**Guidance Note on Credit Risk Management**

BP.BC. **26** /21.04.103/2001

September 20, 2001

**All Commercial Banks**

Dear Sir,

**Guidance Note on Credit Risk Management**

Please refer to our circular DBOD.BP.SC. 98/21.04.103/99 dated October 7, 1999 covering broad contours for management of credit, liquidity, interest rate, foreign exchange and operational risks. These guidelines, together with the guidelines on Asset-Liability Management were purported to serve as a benchmark to those banks, which have not established integrated risk management systems.

2. As a step towards enhancing and fine-tuning the existing risk management practices in banks, a Working Group on Credit Risk was constituted in Reserve Bank of India drawing experts from select banks and FIs for preparing detailed Guidance Notes on Credit Risk Management by banks. The Working Group has identified further steps which are required to be taken by the banks for improving their existing risk management framework, suiting to Indian conditions. On the basis of the feedback received from the members of the Working Group, a draft Guidance Note on Credit Risk has been prepared and placed on the RBI website (http://www.rbi.org.in).

3. Banks are advised to study the guidance note and forward to us their comments, if any, by October 15, 2001 positively.

Yours faithfully,

(**M.R. Srinivasan**)

Chief General Manager-in-Charge

## Guidance Note on Credit Risk Management

### 1. Credit Risk Management: Policy Framework

**1.1** 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, regulatory, fraud and strategy. However, for banks and financial institutions, credit risk is the most important factor to be managed. Credit risk is defined as **the possibility that a borrower or counterparty will fail to meet its obligations in accordance with agreed terms**. Credit

risk, therefore, arises from the banks' dealings with or lending to a corporate, individual, another bank, financial institution or a country. Credit risk may take various forms, such as:

- ? in the case of direct lending, that funds will not be repaid;
- ? in the case of guarantees or letters of credit, that funds will not be forthcoming from the customer upon crystallization of the liability under the contract;
- ? in the case of treasury products, that the payment or series of payments due from the counterparty under the respective contracts is not forthcoming or ceases;
- ? in the case of securities trading businesses, that settlement will not be effected;
- ? in the case of cross-border exposure, that the availability and free transfer of currency is restricted or ceases.

1.1.2 The more diversified a banking group is, the more intricate systems it would need, to protect itself from a wide variety of risks. These include the routine operational risks applicable to any commercial concern, the business risks to its commercial borrowers, the economic and political risks associated with the countries in which it operates, and the commercial and the reputational risks concomitant with a failure to comply with the increasingly stringent legislation and regulations surrounding financial services business in many territories. Comprehensive risk identification and assessment are therefore very essential to establishing the health of any counterparty.

1.1.3 Credit risk management enables banks to identify, assess, manage proactively, and optimise their credit risk at an individual level or at an entity level or at the level of a country. Given the fast changing, dynamic world scenario experiencing the pressures of globalisation, liberalization, consolidation and disintermediation, it is important that banks have a robust credit risk management policies and procedures which is sensitive and responsive to these changes.

1.1.4 The quality of the credit risk management function will be the key driver of the changes to the level of shareholder return. Industry analysts have demonstrated that the **average shareholder return of the best credit performance US banks during 1989 – 1997 was 56% higher than their peers**. Low loan loss banks stage a quicker share price recovery than their peers, and in a credit downturn, the market rewards the banks with the best credit performance with a moderate price decline relative to their peers.

**1.2 Building Blocks on Credit Risk:**

In any bank, the corporate goals and credit culture are closely linked, and an effective credit risk management framework requires the following distinct building blocks:

### 1.2.1 Strategy and Policy

This covers issues such as the definition of the credit appetite, the development of credit guidelines and the identification and the assessment of the credit risk.

### 1.2.2 Organisation

This would entail the establishment of competencies and clear accountabilities for managing the credit risk.

### 1.2.3 Operations/Systems

MIS requirements of the senior and middle management, and the development of tools and techniques will come under this domain.

## 1.3 Strategy and Policy

1.3.1 It is essential that each bank develops its own credit risk strategy or enunciates a plan that defines the objectives for the credit-granting function. This strategy should spell out clearly the organisation's credit appetite and the acceptable level of risk - reward trade-off at both the macro and the micro levels.

1.3.2 The strategy would therefore, include a statement of the bank's willingness to grant loans based on the type of economic activity, geographical location, currency, market, maturity and anticipated profitability. This would necessarily translate into the identification of target markets and business sectors, preferred levels of diversification and concentration, the cost of capital in granting credit and the cost of bad debts.

1.3.3 The policy document should cover issues such as organizational responsibilities, risk measurement and aggregation techniques, prudential requirements, risk assessment and review, reporting requirements, risk grading, product guidelines, documentation, legal issues and management of problem loans. Loan policies apart from ensuring consistency in credit practices, should also provide a vital link to the other functions of the bank. It has been empirically proved that organisations with sound and well-articulated loan policies have been able to contain the loan losses arising from poor loan structuring and perfunctory risk assessments.

1.3.4 The credit risk strategy should provide continuity in approach, and will need to take into account the cyclical aspects of any economy and the resulting shifts in the composition and quality of the overall credit portfolio. This strategy should be viable in the long run and through various credit cycles.

1.3.5 An organisation's risk appetite depends on the level of capital and the quality of loan book and the magnitude of other risks embedded in the balance sheet. Based on its capital structure, a bank will be able to set its target returns to its shareholders and this will

1.3.6 Keeping in view the foregoing, a bank should have the following in place:

i. dedicated policies and procedures to control exposures to designated higher risk sectors such as capital markets, aviation, shipping, property development, defence equipment, highly leveraged transactions, bullion etc.

ii. sound procedures to ensure that all risks associated with requested credit facilities are promptly and fully evaluated by the relevant lending and credit officers.

iii. systems to assign a risk rating to each customer/borrower to whom credit facilities have been sanctioned.

iv. a mechanism to price facilities depending on the risk grading of the customer, and to attribute accurately the associated risk weightings to the facilities.

v. efficient and effective credit approval process operating within the approval limits authorized by the Boards.

vi. procedures and systems which allow for monitoring financial performance of customers and for controlling outstandings within limits.

vii. systems to manage problem loans to ensure appropriate restructuring schemes. A conservative policy for the provisioning of non-performing advances should be followed.

viii. a process to conduct regular analysis of the portfolio and to ensure on-going control of risk concentrations.

**1.4 Credit Policies and Procedures**

The credit policies and procedures should necessarily have the following elements:

? Banks should have written credit policies that define target markets, risk acceptance criteria, credit approval authority, credit origination and maintenance procedures and guidelines for portfolio management and remedial management.

? Banks should establish proactive credit risk management practices like annual / half yearly industry studies and individual obligor reviews, periodic credit calls that are documented, periodic plant visits, and at least quarterly management reviews of troubled exposures/weak credits.

? Business managers in banks will be accountable for managing risk and in conjunction with credit risk management framework for establishing and maintaining appropriate risk limits and risk management procedures for their businesses.

? Banks should have a system of checks and balances in place around the extension of credit which are:

  ? An independent credit risk management function

- ? Multiple credit approvers
- ? An independent audit and risk review function

? The Credit Approving Authority to extend or approve credit will be granted to individual credit officers based upon a consistent set of standards of experience, judgment and ability.

? The level of authority required to approve credit will increase as amounts and transaction risks increase and as risk ratings worsen.

? Every obligor and facility must be assigned a risk rating.

? Banks should ensure that there are consistent standards for the origination, documentation and maintenance for extensions of credit.

? Banks should have a consistent approach toward early problem recognition, the classification of problem exposures, and remedial action.

? Banks should maintain a diversified portfolio of risk assets in line with the capital desired to support such a portfolio.

? Credit risk limits include, but are not limited to, obligor limits and concentration limits by industry or geography.

- ? In order to ensure transparency of risks taken, it is the responsibility of banks to accurately, completely and in a timely fashion, report the comprehensive set of credit risk data into the independent risk system.

**1.5 Organizational Structure**

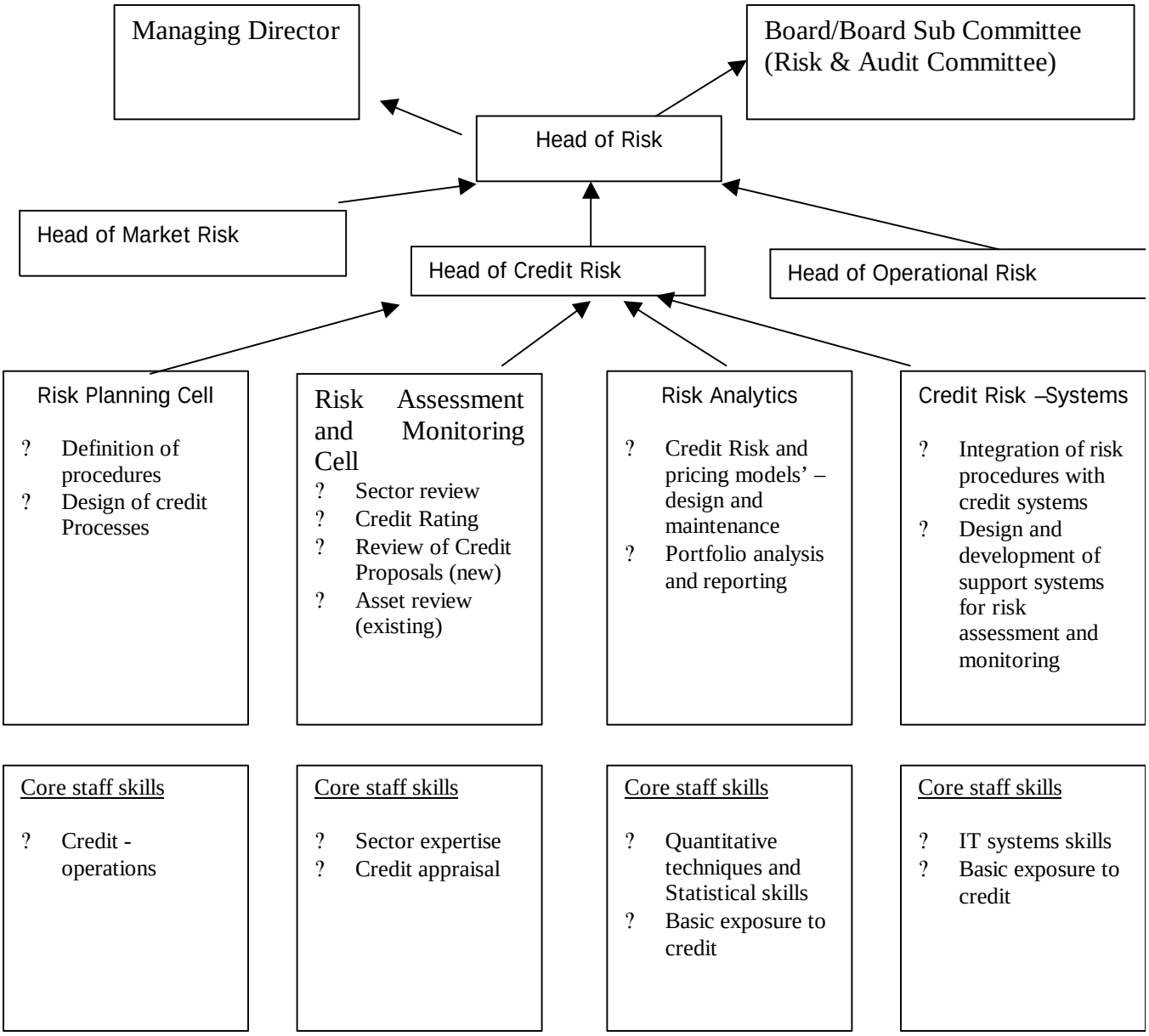
1.5.1 A common feature of most successful banks is to establish an independent group responsible for credit risk management. This will ensure that decisions are made with sufficient emphasis on asset quality and will deploy specialised skills effectively. In some organisations, the credit risk management team is responsible for the management of problem accounts, and for credit operations as well. The responsibilities of this team are the formulation of credit policies, procedures and controls extending to all of its credit risks arising from corporate banking, treasury, credit cards, personal banking, trade finance, securities processing, payment and settlement systems, etc. This team should also have an overview of the loan portfolio trends and concentration risks across the bank and for individual lines of businesses, should provide input to the Asset - Liability Management Committee of the bank, and conduct industry and sectoral studies. Inputs should be provided for the strategic and annual operating plans. In addition, this team should review credit related processes and operating procedures periodically.

1.5.2 It is imperative that the independence of the credit risk management team is preserved, and it is the responsibility of the Board to ensure that this is not allowed to be compromised at any time. Should the Board decide not to accept any recommendation of the credit risk management team and then systems should be in place to have the rationale for such an action to be properly documented. This document should be made available to both the internal and external auditors for their scrutiny and comments.

1.5.3 The credit risk strategy and policies should be effectively communicated throughout the organisation. All lending officers should clearly understand the bank's approach to granting credit and should be held accountable for complying with the policies and procedures.

1.5.4 Keeping in view the foregoing, each bank may, depending on the size of the organization or loan book, constitute a high level Credit Policy Committee also called Credit Risk Management Committee or Credit Control Committee, etc. to deal with issues relating to credit policy and procedures and to analyse, manage and control credit risk on a bank wide basis. The Committee should be headed by the Chairman/CEO/ED, and should comprise heads of Credit Department, Treasury, Credit Risk Management Department (CRMD) and the Chief Economist. The Committee should, inter alia, formulate clear policies on standards for presentation of credit proposals, financial covenants, rating standards and benchmarks, delegation of credit approving powers, prudential limits on large credit exposures, asset concentrations, standards for loan collateral, portfolio management, loan review mechanism, risk concentrations, risk monitoring and evaluation, pricing of loans, provisioning, regulatory/legal compliance, etc. Concurrently, each bank may also set up Credit Risk Management Department (CRMD), independent of the Credit Administration Department. The CRMD should enforce and monitor compliance of the risk parameters and prudential limits set by the CPC. The CRMD should also lay down risk assessment systems, monitor quality of loan portfolio, identify problems and correct deficiencies, develop MIS and undertake loan review/audit. Large banks may consider separate set up for loan review/audit. The CRMD should also be made accountable for protecting the quality of the entire loan portfolio. The Department should undertake portfolio evaluations and conduct comprehensive studies on the environment to test the resilience of the loan portfolio.

## 1.5.5 Typical Organisational Structure




### 1.6 Operations / Systems

1.6.1 Banks should have in place an appropriate credit administration, measurement and monitoring process. The credit process typically involves the following phases:

a) Relationship management phase i.e. business development.

b) Transaction management phase: cover risk assessment, pricing, structuring of the facilities, obtaining internal approvals, documentation, loan administration and routine monitoring and measurement.

c) Portfolio management phase: entail the monitoring of the portfolio at a macro level and the management of problem loans.

1.6.2 Successful credit management requires experience, judgement and a commitment to technical development. Each bank should have a clear, well-documented scheme of delegation of limits. Authorities should be delegated to executives depending on their skill and experience levels. The banks should have systems in place for reporting and evaluating the quality of the credit decisions taken by the various officers.

1.6.3 The credit approval process should aim at efficiency, responsiveness and accurate measurement of the risk. This will be achieved through a comprehensive analysis of the borrower's ability to repay, clear and consistent assessment systems, a process which ensures that renewal requests are analyzed as carefully and stringently as new loans and constant reinforcement of the credit culture by the top management team.

1.6.4 Commitment to new systems and IT will also determine the quality of the analysis being conducted. There is a range of tools available to support the decision making process. These are:

a) Traditional techniques such as financial analysis.

b) Decision support tools such as credit scoring and risk grading.

c) Portfolio techniques such as portfolio correlation analysis.

The key is to identify the tools that are appropriate to the bank.

Banks should develop and utilize internal risk rating systems in managing credit risk. The rating system should be consistent with the nature, size and complexity of the bank's activities.

1.6.5 Banks must have a MIS, which will enable them to manage and measure the credit risk inherent in all on- and off-balance sheet activities. The MIS should provide adequate information on the composition of the credit portfolio, including identification of any concentration of risk. Banks should price their loans according to the risk profile of the borrower and the risks associated with the loans.

## 2. Credit Rating Framework

### 2.1 Background

2.1.1 A Credit-risk Rating Framework (CRF) deploys a number/ alphabet/ symbol as a primary summary indicator of risks associated with a credit exposure. The underlying logic for a CRF is the limitations associated with a binary classification of loans/exposures into a “good” or a “bad” category. Such a rating framework is the basic module for developing a credit risk management system and all advanced models/approaches are based on this structure. Occasionally, a conventional opinion is held that CRFs have lost their relevance and utility and current credit risk management practices have graduated to more scientific/quantitative models. This view is incorrect and without substantial exception, all

users of advanced credit risk management systems have adopted and continue to utilise CRFs. These frameworks have been primarily driven by a need to standardise and uniformly communicate the "judgement" in credit selection procedures. The point here is that these rating frameworks, which are logic-based and utilise responses made on a specified scale, promote the accuracy and consistency of the judgement exercised by the banks/FIs and are not a substitute to the vast lending experience accumulated by their professional staff.

2.1.2 Some of the details collated by the Federal Reserve Board of the United States are useful in indicating the current relevance of CRFs. The survey undertaken by the Federal Reserve (titled "Survey of Terms of Business Lending") has concluded that all the large respondent banks/FIs in the US use an internal risk-rating scale for calibration and communication of the credit-risk associated with each exposure or with each borrower. For large banks/FIs, as indicated in the survey, the proportion of amount of loans rated internally is nearly 100%. This survey has also highlighted that over time, the number of risk categories have increased and the distribution of the credit-exposures over these categories has widened, implying that the users continue to adjust and fine-tune their internal CRFs for facilitating better decision-making.

**2.2 End Use of Risk-Ratings made on the CRF**

The approach to developing and implementing a CRF can be derived backwards from the decision-making that would be supported by these classifications/readings. Broadly, the output from the CRF can be classified into transaction-level analysis and portfolio-level analysis. As evident, the CRF outputs would be relevant for individual credit selection, wherein either a borrower or a particular exposure/facility is rated on the CRF. The other associated decisions would be related to pricing (credit-spread) and specific features of the loan facility. This would largely constitute transaction-level analysis. In addition to this, the risk calibration would be relevant for surveillance and monitoring, internal MIS and assessing the aggregate risk profile of bank/lender. These would be relevant for portfolio-level analysis. For instance, the spread of credit exposures across various CRF categories, the mean and the standard deviation of losses occurring in each CRF category and the overall migration of exposures would highlight the aggregated credit-risk for the entire portfolio of the bank/FI.

**2.3 Basic Architecture of CRFs**

The following elements outline the basic architecture and the operating principles of any CRF. These are discussed in some detail in this section.

1 Grading system for calibration of credit risk

- ✍ Nature of grading system
- ✍ Number of grades used
- ✍ Further refinements in the grading system

2. Operating design of CRF

- ✍ Which exposures are rated?
- ✍ Rating process, credit approval and surveillance procedures
- ✍ Functional responsibilities for the CRF
- ✍ Operating the CRF system
- ✍ Formality of procedures and communications
- ✍ CRF and the credit culture

3. Aggregated credit risk profile and CRFs

- ✍ Portfolio surveillance and reporting
- ✍ Provisioning and reserve creation
- ✍ Profitability and risk mapping of credit products
- ✍ Guidelines for pricing and asset buildup
- ✍ Dynamic asset portfolio management

**2.4 Grading System for Calibration of Credit Risk**

The internal credit-risk grading system should be developed with the singular objective of comprehensive understanding, representation and communication of the default risks associated with an exposure. This communication should be readily comparable, amenable for aggregation/disaggregation and should reflect the regulatory stipulations on asset classification (e.g. the RBI asset classification). In addition, the grading system for the CRFs should be versatile (upgradable) and should have the ability to absorb changes in the lending environment. It is anticipated that over a period of time, risk categorisation is further refined and the spread/distribution of exposures over risk categories widens. The grading system should therefore be amenable to adjustments and should accommodate the refinements in exposure classification.

**2.5 Number of Grades Used in the CRF**

The number of grades used in the CRF depends on the anticipated spread in credit-quality of the exposures taken by the bank. This, in turn, is dependent on the present and the future business profile of the bank and the anticipated level of specialisation/diversification in the credit portfolio. CRFs with a large number of scales/grades on the rating scale are, as

evident, more expensive to operate as the costs of additional information for (very) fine gradation of credit-quality increase sharply. A bank can initiate the risk-grading activity on a relative smaller/narrower scale and introduce new categories as the risk-gradation improves and the spread of exposures widens.

**2.6 Nature of Grading System for the CRF**

2.6.1 The grading system adopted for a CRF could be an alphabetic, numeric or an alpha-numeric scale. Since rating agencies follow a particular scale (AAA, AA+, BBB etc.), it is prudent to avoid a similar gradation system. This could create confusion in internal communications. In addition, since the rating scale is widely used and published, it is best to follow an alternative grading structure since this would permit some comparable benchmarking between the two mechanisms. Several banks utilise a numeric scale to reflect the risk-ratings of their existing and proposed credit exposures. The number of grades for the "acceptable" and the "unacceptable" credit risk categories would depend on the incremental effort and the related benefits of finer risk gradation. Normally, numeric scales developed for CRFs are such that the lower the credit-risk, the lower is the calibration on the scale.

2.6.2 As an illustrations, the CRF scale could consists of 9 categories, of which categories 1 to 5 represent various grades of acceptable credit risk and categories 6 to 9 represent unacceptable levels of credit risk associated with an exposure under consideration/existing exposure. The scale, starting from category "1" (which would represent lowest level credit risk) and ending at "9" (which would represent the highest level of credit risk), could be deployed to calibrate, benchmark, compare and monitor credit risk associated with the bank's exposures and give indicative guidelines for credit risk management activities. The key parameter that would summarise all the credit risks would be the certainty in the business and the financial environment of the borrower and correspondingly the extent to which cash flows would meet the financial obligations. There is a possibility that this scale would increase the rigor and debate involved in the appraisal process for marginal cases (which are expected to be more volatile to changes in the underlying arrangements/assumptions in comparison to credit proposals which have a lower calibration on the grading scale).

**2.7 Key Outputs of the CRF**

2.7.1 The calibration on the risk-grading scale is expected to define the pricing and related terms and conditions for the accepted credit exposures. It is possible to define broad pricing bands and directly link the band with the calibration on the risk-rating scale. Further refinement in the pricing proposal would be based on the bank's judgement of the prominent

2.7.2 In addition to the pricing related decisions, the calibration on the proposed CRF would allow for a superior assessment on the quantum of exposure for any credit proposal. The quantum (or amount of facility sanctioned) would depend on the credit-score on the CRF. For relatively inferior credit quality proposals, bank could link their assistance to a percentage of the total debt required by the obligor/borrower. This would help in a larger dispersion of risk amongst lenders and limit risk concentration in moderate credit-quality projects. A similar benchmarking could be made for decisions related to the tenure of the proposed assistance.

2.7.3 For all adverse movements in the credit-quality over the life cycle of the exposure, the bank would have to initiate specific surveillance arrangements and remedial measures to keep a close track of deteriorating credit quality. For instance, the frequency of surveillance on category 5 exposures could be kept at quarterly intervals, while those on category 3 loans could be half-yearly. More importantly, movement of an existing exposure to the "unacceptable" category of credit risk (grades 6 to 9) should directly identify the extent of provisioning (loan loss reserves) that need to be earmarked for expected losses. Though such loss-provisions are often specified by the regulator (e.g. the RBI provisioning norms), it is often argued (and widely practiced) that banks should develop their own internal norms and certain level of "reasonable over-provisioning" should be maintained as a best practice. Specifically, while the credit exposure/asset is clearly facing rapid/steady erosion and is on the downhill transition path (from "poor" to "sub-standard" categories), anticipatory provisioning can be done based on the calibrations on the risk-rating scale.

### 2.8 Operating Design of the CRF

The above discussions conclude some points of view on the grading system for calibration of credit risk. As mentioned elsewhere in the Note, the judgement exercised by the operations/ risk / credit staff of the bank/FIs is central to the operations of the CRF.

### 2.9 Which Exposures are Rated

The first element of the operating design is to determine which exposures are rated through the CRF. There may be a case for size-based classification of exposures and linking the risk-rating process to these size-based categories. The shortcoming of this arrangement is that though significant credit migration/deterioration/erosion occurs in the smaller sized exposures, these are not captured by the CRF. In addition, the size-criteria are also linked with the tenure-criteria for an exposure. In several instances, large-sized exposures over a short tenure may not require the extent of surveillance and credit monitoring that is required

for a smaller sized long-tenure exposure. Given this apparent lack of clarity, it is perhaps prudent to follow a policy of **'all exposures are to be rated'**.

### 2.10 The Risk-Rating Process

The credit approval process within the bank is expected to replicate the flow of analysis/appraisal of credit-risk calibration on the CRF. The risk rating assigned to each credit proposal directly leads into the related decisions of acceptance (or rejection), amount, tenure and pricing of the (accepted) proposal. The CRF is designed in such a way that the risk-rating has certain (default) linkages with the amount, tenure and pricing of exposure. These default linkages are either specified upfront or are developed with empirical details over a period of time. For each proposal, the credit/risk staff would assign a rating and forward the recommendation to the higher level of credit selection process. The proposed risk-rating is either reaffirmed or re-calibrated at the time of final credit approval and sanction. Any revisions in the risk-ratings are utilised to upgrade the CRF system and the operating guidelines. In this manner, the CRF maintains its "incremental upgradation" feature and changes in the lending environment are captured by the system. The risk-rating process would be equally relevant in the credit-monitoring/surveillance stage. All changes in the underlying credit-quality are calibrated on the risk-scale and corresponding remedial actions are initiated. The risk-rating and the responsibilities for surveillance are finalised as part of the "sign-off" procedures and the required documentation is completed.

### 2.11 Assigning & Monitoring Risk-Ratings

In conventional banks, the practice of segregating the "relationship management" and the "credit appraisal" functions is quite prevalent. One of the variants of this arrangement is that credit limits are specified and corresponding responsibilities for calibration on the risk-rating scale are divided between the "relationship" and the "credit" groups. All large sized exposures (above a limit) are appraised independently by the "credit" group. Generally, the activities of assigning and approving risk-ratings need to be segregated. Though the front-office or conventional relationship staff can assign the risk-ratings, the responsibilities of final approval and monitoring should be vested with a separate credit function.

### 2.12 The Mechanism of Arriving at Risk-Ratings

2.12.1 The risk ratings, as specified above, are collective readings on the pre-specified scale and reflect the underlying credit-risk for a prospective exposure. The CRF could be separate for relatively peculiar businesses like banking, finance companies, real-estate developers,

peculiarity of a particular industry can be captured by assigning different weightages to aspects like entry barriers, access to technology, ability of new entrants to access raw materials, etc. The following step-wise activities outline the indicative process for arriving at risk-ratings.

| | |
|---|---|
| Step I | Identify all the principal business and financial risk elements |
| Step II | Allocate weightages to principal risk components |
| Step III | Compare with weightages given in similar sectors and check for consistency |
| Step IV | Establish the key parameters (sub-components of the principal risk elements) |
| Step V | Assign weightages to each of the key parameters |
| Step VI | Rank the key parameters on the specified scale |
| Step VII | Arrive at the credit-risk rating on the CRF |
| Step VIII | Compare with previous risk-ratings of similar exposures and check for consistency |
| Step IX | Conclude the credit-risk calibration on the CRF |

2.12.2 The risk-rating process would represent collective decision making principles and as indicated above, would involve some in-built arrangements for ensuring the consistency of the output. The rankings would be largely comparative. As a bank's perception of the exposure improves/changes during the course of the appraisal, it may be necessary to adjust the weightages and the rankings given to specific risk-parameters in the CRF. Such changes would be deliberated and the arguments for substantiating these adjustments would be clearly communicated in the appraisal documents.

**2.13 Standardisation and Benchmarks for Risk-Ratings**

2.13.1 In a lending environment dominated by industrial and corporate credits, the assignors of risk-ratings utilise benchmarks or pre-specified standards for assessing the risk profile of a potential borrower. These standards usually consist of financial ratios and credit-migration statistics, which capture the financial risks posed by the potential borrower (e.g. operating and financial leverage, profitability, liquidity and debt-servicing ability). The business risks associated with an exposure (e.g. cyclicality of industry, threats of product or technology substitution etc.) are also addressed in the CRF. The output of the credit-appraisal process, specifically the financial ratios, is directly compared with the specified benchmarks for a particular risk category. In these cases, the risk-rating is fairly standardised and CRF allocates a grade or a numeric value for the overall risk profile of the proposed exposure. For instance, assume a scale from "1" to "6", with "1" representing extremely low financial risk.

| | | |
|---|---|---|
| If Gross Revenues are between Rs.800 to Rs.1000 crores | assign a score of | 2 |
| If Operating Margin is 20% or more | assign a score of | 2 |
| If ROCE is 25% or more | assign a score of | 1 |
| If Debt : Equity is between 0.60 and 0.80 | assign a score of | 2 |
| If interest cover is 3.50 or more | assign a score of | 1 |
| If DSCR is 1.80 or more | assign a score of | 1 |

2.13.2 The next step would be to assign weightages to these risk-parameters. In an industrial credit environment, the CRF may place higher weightages on size (as captured in gross revenues), profitability of operations (operating margins), financial leverage (debt: equity) and debt-servicing ability (interest cover). Assume that the CRF assigns a 20% weightage to each of these four parameters and the ROCE and DSCR are given a 10% weightage each. The weighted-average score for the financial risk of the proposed exposure is 1.40, which would correspond with the extremely low risk/highest safety level-category of the CRF (category 1). Similarly, the business and the management risk of the proposed exposure are assessed and an overall/comprehensive risk rating is assigned.

2.13.3 The industrial credit environment permits a significantly higher level of benchmarking and standardisation, specifically in reference to calibration of financial risks associated with credit exposures. For all prominent industry-categories, any lender can compile profitability, leverage and debt-servicing details and utilise these to develop internal benchmarks for the CRF. As evident, developing such benchmarks and risk-standards for a portfolio of project finance exposures, as in the case of the bank, would be an altogether diverse exercise.

**2.14 Written Communications & Formality of Procedure**

The two critical aspects of the formality of procedure in the risk-rating process are (i) the process-flow through which a credit-transaction would flow across various units and (ii) the written communication on the risk-ratings assigned to a particular proposal. The process-flow required for the credit appraisal exercise, which is possibly a sub-component of the internal MIS for the bank, would be explicitly drafted and communicated and would clearly identify the transactions and linkages between various operating units of the bank.

The above discussion broadly presents some (possibly critical) dimensions of the operating design of the proposed CRF for banks. As evident, these details are merely indicative and could be useful in demarcating the scope of work required for the CRF.

**2.15 CRF and Portfolio Credit Risk**

The outputs of the CRF would highlight the spread (or frequency-distribution) of the credit-risk in the asset-portfolio of the bank and would give indicative guidelines for future asset build-up efforts. This section briefly covers some aspects of portfolio credit-risk management, a process which would possibly be facilitated by implementing the CRF.

### 2.16 Portfolio Surveillance and Reporting

The conventional internal MIS of a bank would identify the problem-loans in the asset portfolio, as per the guidelines given by the regulatory body (i.e. the asset-classification guidelines of RBI). These details, however, represent only a component of the credit-risks accumulated in the asset portfolio of a bank. The CRF can be used for informing the top management on the frequency distribution of assets across risk-rating categories, the extent of migration in the past (e.g. movement of exposures from higher to lower risk-categories or vice-versa) and the anticipated developments in the aggregated credit portfolio. The senior management may benefit from such outputs in terms of steering the organisation through various risk-cycles (e.g. initial low-risk low-return phase to consolidation and further to an incremental rise in relatively high-risk high-return exposures).

### 2.17 Adequate Levels of Provisioning for Credit Events

2.17.1 The spread of the portfolio credit-risk and the trends in credit migration would allow the management of the bank to determine the level of provisioning required to absorb unanticipated erosions in the credit quality of exposures. In most cases, provisions for loan-losses are based on the prevailing regulatory and accounting directives. However, the management may find merit in certain prudent level of “over-provisioning”. This decision may be facilitated by factors like the volume and the spread of credit-exposures in the “average” and “below average but acceptable” risk-rating categories of the CRF. This exercise may add stability and resilience to the capital adequacy and profitability of the bank.

2.17.2 The extent of provisioning required could be estimated from the Expected Loss on Default (which is a product of the Probability of Default and Loss Given. Since these probabilities can be assigned only after significant empirical details are available, the bank could (possibly) adopt a policy of allocating/provisioning an amount which is a proportion of the aggregated exposures in the moderate or “barely-acceptable” levels of credit-risk, as defined by the CRF.

### 2.18 Guidelines for Asset Buildup, Aggregate Profitability and Pricing

2.18.1 As discussed above, a clear analysis of the prevailing risk-posture of the bank, which

buildup and business development activities. The assessment of profitability, across various risk-categories and credit products, would outline the overall risk-adjusted return. The extent of provisioning (allocation of economic capital) would be based on actual and anticipated erosion in credit quality and would define the "cost" of maintaining an exposure in the bank's credit portfolio. A similar analysis could be undertaken for a specific credit-product and the "fully-costed" risk-adjusted return can be assessed. This, as expected, would define the contours of the pricing-decisions and the incremental impact (of a set of exposure/credit-products) on bank's profitability can be assessed with greater clarity and consistency.

2.18.2 Thus a CRF is expected to benefit the bank by enhancing the consistency and the transparency of the credit-selection process. The underlying motivation for acceptance of a CRF, as witnessed in the lending environment, is the standardisation and the explicit communication of the "judgement" involved in credit selection. The CRF, in no manner, is a substitute to the vast lending experience accumulated in a bank/FI. The benefits of such a CRF system, in addition to those described above, could include a more amenable interaction with rating agencies and regulatory bodies.

**2.19 Sample Credit Rating Framework**

2.19.1 Ratings should be based on the following considerations:

a) default likelihood of the debtor
b) nature and provisions of the obligation
c) dilution in the rights of the bank in the event of financial distress, under the laws affecting creditor's rights

2.19.2 Credit risk for counterparty arises from an aggregation of the following:

a) External risk
    - sector risk (including government policies)
b) Internal risk with respect to counterparty
    - business risk
    - financial risk
    - management risk
    - project risk

2.19.3 Any risk rating model would need to evaluate each of the above risks individually and aggregate the same to arrive at an overall rating measure.

*i) Evaluation of industry/sector risk*

The evaluation of industry/sector risk could look at parameters such as :

a) Industry attractiveness determined by intensity of competition, barriers to entry,

b) Industry returns

c) Cyclicality in earnings

Suitable measures to evaluate each of the above may be determined, which could then be aggregated so as to determine overall industry/sector risk.

*ii) Evaluation of business risk*

The business position of a company is a function of its relative positioning within the industry/sector. The business position of a company would be determined by its market position and operating efficiencies.

Suitable parameters, relevant to the industry/sector in which the company is operating may be selected for evaluation of the same. The parameters may be suitably scored based on the relative strength of the company being rated vis-à-vis competitors in the industry. The scores may be aggregated to arrive at an overall business score.

*iii) Evaluation of financial risk*

Evaluation of financial risks could typically entail :

a) Analysis of past financials

- operating margins, ROCE, interest cover, leverage, liquidity ratios, contingent liabilities, etc.

Analysis of past financials should include qualitative aspects like accounting quality, disclosure norms, changes in accounting policies, etc.

b) Analysis of future cash flows including projected profitability

c) Flexibility to raise required resources

d) Strength of sponsor group

e) Adequacy of debt service coverage

f) Projected leverage

The parameters may be suitably scored and aggregated to arrive at the financial risk score.

*iv) Evaluation of management risk*

Evaluation of management risk would involve :

Assessment of management capability in terms of

a) track record of the management

b) quality of the management personnel

c) payment record with banks

d) financial conservatism

e) market standing/credibility

f) support from group companies

The overall score on management would be arrived at by aggregation of the individual scores on these parameters selected.

*v) Evaluation of project risk*

Projects of significant size impact the risk profile of a company (even if existing operations are satisfactory).

Analysis of project risks would involve

a) determination of size of project in relation to existing net worth
b) likelihood and extent of overruns
c) assessment of implementation risks
d) technology/stabilization risks
e) risks related to statutory clearances
f) assessment of funding risks
g) assessment of post-implementation risks such as market, company's business position etc.

**2.20 Estimation of overall risk**

The overall risk rating could be arrived at by aggregation of individual scores of the different risk categories and mapping of the same to a suitable rating symbol.

## 3. APPROACH TO CREDIT RISK MODELS

3.1 A credit risk model seeks to determine, directly or indirectly, the answer to the following question: Given our past experience and our assumptions about the future, what is the value of a given loan or fixed income security? Equivalently, what is the (quantifiable) risk that the promised cash flows will not be forthcoming? The techniques in measuring credit risk that have evolved over the last twenty years are prompted by these questions and dynamic changes in the loan market.

3.1.1 The importance of credit risk modelling should be seen as the consequence of three factors. First, banks are becoming increasingly quantitative in their treatment of credit risk. Second, new markets are emerging in credit derivatives and the marketability of existing loans is increasing through securitizations and the loan sales market. Third, regulators are concerned to improve the current system of bank capital requirements especially as it relates to credit risk.

3.1.2 The credit risk models are intended to aid banks in quantifying, aggregating and managing risk across geographical and product lines. The outputs of these models also play increasingly important roles in banks' risk management and performance measurement processes, including performance-based compensation, customer profitability analysis, risk-based pricing and active portfolio management and capital structure decisions. Credit risk modelling may result in better internal risk management, and may have the potential to be used in the supervisory oversight of banking organisations.

3.1.3 Since banks' credit exposures typically cut across geographical locations and product lines, the use of credit risk models offers banks a framework for examining this risk in a timely manner, centralising data on global exposures and analysing marginal and absolute contributions to risk. These properties of models may contribute to an improvement in a bank's overall ability to identify, measure and manage risk.

3.2 In the measurement of credit risk, models may be classified along three different dimensions: the techniques employed, the domain of applications in the credit process and the products to which they are applied.

3.2.1 **Techniques**: The following are the more commonly used techniques:

(a) **Econometric Techniques** such as linear and multiple discriminant analysis, multiple regression, logic analysis and probability of default, or the default premium, as a

(b) **Neural networks** are computer-based systems that use the same data employed in the econometric techniques but arrive at the decision model using alternative implementations of a trial and error method.

(c) **Optimisation models** are mathematical programming techniques that discover the optimum weights for borrower and loan attributes that minimize lender error and maximise profits.

(d) **Rule-based or expert systems** are characterised by a set of decision rules, a knowledge base consisting of data such as industry financial ratios, and a structured inquiry process to be used by the analyst in obtaining the data on a particular borrower.

(e) **Hybrid Systems** using direct computation, estimation, and simulation are driven in part by a direct causal relationship, the parameters of which are determined through estimation techniques. An example of this is the KMV model, which uses an option theoretic formulation to explain default and then derives the form of the relationship through estimation.

3.2.2 **Domain of application:** These models are used in a variety of domains:

(a) Credit approval: Models are used by themselves or in conjunction with a judgemental override system for approving credit in the consumer lending business. The use of such models has expanded to include small business lending and first mortgage loan approvals. They are generally not used in approving large corporate loans, but they may be one of the inputs to a decision.

(b) Credit rating determination: Quantitative models are used in deriving 'shadow bond rating' for unrated securities and commercial loans. These ratings in turn influence portfolio limits and other lending limits used by the institution. In some instances, the credit rating predicted by the model is used within an institution to challenge the rating as- signed by the traditional credit analysis process.

(c) Credit risk models may be used to suggest the risk premiums that should be charged in view of the probability of loss and the size of the loss given default. Using a mark-to-market model, an institution may evaluate the costs and benefits of holding a financial asset. Unexpected losses implied by a credit model may be used to set the capital charge in pricing.

(d) Financial early warning: Credit models are used to flag potential problems in the portfolio to facilitate early corrective action.

(e) Common credit language: Credit models may be used to select assets from a pool to

to obtain the desired credit rating. Underwriters may use such models for due diligence on the portfolio (such as a collateralized pool of commercial loans).

(f) Collection strategies: Credit models may be used in deciding on the best collection or workout strategy to pursue. If, for example, a credit model indicates that a borrower is experiencing short-term liquidity problems rather than a decline in credit fundamentals, then an appropriate workout may be devised.

3.2.3 **Relevance to the decision maker**: Credit Risk Models have assumed importance because they provide the decision maker with insight or knowledge that would not otherwise be readily available or that could be marshalled at prohibitive cost. In a marketplace where margins are fast disappearing and the pressure to low cost is unrelenting, models give their users a competitive edge.

### 3.3 Credit Risk Models

3.3.1 The literature on quantitative risk modelling has two different approaches to credit risk measurement. The first approach is the development of statistical models through analysis of historical data. This approach was frequently used in the last two decades. The other type of risk modelling comprises structural models where the distribution of assets was modelled by a stochastic process.

3.3.2 The statistical approach tries to rate the firms on a discrete or continuous scale. It basically constructs a mapping from the domain of all potential information on financial variables to a range of values, which can be easily compared and used for the purpose of decision-making. The linear model introduced by Altman (1967), also known as the Z-score Model, is an example of a reduced linear discriminating model. The Altman model separates defaulting firms from non-defaulting ones on the basis of the discriminatory power of a linear combination of financial ratios. Altman, Hartzell, and Peck (1995,1996) have modified the original Z-score model to develop a model specific to emerging markets. This model is known as the Emerging Market Scoring (EMS) model.

3.3.3 The second type of modelling approach tries to capture asset-value distribution of the firm over time. These structured models are developed on the contingent-claim framework of corporate capital structure. The leading example of stock market-based credit risk model is the expected default frequency (EDF) model developed by the KMV Corporation. It calculates the asset value of a firm from the market value of its equity using an option

firm. Mimicking the asset distribution of the firm by a stochastic process, it tries to estimate the asset value path of the firm over a time horizon. Finally, default probability, the chance of the estimated asset value falling below a pre-specified default point, is calculated. This model is based conceptually on Merton's (1974) contingent claim framework and has been working very well for estimating default risk in a liquid market.

3.3.4 Closely related to credit risk models are portfolio risk models. In the last three years, important advances have been made in modelling credit risk in lending portfolios. The new models are designed to quantify credit risk on a portfolio basis, and thus have applications in appropriate diversification as well as portfolio based pricing. Two of these models, the RiskMetrics Group's CreditMetrics Model and Credit Suisse Financial Product's CreditRisk+ Model, have been released freely to the public in 1997 and have quickly become influential benchmarks. Though there are differences in the approaches, both models estimate the loss distribution associated with the portfolio and identify the risky components by inspecting the risk contribution of each member in the portfolio.

3.4 A brief overview of the four credit risk models that have achieved global acceptance as benchmarks for measuring stand-alone as well as portfolio credit risk are given in annexure-I.

3.5 From the foregoing discussion, it may be observed that the methodology in building the models will involve the **conceptual methodology**, **parameter specification** and estimation and **validation**.

3.5.1 **Conceptual methodology**

A wide range of practices is observed in the conceptual approaches to credit risk modelling. They are:

• Different approaches to the **measurement of credit loss**: Most banks employ either of two conceptual definitions of credit loss: the default-mode paradigm, in which a credit loss arises only if a borrower defaults within the planning horizon, and the mark-to-market paradigm, in which credit deterioration short of default is also incorporated. Banks may also choose to adopt different time horizons for monitoring credit risk.

• Different methodologies for the **measurement of exposure and loss given default**: In measuring exposure to a line of credit, some banks employ a largely judgemental approach for estimating recovery values of loans in the event of default, while others rely on more empirically based techniques.

• **Unconditional and conditional models**: Unconditional models typically reflect borrower or facility-specific information, while conditional models also incorporate information on the state of the economy.

• Different approaches to the **aggregation of credit risk**: Credit risk may be measured at the individual asset level, as is typically the case with large corporate and capital market instruments; conversely, aggregate (pooled) data may be used to quantify the risk of smaller loans with similar risk profiles.

• Different techniques for measuring the **interdependence of factors** that contribute to credit losses. For example, banks may utilise various methods for measuring the correlation between defaults and rating migrations.

A bank qualifying for the approach would formally measure its credit risk by developing estimates of probability density functions for losses stemming from credit risk (either independently or in joint fashion). The estimates of loss distributions would be made for all business (or product) lines within the bank. In order not to stifle the evolution of best practices within the risk-modelling arena, a diversity of risk modelling practice would be permitted. In the next stage, the calculation of adequate capital could be made for each business line and then the business line calculations added up to reach an institution-wide capital allocation.

### 3.5.2 **Parameter specification and estimation**

The basic problems in developing models of credit risk are (a) obtaining adequate data and (b) devising a satisfactory way of handling the covariability of credit exposures. On data, banks face the difficulty that they have only recently begun to collect relevant information in a systematic manner. Many do not even know simple facts about defaults in their loan books going back in time. Although serious, **this difficulty is transitional** and will be mitigated as time goes by and perhaps also as banks make arrangements to share data. The more serious data problem is that bank loans and even many corporate bonds are either partly or totally illiquid and mark-to-market values are therefore not available. This means that one must rely on some other measure of value in order to establish and track the riskiness of credit-sensitive exposures. The next major problem faced by credit risk analysis is that of modelling the covariation in credit risk across different exposures.

Due to the current limitations on internal default data, model parameters may require, to some degree, the pooling of information from several sources. The reliability of such data, and its comparability with banks' own portfolio characteristics or default experience, is a

### 3.5.3 **Validation**

If internal models were to be used in setting regulatory capital requirements, regulators would need some means of ensuring that a bank's internal model represents accurately the level of risk inherent in the portfolio and the required regulatory capital. At present, there is no commonly accepted framework for periodically verifying the accuracy of credit risk models and in future methods such as sensitivity testing are likely to play an important role in this process. It is important to note that the internal environment in which a model operates – including the amount of management oversight, the quality of internal controls, the rigour of stress testing, the reporting process and other traditional features of the credit culture – will also continue to play a key part in the evaluation of a bank's risk management framework. Estimation of some model parameters, such as the assignment of an internal loan grading or assignment of an obligor to one or more industry sectors, may also require some judgement.

## 4. Portfolio Management and Risk Limits

4.1 The need for credit portfolio management emanates from the potential adverse impact of concentration of exposures and necessity to optimise the benefits associated with diversification. The conventional approach to credit portfolio management has been largely based on the counterparty exposure limits. The definition of counterparty, specifically in the Indian banking system, has focussed on a single company (obligor) and a Promoter Group. The intention has been to specify limits, based on the capital base of the bank, which would be guidelines for incremental asset/exposure build-up. This "forward" or incremental approach to credit portfolio management is, to an extent, a reactive strategy and though it does guide the decision-making process, it possibly has limited contribution for managing the existing credit portfolio of the bank.

4.2 The recent developments in the measurement and management of portfolio credit risk have been based on two key attributes: correlation and volatility. Though the credit portfolio may be well-diversified and fulfils the prescribed criteria for counterparty exposure limits, the instance of correlation can still be very high and may impact the portfolio quality (default levels) under stress conditions. A part of this is on account of the limited definition of "counterparty". Consider two companies, one operates large capacities in the steel sector and the other a large player in the cement sector, promoted by two entirely unrelated promoters. Though these would classify as two separate counterparties, both of them may be highly sensitive to the Government's expenditure in new projects/investments. Thus, reduction in Government investments would impact these two companies simultaneously (correlation), impacting the credit-quality of such a portfolio (volatility), even though from a regulatory or conventional perspective, the risk had been diversified (2 separate promoters, 2 separate industries).

4.3 In addition to the widespread instances of high correlation and resultant volatility, the emergence of new techniques for managing a bank's credit portfolio have actively contributed to the development and adoption of broader credit risk management practices. Specifically, the adoption and wider acceptance of securitisation of loan assets in the developed markets has permitted banks to pursue credit portfolio management on a proactive note. These have usually been in the nature of collateralised loan obligations. Though securitisation of loan receivables, mainly consumer and auto loans, has been prevalent in India, it has usually been deployed as an asset acquisition or a hive-off approach rather than active credit portfolio management. The steps taken to enhance the liquidity and

depth of debt markets in India and simplify the process of securitisation are expected to improve the prospects of credit portfolio management in the near future.

4.4 The measurement of credit-portfolio concentration has been elaborated in detail in the regulatory prescriptions for counter-party exposures in India. The issue of credit portfolio correlation is discussed here in some detail. In statistical terms, credit portfolio correlation would mean the number of times companies/counter-parties in a portfolio defaulted simultaneously. As evident, this analysis is impossible in practice and the number of such instances for developing a reasonable generalisation would be too few. Some credit portfolio management techniques developed overseas estimate the correlation between defaults and bond-market spreads and generalise this for assessing the correlation in a given portfolio. Given the limited data on corporate bond market spreads and their statistical linkages with ratings in India, this approach may not be appropriate for Indian banks at this stage. In addition to the limited replacability of portfolio credit risk management techniques practiced in the developed markets, recommendations for the Indian banking system must be based on their existing systems and procedures and availability of relevant data.

4.5 One possible technique for analysing credit-portfolio correlation is based on a macro-economic factor model. This approach involves projecting the performance (volatility) of a credit portfolio under altering macro-economic environments. In specific terms, this would involve a stress-test on the debt-servicing ability of a portfolio of borrowers under alternative scenarios. The input data would consist of the projected financial performance (income statement & balance sheet details) of each of these portfolio constituents. In the appraisal system adopted by Indian banks in general, these are normally developed for individual borrowers for seeking credit approvals from the specific internal authorities. Such portfolio constituents could be relatively independent counterparties, spanning a relatively wide spectrum of region, industry, size of operation, adoption of technology and promoters. The key financial parameters of these counterparties (growth, profitability, access to funds, etc.) should be linked to the macro-economic parameters under consideration. Some of the relevant macro-economic parameters could include overall growth rates, growth in exports, industrial and agricultural sectors, interest rates, exchange rates, import duties and equity market and liquidity conditions. By developing alternative scenarios for these parameters, the credit-portfolio's aggregate performance (default rates and levels) can be assessed and possible correlation between a set of obligors (even though they constitute entirely separate counterparties) may be established. For instance, under the assumptions of low overall

economic growth, poor growth in agriculture sector and reduction in import duties, the assessment may give some correlation between the borrowers in the petrochemicals industry and the consumer-electronics industry. Though there may not be any “counterparty” relationship in this set of borrowers, both of them are possibly susceptible to reduced import duties and low economic growth. These illustrations are relatively simplistic and the detailed analysis, as discussed above, may give critical inputs for minimising the credit risk of the given portfolio. A possible advantage of starting with the macro-economic factor model is that it is amenable to the current levels of credit risk assessment practices in Indian Banks and can be correspondingly adopted with relative ease. Though superior and more sophisticated tools have been developed, their findings may be limited due to the lack of representative data. Such options can be considered as Indian Banks further enhance their internal systems and processes in credit risk management.

## 5. Inter-bank Exposure/ Credit Limits

5.1 During the course of its business, a bank often incurs exposures to other banks often on a reciprocal basis, in support of trade transactions, money placements for liquidity management purposes, hedging, for trading and transactional banking services such as clearing and custody. Banks are natural counterparties for several transactions and it is therefore, important that a proper credit evaluation of the banks is undertaken similar to the assessment done for companies.

5.2 Previous default experience in the financial sector has shown that the governments will normally support a large bank in difficulty, as this will otherwise have a ripple effect across the banking industry in particular and the economy in general. However, the South East Asian crisis has shown that this support cannot be taken for granted. The experience in Korea and Indonesia are cases in point, where the existing lenders were perforce to rollover the lines of credit for a number of years. Over the past few years, the global credit environment has changed from a relatively stable condition to a state of extreme volatility, and banks cannot remain insulated from these exogenous factors.

5.3 Sophisticated risk assessment of bank exposures is vital to the sustained growth of any bank, and must cover past data and future trends. It must cover both the interpretation of the bank's financial statements as well as forming a judgement on non-financial areas such as management, ownership, peer/market perception and country factors.

**5.4 The key financial parameters to be evaluated for any bank are:**

a) Capital Adequacy
b) Asset Quality
c) Liquidity
d) Profitability

5.4.1 **Capital Adequacy**

5.4.1.1 Banks with high capital ratios above the Basel Committee’s minimum levels, particularly Tier I, will be assigned a high rating whereas the banks with low ratios well below the Basel standards and with low ability to access capital will be at the other end of the spectrum.

5.4.1.2 Capital adequacy needs to be appropriate to the size and structure of the balance sheet as it represents the buffer to absorb losses during difficult times, whereas over capitalization

can impact overall profitability. Related to the issue of capitalization, is also the ability to raise fresh capital as and when required. Publicly listed banks and state owned banks may be best positioned to raise capital whilst the private banks or regional banks are dependant entirely on the wealth and/or connections of their owners.

5.4.1.3 The capital adequacy ratio is normally indicated in the published audited accounts. In addition, it will be useful to calculate the Capital/Total Assets ratio which indicates the owners' share in the assets of the business. The ratio of Tier I capital to Total Assets represents the extent to which the bank can absorb a counterparty collapse. Tier I capital is not owed to anyone and is available to cover possible losses. It has no maturity or repayment requirement, and is expected to remain a permanent component of the counterparty's capital.

5.4.1.4 The Basel standards currently require banks to have a capital adequacy ratio of 8% with Tier I ratio at 4%. The Reserve Bank of India requirement is 9%. The Basel Committee is planning to introduce the New Capital Accord and these requirements could change the dimension of the capital of banks.

**5.4.2 Asset Quality**

5.4.2.1 The asset portfolio in its entirety should be evaluated and should include an assessment of both funded lines and off-balance sheet items. The quality of the loan book will be reflected in the non-performing assets and provisioning ratios, whilst exposure to the capital market and sensitive sectors will be indicated by the high volatility, affecting both valuations and earnings.

5.4.2.2 The key ratios to be analyzed are charge-offs/Gross Loans ratio, Non-performing Loans/Gross Loans ratio, Provisions/Gross Loans ratio and Provisions/Non-Performing Loans ratio.

5.4.2.3 Some issues which should be taken cognisance of, and which require further critical examination are:

- where exposure to a particular sector is above 10% of total assets
- where a significant part of the portfolio is to counterparties based in countries which are considered to be very risky
- where non-performing advances which are not provided for are above 5% of the loan assets.
- where loan loss provision is less than 50% of the Gross NPA.
- where high risk/return lending accounts for the majority of the assets.

- rapid rates of loan growth. These can be a precursor to reducing asset quality as periods of rapid expansion are often followed by slow downs which make the bank vulnerable.
- net impact of mark-to-market values of treasury transactions.
- correlation between the off-balance sheet items to the total assets.

5.4.2.4 Commercial banks are increasingly venturing into investment banking activities where asset considerations additionally focus on the marketability of the assets, as well as the quality of the instruments. Investments should be reflected on mark-to market basis and sticky investments should be treated as "non-performing".

### 5.4.3 Liquidity

5.4.3.1 Commercial bank deposits generally have a much shorter contractual maturity than loans, and liquidity management needs to provide a cushion to cover anticipated deposit withdrawals. The key ratios to be analyzed are Total Liquid Assets/Total Assets ratio (the higher the ratio the more liquid the bank is), Total Liquid Assets/Total Deposits ratio (this measures the bank's ability to meet withdrawals), Loans/Deposits ratio and the inter-bank ratio.

5.4.3.2 It is necessary to develop an appropriate level of correlation between assets and liabilities. Account should be taken of the extent to which borrowed funds are required to bolster capital and the respective redemption profiles.

5.4.3.3 Generally liquid asset/total deposits ratio of 40% and above is considered to be good. On the other hand, an inter-bank ratio of 35% or higher, high reliance on liquid assets which are exposed to the vagaries of the capital markets, continued downward trend in the liquidity ratios, and lack of core deposits should be viewed with caution.

### 5.4.4 Profitability

5.4.4.1 A consistent year on year growth in profitability is required to provide an acceptable return to shareholders and retain resources to fund future growth. The key ratios to be analyzed are Return on Average Assets (measures a bank's growth/decline in comparison with its balance sheet expansion/contraction), Return on Equity (provides an indication of how well the bank is performing for its owners), Net Interest Margin (measures the difference between interest paid and interest earned, and therefore a bank's ability to earn interest income) and Operating Expenses/Net Revenue (the cost/income ratio of the bank).

5.4.4.2 The degree of reliance upon interest income compared with fees earned, heavy dependency on certain sectors, and the sustainability of income streams are relevant factors to be borne in mind.

**5.5 In addition to the quantitative indices, other key parameters to be assessed are:**
**Ownership**

5.5.1 The spread and nature of the ownership structure is important, as it impinges on the propensity to introduce additional capital. Support from a large body of shareholders is difficult to obtain if the bank's performance is adverse, whilst a smaller shareholder base constrains the ability to garner funds. Where the shareholder base is narrow, or where a single party is the majority shareholder, then the asset book should be examined closely.

**Management Ability**

5.5.2 Frequent changes in senior management, change in a key figure, and the lack of succession planning need to be viewed with suspicion. Risk management is a key indicator of the management's ability as it is integral to the health of any institution. Risk management should be deeply embedded and respected in the culture of the financial institution.

**Peer Comparison/Market Perception**

5.5.3 It is recognized that balance sheets tend to show different structures from one country to another, and from one type of bank to another. Accordingly, it is appropriate to assess a bank's financial statements against those of its comparable peers.

Similarly market sentiment is highly important to a bank's ability to maintain an adequate funding base, but is not necessarily reflective of published information. Account needs to be taken where the overall performance of the peer sector in general falls below international standards.

**Importance of the Bank in the Economy**

5.5.4 This will give an idea about the support which the bank can get from the government. Banks which are systemically important to the country's banking system and national stability are likely to get a higher level of Government support.

**Country of Incorporation/Regulatory Environment**

5.5.5 Country risk needs to be evaluated, as even if a bank is financially strong, it may not be permitted to meet its commitments in view of the regulatory environment or the financial state of the country in which it is operating in.

**5.6 Based on the above factors the banks should be rated** (called bank tierings). An indicative tiering scale is:

| **Bank Tier** | **Description** |
|---|---|
| 1 | Low risk |
| 2 | Modest risk |
| 3 | Satisfactory risk |
| 4 | Fair Risk |
| 5 | Acceptable Risk |
| 6 | Watch List |
| 7 | Substandard |
| 8 | Doubtful |
| 9 | Loss |

**5.7 Facilities**

Facilities to banks can be classified into three categories:

a) on balance sheet items such as cash advances, bond holdings and investments, and off-balance sheet items which are not subject to market fluctuation risk such as guarantees, acceptances and letters of credit.

All these lines should be credit risk weighted at 100 pct.

b) facilities which are off-balance sheet and subject to market fluctuation risk such as FEX and derivative products.

c) **Settlement facilities**

These cover risks arising through payment systems or through settlement of treasury and securities transactions.

The tiering system enables a bank to establish internal parameters to help determine acceptable limits to a particular banking group. These parameters should be used to determine the maximum level of (a), (a) and (b), maximum tenors for term products which may be considered prudent for a bank, and settlement limits.

Medium term loan facilities and standby facilities should be sanctioned very exceptionally. Standby lines, by their very nature, are likely to be drawn only at a time when the risk in making funds available is generally perceived to be unattractive.

The credit risk management of exposure to banks should be centralized. Bank-wise exposure limits should be set taking into account the counterparty and country risks.

## 6. Off Balance Sheet Exposure

### Assessment of Limits

6.1. The mechanics involved in the assessment of non-fund lines should be similar to those entailed in the assessment of funded lines. A non-fund line will become a funded liability in case the customer is not able to meet his commitments. Banks, whilst assessing the funded lines, should take into account the level of Letters of Credit (LCs) and usance LCs proposed to be sanctioned to the customer. Sanction of such lines would in many cases lower the level of the funded requirement of the company.

6.2 Banks must also ensure that the security, which is available to the funded lines, also covers the LC lines and the guarantee facilities. On some occasions, it will be appropriate to take a charge over the fixed assets as well, especially in the case of long term guarantees.

6.3 In the case of guarantees covering contracts, banks must ensure that the clients have the requisite technical skills and experience to execute the contracts. The value of the contracts must be determined on a case-by-case basis, and separate limits should be set up for each contract. The progress vis-à-vis physical and financial indicators should be monitored regularly, and any slippages should be highlighted in the credit review.

6.4 As contracts are generally for a term of 2-3 years, banks must obtain cash flows over this time horizon, arising from the specific contract they intend to support, and determine the viability of financing the contract.

6.5 Financial guarantees and EPCG guarantees are generally long term in nature, and assessment of these requirements should be similar to the evaluation of requests for term loans.

6.6 The temptation to sanction non-fund lines is high in view of the substantial commission incomes which can be obtained. However, as such lines could crystallize into funded liabilities, the utmost care should be taken whilst extending these facilities.

## 7. Country and Transfer Risk

**7.1 Country risk** is the possibility that a country will be unable to service or repay its debts to foreign lenders in a timely manner. In banking this risk arises on account of cross border lending and investment. The risk manifests itself either in **the inability** or **the unwillingness** of the obligor to meet its liability.

Country risk comprises of the following risks:

? **Transfer risk** which is the core risk under country risk, arises on account of the possibility of losses due to restrictions on external remittances. Consequently, an obligor may be able to pay in local currency, but may not be able to pay in foreign currency. This type of risk may occur when foreign exchange shortages either close or restrict a country's cross border foreign exchange market.

? **Sovereign risk** is associated with lending to government of a sovereign nation or to taking government guarantees. The risk lies in the fact that sovereign entities may claim immunity from legal process or might not abide by a judgement, and it might prove impossible to secure redress through legal action. The fact that `sovereigns cannot go bust' does not mean that there is no risk involved in sovereign lending, for the risk may manifest itself in terms of rehabilitation of an indebted country in terms of financial solvency and liquidity for which there may be rescheduling of country debt or external debt.

? **Non-sovereign or political risk** involves risk to lenders/investors that the repatriation of their loan/investment in a particular country is restricted for political reasons. Non-sovereign risk includes, in addition to sovereign risk, private claims and direct investments like lending to corporates and project finance lending and includes risks associated with legal frameworks, economic environment, political environment, legislative process, risks of appropriation and expropriation.

? **Cross border risk** – arises on account of the borrower being a resident of a country other than where the cross border asset is booked, and includes exposures to local residents denominated in currencies other than the local currency.

? **Currency risk** is the possibility that exchange rate changes will alter the expected amount of principal and return of the lending or investment. At times, banks may try to cope with this specific risk on the lending side by shifting the risk associated with exchange rate fluctuations to the borrowers. The risk however does not get extinguished, but gets converted to credit risk.

? **Macroeconomic and Structural Fragility Risk** has come into prominence after the East Asian crises of 1990s. In these crises firms could purchase foreign exchange to service foreign debt but collapse of exchange rates and surge in interest rates due to severe government restrictions on firms owning external debt resulted in highly unfavourable exchange rates and very high interest costs on domestic borrowings for these firms. This severely impaired these firms' ability to service foreign debt. The structural fragility risk can also include that associated with poor development of domestic bankruptcy laws and weak courts for their enforcement.

### 7.2 Broad Contours of CRM

The broad contours of CRM are:

**I. CR Assessment**

CR assessment is concerned with the assessment of the risk associated with lending to or investing in a country, taking into account various economic, social and political factors. For country risk assessment**,** lending banks may use various methods to evaluate the relative risks of interruption in the servicing or repayment of obligations by borrowers of a particular country. The basis of such assessment may be statistical and other information available from national and international sources on a country's economic policy, outlook for development, political and social stability, as also direct experience of local conditions from staff stationed there/visits by staff. Banks may use their own ratings on the basis of internal evaluation or depend upon the external ratings for CRM. In addition to ratings provided by rating agencies, certain periodicals like "Institutional Investor" and "Euromoney" also provide country ratings.

**II. Country Limits**

Banks should fix limits on various categories of lendings and investments based on the assessment of the risk. Country limits may normally suggest the maximum exposure, barring special conditions, which may warrant or justify exposure higher than the limit that could be taken on a country given its risk rating. Country exposure is an individual bank's or banking group's exposure in its total claims on borrowers, in individual foreign countries, which may be higher or lower than the actual country limit. Measures of exposure take into account guarantees or other factors that could transfer country risk to a different country than that of the borrower. **Essentially country exposure consists of all assets, which represent claims on residents of another country.**

**III. Monitoring of Country Exposures**

Banks should monitor their exposure – country by country – on an ongoing basis to ensure that units operate within their limits. For ongoing monitoring banks use early warnings indicators. These indicators cover general economic indicators viz. GDP growth rate, inflation, unemployment, fiscal deficit, foreign exchange (FX) reserves, etc.; welfare and equity indicators viz. rise in unemployment, fall in savings and/or investment, etc.; internal balance like rise in fiscal deficit, inflation and debt; external balance indicators like large trade deficit, heavy debt burden, large negative errors and omissions and fall in reserves. Certain critical levels and significant variations have been defined. Any significant changes and breach of critical levels would warrant a relook at country limits. International banks also keep contingency action plans ready for dealing with sudden deterioration in country risk rating.

## 8. Loan Review Mechanism/ Credit Audit

Credit Audit examines compliance with extant sanction and post-sanction processes and procedures laid down by the Bank from time to time.

### 8.1 Objectives of Credit Audit

- Improvement in the quality of credit portfolio
- Review sanction process & compliance status of large loans
- Feedback on regulatory compliance
- Independent review of Credit Risk Assessment
- Pick-up early warning signals and suggest remedial measures
- Recommend corrective action to improve credit quality, credit administration and credit skills of staff

### 8.2 Structure of Credit Audit Department

The credit audit / loan review mechanism may be assigned with a specific Department or the Inspection and Audit Department.

### 8.3 Functions of Credit Audit Department

- To process Credit Audit Reports
- To follow up with controlling authorities
- To process the responses received and arrange for closure of the relative Credit Audit Reports
- To apprise the Top Management
- To analyse Credit Audit findings and advise the departments/functionaries concerned
- To maintain database of advances subjected to Credit Audit

### 8.4 Scope and coverage of Credit Audit

- Only standard assets, commercial advances accounts with total indebtedness above the prescribed cut-off are covered.
- All accounts of sister/associate concerns of the units at the same branch even with indebtedness of less than cut-off amount are also examined to verify whether the conduct of these accounts is prima facie in order.
- A percentage of accounts below the cut-off amount are also subjected to Credit Audit on random sample basis.

### 8.5 Frequency of Credit Audit

Each account required to be audited is subjected to audit within a period of 3 to 6 months of its sanction/enhancement/renewal.

**8.6 Procedure is followed for Credit Audit**

- Credit Audit is conducted on site, i.e. at the branch which has appraised the advance and where the main operative credit limits are made available.
- Report on conduct of accounts of allocated limits are to be called from the allocatee branches.
- Credit auditors are not required to visit borrowers' factory/office premises.

**8.7 Major areas are examined during Credit Audit**

- Appraisal
- Conformity with guidelines
- CRA rating
- Assessment
- Sanction
- Follow-up
- Supervision
- Monitoring & Control
- Early warning signals
- Asset quality
- Portfolio concentration

**9. RAROC Pricing/ Economic Profit**

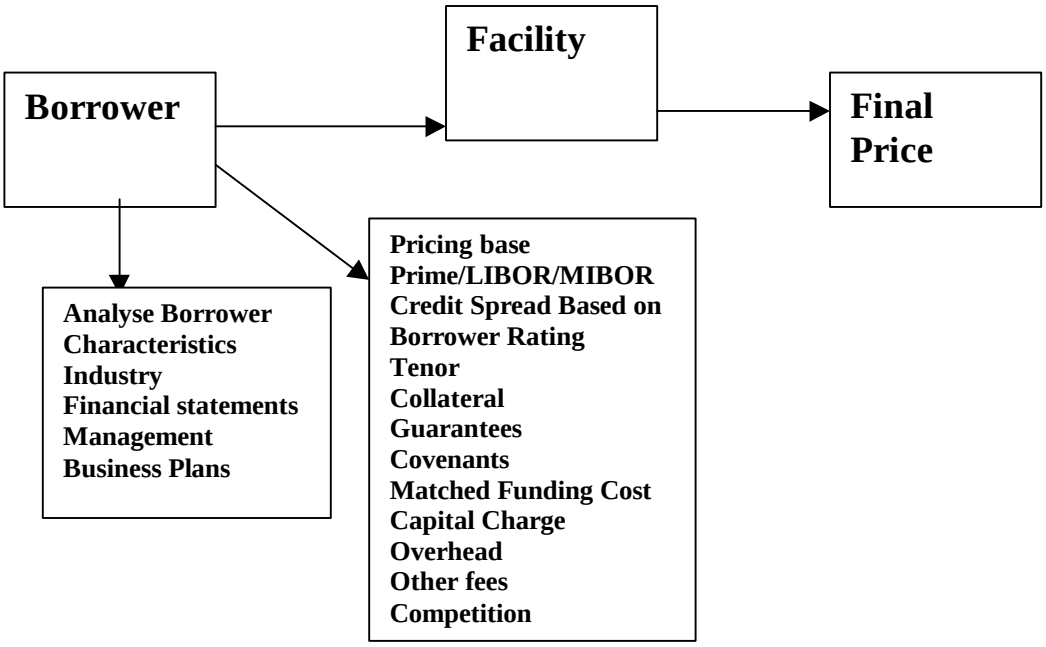
9.1 In acquiring assets, banks should use the pricing mechanism in conjunction with product/geography/industry/tenor limits. For example, if a bank believes that construction loans for suburban malls are unattractive from a portfolio perspective, it can raise the price of these loans to a level that will act as a disincentive to borrowers. This is an instance of **marginal cost pricing**-the notion that the price of an asset should compensate the institution for its marginal cost as measured on a risk-adjusted basis. The more a product increases a lender's portfolio concentration, the higher its marginal cost to that lender. Marginal cost pricing may not always work. A bank may have idle capacity-a large cost base and capital that has not been deployed. While such an institution clearly would not want to make a loan

at a negative spread, it would probably view even a small positive spread as worthwhile as long as the added risk was acceptable.

9.2 Institutions tend to book unattractively priced loans when they are unable to allocate their cost base with clarity or to make fine differentiations of their risks. If a bank cannot allocate its costs, then it will make no distinction between the cost of lending to borrowers that require little analysis and the cost of lending to borrowers that require a considerable amount of review and follow up. Similarly, if the spread is tied to a too coarsely graded risk-rating system (one, for example, with just four grades) then it is more difficult to differentiate among risks when pricing than if the risk rating is graduated over a larger scale with, say, 15 grades.

9.3 A **cost-plus-profit pricing strategy** will work in the short run, but in the long run borrowers will balk and start looking for alternatives. Cost-plus- profit pricing will also work when a bank has some flexibility to compete on an array of services rather than exclusively on price. The difficulties with pricing are greater in markets where the lender is a price taker rather than a price leader.

Traditional pricing for credit risk has followed the cost-plus-profit approach as, shown in Figure.




9.4 Thus the pricing is based on the borrower's risk rating, tenor, collateral, guarantees, and covenants. A capital charge is applied based on a hurdle rate and a capital ratio. The historic loan loss rate used for each of the risk-rating categories is used to calculate the expected loss

allowance to be built into the price. The two other inputs needed are the capital ratio and the required rate of return on capital. Using these assumptions, the rate to be charged for a loan to a customer with a given rating could be calculated.

9.5 This relatively simple approach to credit pricing works well as long as the assumptions are correct-especially those about the borrower's credit quality. This method is used in many banks today. The main drawback is that only 'expected losses are linked to the borrower's credit quality. The capital charge on an 8% capital ratio at 16%t (cost of equity) may not be sufficient, and the capital charge based on the volatility of losses in the credit risk category may also be too small. If the loan were to default, the loss would have to be made up from income from non-defaulting loans. Another drawback of this method is that it implicitly assumes only two possible states for a loan: default or no default. It does not model the credit risk premium or discount resulting from improvement or decline in the borrower's financial condition, which is meaningful only if the asset may be repriced or sold at par.

9.6 Banks have long struggled to find the best ways of allocating capital in a manner consistent with the risks taken. They have found it difficult to come up with a consistent and credible way of allocating capital for such varying sources of revenue as loan commitments, revolving lines of credit (which have no maturity), and secured versus unsecured lending. One approach is to allocate capital to business units based on their asset size. Although it is true that a larger portfolio will have larger losses, this approach also means that the business unit is forced to employ all the capital allocated to it. Moreover, this method treats all risks alike. Another approach is to use the regulatory (risk-adjusted) capital as the allocated capital. The problem with this approach is that regulatory capital may or may not reflect the true risk of a business. For example, for regulatory purposes, a loan to a AAA-rated customer requires the same amount of capital per Rupees lent as one to a small business. Yet another approach is to use unexpected losses in a sub-portfolio (standard deviation of the annual losses taken over time) as a proxy for capital to be allocated. The problem with this approach is that it ignores default correlations across sub-portfolios. The volatility of a sub-portfolio may in fact dampen the volatility of the institution's portfolio, so pricing decisions based on the volatility of the sub-portfolio may not be optimal. In practical terms, this means that one line of business within a lending institution may sometimes subsidize another.

**Risk Adjusted Return on Capital (RAROC)**

9.7 As it became clearer that banks needed to add an appropriate capital charge in the pricing process, the concept of risk adjusting the return or risk adjusting the capital was born. The value-producing capacity of an asset (or a business) is expressed as a ratio that allows comparisons to be made between assets (or businesses) of varying sizes and risk characteristics. The ratio is based either on the size of the asset or the size of the capital allocated to it. When an institution can observe asset prices directly (and/or infer risk from observable asset prices) then it can determine how much capital to hold based on the volatility of the asset. This is the essence of the mark-to-market concept. If the capital to be held is excessive relative to the total return that would be earned from the asset, then the bank will not acquire it. If the asset is already in the bank's portfolio, it will be sold. The availability of a liquid market to buy and sell these assets is a precondition for this approach. When banks talk about asset concentration and correlation, the question of capital allocation is always in the background because it is allocated capital that absorbs the potential consequences (unexpected losses) resulting from such concentration and correlation causes.

**9.8** Risk-adjusted return on capital (RAROC) was introduced by Bankers Trust in the late 1970s. It is based on a mark-to-market concept. As defined by Bankers Trust, RAROC allocates a capital charge to a transaction or a line of business at an amount equal to the maximum expected loss (at a 99% confidence level) over one year on an after-tax basis. As may be expected, **the higher the volatility of the returns, the more capital is allocated. The higher capital allocation means that the transaction has to generate cash flows large enough to offset the volatility of returns, which results from the credit risk, market risk, and other risks taken**. The RAROC process estimates the asset value that may prevail in the worst-case scenario and then equates the capital cushion to be provided for the potential loss.

9.9 There are four basic steps in this process:

I. Analyze the activity or product and determine the basic risk categories that it contains, for example, interest rate (country, directional, basis, yield curve, optionality), foreign exchange, equity, commodity, and credit and operating risks.

2. Quantify the risk in each category by a market proxy.

3. Using the historical price movements of the market proxy over the past three years, compute a market risk factor, given by the following equation

RAROC risk factor = 2.33 x weekly volatility x square root of 52x (I- tax rate)

In this equation, the multiplier 2.33 gives the volatility (expressed as a percent) at the 99 percent confidence level. The term 52 converts the weekly price movement into an annual movement. The term (I - tax rate) converts the calculated value to an after-tax basis.

4. Compute the Rupee amount of capital required for each risk category by multiplying the risk factor by the size of the position.

Establishing the maximum expected loss in each product line and linking the capital to this loss makes it possible to compare products of different risk levels by stating the risk side of the risk-reward equation in a consistent manner. The risk-to-reward ratio thus becomes comparable.

9.10 RAROC is an improvement over the traditional approach in that it allows one to compare two businesses with different risk (volatility of returns) profiles. Using a hurdle rate, a lender can also use the RAROC principle to set the target pricing on a relationship or a transaction. Although not all assets have market price distribution, RAROC is a first step toward examining an institution's entire balance sheet on a mark-to-market basis-if only to understand the risk-return trade-offs that have been made.

**10. New Capital Accord: Implications on Credit Risk**

10.1 The Basel Committee on Banking Supervision had released in June 1999 the first Consultative Paper on a ***New Capital Adequacy Framework*** with the intention of replacing the current broad-brush 1988 Accord. The Basel Committee has now released a Second Consultative Document in January 2001, which contains refined proposals for the three pillars of the New Accord – Minimum Capital Requirements, Supervisory Review and Market Discipline.

10.2 The Committee proposes two approaches, viz., Standardised and IRB for estimating regulatory capital. Under the **standardised approach, the Committee desires neither to produce a net increase nor a net decrease, on an average, in minimum regulatory capital, even after accounting for operational risk.** Under the IRB approach, the Committee's ultimate goals are to ensure that the overall level of regulatory capital is sufficient to address the underlying credit risks and also **provides capital incentives relative to the standardised approach, i.e., a reduction in the risk weighted assets of 2% to 3% (foundation IRB approach) and 90% of the capital requirement under**

**foundation approach for advanced IRB approach to encourage banks to adopt IRB approach for providing capital.**

10.3 The minimum capital adequacy ratio would continue to be 8% of the risk-weighted assets, which cover capital requirements for market (trading book), credit and operational risks. **For credit risk**, the range of options to estimate capital extends to include a **standardised**, a foundation **IRB** and an **advanced IRB** approaches.

**10.4.1 Standardised Approach**

Under the standardised approach, preferential risk weights in the range of 0%, 20%, 50%, 100% and 150% would be assigned on the basis of external credit assessments.

**10.4.2 IRB Approach**

The Committee now proposes two approaches – foundation and advanced - as an alternative to standardised approach for assigning preferential risk weights. Under the foundation approach, banks, which comply with certain minimum requirements viz. comprehensive credit rating system with capability to quantify Probability of Default (PD) could assign preferential risk weights, with the data on Loss Given Default (LGD) and Exposure at Default (EAD) provided by the national supervisors.

In order to qualify for adopting the foundation approach, the internal credit rating system should have the following parameters/conditions:

- each borrower within a portfolio must be assigned the rating before a loan is originated.
- Minimum of 6 to 9 borrower grades for performing loans and a minimum of 2 grades for non-performing loans.
- Meaningful distribution of exposure across grades and not more than 30% of the gross exposures in any one borrower grade.
- Each individual rating assignment must be subject to an independent review or approval by the Loan Review Department.
- Rating must be updated at least on annual basis.
- The Board of Directors must approve all material aspects of the rating and PD estimation.
- Internal and External audit must review annually, the banks' rating system including the quantification of internal ratings.

- Banks should have individual credit risk control units that are responsible for the design, implementation and performance of internal rating systems. These units should be functionally independent.
- Members of staff responsible for rating process should be adequately qualified and trained.
- Internal rating must be explicitly linked with the banks' internal assessment of capital adequacy in line with requirements of Pillar 2.
- Banks must have in place sound stress testing process for the assessment of capital adequacy.
- Banks must have a credible track record in the use of internal ratings at least for **the last 3 years.**
- Banks must have robust systems in place to evaluate the accuracy and consistency – system, processing and the estimation of the PDs.
- Banks must disclose in greater detail the rating process, risk factors, validation etc. of the rating system.

The regulators are required to set rules for estimating the value of Loss Given Default (LGD) - unrealized portion and Exposure At Default (EAD). Under the advanced approach, banks would be allowed to use their own estimates of PD, LGD and EAD, which could be validated by the supervisors. Under both the approaches, risk weights would be expressed as a single continuous function of the PD, LGD and EAD. The IRB approach, therefore, does not rely on supervisory determined risk buckets as in the case of standardised approach. The Committee has proposed an IRB approach for retail loan portfolio, having homogenous characteristics distinct from that for the corporate portfolio. The Committee is also working towards developing an appropriate IRB approach relating to project finance.

10.5 The adoption of the New Accord, in the proposed format, requires substantial upgradation of the existing credit risk management systems. The New Accord also provided in-built capital incentives for banks, which are equipped to adopt foundation or advanced IRB approach. The adoption of IRB approach, however, impinges upon complying with conditionality attached. Banks, may, therefore, upgrade the credit risk management systems for optimising capital.

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## Annexure-I

**Credit Risk Models**

A brief overview of the four credit risk models that have achieved global acceptance as benchmarks for measuring stand-alone as well as portfolio credit risk are given below. The models are

- ? Altman's Z-score model,
- ? KMV model for measuring default risk,
- ? CreditMetrics, and
- ? CreditRisk+.

The first two models were developed to measure the default risk associated with an individual borrower. The Z-score model separates the 'bad' firms or the firms in financial distress from the set of 'good' firms who are able to service their debt obligations in time. The KMV model, on the other hand, estimates the default probability of each firm. Thus, the output of this model can be used as an input for risk based pricing mechanism and for allocation of economic capital. The other two models are the most frequently used portfolio risk models in credit risk literature. The two models are intended to measure the same risks, but impose different restrictions, make different distributional assumptions and use different techniques for calibration.

### 3.4.1 Z-Score Model

Altman's Z-score model is an application of multivariate discriminant analysis in credit risk modelling. Financial ratios measuring profitability, liquidity, and solvency appeared to have significant discriminating power to separate the firm that fails to service its debt from the firms that do not. These ratios are weighted to produce a measure (credit risk score) that can be used as a metric to differentiate the bad firms from the set of good ones.

Discriminant analysis is a multivariate statistical technique that analyzes a set of variables in order to differentiate two or more groups by minimizing the within-group variance and maximizing the between-group variance simultaneously. Altman started with twenty-two variables (financial ratios) and finally five of them were found to be significant. The resulting discriminant function[1] was

$$Z \; ? \; 0.012X_1 \; ? \; 0.014X_2 \; ? \; 0.033X_3 \; ? \; 0.006X_4 \; ? \; 0.999X_5$$

Where,

$X_1$ ? Working Capital / Total Assets,

$X_2$ ? Retained Earnings / Total Assets,

$X_3$ ? Earnings before Interest and Taxes / Total Assets,

$X_4$ ? Market Value of Equity / Book Value of Total Liabilities,

$X_5$ ? Sales / Total Assets.

Altman found a lower bound value of 1.81 (failing zone) and an upper bound of 2.99 (non-failing zone) to be optimal. Any score in-between 1.81 and 2.99 was treated as being in the zone of ignorance.

This original Z-score model was revised and modified several times in order to find the scoring model more specific to a particular class of firms. These resulted in the private firm's Z-score model, non-manufacturers' Z-score model and Emerging Market Scoring (EMS) model.

**3.4.2 KMV Model**

KMV Corporation has developed a credit risk model[2] that uses information on stock prices and the capital structure of the firm to estimate its default probability. This model is based on Merton's (1973) analytical model of firm value. The starting point of this model is the proposition that a firm will default only if its asset value falls below a certain level (*default point*), which is a function of its liability. It estimates the asset value of the firm and its asset volatility from the market value of equity and the debt structure in the option theoretic framework. Using these two values, a metric (*distance from default* or DfD) is constructed that represents the number of standard deviations that the firm's asset value is away from the default point. Finally, a mapping is done between the DfD values and actual default rate, based on the historical default experience. The resultant probability is called *Expected Default Frequency* (EDF).

In summary, EDF is calculated in the following three steps:

i) Estimation of asset value and asset volatility from equity value and volatility of equity return,

ii) Calculation of distance from default:

The DfD is calculated using the following formula:

$$DfD ? \frac{AssetValue ? Default\ point}{AssetValue * AssetVolatility}$$

iii) Calculation of expected default frequency.

### 3.4.3 CreditMetrics Approach

In April 1997, J.P. Morgan released the *CreditMetrics* Technical Document[3] that immediately set a new benchmark in the literature of portfolio risk management. This provides a method for estimating the distribution of the value of the assets in a portfolio subject to changes in the credit quality of individual borrower. A portfolio consists of different stand-alone assets, defined by a stream of future cashflows. Each asset has a distribution over the possible range of future rating class. Starting from its initial rating, an asset may end up in any one of the possible rating categories. Each rating category has a different credit spread, which will be used to discount the future cash flows. Moreover, the assets are correlated among themselves depending on the industry they belong to. It is assumed that the asset returns are normally distributed and change in the asset returns causes the change in the rating category in the future. Finally, the simulation technique is used to estimate the value distribution of the assets. A number of scenarios are generated from a multivariate normal distribution, which is defined by the marginal rating transition distribution of the individual assets and the correlation values among them. Each scenario indicates a future state to which an asset can migrate. Discounting by the appropriate credit spread, the future value of the asset is estimated. Generation of a large number of scenarios can give a fair idea on the distribution of asset values. The mean asset value, asset volatility, percentile level and the marginal risk volume can summarize the output of this model.

Though there are a few subtle issues that have been raised by practitioners regarding the implementation of this model, e.g., the estimation of correlation between the credit quality of two assets, CreditMetrics should be viewed as the first attempt to address a long-standing problem in portfolio risk measurement.

### 3.4.4 CreditRisk+

CreditRisk+, introduced by Credit Suisse Financial Products (CSFP), is a model of default risk. Each asset has only two possible end-of-period states: default and non-default. In the event of default, the lender recovers a fixed proportion of the total exposure. The default rate

is considered as a continuous random variable. It does not try to estimate the default correlation directly. Here, the default correlation is assumed to be determined by a set of risk factors. Conditional on these risk factors, default of each obligor follows a Bernoulli distribution. To get the unconditional probability generating function for the number of defaults, it assumes that the risk factors are independently gamma-distributed random variables. The final step in CreditRisk+ is to obtain the probability generating function for losses. Conditional on the number of default events, the losses are entirely determined by the exposure and the recovery rate. Thus, the distribution of asset values can be estimated from the following input data:

- Exposure of individual asset
- Expected default rate
- Default rate volatilities
- Recovery rate given default
- Risk sectors

The CreditRisk+ manual[4] provides the recurrence relation used to calculate the value distribution.

[3] Source: *CreditMetrics™ : The Benchmark for Understanding Credit Risk.* Technical Document by *Gupton, G.M., Finger, C.C., and Bhatia, M.*; New York: J.P.Morgan, Inc.

**Annexure-II**

The mechanics for the derivation of PD, LGD in the Internal Rating Based (IRB) Approach in the proposed New Capital Accord are presented below.

**(a) Probability of Default (PD)**

There are two scenarios for the estimation of PD, viz., ***Underlying borrower – no third-party guarantor or credit protection seller and Underlying borrower supported by guarantee or credit derivative***

***Underlying borrower – no third-party guarantor or credit protection seller***

The PD of an exposure is the greater of the one-year PD associated with the internal borrower grade to which that exposure is assigned, or 3 basis points (0.03%).

***Underlying borrower supported by guarantee or credit derivative***

There are two approaches for the recognition of credit risk mitigation in the form of guarantees and credit derivatives: a foundation approach and an advanced approach for those banks which meet the specific minimum requirements.

*PD adjustments for guarantees and credit derivatives under the foundation approach.*

The effective probability of default (PD*) applicable to the covered portion of the exposure will be:

PD* = *w* x PDB + (1-*w*) x PDG

where:

PDB is the probability of default of the obligor;

PDG is the probability of default of the guarantor/protection provider; and

*w* is the weight applied to the transaction (0 or 0.15) .

The uncovered portion of the exposure is assigned the PD of the underlying obligor.

*PD adjustments for guarantees and credit derivatives under the advanced approach*

Under this option, banks would use their own internal assessment of the degree of risk transfer, within supervisory defined parameters when credit protection in the form of guarantees or credit derivatives is taken. Specifically, the guaranteed facility would receive a PD appropriate to the borrower or the guarantor's borrower grade, or an intermediate grade if a bank deems full substitution treatment not to be warranted.

**(b) Loss Given Default (LGD)**

3.5.2 A bank must provide an estimate of the loss given default (LGD) for each corporate exposure. There are two approaches for deriving this estimate: a foundation approach and an advanced approach.

*Treatment of unsecured claims and non-recognised collateral*

Under the foundation approach, senior claims on corporates without specifically recognised collateral will be assigned a 50% LGD.

Subordinated claims on corporates without specifically recognised collateral will be assigned a 75% LGD.

*Eligible collateral under the foundation approach*

There are two broad categories of eligible collateral under the foundation IRB approach: financial collateral and specified commercial and residential real estate collateral (physical collateral).

*Methodology for recognition of financial collateral under the foundation approach*

Following the comprehensive approach, the effective LGD applicable to a collateralised transaction can be expressed as follows, where:

? LGD is that of the unsecured exposure before recognition of collateral (either 50% or 75%, as above);

? E is the uncollateralised exposure amount (i.e. cash lent or securities lent or posted);

? C is the current value of the collateral received;

? HE, HC, and HFX are haircuts, and

? *w* is the floor factor applied to the secured portion of the transaction and is set at 0.15.

The adjusted value after haircut of the collateral (CA ) is:

$CA=C/1+HC+HE+HFX$

If the value of the exposure exceeds the adjusted value of the collateral, i.e. $E > CA$,

then:

$LGD^* = LGD \times [1-(1-w) \times (CA/E)]$

If the value of the exposure is less than the adjusted value of the collateral, i.e. $E < CA$, then LGD* is subject to a floor:

$LGD^* = w \times LGD$

*Methodology for Recognition of CRE and RRE Collateral*

The methodology for determining the effective LGD (LGD*) under the foundation approach for cases where banks have taken commercial real estate (CRE) or residential real estate (RRE) collateral to secure a corporate exposure is as follows.

Exposures where the minimum eligibility requirements are met, but the ratio of current collateral value (C) to the nominal exposure (E) is below a threshold level of 30% would receive the appropriate LGD for unsecured exposures or those secured by non- recognised collateral of 50%.

Exposures where the ratio of collateral value to the nominal exposure exceeds a second, higher threshold level of 140% would be assigned an LGD of 40%.

### *3.6.3 LGD under the Advanced Approach*

Subject to certain additional minimum requirements, supervisors may permit banks to use their own internal estimates of LGD for corporate exposures. Supervisory recognition of internal estimates of LGD will be limited to banks that meet qualitative and quantitative minimum requirements that are more rigorous than those required of institutions making use of the foundation IRB approach. Banks eligible for the IRB approach that are unable to meet these higher minimum requirements would utilise the foundation LGD treatment described above.