Guidance Note on Market Risk Management

BP./21.04.103/2001

March 26, 2002

All Commercial Banks

Dear Sir,

Guidance Note on Market 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 benchmark to those banks, which have not established integrated risk management systems.

2. As already indicated in our circular DBOD.BP.BC.26/21.04.103/2001 dated September 20, 2001, as a step towards enhancing and fine-tuning the existing risk management practices in banks, two Working Groups were constituted in Reserve Bank of India drawing experts from select banks and FIs for preparing detailed Guidance Notes on Credit Risk and Market Risk management by banks. The Working Groups have identified further steps which are required to be taken by banks for Improving their existing risk management framework, suiting to Indian conditions. On the basis of feedback received from the members of the Working Group, a draft Guidance Note on Credit Risk has already been placed on the website of RBI for comments by banks and other market participants.

3. The draft Guidance Note on Market Risk is now being placed in the website of RBI (http://www.rbi.org.in). Banks are advised to study the Guidance Note and forward to us their comments by April 15, 2002 positively.

Yours faithfully,

(M.R. Srinivasan)
Chief General Manager-in-Charge
# GUIDANCE NOTE ON MARKET RISK

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Introduction

1.1 The Indian financial markets, in the last few years have seen wide ranging changes due to the deregulation of interest rate and foreign exchange markets. Intense competition for business coupled with increasing volatility in the domestic interest rates as well as foreign exchange rates have brought pressure on banks to maintain a balance among spreads, profitability and long-term viability. Banks have to base their business decisions on a dynamic and integrated risk management system and process, driven by corporate strategy. Further, the Core Principles for Effective Banking Supervision (Principles 11, 12 and 13) of the Basel Committee on Banking Supervision (BCBS) of the Bank for International Settlements (BIS) mandate that Supervisors must be satisfied that banks have adequate policies and procedures for identifying, monitoring and controlling credit, market, operational, country and transfer risks. It is thus essential that the banks adopt a more structured and comprehensive approach to Market Risk Management.

1.2 Market Risk Management provides a comprehensive and dynamic framework for measuring, monitoring and managing liquidity, interest rate, foreign exchange and equity and commodity price risks of a bank that needs to be closely integrated with the bank’s business strategy. Accordingly, the Reserve Bank of India (RBI) vide circular (DBOD. No. BP.BC.8/21.04.098/99) dated February 10, 1999 has issued guidelines on the implementation of the Asset-Liability Management (ALM) system in banks. These guidelines were implemented effective April 1, 1999. This was supplemented with detailed operative Guidelines on Risk Management Systems issued in October 1999, covering broad contours for management of credit, liquidity, interest rate, forex and operational risks. These guidelines, together with the ALM guidelines were purported to serve as a benchmark to those banks, which have not established integrated risk management systems.

1.3 Market Risk may be defined as the possibility of loss to a bank caused by changes in the market variables. The BIS defines market risk as “the risk that the value of on-or off-balance-sheet positions will be adversely affected by movements in equity and interest rate markets, currency exchange rates and commodity prices”. Thus, Market Risk is the risk to the bank’s earnings and capital due to changes in the market
level of interest rates or prices of securities, foreign exchange and equities, as well as the volatilities of those prices.

1.4 Market Risk Management of a bank thus involves management of interest rate risk, foreign exchange risk, commodity price risk and equity price risk. Besides, it is equally concerned about the bank’s ability to meet its obligations as and when they fall due. In other words, it should be ensured that the bank is not exposed to Liquidity Risk. This Guidance Note would, thus, focus on the management of Liquidity Risk and Market Risk, further categorized into interest rate risk, foreign exchange risk, commodity price risk and equity price risk.
Policy Framework

All banks should establish specific policies on market risk management. The policies should represent minimum requirements for the bank including approval levels and requirements for any exceptions, deviations or waivers. The policies should cover the following minimum requirements.

2.1 The responsibilities of Risk Management Committee (or whatever name it is called) with regard to market risk management aspects:
- setting policies and guidelines for market risk measurement, management and reporting
- ensuring that market risk management processes (including people, systems, operations, limits and controls) satisfy bank’s policy
- reviewing and approving market risk limits, including triggers or stop-losses for traded and accrual portfolios
- ensuring certification of financial models – through appointment of qualified and competent staff – and the effectiveness of all systems used to calculate market risk
- appointment of independent market risk manager/s, etc.

2.2 The responsibilities of Risk Taking Unit and Line Management:
- managing all aspects of market risk in accordance with approved policies as established by Risk Policy Committee
- ensuring that people in the Risk Taking Unit have the capability and capacity to meet their business objectives
- operating each Risk Taking Unit at all times at acceptable levels as defined by internal audits and self-assessments
- maintaining independent checks and balances through Operations (back-office)
- maintaining the integrity of financial reporting through financial control department
- establishing a process to identify all market risk
- operating within approved Price and Liquidity Risk limits, etc.

2.3 The Responsibilities of Market Risk Manager:
- ensuring that Traders and Operations (back-office) are properly applying all policies and procedures with respect to market risk
- immediately advising Line Management and if material, the Risk Policy Committee, should any of those policies and procedures not be observed, and reducing or curtailing business activity until they have been restored
- ensuring that usage of risk limits accurately reflects current or expected market conditions by making changes, amending the volatility used in calculation of Value-At-Risk to capture changes in market liquidity

2.4 **Risk Identification**

- All Risk Taking Units must operate within an approved, current Market Risk Product Programme; this should define procedures, limits and controls for all aspects of the product.
- New products may operate under a Product Transaction Memorandum on a temporary, not more than one year, basis while a full Market Risk Product Programme is being prepared. At the minimum this should include procedures, limits and controls. The final product transaction program should include market risk measurement at an individual product and aggregate portfolio level.

2.5 **Limits and Triggers**

- All trading transactions will be booked on systems capable of accurately calculating relevant sensitivities on a daily basis; usage of Sensitivity and Value at Risk limits for trading portfolios and limits for accrual portfolios (as prescribed for ALM) must be measured daily. Where market risk is not measured daily, Risk Taking Units must have procedures that monitor activity to ensure that they remain within approved limits at all times.
- Mandatory market risk limits are required for Factor Sensitivities and Value at Risk for mark to market trading and appropriate limits *(to be determined)* for accrual positions including Available-for-Sale portfolios. Requests for limits will be submitted annually for approval by the Risk Policy Committee. The approval will take into consideration the Risk Taking Unit's capacity and capability to perform within those limits evidenced by the experience of the Traders, controls and risk management, audit ratings and trading revenues.
- Approved Management Action Triggers or Stop-loss are required for all mark to market risk taking activities.
- Risk Taking Units are expected to apply additional, appropriate market risk limits, including limits for basis risk, to the products involved; these will be detailed in the Market Risk Product Programme.

2.6 Trading
- All trading activities will be conducted on an arm’s length basis in a manner conforming to applicable legal, tax, regulatory and accounting provisions of the country as well as to bank’s own internal policies and procedures.
- Traders may only enter into transactions with counterparties or trade in secondary market debt, equity and forex instruments if the counterparties and the issuers have been approved. All transactions will be executed at market rates, prevailing at the time the transaction was entered into. All transactions must have complete documentation, both for the transaction and for the counterparty; sales of derivative and structured products must comply with requirements for Suitability and Appropriateness.
- Brokers must be on an annually approved list maintained by Risk Taking Unit. The list of brokers should be recommended by the risk taking unit but the candidature of each brokers needs to be independently verified taking into account the financial stability of the broker and feedback from market participants.
- All deals, external and internal, must represent an actual economic market transaction to which the Risk Taking Unit is a party. Each deal must be approved by a properly authorised trader. Deals are to be recorded immediately. Confirmations must be sent to and received from counterparties for all transactions; all aspects of the confirmation process must be handled independently by Operations. Where required, each Risk Taking Unit is required to install a specific approval process for both off premises trading and after hours trading; those Traders authorised to carry out such trading must be approved individually.
- All involved in trading are expected to remain within approved limits and triggers for market risk, credit risk and liquidity risk. Market risk limits and triggers are allocated to individual Risk Taking Units, and may not be reallocated. The bank should decide on the ratification procedure for inadvertent limit excesses and the time limit within which the elimination of inadvertent limit excesses should be carried out.

2.7 Risk Monitoring
- A rate reasonability process is required to ensure that all transactions are executed and revalued at prevailing market rates; rates used at inception or for periodic marking to market for risk management or accounting purposes must be independently verified.
- Financial Models used for revaluations for income recognition purposes or to measure or monitor Price Risk must be independently tested and certified.
- Stress tests must be performed at least quarterly for both trading and accrual portfolios.

2.8 Funding and Liquidity
- Funding and liquidity management is both a business and a corporate responsibility performed by the Asset-Liability Management Committee (ALCO) and with oversight by the Risk Management Committee.
- A Liquidity and Capital Plan including Liquidity Limits and a Contingency Funding Plan are required for each legal vehicle in the country, together with where appropriate Liquidity ratios, limits on Large Funds Providers, and limits on Cross Currency Funding.
- A Liquidity and Capital Plan must be submitted annually and Contingency Funding Plans quarterly; Contingency Funding Plans should not show a deficit for short tenors.

2.9 Models of analysis
- Line Management must ensure that the software used in Financial Models that value positions or measure market risk has independent certification that it is performing appropriate calculations accurately.
The Risk Policy Committee is responsible for administering the model control and certification policy, providing technical advice through qualified and competent personnel, and maintaining a register of qualified certifiers.

Financial Models must be fully documented to qualify for certification and minimum standards of documentation must be established.

Certification of models must be performed by someone other than the person who wrote the software code; testers must be competent in designing and conducting tests; records of testing must be kept, including details of the type of tests and their results. Assumptions contained in the Financial Models must be documented as part of the initial certification and reviewed annually by a qualified validator. Unusual parameter sourcing conventions require annual approval by the Risk Policy Committee.

Any mathematical model which uses theory, formulae or numerical techniques involving more than simple arithmetic operations must be validated to ensure that the algorithm employed is appropriate and accurate.

Models must be validated in writing by persons who are acceptable to the Risk Policy Committee and independent of the area creating the model.

Models to calculate risk measures like Sensitivities to market factors either at transaction or portfolio level and Value-at-Risk should be certified independently as per the model control and certification policy.

Unauthorised or unintended changes cannot be made to the models. These standards should also apply to models that are run on spreadsheets until development of fully automated processors for generating valuations and produce risk measurements.

The models should also be subject to model assumption review on a periodic basis. The purpose of this review is to ensure applicability of the model over time and that the model is valid for its original intended use. The review consists of evaluating the components of the financial model and the underlying assumptions, if any.

2.10 Risk Reporting: Risk report should enhance risk communication across different levels of the firm, from the trading desk to the CEO. In order of importance, senior management reports should

be timely
be reasonably accurate
highlight portfolio risk concentrations
include written commentary, and
be concise
Organisational Set Up

3.1 Management of market risk should be the major concern of top management of banks. The Boards should clearly articulate market risk management policies, procedures, prudential risk limits, review mechanisms and reporting and auditing systems. The policies should address the bank’s exposure on a consolidated basis and clearly articulate the risk measurement systems that capture all material sources of market risk and assess the effects on the bank. The operating prudential limits and the accountability of the line management should also be clearly defined. The Asset-Liability Management Committee (ALCO) should function as the top operational unit for managing the balance sheet within the performance/risk parameters laid down by the Board.

3.2 Successful implementation of any risk management process has to emanate from the top management in the bank and its strong commitment to integrate basic operations and strategic decision making with risk management. Ideally, the organization set up for Market Risk Management should be as under:

- The Board of Directors
- The Risk Management Committee
- The Asset-Liability Management Committee (ALCO)
- The ALM support group/Market Risk Group

i) The Board of Directors should have the overall responsibility for management of risks. The Board should decide the risk management policy of the bank and set limits for liquidity, interest rate, foreign exchange and equity price risks.

- The Asset-Liability Management Committee, popularly known as ALCO should be responsible for ensuring adherence to the limits set by the Board as well as for deciding the business strategy of the bank in line with bank’s budget and decided risk management objectives. The ALCO is a decision-making unit responsible for balance sheet planning from risk-return perspective including strategic management of interest rate and liquidity risks. The role of the ALCO should include, inter alia, the following:

  - product pricing for deposits and advances
deciding on desired maturity profile and mix of incremental assets and liabilities
articulating interest rate view of the bank and deciding on the future business strategy
reviewing and articulating funding policy
reviewing economic and political impact on the balance sheet

The ALCO will be responsible for ensuring the adherence to the limits set by the Board of Directors. The ALCO will also decide the transfer pricing policy of the bank. The ALCO will comprise of the Managing Director, heads of various divisions and other senior personnel involved with the ALM process.

The ALM Support Groups consisting of operating staff should be responsible for analysing, monitoring and reporting the risk profiles to the ALCO. The Risk management group should prepare forecasts (simulations) showing the effects of various possible changes in market conditions related to the balance sheet and recommend the action needed to adhere to bank’s internal limits, etc.

3.3 Composition of ALCO

The size (number of members) of ALCO would depend on the size of each institution, business mix and organisational complexity. To ensure commitment of the Top Management and timely response to market dynamics, the CEO/CMD or the ED should head the Committee. The Chiefs of Investment, Credit, Resources Management or Planning, Funds Management / Treasury (forex and domestic), International Banking and Economic Research can be members of the Committee. In addition, the Head of the Technology Division should also be an invitee for building up of MIS and related computerisation. Some banks may even have Sub-committees and Support Groups.

3.4 The Middle Office

The Middle Office is responsible for the critical functions of independent market risk monitoring, measurement, analysis and reporting for the bank's ALCO. Ideally this is a full time function reporting to, or encompassing the responsibility for, acting as ALCO's secretariat. An effective Middle Office provides the independent risk assessment which is critical to ALCO's key-function of controlling and managing market risks in accordance
with the mandate established by the Board/Risk Management Committee. It is a highly specialised function and must include trained and competent staff, expert in market risk concepts. The methodology of analysis and reporting will vary from bank to bank depending on their degree of sophistication and exposure to market risks. These same criteria will govern the reporting requirements demanded of the Middle Office, which may vary from simple gap analysis to computed VaR modelling. Middle Office staff may prepare forecasts (simulations) showing the effects of various possible changes in market conditions related to risk exposures. Banks using VaR or modelling methodologies should ensure that its ALCO are aware of and understand the nature of the output, how it is derived, assumptions and variables used in generating the outcome and any shortcomings of the methodology employed. Segregation of duties principles must be evident in this function which must report to ALCO independently of the treasury function.

Bank's without formal Middle Offices must for banks without a formal Middle Office, it should be ensured that risk control and analysis should rest with a department with clear reporting independence from Treasury or risk taking units, until formal Middle Office frameworks are established.

### 3.5 The Dealing Room

The Treasury Dealing Room within a bank is generally the clearinghouse for matching, managing and controlling market risks. It may provide funding, liquidity and investment support for the assets and liabilities generated by regular business of the bank. The Dealing Room is responsible for the proper management and control of market risks in accordance with the authorities granted to it by the bank's Risk Management Committee. The Dealing Room also is responsible for meeting the needs of business units in pricing market risks for application to its products and services. The Dealing Room acts as the bank's interface to international and domestic financial markets and generally bears responsibility for managing market risks in accordance with instructions received from the bank's Risk Management committee.
The Dealing Room may also have allocated to it by Risk Management Committee, a
discretionary limit within which it may take market risk on a proprietary basis. For these
reasons effective control and supervision of bank's Dealing Room activities is critical to
its effectiveness in managing and controlling market risks.

Critical to a Dealing Room's effective functioning is all dealer's access to a
comprehensive Dealing Room manual covering all aspects of their day to day activities.
All dealers active in day to day trading activities must acknowledge familiarity with and
provide an undertaking in writing to adhere to the bank's dealing guidelines and
procedures. A Dealing Room procedures manual should be comprehensive in nature
covering operating procedures for all the bank’s trading activities in which the Dealing
Room is involved and in particular must cover the bank's requirements in respect of:

? **Code of Conduct** - all dealers active in day to day trading activities in the Indian
market must acknowledge familiarity with and provide an undertaking to adhere
to FEDAI code of conduct (and FIMMDA when available).

? **Adherence to Internal Limits** - All dealers must be aware of, acknowledge and
provide an undertaking to adhere to the limits governing their authority to commit
the bank to risk exposures as they apply to their own particular risk
responsibilities and level of seniority.

? **Adherence to RBI limits and guidelines** - All dealers must acknowledge and
provide an undertaking to adhere to their responsibility to remain within RBI
limits and guidelines in their area of activity.

? **Dealing with Brokers** - All dealers should be aware of, acknowledge and provide
an undertaking to remain within the guidelines governing the bank's activities
with brokers including conducting business only with brokers authorised by
bank's Risk Management Committee on the bank's Brokers Panel

? Ensuring their activities with brokers do not allow for the brokers to act as
principals in transactions but remain strictly in their authorised role as market
intermediaries

? Requiring brokers to provide all brokers notes and confirmations of transactions
before close of business each day (or exceptionally by the beginning of the next
business day, in which case the note must be prominently marked by the broker as
having been transacted the previous day, and the Back Office must recast the previous night's position against limits reports) to the bank's Back Office for reconciliation with transaction data.

? Ensuring all brokerage payments and statements are received, reconciled and paid by the bank's Back Office department and under no circumstances authorised or any payment released by dealers

? Prohibiting the acceptance by dealers of gifts, gratifications or other favours from brokers, instances of which should be reported in detail to RBI’s Department of Banking Supervision indicating the nature of the case

? Prohibiting dealers from nominating a broker in transactions not done through that broker.

? Rules for the prompt investigation of complaints against dealers and malpractices by brokers and reporting to FEDAI and RBI’s Department of Banking Supervision.

? Dealing Hours - All Dealers should be aware of the bank's normal trading hours, cut off time for overnight positions and rules governing after hours and off-site trading (if allowed by the bank)

? Security and Confidentiality - All dealers should be aware of the bank's requirements in respect of maintaining confidentiality over its own and its customers' trading activities as well as the responsibility for secure maintenance of access media, keys, passwords and PINS.

? Staff Rotation and leave requirements - All dealers should be aware of the requirement to take at least one period of leave of not less than 14 days continuously per annum, and the bank's internal policy in regards to staff rotation.

3.6 The Back Office:
The key controls over market risk activities, and particularly over Dealing Room activities, exist in the Back Office. It is critical that both a clear segregation of duties and reporting lines is maintained between Dealing Room staff and Back Office staff, as well as clearly defined physical and systems access between the two areas. It is essential that
critical Back Office controls are executed diligently and completely at all times including:

? **The control over confirmations both inward and outward**: All confirmations for transactions concluded by the Dealing Room must be issued and received by the Back Office only. Discrepancies in transaction details, non-receipts and receipts of confirmations without application must be resolved promptly to avoid instances of unrecorded risk exposure.

? **The control over dealing accounts** (vostros and nostros)- Prompt reconciliation of all dealing accounts is an essential control to ensure accurate identification of risk exposures. Discrepancies, non-receipts and receipts of funds without application must be resolved promptly to avoid instances of unrecorded risk exposure. Unreconciled items and discrepancies in these accounts must be kept under heightened management supervision as such discrepancies may at times have significant liquidity impacts, represent unrecognised risk exposures, or at worst represent collusion or fraud.

? **Revaluations and marking-to-market of market risk exposures**: All market rates used by the bank for marking risk exposures to market, used to revalue assets or for risk analysis models such as Value at Risk analysis, must be sourced independently of the Dealing Room to provide an independent risk and performance assessment. If the bank has an established and independent Middle Office function, this responsibility may properly pass to the Middle Office.

? **Monitoring and reporting of risk limits and usage**: Reporting of usage of risk against limits established by the Risk Management Committee (as well as Credit Department for Counterparty risk limits) should be maintained by the Back Office independently of the Dealing Room. Maintenance of all limit systems must also be undertaken by the Back Office and access to limit systems (such as counterparty limits, overnight limits etc.) must be secure from access and tampering by unauthorised personnel. If the bank has an established and independent Middle Office function, this responsibility may properly pass to the Middle Office.
Control over payments systems: The procedures and systems for making payments must be under at least dual control in the Back Office independent from the dealing function. Payments systems should be at all times secure from access or tampering by unauthorised personnel.
Liquidity Risk Management

4.1 Liquidity risk is the potential inability to meet the bank’s liabilities as they become due. It arises when the banks are unable to generate cash to cope with a decline in deposits or increase in assets. It originates from the mismatches in the maturity pattern of assets and liabilities. Measuring and managing liquidity needs are vital for effective operation of commercial banks. By assuring a bank’s ability to meet its liabilities as they become due, liquidity management can reduce the probability of an adverse situation developing.

4.2 Analysis of liquidity risk involves the measurement of not only the liquidity position of the bank on an ongoing basis but also examining how funding requirements are likely to be affected under crisis scenarios. Net funding requirements are determined by analysing the bank’s future cash flows based on assumptions of the future behaviour of assets and liabilities that are classified into specified time buckets and then calculating the cumulative net flows over the time frame for liquidity assessment.

4.3 Future cash flows are to be analysed under “what if” scenarios so as to assess any significant positive / negative liquidity swings that could occur on a day-to-day basis and under bank specific and general market crisis scenarios. Factors to be taken into consideration while determining liquidity of the bank’s future stock of assets and liabilities include their potential marketability, the extent to which maturing assets /liability will be renewed, the acquisition of new assets / liability and the normal growth in asset / liability accounts.

4.4 Factors affecting the liquidity of assets and liabilities of the bank cannot always be forecast with precision; hence they need to be reviewed frequently to determine their continuing validity, especially given the rapidity of change in financial markets.

4.5 The liquidity risk in banks manifest in different dimensions:

i) Funding Risk – need to replace net outflows due to unanticipated withdrawal/non-renewal of deposits (wholesale and retail);

ii) Time Risk - need to compensate for non-receipt of expected inflows of funds, i.e. performing assets turning into non-performing assets; and
iii) **Call Risk** - due to crystallisation of contingent liabilities and unable to undertake profitable business opportunities when desirable.

4.6 The first step towards liquidity management is to put in place an effective liquidity management policy, which, *inter alia*, should spell out the funding strategies, liquidity planning under alternative scenarios, prudential limits, liquidity reporting / reviewing, etc. Liquidity measurement is quite a difficult task and can be measured through stock or cash flow approaches. The key ratios, adopted across the banking system are Loans to Total Assets, Loans to Core Deposits, Large Liabilities (minus) Temporary Investments to Earning Assets (minus) Temporary Investments, Purchased Funds to Total Assets, Loan Losses/Net Loans, etc.

4.7 While the liquidity ratios are the ideal indicator of liquidity of banks operating in developed financial markets, the ratios do not reveal the intrinsic liquidity profile of Indian banks which are operating generally in an illiquid market. Experiences show that assets commonly considered as liquid like Government securities, other money market instruments, etc. have limited liquidity as the market and players are unidirectional. Thus, analysis of liquidity involves tracking of cash flow mismatches. For measuring and managing net funding requirements, the use of maturity ladder and calculation of cumulative surplus or deficit of funds at selected maturity dates is recommended as a standard tool. The format prescribed by RBI in this regard under ALM System should be adopted for measuring cash flow mismatches at different time bands. The cash flows should be placed in different time bands based on future behaviour of assets, liabilities and off-balance sheet items. In other words, banks should have to analyse the behavioural maturity profile of various components of on / off-balance sheet items on the basis of assumptions and trend analysis supported by time series analysis. Banks should also undertake variance analysis, at least, once in six months to validate the assumptions. The assumptions should be fine-tuned over a period which facilitate near reality predictions about future behaviour of on / off-balance sheet items. Apart from the above cash flows, banks should also track the impact of prepayments of loans, premature closure of deposits and exercise of options built in certain instruments which offer put/call options after specified times. Thus, cash outflows can be ranked by the date on
which liabilities fall due, the earliest date a liability holder could exercise an early repayment option or the earliest date contingencies could be crystallised.

4.8 The difference between cash inflows and outflows in each time period, the excess or deficit of funds, becomes a starting point for a measure of a bank’s future liquidity surplus or deficit, at a series of points of time. The banks should also consider putting in place certain prudential limits as detailed below to avoid liquidity crisis:
1. Cap on inter-bank borrowings, especially call borrowings;
2. Purchased funds vis-à-vis liquid assets;
3. Core deposits vis-à-vis Core Assets i.e. Cash Reserve Ratio, Liquidity Reserve Ratio and Loans;
4. Duration of liabilities and investment portfolio;
5. Maximum Cumulative Outflows across all time bands;
6. Commitment Ratio – track the total commitments given to corporates/banks and other financial institutions to limit the off-balance sheet exposure;
7. Swapped Funds Ratio, i.e. extent of Indian Rupees raised out of foreign currency sources.

4.9 Banks should also evolve a system for monitoring high value deposits (other than inter-bank deposits) say Rs.1 crore or more to track the volatile liabilities. Further, the cash flows arising out of contingent liabilities in normal situation and the scope for an increase in cash flows during periods of stress should also be estimated. It is quite possible that market crisis can trigger substantial increase in the amount of draw downs from cash credit/overdraft accounts, contingent liabilities like letters of credit, etc.

4.10 The liquidity profile of the banks could be analysed on a static basis, wherein the assets and liabilities and off-balance sheet items are pegged on a particular day and the behavioural pattern and the sensitivity of these items to changes in market interest rates and environment are duly accounted for. The banks can also estimate the liquidity profile on a dynamic way by giving due importance to:
1) Seasonal pattern of deposits/loans;
2) Potential liquidity needs for meeting new loan demands, unavailed credit limits, potential deposit losses, investment obligations, statutory obligations, etc.
4.11 Contingency Funding Plan

All banks are required to produce a Contingency Funding Plan. These plans are to be prepared by the ALCO, submitted annually as part of the Liquidity and Capital Plan, and reviewed quarterly.

Contingency Funding Plans are liquidity stress tests designed to quantify the likely impact of an event on the balance sheet and the net potential cumulative gap over a 3-month period. The plan also evaluates the ability of the bank to withstand a prolonged adverse liquidity environment. At least two scenarios require testing: Scenario A, a local liquidity crisis, and Scenario B, where there is a nationwide name problem or a downgrade in the credit rating if the bank is publicly rated.

The bank’s contingency funding plans should reflect the funding needs of any bank managed mutual fund whose own Contingency Funding Plan indicates a need for funding from the bank.

Reports of Contingency Funding plans should be performed at least quarterly and reported to ALCO.

If a Contingency Funding plan results in a funding gap within a 3-month time frame, the ALCO must establish an action plan to address this situation. The Risk Policy Committee should approve the action plan.

At a minimum, Contingency Funding plans under each scenario must consider the impact of accelerated runoff of Large Funds Providers.

The plans must consider the impact of a progressive, tiered deterioration, as well as sudden, drastic events.

Balance sheet actions and incremental sources of funding should be dimensioned with sources, time frame and incremental marginal cost and included in the Contingency Funding plans for each scenario.

Assumptions underlying the Contingency Funding plans, consistent with each scenario, must be reviewed and approved by ALCO.

The Chief Executive / Chairman must be advised as soon as a decision has been made to activate or implement a Contingency Funding Plan. Implementation of a Contingency
Funding Plan may be called for by either the Chief Executive or the Risk Policy Committee.

The ALCO will implement the Contingency Funding Plan, amending it in agreement with the Risk Policy Committee, where necessary, to meeting changing conditions; daily reports are to be submitted to the Treasury Head and the Risk Policy Committee, comparing actual cashflows with the assumptions of the Contingency Funding Plan.
Interest Rate Risk (IRR) Management

5.1 Interest rate risk is the risk where changes in market interest rates might adversely affect a bank’s financial condition. The immediate impact of changes in interest rates is on the Net Interest Income (NII). A long term impact of changing interest rates is on the bank’s networth as the economic value of bank’s assets, liabilities and off-balance sheet positions get affected due to variation in market interest rates. The interest rate risk when viewed from these two perspectives is known as ‘earnings perspective’ and ‘economic value’ perspective, respectively.

5.2 Management of interest rate risk aims at capturing the risks arising from the maturity and repricing mismatches and is measured both from the earnings and economic value perspective.

Earnings perspective involves analysing the impact of changes in interest rates on accrual or reported earnings in the near term. This is measured by measuring the changes in the Net Interest Income (NII) or Net Interest Margin (NIM) i.e. the difference between the total interest income and the total interest expense.

Economic Value perspective involves analysing the expected cash flows on assets minus the expected cash flows on liabilities plus the net cash flows on off-balance sheet items. It focuses on the risk to networth arising from all repricing mismatches and other interest rate sensitive positions. The economic value perspective identifies risk arising from long-term interest rate gaps.

5.3 The management of Interest Rate Risk should be one of the critical components of market risk management in banks. The regulatory restrictions in the past had greatly reduced many of the risks in the banking system. Deregulation of interest rates has, however, exposed them to the adverse impacts of interest rate risk. The Net Interest Income (NII) or Net Interest Margin (NIM) of banks is dependent on the movements of interest rates. Any mismatches in the cash flows (fixed assets or liabilities) or repricing dates (floating assets or liabilities), expose bank’s NII or NIM to variations. The earning of assets and the cost of liabilities are now closely related to market interest rate volatility.
5.4 Generally, the approach towards measurement and hedging of IRR varies with the segmentation of the balance sheet. In a well functioning risk management system, banks broadly position their balance sheet into Trading and Banking Books. While the assets in the trading book are held primarily for generating profit on short-term differences in prices/yields, the banking book comprises assets and liabilities, which are contracted basically on account of relationship or for steady income and statutory obligations and are generally held till maturity. Thus, while the price risk is the prime concern of banks in trading book, the earnings or economic value changes are the main focus of banking book.

5.5 Trading Book
The top management of banks should lay down policies with regard to volume, maximum maturity, holding period, duration, stop loss, defeasance period, rating standards, etc. for classifying securities in the trading book. While the securities held in the trading book should ideally be marked to market on a daily basis, the potential price risk to changes in market risk factors should be estimated through internally developed Value at Risk (VaR) models. The VaR method is employed to assess potential loss that could crystalise on trading position or portfolio due to variations in market interest rates and prices, using a given confidence level, usually 95% to 99%, within a defined period of time. The VaR method should incorporate the market factors against which the market value of the trading position is exposed. The top management should put in place bank-wide VaR exposure limits to the trading portfolio (including forex and gold positions, derivative products, etc.) which is then disaggregated across different desks and departments. The loss making tolerance level should also be stipulated to ensure that potential impact on earnings is managed within acceptable limits. The potential loss in Present Value Basis Points should be matched by the Middle Office on a daily basis vis-à-vis the prudential limits stipulated (see section 2.5 for mandatory risk limits). The advantage of using VaR is that it is comparable across products, desks and Departments and it can be validated through ‘back testing’. However, VaR models require the use of extensive historical data to estimate future volatility. VaR model also may not give good results in extreme volatile conditions or outlier events and stress test has to be employed to complement VaR. The stress tests provide management a view on the potential impact
of large size market movements and also attempt to estimate the size of potential losses due to stress events, which occur in the ‘tails’ of the loss distribution. Banks may also undertake scenario analysis with specific possible stress situations (recently experienced in some countries) by linking hypothetical, simultaneous and related changes in multiple risk factors present in the trading portfolio to determine the impact of moves on the rest of the portfolio. VaR models could also be modified to reflect liquidity risk differences observed across assets over time. International banks are now estimating Liquidity adjusted Value at Risk (LaVaR) by assuming variable time horizons based on position size and relative turnover. In an environment where VaR is difficult to estimate for lack of data, non-statistical concepts such as stop loss and gross/net positions can be used.

5.6 Banking Book
The changes in market interest rates have earnings and economic value impacts on the bank’s banking book. Thus, given the complexity and range of balance sheet products, banks should have IRR measurement systems that assess the effects of the rate changes on both earnings and economic value. The variety of techniques ranges from simple maturity (fixed rate) and repricing (floating rate) gaps and duration gaps to static simulation, based on current on-and-off-balance sheet positions, to highly sophisticated dynamic modelling techniques that incorporate assumptions on behavioural pattern of assets, liabilities and off-balance sheet items and can easily capture the full range of exposures against basis risk, embedded option risk, yield curve risk, etc.

5.7 Rigidities and the remedial measures:
5.7.1 However, there are certain rigidities at micro level of banks and also at the systemic level, which the banks have to address. At the micro level, the banks have to strengthen their Management Information System (MIS) and computer processing capabilities for accurate measurement of interest rate risk in their banking books, which impact, in the short-term, their net interest income (NII) or net interest margin (NIM) or “spread” and in the long-term, the economic value of the bank.

5.7.2 At the systemic level, the rigidities are the following:
Most of the liabilities of banks, like deposits and borrowings, are on fixed interest rate basis while their assets like loans and advances are on floating rate basis.

There is still some regulation in place on interest rates in the system, such as savings bank deposit, export credit, refinances, etc.

There is no definite interest rate repricing dates for floating Prime Lending Rate (PLR) based products like loans and advances, thereby placing them in accurate time buckets for measurement of interest rate risk difficult.

The RBI has taken a number of measures to correct the systemic rigidities, like introduction of:

- Floating rate deposits,
- Fixed rate lending,
- Tenor-linked PLR,
- Interest rate derivative products like Interest Rate Swaps (IRSs) and Forward Rate Agreements (FRAs), and
- For pricing of rupee interest rate derivatives, banks have been allowed to use interest rate implied in foreign exchange forward market, etc.

5.7.3 In order to align the Indian accounting standards with the international best practices and taking into consideration the evolving international developments, the norms for classification and valuation of investments have been modified with effect from September 30, 2000. Now, the entire investment portfolio is required to be classified under three categories, viz., **Held to Maturity**, **Available for Sale** and **Held for Trading**. While the securities ‘Held for Trading’ and ‘Available for Sale’ should be marked to market periodically, the securities ‘Held to Maturity’, which should not exceed 25% of the total investments need not be marked to market.

5.8 The Narasimham Committee II on Banking Sector Reforms had recommended that in order to capture market risk in the investment portfolio, a risk-weight of 5% should be applied for Government and other approved securities for the purpose of capital adequacy. The Reserve Bank of India has prescribed 2.5% risk-weight for capital adequacy for market risk on SLR and non-SLR securities, with effect from 31 March 2000 and 2001 respectively, in addition to appropriate risk-weights for credit risk. It may
be mentioned here that the Basle Committee on Banking Supervision (BCBS) of the Bank for International Settlements (BIS) has introduced capital charge for market risk, inter alia, for the interest rate related instruments and equity positions in the trading book and gold and forex position in both trading and banking books. The banks in India are required to apply the 2.5% risk-weight for capital charge for market risk for the whole investment portfolio and 100% risk-weight on open gold and forex position limits. In the “New Capital Adequacy Framework” consultative paper, the BCBS recognises the significance of interest rate risk in some banking books and proposes to develop a capital charge for interest rate risk in the banking book for banks where interest rate risks are significantly above average (“outliers”). (The proposed Basel Capital Accord is separately covered in Chapter 7 and annexure-1)

5.9 Equity Position Risk Management
Internationally banks use VaR models for management of equity position risk. The banks should devise specific price risk structure (like sensitivity limits, VAR, stop-loss limits) and the methods to measure liquidity of shares to mitigate equity position risk.
Foreign Exchange Risk Management

6.1 The risk inherent in running open foreign exchange positions have been heightened in recent years by the pronounced volatility in forex rates, thereby adding a new dimension to the risk profile of banks’ balance sheets. **Foreign Exchange Risk maybe defined as the risk that a bank may suffer losses as a result of adverse exchange rate movements during a period in which it has an open position, either spot or forward, or a combination of the two, in an individual foreign currency.** The banks are also exposed to interest rate risk, which arises from the maturity mismatching of foreign currency positions. Even in cases where spot and forward positions in individual currencies are balanced, the maturity pattern of forward transactions may produce mismatches. As a result, banks may suffer losses as a result of changes in premia/discounts of the currencies concerned.

6.2 In the forex business, banks also face the risk of default of the counterparties or settlement risk. While such type of risk crystallisation does not cause principal loss, banks may have to undertake fresh transactions in the cash/spot market for replacing the failed transactions. Thus, banks may incur replacement cost, which depends upon the currency rate movements. Banks also face another risk called time-zone risk or Herstatt risk which arises out of time-lags in settlement of one currency in one centre and the settlement of another currency in another time-zone. The forex transactions with counterparties from another country also trigger sovereign or country risk.

6.3 The three important issues that need to be addressed in this regard are:

? Nature and Magnitude of exchange risk

? The strategy to be adopted for hedging or managing exchange risk.

? The tools of managing exchange risk and their relative merits.

6.4 Nature and Magnitude of Risk

6.4.1 The first aspect of management of foreign exchange risk is to acknowledge that such risk does exist and that it must be managed to avoid adverse financial consequences. Many banks refrain from active management of their foreign exchange exposure because they feel that financial forecasting is outside their field of expertise or because they find it difficult to measure currency exposure precisely. However not recognising a risk would
not make it go away. Nor is the inability to measure risk any excuse for not managing it. Having recognized this fact the nature and magnitude of such risk must now be identified.

6.4.2 The basic difficulty in measuring exposure comes from the fact that available accounting information which provides the most reliable base to calculate exposure (accounting or translation exposure) does not capture the actual risk a bank faces, which depends on its future cash flows and their associated risk profiles (economic exposure). Also there is the distinction between the currency in which cash flows are denominated and the currency that determines the size of the cash flows. For instance a borrower selling jewellery in Europe may keep its records in Rupees, invoice in Euros, and collect Euro cash flow, only to find that its revenue stream behaves as if it were in U.S. dollars! This occurs because Euro-prices for the exports might adjust to reflect world market prices which could be determined in U.S. dollars.

6.4.3 Another dimension of exchange risk involves the element of time. In the very short run, virtually all local currency prices for goods and services (although not necessarily for financial assets) remain unchanged after an unexpected exchange rate change. However, over a longer period of time, prices and costs respond to price changes. It is therefore necessary to determine the time frame within which the bank can react to (unexpected) rate changes.

6.4.4 For a bank, being a financial entity, it is relatively easier to gauge the nature as well as the measure of forex risk simply because all financial assets/liabilities are denominated in a currency. A bank’s future cash streams are more predictable than those of a non-financial firm. Its net exposure, or position, completely encapsulates the measure of its exposure to forex risk.

6.4.5 In order to manage forex risk some forex market relationships need to be understood well. The first and most important of these is the covered interest parity relationship. If there is free and unrestricted mobility of capital, the interest differential between two currencies will equal the forward premium/discount for either of the currency. This relationship must hold under the assumptions; otherwise arbitrage opportunities will arise to restore the relationship. However, in the case of Rupee, since it is not totally convertible, this relationship does not hold exactly. Although interest rate differentials are the driving factor for the Dollar premium against the Rupee, it also is a
factor of forward demand / supply factors. This brings in typical complications to forward hedging which must be taken into account.

6.4.6 From the above it can easily be determined that a currency with a lower interest rate will be at a premium to a currency with a higher interest rate. The other relationships in the forex market are not as deterministic as the covered interest parity, but needs to be recognised to manage forex exposure because they are the theoretical tools used for predicting exchange rate movements, essential to any hedging strategy particularly to economic risk as opposed to accounting risk. The most important of these is the Purchasing Power Parity relationship which says exchange rate changes are determined by inflation differentials. The Uncovered Interest Parity theory says that the forward exchange rate is the best and unbiased predictor of future spot rates under risk neutrality. These relationships have to be clearly understood for any meaningful forex risk management process.

6.5 Managing Forex Exposure

6.5.1 For a bank therefore the first major decision on forex risk management is for the management to fix its open foreign exchange position. Although typically this is a management decision, it could also be subject to regulatory capital and could also be required to be in tune with the regulatory environment that prevails. These open position limits have two aspects, the **Daylight limit** and the **Overnight limit**. The daylight limit could typically be substantially higher for two reasons, (a) It is easier to manage exchange risk when the market is open and the bank is actively present in the market and (b) the bank needs a higher limit to accommodate client flows during business hours. Overnight position, being subject to more uncertainty and therefore being more risky should be much lower.

6.5.2 Having decided on the overall open position limits, the next step is to allocate these limits among different operating centres of the bank (in the case of banks which hold positions at multiple centres). Within a centre there could be a further allocation among different dealers. It must however be ensured that the bank has a system to monitor the overall open position limit for the bank on a **real time basis**.

6.6 Tools and Techniques for managing forex risk
6.6.1 There are various tools, often substitutes, available for hedging of foreign exchange risk like over the counter forwards, futures, money market instruments, options and the like. Most currency management instruments enable the bank to take a long or a short position to hedge an opposite short or long position. In equilibrium and in an efficient market the cost of all will be the same, according to the fundamental relationships. Also tools differ in that they hedge different risks. In particular, symmetric hedging tools like futures cannot easily hedge contingent cash flows where risk is non-linear: options may be better suited to the latter.

6.6.2 **Foreign exchange forward contracts** are the most common means of hedging transactions in foreign currencies. However since they require future performance, and if one party is unable to perform on the contract, the hedge disappears, bringing in replacement risk which could be high. This default risk also means that many banks may not have access to the forward market to adequately hedge their exchange exposure. For such situations, futures may be more suitable where available since they are exchange traded and effectively minimise default risk. However, futures are standardised and therefore may not be as versatile in terms of quantity and tenor as over the counter forward contracts. This in turn gives rise to assumption of basis risk.

6.6.3 Money market borrowing to invest in interest-bearing assets to offset a foreign currency payment – also serves the same purpose as forward contracts. This follows from the covered interest parity principle. Since the carrying cost of a position is the same in either, the forex or the money market hedging can also be done in either market. For instance, let us say a bank has a short forward Dollar position. It can of course hedge the position by buying forward Dollars. Alternatively it can borrow Rupees now, buy Dollar with the proceeds, and place the Dollars in a forward deposit to meet the short Dollar position on maturity. The Rupees received on the sale on maturity are used to pay off the Rupee borrowing. The cost of this money market hedge is the difference between the Rupee interest rate paid and the US dollar interest rate earned. According to the interest rate parity theorem, the interest differential equals the forward exchange premium, the percentage by which the forward rate differs from the spot exchange rate. So the cost of the money market hedge should be the same as the forward or futures market hedge.

6.6.4 **Currency options** are another tool for managing forex risk. A foreign exchange option is a contract for future delivery of a currency in exchange for another, where the
holder of the option has the right to buy (or sell) the currency at an agreed price, the
strike or exercise price, but is not required to do so. The right to buy is a call; the right to
sell, a put. For such a right he pays a price called the option premium. The option seller
receives the premium and is obliged to make (or take) delivery at the agreed-upon price if
the buyer exercises his option. In some options, the instrument being delivered is the
currency itself; in others, a futures contract on the currency. American options permit
the holder to exercise at any time before the expiration date; European options, only on
the expiration date.

6.6.5 Futures and forwards are contracts in which two parties oblige themselves to
exchange something in the future. They are thus useful to hedge or convert known
currency or interest rate exposures. An option, in contrast, gives one party the right but
not the obligation to buy or sell an asset under specified conditions while the other party
assumes an obligation to sell or buy that asset if that option is exercised. Options being
non-linear instruments are more difficult to price and therefore their risk profiles need to
be well understood before they can be used. For example it needs to be understood that
the value of a currency changes not just when exchange rate changes (the event for which
the bank usually hedges using forwards/futures) but also if the underlying volatility of the
currency pair changes, a risk banks are not directly concerned with while hedging.

6.7 Treasury operations.

6.7.1 The primary treasury operation of a bank is that of catering to customer needs, both
in the spot as well as forward market. This lands the bank with net foreign exchange
positions which it needs to manage on a real time basis. If the bank needs to sell Dollars
forward to an importer, the bank has a short Dollar position. It can offset the position by
buying matching forward Dollars in the market in which case all risks apart from the
profit element are covered for the bank. However, it may be easier for the bank to
immediately cover the forex risk with a purchase of Dollars in the spot market. Here
again the exchange risk is fully covered except for the profit element. However the bank
now has a swap position. This is called a gap. The bank has a gap risk which affects it if
interest rates change affecting the forward premia for Dollar. In the case of our domestic
markets, in addition, premia could also change due to forward demand/supply factors.
However, gap risks are easier to manage than exchange risks. So the bank can build up
gaps, subject to the management mandated gap limits, and do offsetting swaps to reduce gap risks if it so desires periodically.

6.7.2 The bank’s treasury might also do transactions to take advantage of disequilibrium situations, subject to such transactions being permissible. For instance if the forward premium for 6 months is say 5% while the 6-month interest differential between Rupee and Dollar is say 4%, the bank can receive in the forex market (buy spot, sell 6-month swap to earn 5% annualized for 6 months) and finance the transaction by borrowing in the money market (money market cost being 4% annualized for 6 months).

6.7.3 The bank can also do transactions to take advantage of expected interest rate changes. It can then use either the money market route (mismatched cash-flow maturities) or the forex market route (by running a gap risk).

6.7.4 The bank of course also trades on currency movements with a view to make profits. Here the management must keep in place systems of stop loss discipline, proper monitoring and evaluation of open positions, etc.

6.8 Risk Control Systems:
The management of the bank need to lay out clear and unambiguous performance measurement criteria, accountability norms and financial limits in its treasury operations. Management must specify in operational terms the goals of exchange risk management. It must also clearly recognise the risks of trading arising from open positions, credit risks, and operations risks. The bank must also keep in place a system to independently evaluate through marking to market the net positions taken. Marking to market should ideally be based on objective market prices provided by an external agency. All position limits should be made explicit and expressed in simple terms for easy control.
7.1 The Basle Committee on Banking Supervision (BCBS) had issued comprehensive guidelines to provide an explicit capital cushion for the price risks to which banks are exposed, particularly those arising from their trading activities. The banks have been given flexibility to use in-house models based on VaR for measuring market risk as an alternative to a standardised measurement framework suggested by Basle Committee. The internal models should, however, comply with quantitative and qualitative criteria prescribed by Basle Committee.

7.2 Reserve Bank of India has accepted the general framework suggested by the Basle Committee. RBI has also initiated various steps in moving towards prescribing capital for market risk. As an initial step, a risk weight of 2.5% has been prescribed for investments in Government and other approved securities, besides a risk weight each of 100% on the open position limits in forex and gold. RBI has also prescribed detailed operating guidelines for Asset-Liability Management System in banks. As the ability of banks to identify and measure market risk improves, it would be necessary to assign explicit capital charge for market risk. While the small banks operating predominantly in India could adopt the standardised methodology, large banks and those banks operating in international markets should develop expertise in evolving internal models for measurement of market risk.

7.3 The Basle Committee on Banking Supervision proposes to develop capital charge for interest rate risk in the banking book as well for banks where the interest rate risks are significantly above average (‘outliers’). The Committee is now exploring various methodologies for identifying ‘outliers’ and how best to apply and calibrate a capital charge for interest rate risk for banks. Once the Committee finalises the modalities, it may be necessary, at least for banks operating in the international markets to comply with the explicit capital charge requirements for interest rate risk in the banking book.

7.4 The Proposed New Capital Adequacy Framework
The Basel Committee on Banking Supervision has released a Second Consultative Document, which contains refined proposals for the three pillars of the New Accord –
Minimum Capital Requirements, Supervisory Review and Market Discipline. It may be recalled that the Basel Committee had released in June 1999 the first Consultative Paper on a *New Capital Adequacy Framework* for comments. However, the proposal to provide explicit capital charge for market risk in the banking book which was included in the Pillar I of the June 1999 Document has been shifted to Pillar II in the second Consultative Paper issued in January 2001. The Committee has also provided a technical paper on evaluation of interest rate risk management techniques. The Document has defined the criteria for identifying *outlier* banks. According to the proposal, a bank may be defined as an outlier whose economic value declined by more than 20% of the sum of Tier 1 and Tier 2 capital as a result of a standardised interest rate shock (200 bps.).

7.5 The second Consultative Paper on the New Capital Adequacy framework issued in January, 2001 has laid down 13 principles intended to be of general application for the management of interest rate risk, independent of whether the positions are part of the trading book or reflect banks’ non-trading activities. They refer to an interest rate risk management process, which includes the development of a business strategy, the assumption of assets and liabilities in banking and trading activities, as well as a system of internal controls. In particular, they address the need for effective interest rate risk measurement, monitoring and control functions within the interest rate risk management process. The principles are intended to be of general application, based as they are on practices currently used by many international banks, even though their specific application will depend to some extent on the complexity and range of activities undertaken by individual banks. Under the New Basel Capital Accord, they form minimum standards expected of internationally active banks. The principles are given in Annexure I.
Annexure I
BCBS Principles for Interest Rate Risk Management

Board and senior management oversight of interest rate risk

**Principle 1**: In order to carry out its responsibilities, the board of directors in a bank should approve strategies and policies with respect to interest rate risk management and ensure that senior management takes the steps necessary to monitor and control these risks. The board of directors should be informed regularly of the interest rate risk exposure of the bank in order to assess the monitoring and controlling of such risk.

**Principle 2**: Senior management must ensure that the structure of the bank's business and the level of interest rate risk it assumes are effectively managed, that appropriate policies and procedures are established to control and limit these risks, and that resources are available for evaluating and controlling interest rate risk.

**Principle 3**: Banks should clearly define the individuals and/or committees responsible for managing interest rate risk and should ensure that there is adequate separation of duties in key elements of the risk management process to avoid potential conflicts of interest. Banks should have risk measurement, monitoring and control functions with clearly defined duties that are sufficiently independent from position-taking functions of the bank and which report risk exposures directly to senior management and the board of directors. Larger or more complex banks should have a designated independent unit responsible for the design and administration of the bank's interest rate risk measurement, monitoring and control functions.

Adequate risk management policies and procedures

**Principle 4**: It is essential that banks' interest rate risk policies and procedures are clearly defined and consistent with the nature and complexity of their activities. These policies should be applied on a consolidated basis and, as appropriate, at the level of individual affiliates, especially when recognising legal distinctions and possible obstacles to cash movements among affiliates.

**Principle 5**: It is important that banks identify the risks inherent in new products and activities and ensure these are subject to adequate procedures and controls before being introduced or undertaken. Major hedging or risk management initiatives should be approved in advance by the board or its appropriate delegated committee.
Risk measurement, monitoring and control functions

Principle 6: It is essential that banks have interest rate risk measurement systems that capture all material sources of interest rate risk and that assess the effect of interest rate changes in ways that are consistent with the scope of their activities. The assumptions underlying the system should be clearly understood by risk managers and bank management.

Principle 7: Banks must establish and enforce operating limits and other practices that maintain exposures within levels consistent with their internal policies.

Principle 8: Banks should measure their vulnerability to loss under stressful market conditions - including the breakdown of key assumptions - and consider those results when establishing and reviewing their policies and limits for interest rate risk.

Principle 9: Banks must have adequate information systems for measuring, monitoring, controlling and reporting interest rate exposures. Reports must be provided on a timely basis to the bank's board of directors, senior management and, where appropriate, individual business line managers.

Internal controls

Principle 10: Banks must have an adequate system of internal controls over their interest rate risk management process. A fundamental component of the internal control system involves regular independent reviews and evaluations of the effectiveness of the system and, where necessary, ensuring that appropriate revisions or enhancements to internal controls are made. The results of such reviews should be available to the relevant supervisory authorities.

Information for supervisory authorities

Principle 11: Supervisory authorities should obtain from banks sufficient and timely information with which to evaluate their level of interest rate risk. This information should take appropriate account of the range of maturities and currencies in each bank's portfolio, including off-balance sheet items, as well as other relevant factors, such as the distinction between trading and non-trading activities.
Capital adequacy

**Principle 12:** Banks must hold capital commensurate with the level of interest rate risk they undertake.

Disclosure of interest rate risk

**Principle 13:** Banks should release to the public information on the level of interest rate risk and their policies for its management.
Annexure-II

Sources, effects and measurement of interest rate risk

Interest rate risk is the exposure of a bank's financial condition to adverse movements in interest rates. Accepting this risk is a normal part of banking and can be an important source of profitability and shareholder value. However, excessive interest rate risk can pose a significant threat to a bank's earnings and capital base. Changes in interest rates affect a bank's earnings by changing its net interest income and the level of other interest-sensitive income and operating expenses. Changes in interest rates also affect the underlying value of the bank's assets, liabilities and off-balance sheet instruments because the present value of future cash flows (and in some cases, the cash flows themselves) change when interest rates change.

A. Sources of Interest Rate Risk

Repricing risk: As financial intermediaries, banks encounter interest rate risk in several ways. The primary and most often discussed form of interest rate risk arises from timing differences in the maturity (for fixed rate) and repricing (for floating rate) of bank assets, liabilities and off-balance-sheet (OBS) positions. While such repricing mismatches are fundamental to the business of banking, they can expose a bank's income and underlying economic value to unanticipated fluctuations as interest rates vary. For instance, a bank that funded a long-term fixed rate loan with a short-term deposit could face a decline in both the future income arising from the position and its underlying value if interest rates increase. These declines arise because the cash flows on the loan are fixed over its lifetime, while the interest paid on the funding is variable, and increases after the short-term deposit matures.

Yield curve risk: Repricing mismatches can also expose a bank to changes in the slope and shape of the yield curve. Yield curve risk arises when unanticipated shifts of the yield curve have adverse effects on a bank's income or underlying economic value. For instance, the underlying economic value of a long position in 10-year government bonds hedged by a short position in 5-year government notes could decline sharply if the yield curve steepens, even if the position is hedged against parallel movements in the yield curve.
**Basis risk:** Another important source of interest rate risk (commonly referred to as basis risk) arises from imperfect correlation in the adjustment of the rates earned and paid on different instruments with otherwise similar repricing characteristics. When interest rates change, these differences can give rise to unexpected changes in the cash flows and earnings spread between assets, liabilities and OBS instruments of similar maturities or repricing frequencies.

**Optionality:** An additional and increasingly important source of interest rate risk arises from the options embedded in many bank assets, liabilities and OBS portfolios. Formally, an option provides the holder the right, but not the obligation, to buy, sell, or in some manner alter the cash flow of an instrument or financial contract. Options may be stand alone instruments such as exchange-traded options and over-the-counter (OTC) contracts, or they may be embedded within otherwise standard instruments. While banks use exchange-traded and OTC-options in both trading and non-trading accounts, instruments with embedded options are generally most important in non-trading activities. They include various types of bonds and notes with call or put provisions, loans which give borrowers the right to prepay balances, and various types of non-maturity deposit instruments which give depositors the right to withdraw funds at any time, often without any penalties. If not adequately managed, the asymmetrical payoff characteristics of instruments with optionality features can pose significant risk particularly to those who sell them, since the options held, both explicit and embedded, are generally exercised to the advantage of the holder and the disadvantage of the seller. Moreover, an increasing array of options can involve significant leverage which can magnify the influences (both negative and positive) of option positions on the financial condition of the firm.

**B. Effects of Interest Rate Risk**

As the discussion above suggests, changes in interest rates can have adverse effects both on a bank's earnings and its economic value. This has given rise to two separate, but complementary, perspectives for assessing a bank's interest rate risk exposure.

**Earnings perspective:** In the earnings perspective, the focus of analysis is the impact of changes in interest rates on accrual or reported earnings. This is the traditional approach to interest rate risk assessment taken by many banks. Variation in earnings is an important focal point for interest rate risk analysis because reduced earnings or outright
losses can threaten the financial stability of an institution by undermining its capital adequacy and by reducing market confidence. In this regard, the component of earnings that has traditionally received the most attention is net interest income (i.e. the difference between total interest income and total interest expense). This focus reflects both the importance of net interest income in banks' overall earnings and its direct and easily understood link to changes in interest rates. However, as banks have expanded increasingly into activities that generate fee-based and other non-interest income, a broader focus on overall net income - incorporating both interest and non-interest income and expenses - has become more common. The non-interest income arising from many activities, such as loan servicing and various asset securitisation programs, can be highly sensitive to market interest rates. For example, some banks provide the servicing and loan administration function for mortgage loan pools in return for a fee based on the volume of assets it administers. When interest rates fall, the servicing bank may experience a decline in its fee income as the underlying mortgages prepay. In addition, even traditional sources of non-interest income such as transaction processing fees are becoming more interest rate sensitive. This increased sensitivity has led both bank management and supervisors to take a broader view of the potential effects of changes in market interest rates on bank earnings and to factor these broader effects into their estimated earnings under different interest rate environments.

**Economic value perspective**: Variation in market interest rates can also affect the economic value of a bank's assets, liabilities and OBS positions. Thus, the sensitivity of a bank's economic value to fluctuations in interest rates is a particularly important consideration of shareholders, management and supervisors alike. The economic value of an instrument represents an assessment of the present value of its expected net cash flows, discounted to reflect market rates. By extension, the economic value of a bank can be viewed as the present value of bank's expected net cash flows, defined as the expected cash flows on assets minus the expected cash flows on liabilities plus the expected net cash flows on OBS positions. In this sense, the economic value perspective reflects one view of the sensitivity of the net worth of the bank to fluctuations in interest rates. Since the economic value perspective considers the potential impact of interest rate changes on the present value of all future cash flows, it provides a more comprehensive view of the potential long-term effects of changes in interest rates than is offered by the
earnings perspective. This comprehensive view is important since changes in near-term earnings – the typical focus of the earnings perspective - may not provide an accurate indication of the impact of interest rate movements on the bank's overall positions.

**Embedded losses:** The earnings and economic value perspectives discussed thus far focus on how future changes in interest rates may affect a bank's financial performance. When evaluating the level of interest rate risk it is willing and able to assume, a bank should also consider the impact that past interest rates may have on future performance. In particular, instruments that are not marked to market may already contain embedded gains or losses due to past rate movements. These gains or losses may be reflected over time in the bank's earnings. For example, a long term fixed rate loan entered into when interest rates were low and refunded more recently with liabilities bearing a higher rate of interest will, over its remaining life, represent a drain on the bank's resources.

**C. Measuring Interest Rate Risk**

The techniques available for measuring interest rate risk range from calculations that rely on simple maturity and repricing tables, to static simulations based on current on- and off-balance sheet positions, to highly sophisticated dynamic modelling techniques that incorporate assumptions about the behaviour of the bank and its customers in response to changes in the interest rate environment. Some of these general approaches can be used to measure interest rate risk exposure from both an earnings and an economic value perspective, while others are more typically associated with only one of these two perspectives. In addition, the methods vary in their ability to capture the different forms of interest rate exposure: the simplest methods are intended primarily to capture the risks arising from maturity and repricing mismatches, while the more sophisticated methods can more easily capture the full range of risk exposures.

**Gap analysis:** Simple maturity/repricing schedules can be used to generate simple indicators of the interest rate risk sensitivity of both earnings and economic value to changing interest rates. When this approach is used to assess the interest rate risk of current earnings, it is typically referred to as gap analysis. Gap analysis was one of the first methods developed to measure a bank's interest rate risk exposure, and continues to be widely used by banks. To evaluate earnings exposure, interest rate sensitive liabilities
in each time band are subtracted from the corresponding interest rate sensitive assets to produce a repricing "gap" for that time band. This gap can be multiplied by an assumed change in interest rates to yield an approximation of the change in net interest income that would result from such an interest rate movement. The size of the interest rate movement used in the analysis can be based on a variety of factors, including historical experience, simulation of potential future interest rate movements, and the judgement of bank management.

A negative, or liability-sensitive, gap occurs when liabilities exceed assets (including off-balance sheet positions) in a given time band. This means that an increase in market interest rates could cause a decline in net interest income. Conversely, a positive, or asset-sensitive, gap implies that the bank's net interest income could decline as a result of a decrease in the level of interest rates.

**Limitations of Gap Analysis:** Although gap analysis is a very commonly used approach to assessing interest rate risk exposure, it has a number of shortcomings. First, gap analysis does not take account of variation in the characteristics of different positions within a time band. In particular, all positions within a given time band are assumed to mature or reprice simultaneously, a simplification that is likely to have greater impact on the precision of the estimates as the degree of aggregation within a time band increases. Moreover, gap analysis ignores differences in spreads between interest rates that could arise as the level of market interest rates changes (basis risk). In addition, it does not take into account any changes in the timing of payments that might occur as a result of changes in the interest rate environment. Thus, it fails to account for differences in the sensitivity of income that may arise from option-related positions. For these reasons, gap analysis provides only a rough approximation to the actual change in net interest income which would result from the chosen change in the pattern of interest rates. Finally, most gap analyses fail to capture variability in non-interest revenue and expenses, a potentially important source of risk to current income.

**Duration**

A maturity/repricing schedule can also be used to evaluate the effects of changing interest rates on a bank's economic value by applying sensitivity weights to each time band. Typically, such weights are based on estimates of the duration of the assets and liabilities
that fall into each time band. **Duration is a measure of the percent change in the economic value of a position that will occur given a small change in the level of interest rates.** Duration may also be defined as the weighted average of the time until expected cash flows from a security will be received, relative to the current price of the security. The weights are the present values of each cash flow divided by the current price. In its simplest form, duration measures changes in economic value resulting from a percentage change of interest rates under the simplifying assumptions that changes in value are proportional to changes in the level of interest rates and that the timing of payments is fixed.

**Modified duration** is standard duration divided by $1 + r$, where $r$ is the level of market interest rates - is an elasticity. As such, it reflects the percentage change in the economic value of the instrument for a given percentage change in $1 + r$. As with simple duration, it assumes a linear relationship between percentage changes in value and percentage changes in interest rates.

In other words, Modified Duration = Macaulay’s Duration/$(1+r)$, where

Macaulay’s Duration = $\frac{\sum \text{CF}_t/(1+r)/ \text{CF}_t/(1+r)^t}{\text{T}}$

$\text{CF}_t$=Rupee value of cash flow at time $t$

$\text{T}$= Number of periods of time until the cash flow payment

$r$=Periodic yield to maturity of the security generating cash flow and

$k$=the number of cash flows

Duration reflects the timing and size of cash flows that occur before the instrument's contractual maturity. Generally, the longer the maturity or next repricing date of the instrument and the smaller the payments that occur before maturity (e.g. coupon payments), the higher the duration (in absolute value). Higher duration implies that a given change in the level of interest rates will have a larger impact on economic value.

Duration-based weights can be used in combination with a maturity/ repricing schedule to provide a rough approximation of the change in a bank’s economic value that would occur given a particular change in the level of market interest rates. Specifically, an "average" duration is assumed for the positions that fall into each time band. The average durations are then multiplied by an assumed change in interest rates to construct a weight for each time band. In some cases, different weights are used for different positions that
fall within a time band, reflecting broad differences in the coupon rates and maturities (for instance, one weight for assets, and another for liabilities). In addition, different interest rate changes are sometimes used for different time bands, generally to reflect differences in the volatility of interest rates along the yield curve. The weighted gaps are aggregated across time bands to produce an estimate of the change in economic value of the bank that would result from the assumed changes in interest rates.

Alternatively, a bank could estimate the effect of changing market rates by calculating the precise duration of each asset, liability and off-balance sheet position and then deriving the net position for the bank based on these more accurate measures, rather than by applying an estimated average duration weight to all positions in a given time band. This would eliminate potential errors occurring when aggregating positions/cash flows. As another variation, risk weights could also be designed for each time band on the basis of actual percent changes in market values of hypothetical instruments that would result from a specific scenario of changing market rates. That approach - which is sometimes referred to as effective duration - would better capture the non-linearity of price movements arising from significant changes in market interest rates and, thereby, would avoid an important limitation of duration.

Estimates derived from a standard duration approach may provide an acceptable approximation of a bank's exposure to changes in economic value for relatively non-complex banks. Such estimates, however, generally focus on just one form of interest rate risk exposure - repricing risk. As a result, they may not reflect interest rate risk arising – for instance - from changes in the relationship among interest rates within a time band (basis risk). In addition, because such approaches typically use an average duration for each time band, the estimates will not reflect differences in the actual sensitivity of positions that can arise from differences in coupon rates and the timing of payments. Finally, the simplifying assumptions that underlie the calculation of standard duration means that the risk of options may not be well-captured.

The other methods of measurement of market risk, viz., Value at Risk (VaR) and Stress Testing Techniques are elaborately discussed in the subsequent chapters.
**Annexure-III**

**Value at Risk (VaR)**

**Definition:** VaR is defined as an estimate of potential loss in a position or asset/liability or portfolio of assets/liabilities over a given holding period at a given level of certainty.

VaR measures risk. Risk is defined as the probability of the unexpected happening - the probability of suffering a loss. VaR is an estimate of the loss likely to suffer, not the actual loss. The actual loss may be different from the estimate. It measures potential loss, not potential gain. Risk management tools measure potential loss as risk has been defined as the probability of suffering a loss. VaR measures the probability of loss for a given time period over which the position is held. The given time period could be one day or a few days or a few weeks or a year. VaR will change if the holding period of the position changes. The holding period for an instrument/position will depend on liquidity of the instrument/ market. With the help of VaR, we can say with varying degrees of certainty that the potential loss will not exceed a certain amount. This means that VaR will change with different levels of certainty.

The Bank for International Settlements (BIS) has accepted VaR as a measurement of market risks and provision of capital adequacy for market risks, subject to approval by banks' supervisory authorities.

**VaR Methodologies**

VAR can be arrived as

**The expected loss on a position from an adverse movement in identified market risk parameter(s) with a specified probability over a nominated period of time.**

Volatility in financial markets is usually calculated as the standard deviation of the percentage changes in the relevant asset price over a specified asset period. The volatility for calculation of VaR is usually specified as the standard deviation of the percentage change in the risk factor over the relevant risk horizon.

The following table describes the three main methodologies to calculate VaR:

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Description</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parametric</td>
<td>Estimates VaR with equation that</td>
<td>Accurate for traditional</td>
</tr>
<tr>
<td>Method</td>
<td>Description</td>
<td>Appropriate for</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Monte Carlo simulation</td>
<td>Estimates VaR by simulating random scenarios and revaluing positions in the portfolio</td>
<td>All types of instruments, linear and nonlinear</td>
</tr>
<tr>
<td>Historical simulation</td>
<td>Estimates Var by reliving history; takes actual historical rates and revalues positions for each change in the market</td>
<td>All types of instruments, linear and nonlinear</td>
</tr>
</tbody>
</table>

There are three main approaches to calculating value-at-risk: the correlation method, also known as the variance/covariance matrix method; historical simulation and Monte Carlo simulation. All three methods require a statement of three basic parameters: holding period, confidence interval and the historical time horizon over which the asset prices are observed.

Under the correlation method, the change in the value of the position is calculated by combining the sensitivity of each component to price changes in the underlying asset(s), with a variance/covariance matrix of the various components' volatilities and correlation. It is a deterministic approach.

The historical simulation approach calculates the change in the value of a position using the actual historical movements of the underlying asset(s), but starting from the current value of the asset. It does not need a variance/covariance matrix. The length of the historical period chosen does impact the results because if the period is too short, it may not capture the full variety of events and relationships between the various assets and within each asset class, and if it is too long, may be too stale to predict the future. The advantage of this method is that it does not require the user to make any explicit assumptions about correlations and the dynamics of the risk factors because the simulation follows every historical move.

The Monte Carlo simulation method calculates the change in the value of a portfolio using a sample of randomly generated price scenarios. Here the user has to make certain
assumptions about market structures, correlations between risk factors and the volatility of these factors. He is essentially imposing his views and experience as opposed to the naive approach of the historical simulation method.

At the heart of all three methods is the model. The closer the models fit economic reality, the more accurate the estimated VAR numbers and therefore the better they will be at predicting the true VAR of the firm. There is no guarantee that the numbers returned by each VAR method will be anywhere near each other.

**Other uses of VaR**

VaR is used as a MIS tool in the trading portfolio in the trading portfolio to “slice and dice” risk by levels/products/geographic/level of organisation etc. It is also used to set risk limits. In its strategic perspective, VaR is used to decisions as to what business to do and what not to do. However VaR as a useful MIS tool has to be “back tested” by comparing each day’s VaR with actuals and necessary reexamination of assumptions needs to be made so as to be close to reality. VaR, therefore, cannot substitute sound management judgement, internal control and other complementary methods. It is used to measure and manage market risks in trading portfolio and investment portfolio.

**Estimating Volatility**

VaR uses past data to compute volatility. Different methods are employed to estimate volatility. One is arithmetic moving average from historical time series data. The other is the exponential moving average method. In the exponential moving average method, the volatility estimates rises faster to shocks and declines gradually. Further, different banks take different number of days of past data to estimate volatility. Volatility also does not capture unexpected events like EMU crisis of September 1992 (called “event risk”). All these complicate the estimation of volatility.

VaR should be used in combination with “stress testing” to take care of event risks. Stress test takes into account the worst case scenario.
**Why Backtest**

Backtests compare realized trading results with model generated risk measures, both to evaluate a new model and to reassess the accuracy of existing models. Although no single methodology for backtesting has been established, banks using internal VaR models for market risk capital requirements must backtest their models on a regular basis. Banks should generally backtest risk models on a monthly or quarterly basis to verify accuracy. In these tests, they should observe whether trading results fall within pre-specified confidence bands as predicted by the VaR models. If the models perform poorly, they should probe further to find the cause (e.g., check integrity of position and market data, model parameters, methodology). The BIS outlines backtesting best practices in its January 1996 publication “Supervisory framework for the use of ‘backtesting’ in conjunction with the internal models approach to market risk capital requirements.”
“Stress testing” has been adopted as a generic term describing various techniques used by banks to gauge their potential vulnerability to exceptional, but plausible, events. Stress testing addresses the large moves in key market variables of that kind that lie beyond day to day risk monitoring but that could potentially occur. The process of stress testing, therefore, involves first identifying these potential movements, including which market variables to stress, how much to stress them by, and what time frame to run the stress analysis over. Once these market movements and underlying assumptions are decided upon, shocks are applied to the portfolio. Revaluing the portfolios allows one to see what the effect of a particular market movement has on the value of the portfolio and the overall Profit and Loss.

Stress test reports can be constructed that summarise the effects of different shocks of different magnitudes. Normally, then there is some kind of reporting procedure and follow up with traders and management to determine whether any action need to be taken in response.

**Stress testing and value-at-risk**

Stress tests supplement value-at-risk (VaR). VaR is thought to be a critical tool for tracking the riskiness of a firm’s portfolio on a day-to-day level, and for assessing the risk-adjusted performance of individual business units. However, VaR has been found to be of limited use in measuring firms’ exposures to extreme market events. This is because, by definition, such events occur too rarely to be captured by empirically driven statistical models. Furthermore, observed correlation patterns between various financial prices (and thus the correlations that would be estimated using data from ordinary times) tend to change when the price movements themselves are large. Stress tests offer a way of measuring and monitoring the portfolio consequences of extreme price movements of this type.
**Stress Testing Techniques**: Stress testing covers many different techniques. The four discussed here are listed in the Table below along with the information typically referred to as the “result” of that type of a stress test.

<table>
<thead>
<tr>
<th>Stress Testing Techniques</th>
<th>What is the “stress test result”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Sensitivity Test</td>
<td>Change in portfolio value for one or more shocks to a single risk factor</td>
</tr>
<tr>
<td>Scenario Analysis (hypothetical or historical)</td>
<td>Change in portfolio value if the scenario were to occur</td>
</tr>
<tr>
<td>Maximum loss</td>
<td>Sum of individual trading units’ worst-case scenarios</td>
</tr>
<tr>
<td>Extreme value theory</td>
<td>Probability distribution of extreme losses</td>
</tr>
</tbody>
</table>

A **simple sensitivity test** isolates the short-term impact on a portfolio’s value of a series of predefined moves in a particular market risk factor. For example, if the risk factor were an exchange rate, the shocks might be exchange rate changes of +/- 2 percent, 4 percent, 6 percent and 10 percent.

A **scenario analysis** specifies the shocks that might plausibly affect a number of market risk factors simultaneously if an extreme, but possible, event occurs. It seeks to assess the potential consequences for a firm of an extreme, but possible, state of the world. A **scenario analysis can be based on an historical event or a hypothetical event.** Historical scenarios employ shocks that occurred in specific historical episodes. Hypothetical scenarios use a structure of shocks thought to be plausible in some foreseeable, but unlikely circumstances for which there is no exact parallel in recent history. Scenario analysis is currently the leading stress testing technique.

A **maximum loss** approach assesses the riskiness of a business unit’s portfolio by identifying the most potentially damaging combination of moves of market risk factors. Interviewed risk managers who use such “maximum loss” approaches find the output of such exercises to be instructive but they tend not to rely on the results of such exercises in
the setting of exposure limits in any systematic manner, an implicit recognition of the arbitrary character of the combination of shocks captured by such a measure.

**Extreme value theory** (EVT) is a means to better capture the risk of loss in extreme, but possible, circumstances. EVT is the statistical theory on the behaviour of the “tails” (i.e., the very high and low potential values) of probability distributions. Because it focuses only on the tail of a probability distribution, the method can be more flexible. For example, it can accommodate skewed and fat-tailed distributions. A problem with the extreme value approach is adapting it to a situation where many risk factors drive the underlying return distribution. Moreover, the usually unstated assumption that extreme events are not correlated through time is questionable. Despite these drawbacks, EVT is notable for being the only stress test technique that attempts to attach a probability to stress test results.

**What Makes a good Stress Test**

A good stress test should

- be relevant to the current position
- consider changes in all relevant market rates
- examine potential regime shifts (whether the current risk parameters will hold or break down)
- spur discussion
- consider market illiquidity, and
- consider the interplay of market and credit risk

**How should risk managers use stress tests:**

Stress tests *produce information summarising the firm’s exposure to extreme, but possible, circumstances*. The role of risk managers in the bank should be assembling and summarising information to enable senior management to understand the strategic relationship between the firm’s risk-taking (such as the extent and character of financial leverage employed) and risk appetite. Typically, the results of a small number of stress scenarios should be computed on a regular basis and monitored over time.

Some of the specific ways stress tests are used to influence decision-making are to:

- manage funding risk
provide a check on modelling assumptions
set limits for traders
determine capital charges on trading desks’ positions

Manage funding risk: Senior managers use stress tests to help them make decisions regarding funding risk. Managers have come to accept the need to manage risk exposures in anticipation of unfavourable circumstances. The significance of such information will vary according to a bank’s exposure to funding or liquidity risk.

Provide a check on modelling assumptions: Scenario analysis is also used to highlight the role of particular correlation and volatility assumptions in the construction of banks’ portfolios of market risk exposures. In this case, scenario analysis can be thought of as a means through which banks check on the portfolio’s sensitivity to assumptions about the extent of effective portfolio diversification.

Set limits for traders: Stress tests are also used to set limits. Simple sensitivity tests may be used to put hard limits on bank’s market risk exposures.

Determine capital charges on trading desks’ positions: Banks may also initiate capital charges based on hypothetical losses under certain stress scenarios. The capital charges are deducted from each business unit’s bonus pool. This procedure may be designed to provide each business unit with an economic incentive to reduce the risk of extreme losses.

Limitations of Stress Tests
Stress testing can appear to be a straightforward technique. In practice, however, stress tests are often neither transparent nor straightforward. They are based on a large number of practitioner choices as to what risk factors to stress, how to combine factors stressed, what range of values to consider, and what time frame to analyse. Even after such choices are made, a risk manager is faced with the considerable tasks of sifting through results and identifying what implications, if any, the stress test results might have for how the firm should manage its risk-taking activities.

A well-understood limitation of stress testing is that there are no probabilities attached to the outcomes. Stress tests help answer the question “How much could be lost?” The lack of probability measures exacerbates the issue of transparency and the seeming arbitrariness of stress test design. Systems incompatibilities across business units make
frequent stress testing costly for some firms, reflecting the limited role that stress testing had played in influencing the firm’s prior investments in information technology.

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7 Timothy Koch (1995): Bank Management (Dryden, New York)
7 Stress Testing by Large Financial Institutions: Current Practice and Aggregation Issues, Committee on Global Financial Systems, BIS, April, 2000