making credit risk models fully operational. For credit risk models to be of any meaning the challenge lies not in the technicians showing off their skills but in producing a Child's Guide to credit modeling so that the relevant decision taking hierarchical layers are able to understand these concepts and thereby effectively contribute to the decision making process. It is no exaggeration to say that the lynch-pin of the future is not going to be the Chief Executive Officer but the Chief Risk Officer (Tarapore, 1999).

### **CREDIT SCORING: IS IT RIGHT FOR YOUR BANK?** (Dean Caire and Robert Kossman)

Banks operates in different environments, and has different procedures and policies, and sells

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credit products differently. Instead, this document aims to provide a road map of the steps in designing, implementing and monitoring a custom credit scoring model. Credit scoring uses quantitative measures of the performance and characteristics of past loans to predict the future performance of loans with similar characteristics. It is a scientific method of assessing the credit risk associated with new credit applications. Statistical models derive predictive relationships between application information and the likelihood of satisfactory repayment. The credit scoring is an objective risk assessment tool, as opposed to subjective methods that rely on a loan officer's opinion. Clearly, credit scoring is a risk management tool. Scoring systems can help a bank ensure more consistent underwriting and can provide management with a more insightful measure of credit risk. Credit scoring cannot predict individual loan loss; rather it predicts the likelihood or odds of a "bad" outcome, as defined by each bank—usually this will be some level of average or total days in arrears at which associated costs make the loans unprofitable. Nor should a credit scoring system alone approve or reject a loan application; rather the underwriter must decide how he or she will incorporate the credit score into the loan review. Finally, credit scoring is not meant to increase approval rates; rather, it promotes consistency and efficiency while maintaining or reducing historic delinquency rates. It also allows the users to focus their attention and time on applications

that are not obvious approvals or obvious declines.

### Six steps to Credit Scoring

- 1. Present the concept:** With constant improvements in technology and growing competition, credit scoring approaches are likely to be relevant to small business lending in the overwhelming majority of the banks throughout the world. This does not mean, however, that all banks will be aware of scoring and its potential benefits and drawbacks. In cases where management has not already put scoring on its agenda, a concise (approximately one hour), informative presentation on the topic of credit scoring will always add at least the value of exposing management to what is an ever more popular approach to consumer and small business lending in western banking markets.
- 2. Understand what kind of system, if any, would work in your bank:** Now that the bank is interested in using a scoring approach, which need to do some serious due diligence work to determine just what that approach should be. A credit scoring system not only has to fit well within a bank's institutional business strategy and technology plans, but also it must be integrated into the bank's policies, procedures and limits. While a scoring system can and probably should recommend certain policy changes, these should refine

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rather than redefine the bank's overall credit policy.

**3. Put together a "steering committee" to discuss strategic and technical issues:**

At this point one should have a decent feel for whether the bank has the ability and capacity to make scoring work and an idea of what type of model, judgmental or statistical to develop. The results of the analysis should now be drafted into a recommendation and action plan that will present to the bank. But before address the invitations to the presentation, make sure about the identified key players-senior managers from each of the functional departments (retail, credit risk management, credit department, IT, legal and if available audit/compliance)-credit scoring will touch.

**4. Design and test the model:**

Once the steering committee has decided to move forward, it will have to hunker down to design and test the model. We won't recommend how to design your model-this will depend upon whether it is judgmental or statistical and on the credit policies of the bank. However, if the bank has significant small loan historical data, for example four the loan application and subsequent payment performance data for 15,000 loans, then one may have an opportunity to look into developing a statistical model.

**5. Present the model and provide introductory training:**

After the pilot test has run for a predetermined period of time or issued a certain number of

loans, it will need to analyze the data gathered to that point-not only the loan and scoring data, but also the feedback of the pilot branches-to determine the initial success of the model and to prepare a recommendation to the steering committee. At this point it is crucial to consider how all marketing and credit issues need to come together to result in a successful launch of the scoring model bank-wide.

**6. Monitor the model and provide follow up training:**

The final step in model implementation is monitoring the portfolio and the model performance and either adjusting or, in the case of statistical models, refreshing the model.

### DEVELOPING CREDIT RISK SCORING AND RATING MODELS

The credit default swap (CDS) is the most widely traded and fastest growing segment in the credit derivatives market and its phenomenal growth can be attributed to trading activity primarily in the US and Europe. Credit default swaps are instruments that offer protection from the default risk of a loan or bond (*Sivakumar and Magdal, 2007*). There are four parameters used in the risk scoring and rating system in Indian banks can broadly be grouped under following four main heads i.e., (1) Operational/Financial Performance of the Unit, (2) Bank Accounts and Securities available, (3) Business/Industry Outlook, and (4) Promoters/Management.

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## CREDIT SCORING IN INDIA: CONCEPTS, PERSPECTIVES AND MODELS

Credit score is relatively a new term in India. The establishment of Credit Information Bureau (India) Limited (CIBIL), India's first Credit Information Bureau, is an effort made by the Government of India and the Reserve Bank of India to improve the functionality and stability of the Indian financial system by containing NPAs. CIBIL is the India's first credit information bureau which came into effect in 2000 and contains the credit history of commercial and consumer borrowers. CIBIL was promoted by State Bank of India (SBI), Housing Development Finance Corporation (HDFC), Dun & Bradstreet Information Services India Private Limited (D&B) and TransUnion International Inc. (TransUnion) to provide comprehensive credit information by collecting, collating and disseminating credit information pertaining to both commercial and consumer borrowers, to a closed user group of Members. Credit Information Bureau India Limited (CIBIL) and TransUnion, a US-based analytics

firm, have created a generic credit score for the Indian borrower. While this score is currently used only by lenders, borrowers may also soon be able to use this to bargain for better rates, once the Credit Information Act is passed.

Mr S. Santhanakrishnan, Chairman, CIBIL, said the score will be available to its 143 members. The members currently include banks, housing finance companies and non-banking finance companies, credit card companies, financial institutions and state finance corporations. A credit score takes a 'snapshot' of a consumer's payment history, outstanding debt and credit account history and turns this into a 3-digit number. The score, which ranges from 300 up to 900, represents the amount of risk a consumer brings to a particular transaction. It will indicate the chances of the borrower becoming a defaulter in more than 91 days within the next year. This score will reflect information from several lenders and across various loans such as home loans, credit cards and personal loans. The shareholder's holding percentages were as follows:

Sl. No.	Particulars	Percentages
1.	SBI	10.0%
2.	HDFC	10.0%
3.	Dun & Bradstreet	10.0%
4.	Trans Union	10.0%
5.	ICICI Bank	10.0%
6.	Bank of Baroda	5.0%
7.	Bank of India	5.0%
8.	HSBC	5.0%
9.	IOB	5.0%
10.	PNB	5.0%
11.	Union Bank	5.0%

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12.	Citicorp Finance	5.0%
13.	Central Bank	5.0%
14.	Stan C K	5.0%
15.	Sundaram Finance	2.5%
16.	GE Strategic Investments India	2.5%
<b>Total</b>		<b>100.0%</b>

A credit score is a numerical expression based on a statistical analysis of a person's credit files, to represent the creditworthiness of that person. A Credit Information Report (CIR) is a factual record of a borrower's credit payment history compiled from information received from different credit grantors (e.g., banks). Its purpose is to help credit grantors make informed lending decisions quickly and objectively. A credit information report contains the following information:

**Basic borrower information like:**

1. Name
2. Address

**In case of individuals:**

1. Identification numbers
2. Passport ID
3. Voters ID
4. Date of birth

**In case of non-individuals:**

1. D-U-N-S Number
2. Registration Number
3. Legal Constitution
4. Records of all the credit facilities availed by the borrower
5. Past payment history
6. Amount overdue
7. Number of inquiries made on that borrower, by different Members
8. Suit-filed status

**Note:** DUNS stands for Data Universal Numbering System.

In order to evaluate loan applicants, banks increasingly use credit scoring models. The main objective of such models typically to minimize default rates or the number of incorrectly classified loans. The model proves to be an effective tool to separate applicants with short survival times from those with long survivals. The bank's loan provision process is shown to be inefficient; loans are granted in a way that conflicts with both default risk minimization and survival time maximization. There is thus no trade-off between higher default risk and higher return in the lending policy.

Credit scoring has emerged as an effective tool, which facilitates lenders in assessing the creditworthiness of customers and determining the future risk of sanctioning credit based on their past record. Banks and financial institutions have been using credit scores in their credit-deciding process. Of late, the scope of credit scoring has expanded widely and is now increasingly used by telecom companies, utility service providers, insurers and Government agencies. Employers are also making use of credit scores in the hiring process. Traditionally, lending institutions have relied heavily on the judgement and opinion of loan officers. Credit scoring involves use of statistical techniques and models to analyze factors such as past payment history, amount outstanding, length of credit history

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and types of credit accounts held by customers. As such, it provides opportunity for more accurate assessment of the creditworthiness of the prospective and existing customers. It facilitates companies in swift disposal of applications and helps in devising effective collection strategies.

## RATING MODELS OF EMINENT PERSONS

### 1. Edward I. Altman's Z-score model

Some financial ratios having significant discriminating power to separate healthy and weak units. The formula may be used to predict the probability that a firm will go into bankruptcy within two years. Z-scores are used to predict corporate defaults and an easy-to-calculate control measure for the financial distress status of companies in academic studies. The Z-score uses multiple corporate income and balance sheet values to measure the financial health of a company. The original Z-score formula was as follows:

$$Z = 1.2T_1 + 1.4T_2 + 3.3T_3 + .6T_4 + .999T_5$$

$T_1$  = Working Capital/Total Assets. It measures liquid assets in relation to the size of the company.

$T_2$  = Retained Earnings/Total Assets. It measures profitability that reflects the company's age and earning power.

$T_3$  = Earnings before Interest and Taxes/Total Assets. It measures operating

efficiency apart from tax and leveraging factors. It recognizes operating earnings as being important to long-term viability.

$T_4$  = Market Value of Equity/Book Value of Total Liabilities. It adds market dimension that can show up security price fluctuation as a possible red flag.

$T_5$  = Sales/Total Assets. Standard measure for sales turnover (varies greatly from industry to industry).

Where Z = Overall Score

$T_1$  = Working Capital/Total Assets

$T_2$  = Retained Earnings/Total Assets

$T_3$  = Earnings Before Interest and Taxes/Total Assets

$T_4$  = Market Value of Equity/Total Liabilities

$T_5$  = Sales/Total Assets

### Z score Bankruptcy Model

$$Z = (1.2T_1 + 1.4T_2 + 3.3T_3 + 0.6T_4 + 99.9T_5)/100$$

### Zones of Discrimination

$Z > 2.99$  -"Safe" Zone

$1.8 < Z < 2.99$  -"Grey" Zone

$Z < 1.80$  -"Distress" Zone

### 2. THE KMV MODEL TO ESTIMATE DEFAULT PROBABILITY

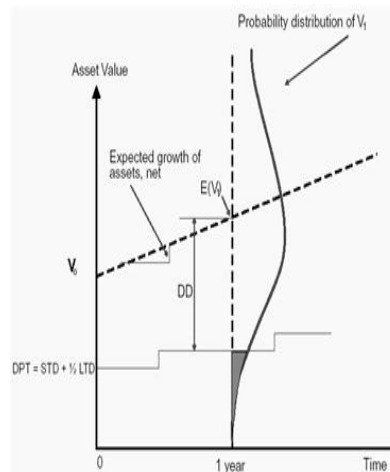
KMV is a trademark of KMV Corporation that was founded in 1989. The KMV model calculates the Expected

Default Frequency (EDF) based on the firm's capital structure, the volatility of the assets returns and the current asset value. This model best applies to publicly traded companies for which the value of equity is market determined.

The translation of the public information into probabilities of default proceeds in 3 stages:

**1st Stage:** Estimation of the asset value and the volatility of asset return. Financial models usually consider market values of assets, and not book values which only represent historical costs of the physical assets, net of their depreciation. The calculation of the market value of the firm's assets and their volatility would be simple if all the liabilities of the firm were traded and market-to-market every day.

**2nd Stage:** Calculation of the distance-to-default. According to KMV, the default occurs when the asset value reaches a level somewhere between the value of total liabilities and the value of short-term debt. This point is named default point (DPT), and it is considered by KMV as the short-term debt plus half the long-term debt. The distance-to-default (DD) is the number of standard deviations between the mean of the distribution of the assets value and the default point (DPT).



Source: **Journal of Banking & Finance (2000)**

$$DD = \frac{E(V_1) - DPT}{S}$$

$E(V_1)$  = expected asset value in 1 year

$DPT$  = (short-term debt) + 1/2 (long-term debt)

$S$  = volatility of asset returns

**3rd Stage:** Derivation of the probabilities of default. The last stage consists as mapping the DD to the Expected Default Frequency (EDF), for a given time horizon. Once we have the EDF for a given obligor, KMV uses a risk neutral valuation model to derive prices as a discounted expected value of future cash flows. The valuation of risky cash flows consists of (1) the valuation of the default-free component and (2) the valuation of the component exposed to credit risk:

$$PV = \frac{FV \cdot (1 - LGD) + FV \cdot LGD (1 - Q)}{(1 + i)}$$

$PV$  = Present Value of the cash flow

$FV$  = Future Value (the obligation)

$LGD$  = Loss Given Default, in percent

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$1 - LGD =$  recovery rate  
 $i =$  the 1-year risk-free rate

$Q =$  probability that the issuer defaults in 1 year, which is derived from EDF

### 3. DR. L.C.GUPTA MODELS TO MEASURE HEALTH OF UNITS

Dr. L.C. Gupta made an attempt to distinguish between sick and non-sick companies on the basis of financial ratios. He used a simple non-parametric test for measuring the relative predicting power of different financial ratios. A mixed sample of sick and non-sick

Observing the pattern of occurrence of 'S' and 'N' a cutoff point is chosen to separate the sick group from the non-sick group. Companies that fall to the left of the cutoff point lie in the sick group while companies that fall to the right of the cutoff point lie in the non-sick group. The cutoff point is so chosen that the number of misclassifications are minimised. The ratio that showed the least percentage classification error at the earliest possible time is deemed to have the highest predicative power. Referring to the four patterns shown above, the pattern of sequence shown in (B) is the most accurate one since the cutoff point will be located exactly midway in the sample group and the percentage of classification error will be zero since there are no misclassifications. Pattern shown in (C) is bound to have a higher error since the sick companies are

companies was made and the companies in the sample were arranged in a single ordered sequence from the smallest to the largest, according to the financial ratio that is tested for its predictive power. The companies in the sample are arranged in increasing order of this particular ratio. Let the sick companies be denoted by the letter 'S' and the non-sick ones by the letter 'N'. Let us assume that 8 sick companies and 8 non-sick companies are taken for building up the sample. When arranged in a sequential order as stated above, the sequence may result in any pattern as shown below:

- (A) S-N-S-N-S-S-N-S-N-N-S-N-S-N-S-N  
 (B) S-S-S-S-S-S-S-N-N-N-N-N-N-N-N  
 (C) S-S-S-S-N-N-N-N-N-N-N-N-S-S-S-S  
 (D) S-S-S-N-S-S-N-N-S-S-N-N-S-N-N-N

concentrated on both the extreme ends.

### 4. FIVE C'S ASSESSMENT OF CREDIT RISK

There are five C's assessments of credit risk. They are:

- 1.Character:** It will examine the character and commitment of the principals/borrowers/company.
- 2.Capacity:** It will review the ability of potential clients, repays debt (as evidenced by historical financials, cash flow projections and the credit history of company, principals, guarantors, co-signers) and managerial capabilities of the financial institution's owners and management team.

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3. **Collateral:** It will help the clients to pledge their business assets or personal properties as collateral to secure or back up the loan request.
4. **Capital:** It will help towards the equity contribution or financial investment.
5. **Creditworthiness:** It will study the past credit history and performance on previous loans

### HOW CIBIL WORKS?

CIBIL (Credit Information Bureau of India) evaluates every customer on the basis of credit score. A credit score takes a snapshot of a consumer's credit report and through advanced analytics turns the information into three-digit number representing the amount of risk a consumer brings to a particular transaction. A credit score is a number between 300 and 900 that sums up a customer's credit record. It is inversely related with the risk of a borrower defaulting on repayment for more than 91 days.

### HOW TO IMPROVE CREDIT SCORE?

Improving credit scores is the single most effective way to ensure that the financial future will be filled with happiness and contentment, instead of stress and insecurity. A credit score is a three-digit number that will be used to evaluate the credit worthiness by lenders. In the US, for example, where credit scores range from 300 to 900, a person who has a score of anything above 750 is likely to get

loans at a rate that is about 1.5 percentage points lower than somebody with a score of about 600. The score is based on a set of criteria that includes, among other things, past loan history, number and amount of loans taken, number and amount of loans defaulted, filings for bankruptcy, credit card payment delays, balance outstanding in various loans and the like.

Indian banks follow a fairly uniform rate of interest for all borrowers currently. Mr S. Santhanakrishnan, Chairman and CEO of Credit Information Bureau of India (CIBIL), which is in the process of getting the score ready, said, "We have the credit history for the last 18 months. We should be able to start providing credit scores within six months. The major benefit that will come from this is that borrowers will be discipline, because their track record is being documented. The rewards for good behaviour will be lower rates. Such borrowers will be able to command a premium in the market." According to Mr. Santhanakrishnan, "Banks will now know *ab initio* the risk that borrowers have. Smaller banks that do not have elaborate risk management and credit appraisal systems will certainly benefit from this." CIBIL has so far amassed 42 million individual records from various banks and finance companies. Mr Santhanakrishnan expects the number of records to touch 75 million within the next couple of months. He said that banks have begun using the system in a "substantial way" for lending decisions. Following are the few steps which can improve the credit score:

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1. One can establish a budget in order to control the cash outflows.
2. One should ensure that the income level permits an additional monthly outflow if one plans to take a loan.
3. One should investigate the options in order to reduce the interest and other credit related costs. i.e., refinance an outstanding loan at fixed interest rates if there is a significant drop in interest rates or discovering a significantly cheaper option.
4. Repayment of some of the debt out of past savings.

#### APPLICATION OF CREDIT SCORING

India's banking industry is at a watershed. Evidence from across the world suggests that a sound and evolved banking system is required for sustained economic development. India has a better banking system in place vis-a-vis other developing countries, but there are several issues that need to be ironed out. Indian banks operate in an increasingly deregulated and competitive environment. Against this backdrop, the Credit Rating Information Services of India Limited (CRISIL) expects a greater differentiation in creditworthiness of banks based on their risk management strategies. At present, systems for measuring and controlling risk vary considerably across the banking system, and are relatively unsophisticated when compared with international best practices. The efforts involved in upgrading skills and revamping operating procedures are expected to

be considerable, and banks which adopt a proactive approach would be better placed to survive and prosper in the future. A strong performance in the current year, strengthening the positive trends of the past, will certainly improve the short-term risk perception but focus must rest on key structural changes that have to occur if Indian banking is to be a positive force and not a drag on the rest of the economy. Indian banks now have been enjoying high profits, with stable credit growth and non-interest income will have to face challenging times ahead. Though banks are showing high profits in their balance sheet, the main figure to impact in coming quarters will be of Non-Performing Assets (NPAs).

#### RESULTS AND DISCUSSIONS

Credit score is a statistical method to assess the credit worthiness of a prospective borrower. It has all the in depth information about the credit experiences. Consider a time horizon starting at the current time 0 and ending at some future time  $t$ . A one year horizon is typical, but financial institutions usually consider credit risk over several horizons. Let  $L$  represent the financial loss, if any, due to default on a particular obligation—a bond, loan, derivative instrument, etc.—over the horizon.  $L$  is a random variable. Its expected value  $E(L)$  is a metric of the credit risk of the obligation. It can be calculated as the product

$E(L) = Pr(\text{default}) \text{ EAD LGD}$ ,  
where

1.  $Pr(\text{default})$  is the probability of default on the

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- obligation during the horizon—what is called the default probability.
- EAD is **exposure at default**—the credit exposure on the obligation at the time of default. In [1], this is treated as a known constant.
  - LGD is **loss given default**—the fraction of EAD that will not be recovered following default. EAD is simply 1 minus the recovery rate. In [1], it too is treated as a known constant.

The essential purpose of a default model is to calculate the default probability. However, sophisticated models may do more than this. For example, models might treat EAD and LGD as random, and substitute their expectations into [1]. Treating both in this manner requires an assumption that they are independent. Such an assumption is difficult to justify, but it may be made to simplify models. A simple default model can be constructed by calibrating credit ratings to historical frequencies of migrations between ratings. Exhibit 1 indicates a **ratings transition matrix** constructed by Standard & Poor's indicating one-year ratings migration probabilities based upon bond rating data.

**One-Year Ratings Transition Matrix**

**Exhibit 1**

Original Rating	Probability of migrating to rating by year end (%)							Default
	A	A	A	B	B	B	C	
	A	A		B	B		C	
	A			B			C	

ti								t
<b>A</b>	9	5	0	0	0	0	0	0.
<b>A</b>	3	.	.	.	.	.	.	0
<b>A</b>	.	8	4	0	0	0	0	0
	6	3	0	8	3	0	0	
	6							
<b>A</b>	0	9	6	0	0	0	0	0.
<b>A</b>	.	1	.	.	.	.	.	0
	6	.	9	4	0	0	0	1
	6	7	4	9	6	9	2	
	2							
<b>A</b>	0	2	9	5	0	0	0	0.
	.	.	1	.	.	.	.	0
	0	2	.	1	4	2	0	4
	7	5	7	9	9	0	1	
			6					
<b>B</b>	0	0	4	8	4	0	0	0.
<b>B</b>	.	.	.	9	.	.	.	2
<b>B</b>	0	2	8	.	4	8	1	2
	3	5	3	2	4	1	6	
			6					
<b>B</b>	0	0	0	6	8	7	1	0.
<b>B</b>	.	.	.	3	.	.	.	9
	0	0	4	6	.	4	0	8
	3	7	4	7	3	7	5	
				1				
<b>B</b>	0	0	0	0	5	8	3	5.
	.	.	.	.	.	4	.	3
	0	1	3	4	7	.	8	0
	0	0	3	6	7	1	7	
						9		
<b>C</b>	0	0	0	0	2	1	6	2
<b>C</b>	.	.	.	.	.	0	3	1.
<b>C</b>	1	0	3	9	0	.	.	9
	6	0	1	3	0	7	9	4
						4	6	
<b>D</b>	0	0	0	0	0	0	0	1
<b>ef</b>	.	.	.	.	.	.	.	0
<b>a</b>	0	0	0	0	0	0	0	0.
<b>ul</b>	0	0	0	0	0	0	0	0
<b>t</b>								0

One-year ratings migration probabilities based upon bond rating data from 1981-2000. Data is adjusted for rating withdrawals. Numbers in each row should sum to

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100%. Due to round-off error, they may not do so exactly. Source: Standard & Poor's.

For example, based upon the matrix, a BBB-rated bond has a 4.44% probability of being downgraded to a BB-rating by the end of one year. The matrix is based upon raw data, so it exhibits statistical anomalies. A CCC-rated bond is given a 0.16% probability of being upgraded to AAA, but a B-rated bond has a 0.00% probability of such an upgrade. If it were used to model defaults, the numbers in the matrix might be smoothed. To use a ratings transition matrix as a default model, we simply take the default probabilities indicated in the last column and ascribe them to bonds of the corresponding credit ratings. For example, with this approach, we would ascribe an A-rated bond a 0.04% probability of default within one year. If we want two-year default probabilities, we simply multiply the matrix by itself once (i.e. employ matrix multiplication as defined in linear algebra) to obtain a two-year ratings transition matrix. The last column of that matrix will provide the desired default probabilities. For three-year default probabilities, we multiply the matrix by itself three times, etc. Exhibit 2 indicates a five-year ratings transition matrix obtained by multiplying the one-year matrix of Exhibit 1 by itself five times.

**Five-Year Ratings Transition Matrix**

**Exhibit 2**

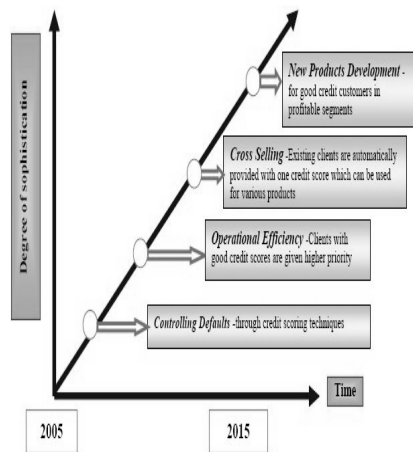
O r i g i n a l	Probability of migrating to rating by year end (%)							
	A	A	A	B	B	B	C	D
	A	A		B	B		C	ef
	A			B			C	a

ra ti n g								ul t
A	7	2	4	0	0	0	0	0.
A	2	1	.	.	.	.	.	0
A	.	.	7	8	2	0	0	2
	3	6	4	6	0	8	1	
	9	9						
A	2	6	2	4	0	0	0	0.
A	.	6	5	.	.	.	.	1
	4	.	.	4	7	5	0	8
	9	4	0	5	5	1	9	
	5	5						
A	0	8	6	1	3	1	0	0.
	.	.	8	8	.	.	.	5
	3	1	.	.	1	3	1	0
	9	9	2	0	9	2	8	
			2	5				
B	0	1	1	6	1	4	0	2.
B	.	.	6	0	3	.	.	0
B	1	7	.	.	.	6	7	8
	6	2	8	6	1	8	9	
			0	1	6			
B	0	0	3	1	4	1	3	8.
B	.	.	.	9	4	9	.	3
	1	5	8	.	.	.	0	4
	3	3	1	5	7	8	9	
				0	7	4		
B	0	0	1	4	1	4	6	2
	.	.	.	.	5	6	.	5.
	0	4	6	1	.	.	5	1
	6	2	2	5	1	9	4	5
					8	7		
C	0	0	1	3	6	1	1	5
C	.	.	.	.	.	8	2	8.
C	3	2	2	0	3	.	.	5
	4	0	1	5	3	1	3	1
						0	6	
D	0	0	0	0	0	0	0	1
ef	.	.	.	.	.	.	.	0
a	0	0	0	0	0	0	0	0.
ul	0	0	0	0	0	0	0	0
t								0

Five-year ratings migration probabilities obtained by multiplying the matrix of Exhibit 1 by itself five times.

**Short-term Challenges and Long-term Implications of Credit Risk Scoring and Rating Models in Indian Banking**

Based on the information, a strategic continuum of risk scoring model is given below:



**Figure-1:** Strategic Continuum of Risk Scoring Model

### SHORT-TERM CHALLENGES:

First of all, the operational challenge. A year ago, the credit derivatives market was a mess. It was an accident waiting to happen. The industry was initiating over one hundred thousand trades per month-but it was taking, on average, over forty business days to confirm a plain vanilla credit derivative transaction and considerably longer to confirm more structured transactions. Settlement breaks at quarterly roll dates were common, and took long periods to resolve. Settlements in the event of default by the issuer of a reference obligation also had in many cases to be negotiated after the event, adding to uncertainty and cost. To compound matters, some counterparties had fallen into the habit of assigning a trade to a new, third counterparty without receiving the prior approval of the other original counterparty to the deal. In the worst case, unconfirmed trades

may have been assigned to third parties-at best a recipe for operational chaos and at worst an open door to fraud, possibly on a massive scale. As is well known, regulators around the world simply told the industry "enough is enough". Regulators could not allow individual firms or the industry as a whole to run a market where counterparties did not know

### LONG-TERM IMPLICATIONS

Risk is inherent in all aspects of a commercial operation and covers areas such as customer services, reputation, technology, security, human resources, market price, funding, legal, and regulatory, fraud and strategy. However, for banks and financial institutions, credit risk is the most important factor to be managed. Credit risk management must play its role then to help banks be in compliance with Basel II Accord and other regulatory bodies. For assessing the risk, banks should plan certain estimates, conduct monitoring, and perform reviews of the performance of the bank. They should also do Loan reviews and portfolio analysis in order to determine risk involved. Banks must be active in managing the risks in various securities and derivatives. Still progress has to be made for analyzing the credits and determining the probability of defaults and risks of losses. So credit risk management becomes a very important tool for the survival of banks.

Future or derivative trading is the process of buying or selling stock future or index future for a certain period of time and squaring off before the expiry date. Expiry

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period can be of one month, two month and three month and not more than of three month. It's not compulsion that you have to square off your positions on the expiry date or wait till the expiry period but in fact you can square off at any time even, at the same day, or you can hold as long as you want but remember to square off before expiry date.

## CONCLUSION

Public Sector Banks (PSB's) have been playing key role in the development of the economy. In the process they have gained confidence of masses. Through branch networking and Priority sector lending activities, PSB's have demonstrated their socio-economic commitment. One of the major factors which have transformed the Indian Banking Sector has been the launching of economic reforms. The hue and cry about-redesigning the economic and financial architecture of the Indian Banking System gained momentum since the early part of 1990's. Many sectors of the economy benefited significantly from the increased integration of the sectors within the country and with the world. The traditional face of banking is also undergoing a change, from one of mere intermediates to one of provider of quick efficient consumer-centric services.

Credit risk management is a very important area for the banking sector and there are wide prospects of growth and other financial institutions also face problems which are financial in nature. Banking professionals have to maintain a balance between the risks

and the returns. Indian banks and financial Institutions have already started paying greater attention to management and mitigation of credit risk. This has become necessary in the context of the increasing competition due to entry of private banks, globalization of the financial sector, stricter supervisory environment and the realization that like banks and institutions elsewhere in the world, Indian Institutions can also fail not being able to carry excessive risk in their credit portfolio (*Mishra, 2002*). It makes a strong case for Indian regulators to examine the mechanisms for introducing a strong and vibrant exchange-traded corporate bond market and resultant credit derivatives market. A credit derivative is a financial instrument used to mitigate or to assume specific forms of credit risk by hedgers and speculators. Credit derivative values with three examples: a commercial bank using credit derivatives to manage loan portfolio risk; an investment bank using them to manage the risks of underwriting securities; and an investor, such as an insurance company, asset manager, or hedge fund, using them to align credit risk exposure with a desired credit risk profile. The growth of the Indian market is spear-headed mainly by retail investors, private sector institutions and large corporations. The generic credit risk of an entity is the probability that the entity may suffer losses that may impair its ability to meet its liabilities, or may enter into bankruptcy or forced restructuring of its obligations.

## Short-term Challenges and Long-term Implications of Credit Risk Scoring and Rating Models in Indian Banking

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