CHAPTER ONE

INTRODUCTION

1.1 ASSETS LIABILITY MANAGEMENT AND ALCO

Assets Liability Management (ALM) is a strategic balance sheet management of risks associated with it namely credit risks, market risks (liquidity, interest rate, currency, equity risks) and operational risks. ALM addresses the issue of defining adequate structures of the balance sheet and the hedging programmes for these risks. The mission of ALM is to provide relevant risk measures for these risks and keep them under control.

The ALM Committee (ALCO) is in charge of implementing ALM decisions. The ALCO agenda includes ‘global balance sheet management’.

ALM scope varies across institutions:
- it may be subordinated to business policy
- it may be active in business policy making
- it may be defined as a P & L unit with its own decision making functions, in addition to the hedging policy for the bank

The traditional scope of ALM is dedicated to tools, procedures and processes for managing the risks associated with balance sheet globally. The wider scope envisages tools, models and processes, facilitating the implementation of both business and financial policy and an aid to decision making at the global level.
1.2 AN OVERVIEW OF ALM RISKS

In banks, there has been a significant extension of focus, from the traditional qualitative risk assessment towards the quantitative management of risks, due to both evolving risk practices and strong regulatory incentives\(^5-8\). The regulations, imposing capital charge against all risks, greatly helped this process. The underlying philosophy of capital requirement is to bring capital in line with the risks and it implies modeling the value of risk. Under an economic view, it implies modelling potential losses from each source of risk, which turns out to be the 'economic' capital 'adequate' to risk. An overview of various ALM risks, is presented below: -

Credit Risk

For banks, credit risk is the foremost of all the risks, in terms of importance\(^9-10\). Default risk, a major source of loss, is the risk that customers fail to comply with their obligations to service debt. Default triggers a total or partial loss of any amount lent to counter party.

Decline in the credit standing of an obligor of the issuer of a bond or stock, is also a type of credit risk. Such deterioration does not imply default, but the probability of default increases. In the market, a deterioration of the credit standing of a borrower does materialise into a loss because it triggers an upward move of the required market yield to compensate the higher risk and triggers a value decline.

The value of credit risk differs for the banking portfolio and trading portfolio.
Banking portfolio. In banking portfolio, credit risk is critical since the default of a small number of important customers can generate large losses, potentially leading to insolvency. Various default events are a) delay in payment obligations, b) restructuring of debt obligations due to a major deterioration of credit standing, c) bankruptcies etc. Default means any situation other than a simple delinquency. Credit risk is difficult to quantify on an 'ex ante' basis, since we need an assessment of the likelihood of a default event and of the recoveries under default, which are context dependent. Besides, there is scarcity of data on interdependence between default events.

Trading portfolio. The capability of trading market mitigates the credit risk since there is no need to hold these securities until the deterioration of credit risk materializes into effective losses. If the credit standing of the obligor declines, it is still possible to sell these instruments in the market at a lower value.

However, in the case of over-the-counter instruments, such as derivatives (swaps and options), the bank faces the risk of losing the value, since the value varies during the entire residual life of the instrument.

Measuring credit risk. The major credit risk are exposure, likelihood of default, or a deterioration of the credit standing, and the recoveries under default. Scarcity of data makes the assessment of these components a challenge.

Ratings are traditional measure of credit quality of the debts. Because ratings are ordinal measures of credit risk, they are not sufficient to value credit risk.

Portfolio models show that portfolio risk varies across banks depending on the number of borrowers, the discrepancies in size between exposures and the extent of diversification among types of borrowers, industries and countries.
Challenges of credit risk measurement. The various challenges of credit risk measurement may be enumerated as under:-

- Credit risk for traded instruments raises a number of conceptual and practical difficulties: a) what is the value subject to loss, or exposure, in future periods?, b) does the current price embed already the credit risk, since the market prices normally anticipate future events and to what extent?, c) will it be easy to sell these instruments when signs of deterioration get stronger? and d) will the bank hold these instruments longer than under normal conditions?

- Modelling default probability directly with credit risk models remains a major challenge.

- Another challenge of credit risk measurement is capturing portfolio effects. Due to scarcity of data, quantifying the diversification effects poses a great challenge. It requires assessing the joint likelihood of default for any pair of borrowers, which gets higher if their individual risks correlate.

**Interest Rate Risk**

The interest rate risk is the risk of a decline in earnings due to the movements of interest rates. Most of the items of bank's balance sheets are interest driven. Since interest rates are unstable, so are earnings.

The lender earning a variable rate has the risk of reduction in revenues, when interest rates decline. On the other hand, a borrower paying a variable rate bears higher costs when interest rates rise. Both the positions are risky, since the revenues and costs are indexed to market rates. There are, however chances of gains, when reverse situation occurs.
Various complex indexations exist on market rates. Variable rate loans have their rates periodically reset using some market reference rates. In the case of transactions reaching maturity and renewed at that point will stick to the future and uncertain market conditions. Therefore, fixed rate become variable at maturity for loan renewals and variable rates remain fixed between two reset dates. This variety makes the measure of interest rate sensitivity of assets and liabilities to market rates more complex.

Implicit options in banking products are another source of interest rate risk. A borrower of fixed rate loan will exercise the option of prepayment when the interest rate declines. Deposit holders transfer funds to term deposits, when interest rates for this rise. Optional risks are indirect interest rate risks. Besides arising from a change in interest rate, the behaviour of customer such as geographic mobility etc. do also have result in indirect interest rate risks.

Measuring interest rate risk. Measuring the option risk is more difficult than measuring the usual interest rate risk, arising from simple indexation to market rates.

NPV and Interest rate risk. The Net Present Value (NPV) is an alternative target variable to interest income. The sensitivity of interest rate assets and liabilities is the ‘duration’. Since the NPV is the difference between mark-to-market values of loans and debts, its sensitivity to rate changes depends on their durations.

The duration is the percentage change of a market value for a unit 'parallel' shift of the yield curve (up and down moves of all rates). The duration of assets and liabilities is readily available from their time profile of cash flows and the current rates. The interest rate sensitivity of the NPV depends on mismatches between the duration of assets and duration of liabilities. Such mismatches are duration gaps. The duration increases with maturity, but less than proportionately. It is a
convex function of maturity. The change in duration with maturity is the slope of the tangent to the curve that relates the duration to the maturity for a given asset.

Controlling the duration gap between assets and liabilities allow us to maintain the overall sensitivities of the NPV within desired bounds. When interest rate drifts get wider, the difference in curvatures, or convexities of the asset-rate and the liability-rate profiles becomes significant, resulting in significant variation of the NPV even when slopes are similar at the current rate. This is convexity risk, which becomes relevant in times of high interest rate volatility. The duration is the first-order derivative with respect to interest rate, while the convexity is the second-order derivative.

**Liquidity Risk**

Liquidity risk refers to multiple dimensions such as a) inability to raise funds at normal cost, b) market liquidity risk and c) asset liquidity risk.\(^{15}\)

**Funding risk** depends on how risky the market perceives the issuer and its funding policy. The cost of funding is a critical profitability driver. The cost of the funds depend on the bank’s credit standing. In addition, the rating drives the ability to do business with other banks/financial institutions and to attract investors.

The liquidity of the market relates to liquidity crunches because of lack of volume. In such a scenario, the prices become highly volatile, sometimes embedding high discounts from par, when counter parties are unwilling to trade. Market liquidity risk materialises as an impaired ability to raise money at a reasonable cost.
Asset liquidity risk results from lack of liquidity related to the nature of assets rather than to the market liquidity. In fluctuating market liquidity, holding a pool of liquid assets, acts as a cushion, to meet short-term obligations.

When a bank gets into trouble, massive withdrawals of funds by depositors and closing of credit-lines by institutions, results into brutal liquidity crisis, ending up in bankruptcy of bank.

Measuring liquidity risk. The time profiles of projected uses and sources of funds, and their 'gaps' or liquidity mismatches, capture the liquidity position of a bank. Given the market perception of the bank, the debt management has to be judicious.

Challenges of liquidity risk measurement. Adequate techniques need to address fully the liquidity risk, in terms of market liquidity or asset liquidity. The practices rely on empirical and continuous observations of market liquidity, whereas liquidity risk models appear too theoretical to permit instrumental applications.

Currency Risk

When a bank is involved in multi-currency operations, it is exposed to foreign exchange risk. The exchange rate keeps changing depending on value of the currency which is influenced by various factors which include demand and supply, balance of payments, trade deficit, Government borrowing, inflation, interest rates, political stability, etc.

Foreign exchange exposure. These can be broadly classified into three categories:-

- **Transaction exposure.** The transaction exposure measures the risk involved due to the change in the foreign exchange rate between the time
the transaction is executed and the time it is settled. It is defined as a measure of the home currency value of assets and liabilities which are denominated in a foreign currency, to unanticipated changes in exchange rates, when the assets or liabilities are liquidated.

Examples of foreign exchange transactions which may expose to transaction exposure: a) purchase or sale of goods and services made in foreign currency, b) dividends paid or received in foreign currency and c) loan repayments made in foreign currency.

Banks, generally hold a square position at the end of day by going long (short) corresponding to every transaction (merchant transaction) with the customer which is short (long). The bank helps its customers to hedge their exposure while ensuring that it hedges its own exposure. A bank may also have transaction exposure of its own if it takes position/trade on its own account.

• **Translation exposure.** Valuation of foreign assets and liabilities at current exchange rates results in losses or gains to the banks, depending on the composition of its assets and liabilities and the direction of the exchange rate movement. It affects the accounting profit and correspondingly the valuation of the banks in the market. This assumes greater significance when it involves preparing of a consolidated balance sheet for a parent company which includes all its subsidiaries, some of which may be located in different countries and hence operate in different currencies.

• **Operating exposure.** In contrast to the transaction and translation exposures which affect the cash flows and the current balance sheet of the banks due to changes in the exchange rate, the operating exposure is a measure of the sensitivity of future cash flows and profits of a bank to unanticipated exchange rate changes.
The distinct features of operating exposures are: a) it cannot be related to specific transaction, b) dealing in foreign exchange is not a prerequisite for being subjected to operating exposure and c) it has a long-term implication beyond the current financial year.

Managing currency risk. Managing an exposure refers to bringing the level of exposure to a targeted level. Banks acquire transaction exposure as a part of their normal business operations, and manage this exposure by hedging. Keeping in view the distinct nature of operating exposure, its management involves strategic decisions, which have long-term implications on capital investment.

There are various internal and external techniques of exposure management:

- **Internal techniques**, include netting, leading & lagging and invoicing. Netting presupposes a simultaneous occurrence of inflows and outflows in the same currency and for the same amount—though, these conditions in real life are difficult. To illustrate, if a bank has a FCNR(B) deposit maturing along with a foreign currency denominated loan, then netting the loan can take place.

As the foreign exchange transactions materialize according to their tenor, the techniques of leading and lagging become handy for the purpose of such matching. Leading means making a flow occur earlier than the due date while lagging means delaying a flow beyond the due date.

In the above two techniques, attempts are made to hedge the exposure it does not in any way affect the exposure, if any, of the counter party. The entire exchange risk is emanating because of the need to convert foreign currency into another currency. Invoicing technique helps in avoiding this, if an invoice is made in domestic currency. In fact most of the international
trade gets denominated in US $, irrespective of the currencies of importer and exporter. Hence, *managing exposure by invoicing is more an exception than rule.*

- **External techniques**, include tools like *forward contract, currency futures, currency options and currency swaps.* Under these techniques, the bank with the purpose of hedging, undertakes a transaction consequent to which a part or whole of the exchange risk is transferred to others. These tools can be used, either independently or in combination.

A **forward contract** is an agreement to buy or sell foreign exchange for a predetermined amount, at a predetermined rate, and on a predetermined date. These contracts are OTC products that are entered into depending on the need of a hedger. The counterpart in these transactions happens to be a banker and hence a bank acquires transaction exposure through such contracts. The bank normally covers its position by, in turn, entering into a forward contract with another banker. This does not involve any cash flow at the time of entering a contract, but actual cash flows occur on the date of delivery. The forward rate of a currency can be at a premium or discount.

**Currency futures** are similar to forward contracts to the extent that both provide for a delivery of foreign exchange by one party at a predetermined price on a specified future date. The essential difference is that *forward contracts are OTC products and there is no secondary market for the same and they cannot be transferred.* The only way to exit from such a contract is to cancel. However, *currency futures are traded on an exchange and hence have a standard size, standard maturity date, and a set of guidelines stipulated by the exchange concerned for settlement and payment which includes depositing of margin money with exchange.* The margin money to be deposited will change on daily basis depending on...
the movement of the prices of the underlying futures. It is easier to exit from a futures contract, by simply selling it on the exchange at the prevailing prices.

A currency option provides the hedger with an advantage which is not available under a forward contract. A currency option contract gives the buyer of the option a right, without an obligation, to buy or sell foreign currency at a predetermined price on a specified future date. The contract which gives the right to buy is known as call option and the contract which gives the right to sell is known as put option. Options are traded on exchanges and hence have standard sizes, standard maturity dates and guidelines stipulated by the exchange concerned for the settlement and payment. The exchange stipulates margin maintenance only for sellers since they have obligations unlike the buyers who have only rights.

Besides managing transaction exposures as above, it becomes imperative for the bank to look at the composition of its foreign currency assets and liabilities and take a view on whether there is a need to change the composition, depending on the future outlook about the currencies concerned. Currency swaps are useful in this context. Under a currency swap both the parties agree to exchange a series of cash flows over the life of a swap.

Challenges of liquidity risk measurement. Measurement of operating exposure is relatively difficult as it is an attempt to assess the effect of exchange rate changes on future revenues, costs, cash flows and profits of the bank.

Equity Risk

The fall in the market price of shares has a bearing on the equity price risk. It adversely affects the investment portfolio of Banks.
The mark-to-market technique quantifies the loss in investment portfolio due to adverse movement in stock prices. Stock/index option and futures contracts are used to hedge this risk.

**Operational Risk**

Operational risks relate to malfunctions of internal risk-monitoring rules, internal procedures, and reporting and information system. The New Basel Accord defines operational risk as ‘the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events’.

In absence of efficient tracking and reporting of risks, some important risks remain ignored and can result into disastrous consequences. Operational risk is in essence ‘event risk’ and appears at different levels: a) people, b) processes, c) technical and d) information technology.

Operational risks, relating to ‘people’, results from:-
- human errors
- lack of expertise
- fraud
- non-compliance with existing procedures and policies

Operational risks, linked to ‘processes’, results from:-
- inadequate procedures and controls for reporting, monitoring and decision-making
- inadequate procedures relating to processing information, such as errors in booking transactions and failure to scrutinize legal documentation/s, deficiencies in execution of documents etc.
- deficiency in risk surveillance: management deficiencies in risk monitoring
- errors in recording transaction/s
Operational risks, arising from 'technical' aspects have their origins in:–
- model errors
- absence of adequate tools for measuring risks

Operational risks, relating to information technology aspects, occur because of deficiencies of the information system and system failure.

Measuring operational risk. The general principle for addressing operational risk measurement is to assess the likelihood and cost of adverse events. The methodology adopted begins first by data gathering phase, followed by data classification and analysis employing statistical techniques.

There are historical data (external/internal statistics) on various incidents and their costs, which enable to measure the number of incidents and the direct costs attached to such incidents.

Proxy sources on operational events such as expert judgments and opinions of local managers on possible events and their implications help in pooling data relating to frequencies anc costs of events.

Challenges of operational risk measurement. The practical difficulties lie in agreeing on a common classification of events and on data gathering process, with several potential sources of event frequencies and costs.

1.3 QUANTITATIVE MEASURES OF RISK

Risk management relies on quantitative measures of risks\textsuperscript{1,24-26}. The various risk measures aim at capturing the variation of a given target variable e.g. earnings,
market value or losses due to default, etc. The quantitative indicators of risks fall into three categories:-

- **Sensitivity**, are ratios of the variation of a target variable, such as interest margin or change in mark-to-market values of instruments, to a forfeit shock of the underlying random parameter driving this change. Examples of underlying parameters are interest rates, exchange rates and stock prices. The interest rate gap is the sensitivity of the interest margin of the banking portfolio to a forfeit move of the yield curve.

**Market risk models use sensitivities widely.** ALM uses gaps, which are sensitivities of the interest income of the banking portfolio, to shifts of interest rates.

Sensitivities have drawbacks as well, firstly, they refer to a given forfeit change of risk drivers, without considering that some parameters are quite unstable while others are not and secondly, they depend on the prevailing conditions, the value of the market parameters and of assets, making them proxies of actual changes.

- **Volatility**, which captures the variations around the average of any random parameter or target variable, both upside and downside. Unlike forfeit movements, volatility characterizes the varying instability of any uncertain parameters, which is ignored by forfeit changes.

Volatility is a common statistical measure of the dispersion around the average of any random variable such as market parameters, earnings or mark-to-market values. Volatility is the standard deviation of the values of these variables (and standard deviation is the square root of the variance of a random variable).
Volatility need constant updating when new observations are available. An alternative measure of volatility is the implicit volatility embedded in option prices. It determines the value of volatility from the theoretical relationship (the Black-Scholes formula) of observed option prices with all underlying parameters, one of them being the volatility of the underlying. A benefit of implicit volatilities is that they are forward looking measures. A drawback of this approach is that implicit volatilities are fairly volatile, more than historical volatility.

A limited number of observations might result in a distorted image of the dispersion. Thus, when the sample size gets smaller, there is ‘sampling error’. The Earnings at risk (EaR) approach for estimating economic capital uses the observed volatility of earning values as the basis for calculating potential losses.

- **Downside measures of risk**, which focus on adverse deviations only. They characterize the ‘worst case’ deviations of a target variable, such as earnings, market values or credit losses, with probabilities for all potential values. Downside risk measures require modeling to have probability distributions of target variables.

The ‘Value at Risk’ is a downside risk measure. It is the adverse deviation of a target variable, such as the value of a transaction, not exceeded in more than a preset fraction of all possible future outcomes. **Downside risk is the most comprehensive measure of risk** as it integrates sensitivity and volatility with the adverse effect of uncertainty.
VALUE AT RISK (VaR) AND CAPITAL

The Value at Risk (VaR) is a potential loss. Practically, VaR is the maximum loss at a preset confidence level. The confidence level is the probability that the loss exceeds this upper bound.

**Determination of VaR.** VaR requires modeling the distribution of values at some future time point, in order to define various 'loss percentiles', each one corresponding to a confidence level.

**Applicability of VaR.** VaR applies to all risks. Market risk is an adverse deviation of value during a certain liquidation period. Credit risk materializes through defaults of migrations across risk classes. Defaults trigger losses. Migrations trigger risk-adjusted value changes. VaR for credit risk is an adverse deviation of value, due to credit risk losses or migrations, at a present confidence level. **VaR applies to various risks as long as we can build up a distribution of future values of transactions or of losses.**

**VaR and Capital.** VaR methodology serves to define risk-based capital, or economic capital, which is the capital required to absorb potential unexpected losses at the preset confidence level. The confidence level reflects the risk appetite of the bank. By definition, it is also the probability that the loss exceeds the capital, triggering bank insolvency. Hence, the confidence level is equivalent to the default probability of the bank.

**Advantages of VaR.** The VaR concept has three distinct advantages:-
- it provides a complete view of portfolio risk
- it measures economic capital
- it assigns fungible values to risks
Because VaR captures the downside risk, it is the basis for measuring economic capital, the ultimate safety cushion for absorbing losses. Further, instead of assigning qualitative indicators (sensitivities, ratings, watch lists, excess limits, etc), VaR assigns a dollar or rupee value to risk. Valuation makes all risks fungible, whatever the sources of uncertainty.

EARNINGS AT RISK (EaR) AND CAPITAL

Earnings at Risk (EaR) measures, at present confidence levels, the potential adverse deviations of earnings. Though EaR is not VaR, but it shares the same underlying concept, and has the benefit of being relatively easy to measure.

A simple way of approaching risk is to use the historical distributions of earnings. The wider the dispersion of time series of earnings, the higher the risk of the bank.

**Determination of EaR.** Several measures of earnings can be used to capture their instability over time: accounting earnings, interest margins, cash flows, market values, especially for the trading portfolio. The volatility is the adequate measure of such dispersion. It is the standard deviation of series of observations.

Once earnings distributions are obtained, it is easy to use loss volatility as the unit for measuring capita. Deriving capital follows the same principle as VaR. It implies looking for aggregated level of losses that is not likely to be exceeded in more than a given fraction of all outcomes.

**Applicability of EaR.** EaR provides a very easy overview of risks.
**EaR and Capital.** EaR serves to define aggregated capital, but it does not allow us to trace back risks to their sources. EaR concept is a simpler route to capital than VaR.

**Advantages of EaR.** Earnings at Risk (EaR) is a simple and practical version of VaR:-
- this is a quicker approach to risk management-- not time intensive
- it does not require much data, as it relies on existing data, since incomes are always available
- it requires less information technology resources; there is no need of constructing a risk data warehouse, since existing databases provide most of the information and relate it easy to transactions
- it is easy to track major variations of earnings to some specific events and to interpret them
- EaR provides a number of outputs: the earnings volatility, the changes of earnings volatility when the perimeter of aggregation increases, measuring the diversification of effect
- the level of capital is an amount that losses are not likely to exceed

**Disadvantages of EaR.** There are number of drawbacks to EaR:-
- a volatility calculation raises technical issues, for instance when trends of time series increase volatility--in such cases the volatility comes from trend rather than instability
- It is not possible to define the sources of the risk making the earnings volatile. EaR does not relate the adverse deviations of earnings to the underlying risks because EaR aggregates the effects of all risks. Unlike VaR models, EaR captures risks as an outcome of all risks, not at their source.

On the contrary VaR requires linking losses to each risk. VaR models the value of the risk *ex ante*, rather than after its materialization into losses. VaR models the value of risk and relates it to the instrumental variables, allowing
ex ante control of risk using such parameters as sensitivities to market risk, exposure limits, concentration for each credit risk, etc.

Therefore, EaR appears to be an additional tool for risk management, but not a substitute.

LIMITATIONS OF SIMPLE APPROACHES TO CAPITAL AND RISK BASED CAPITAL: REGULATORY AND ECONOMIC CAPITAL

The common practice to define the required capital is to use regulatory capital. The fact is that the regulatory capital has many limitations, even after the enhancements proposed by the New Basel Accord.

Using regulatory capital as a surrogate for economic capital generates important distortions because of the divergence between the real risks and the forfeited risks of regulatory capital. For regulatory purposes, credit risk is dependent on outstanding balances (book exposures) and on risk weights. Such forfeits are less risk sensitive than economic measures. In addition, standardized regulatory approaches measure risk over a portfolio by a simple addition of individual risks for credit risk. This ignores the diversification effect and results in the same measure of risk for widely diversified portfolios and for highly concentrated portfolios.

The shortcomings of forfeit measures have implications for the entire risk management system. The most important benefit of economic capital is to correct such distortions.

The VaR methodology applies to measure risk-based capital. The VaR differs from regulatory capital or from available capital in that it measures actual risks. Economic
capital necessitates the VaR methodology, with the modeling of loss distribution, with the related complexities.

MEASURING EXPECTED AND UNEXPECTED LOSSES : LOSS DISTRIBUTION AND CONFIDENCE LEVEL

The two major ingredients for defining expected and unexpected losses are the loss distribution and the confidence level.

Modelling loss distributions raises major technical challenges because the focus is on extreme deviations rather than on the central tendency. The confidence level results from a management choice reflecting the risk appetite, or the tolerance for risk, of the management and the bank's policy with respect to its credit standing.

Since downside risk characterizes VaR and economic capital, loss volatility and the underlying loss distribution are critical.

Loss Distributions. For market risk, loss distributions are simply the loss distributions of adverse price deviations of the instruments. Since there are approximately as many chance that value increases or decreases, such deviations tend to be bell shaped, with some central tendency.

As for credit risk, historical data is scarce and does not necessarily reflect the current risk of banks. Therefore, it becomes necessary for modeling loss distributions. For credit risk, losses are not negative earnings, they result from defaults, or loss of asset value because of credit standing deterioration. Such distributions are highly skewed to the left, because the most frequent losses are very small. These distributions are shown in the following page (Figure 1.1).
FIGURE 1.1

FAT TAILS AND EXTREME LOSSES

- Large losses
- Low probability

UNELECTED LOSS AND VaR
With distributions, the visual representation of losses is simple. The VaR at a given confidence level is such that the probability of exceeding the unexpected loss is equal to this confidence level. The area under the curve at the right of VaR represents this probability. The maximum total loss at the same confidence level is the sum of the expected loss plus unexpected loss (or VaR).

Losses at the extreme right hand side and beyond unexpected losses are 'exceptional'. The VaR represents the capital in excess of expected loss necessary for absorbing deviations from average losses. A well known characteristics of loss distributions is that they have 'fat tails'—extreme sections of the distributions, indicating large losses, although unlikely (low probabilities).

The VaR is easy to determine under simplifying assumptions on the distribution curve of losses. With normal curve, the VaR is a multiple of loss volatility that depends on the confidence level. To illustrate, the 2.5 per cent one-tailed confidence level corresponds to a multiple of loss volatility of 1.96. Therefore, if the loss volatility is 100, the unexpected loss will not exceed the upper bound of 196 in more than 2 or 3 cases out of 100 scenarios. Unfortunately, such multiples do not apply when the distribution has a different shape, for instance for credit risk.

*When implementing techniques based on confidence levels and loss percentiles, there is a need for common benchmarks, such as confidence levels, for all players (banks).*

**Loss Percentiles (at Confidence Levels) of the Normal Distribution**

The normal distribution is a proxy for market random P&L over a short period, but it cannot apply to credit risk, for which loss distributions are highly asymmetrical.
VOLATILITY AND DOWNSIDE RISK

CONFIDENCE LEVELS WITH THE NORMAL DISTRIBUTION

FIGURE 1.2

VOLATILITY AND DOWNSIDE RISK

CONFIDENCE LEVELS WITH THE NORMAL DISTRIBUTION
The VaR at a confidence level $x$ is the 'loss percentile' $L(x)$. The area under the curve in Figure 1.2, beyond the boundary value on the left-hand side, represents the probability that losses exceed this boundary value. Visually, a higher volatility means that the curve dispersion around its mean is wider. Hence, the chances that losses exceed a given boundary value grow larger. The confidence intervals are probabilities that losses exceed an upper bound (negative earnings, beyond the zero level). They are 'one-tailed' because only one-sided negative deviations materialise downside risk.

When both upside and downside deviations of the mean are considered, the confidence interval is 'two-tailed'. With a symmetric distribution, the two-tailed probability is twice the one-tailed probability. When the probability of losses exceeding a maximum value is 2.5 per cent, the probability that losses exceed the lower or the upper bounds is 5 per cent.

Confidence intervals are boundary values corresponding to a specified confidence level. In the normal curve, confidence intervals are simply multiples of the volatility. With the normal curve, the upper bounds of (negative) deviations corresponding to the confidence levels of 16 per cent, 10 per cent, 5 per cent, 2.5 per cent and all other values are in the normal distribution. They correspond respectively to deviations from the mean of 1, 1.28, 1.65 and 1.96 times the standard deviation $\sigma$ of the curve. Any other confidence interval corresponds to deviations expressed as multiples of volatilities for this distribution.

**Issues in modelling VaR and Portfolio Risks**

A 'standalone' VaR serves only as an intermediate step for moving from 'standalone' loss distributions of individual assets held in the portfolio loss distribution, which combines losses from all individual assets held in the portfolio.
The difficulty in VaR measures is the modelling of the loss distribution of a portfolio. The focus on high losses implies modeling ‘the ‘fat tail’ of the distributions rather than looking at the central tendency. Even with market-driven P&L, the normal distribution does a poor job of modeling distribution tails. For credit risk, the issue is worse since the loss distributions are highly skewed.

Loss distributions depend on portfolio structure, size discrepancies (concentration risk on big exposures) and the interdependencies between individual losses (the fact that loss occurrence increases or decreases the likelihood of occurrence of other losses). The new portfolio models provide the ability to quantify concentration and diversification effects on the portfolio risk.

‘Fat tails’ of actual distributions make the quantification of extreme losses and their probability of occurrence quite difficult. The major drawback of VaR modelling is that they are highly demanding in terms of data.

**MARK-TO-MARKET VALUATION AND MARK-TO-MODEL**

In traditional accounting, the book value of loan does not change when the revenues or the risks are higher or lower than average. Therefore, book values are not revenue-or risk-adjusted, while ‘economic values’ are.

Accounting standards have evolved progressively. The Financial Accounting Standard Board (FASB) promotes the Generally Accepted Accounting Practices (GAAP) that apply to all financial institutions that apply to all financial institutions. The International Accounting Standards (IAS) Committee promotes guidelines to which multinational banks, abide. All Committees and Boards promote the ‘fair value’ concept, which is a mark-to-market value.

**Mark-to-Market Measure.** In essence, an ‘economic value’ is a form of mark-to-market measure, as it is a discounted value of future contractual cash flows
generated by assets, using appropriate discount rates. The discounting process embeds the revenues from the assets in the cash flows, and embeds the risk also in the discount rates.

Marking-to-market does not imply that assets are actually tradable. The mark-to-market values of the trading portfolio are market prices. However, a loan has also a mark-to-market value even though it is not tradable.

**Mark-to-Model.** Risk models also rely on mark-to-market valuations. 'Mark-to-Model' are similar to mark-to-market, but exclude some drivers. For example, isolating the effect of credit risk on value does not require using continuously adjusted interest rates.

'Mark-to-future' is a 'mark-to-model' valuation at future time points, differentiated across scenarios characterising the random outcomes from current date up to a future time point.

'Value at Risk models' use revaluations of assets at future dated for all sets of random outcomes, to provide the value distribution from which VaR derives.

*However, 'Fair value' is a significant step ahead* because of the implication in terms of profitability. The relevant measure of profitability becomes P&L rather than accrual income. The main implication of fair value accounting is that earnings would result from the fluctuation of values, generating volatile P&L. The sensitivity of value to market movements is much higher for interest-earning assets with fixed rates than with floating rates.

**Risk models and their valuation building blocks.** In many risk models, the valuation building block plays a critical role:-
• **ALM-interest risk Models.** The Net Present Value (NPV) of the balance sheet is the present value of assets minus the value of liabilities. It serves as the target variable of ALM models because it captures the entire stream of cash flows generated by assets and liabilities.

If assets provide excess return over market yields, and liabilities cost less than market yields, assets are above par and liabilities below par value. The difference captures the expected profitability of the balance sheet in terms of present value.

The NPV of the balance sheet uses a single set of market rates differentiated by maturity, but not by risk class. The calculation differs from mark-to-market and fair value, in that it does not differentiate the discount rates according to the risk of each individual asset.

As per NPV concept, if we consider the bank as 'borrowing' from the market as its average cost of funding, which depends on its risk class--then the bank could effectively bring back all future asset cash flows to present by borrowing against them. Borrowings 'against' those means borrowing the exact amount that would require future payments, inclusive of interest, identical to the cash flows of all assets at this future date. *This is a mark-to-model rather than a full mark-to-market.*

• **Market risk VaR Models.** For market risk VaR models, the loss percentile derives from the distribution of future values of all assets at a future time point. The future value is random because of market movements and the distribution implies revaluation of assets at the future time point as a function of random market moves.

• **Credit risk Models.** For credit risk models, the same principle applies, except that we focus on random credit risk events to find the distribution of
uncertain values at a future horizon. The credit events include defaults and changes of credit standing, implying a value adjustment with market risky yields. The revaluation building block provides the spectrum of future values corresponding to all future credit states.

The valuation calculation depends on various options. Full mark-to-market valuation uses all parameters influencing prices to find out the distribution of random values at future time points. This not so with ALM-interest risk model and Credit risk model.

RISK MODELS

The development of risk models for banks has been relatively fast and rich in the recent period, starting with ALM-interest risk models, followed by market VaR models and credit risk models.

The ALM-interest risk models, the first to appear, aimed at capturing the interest rate risk of the banking book of commercial banks. Later they developed into several building blocks, some of them addressing the interest rate risk of the interest income, others the interest rate risk of the mark-to-market value of the balance sheet, and others aiming to value embedded prepayment options in banking products.

As the regulations focused on capital requirements, the banks focused on economic capital. The capital adequacy principle led to the VaR concept and to VaR models for market risk and credit risk. Market risk models aim to capture the market portfolio risk and find the capital requirement adequate for making this risk sustainable. They address the behaviour of risk drivers, interest rates, foreign exchange rates and equity indexes.
Because of the requirements of the New Basel Accord, the new generation of risk models are aiming to provide better measures of credit risk drivers and address both transaction risk and portfolio risk with new approaches. Risk drivers are exposures, default probabilities and recoveries.

New models appeared relating observable attributes of firms to default and ratings, using new techniques, such as neural network approach. Amongst various techniques for modeling ratings and default probabilities, neural networks approach, offers theoretical benefits over multivariate statistical techniques. Neural networks accommodate interdependencies and non-linear relationships. These features might improve accuracy.

There are basic principles, defining the basic building blocks of risk models:

- the risk-return profiles of transactions or portfolios are a centerpiece of risk management processes
- risk-return measures appear as the ultimate goal of risk models and these models achieve this by assembling various techniques and tools that articulate to each other
- risk models differ along two main dimensions: the nature of the risk (interest rate risk, market, credit, etc.) that they address; whether they apply to isolated transactions or portfolios, because the portfolios raise the issue of measuring diversification in addition to measuring the standalone risk of transactions. Accordingly, techniques to address various risks for standalone transactions or portfolios differ.

There are four main building blocks of risk models:

i) Risk drivers and standalone risk of transactions. Risk drivers are all factors influencing risks, which are necessary inputs for measuring the risk of individual transactions. When considered in isolation, the intrinsic of a transaction is 'standalone'.

□PAGE □27□
ii) Portfolio risk. Portfolio models aim to capture the diversification effect that makes the risk of a portfolio of transactions smaller than the sum of the risks of the individual transactions. They serve to measure the economic capital under the VaR methodology.

iii) Top-down and bottom-up links. These links relate global risk to individual transaction risks, or sub-portfolio risks. They convert global risk and return targets into risk limits and target profitability for business lines (top-down) and, conversely, for facilitating decision-making at the transaction level and for aggregating business line risks and returns for global purposes (bottom-up).

iv) Risk-adjusted performance measuring and reporting, for transactions and portfolios. Both risk-return profiles feed the basic risk processes: profitability and limit setting providing guidelines for risk decisions and monitoring.

RISK ADJUSTED PERFORMANCES: RAROC AND EVA

Risk-adjusted performances are a compromise between accounting measures of performance and the necessity of adjusting income for risk. The popular risk adjusted measures of accounting profitability are the Risk-adjusted Return on Capital (RAROC) and the Shareholders Value Added (SVA). Both combine profitability and risk.

RAROC nets expected losses from accrued revenues and divides them by the capital allocated to a transaction, using a capital (risk) allocation system. The RAROC ratio should be above an appropriate hurdle rate representative of a minimum profitability.

SVA nets both the expected loss from revenues and the cost of the required capital, valued with an appropriate price in line with shareholder’s required return. A positive SVA implies creation of value, while a negative SVA implies destruction of value from the bank’s shareholders’ standpoint.
1.4 IMPLICATIONS OF NEW BASEL II CAPITAL ACCORD ON BANKS

With the changing perception of risks, the Basel II, set to be finalised soon, will provide a catalyst for change for banks and financial institution around the world. The objectives of the Basel II Accord may be summarised as under:-

- To promote safety and soundness in the financial system
- To enhance competitive equality
- To provide a more comprehensive approach to addressing risks
- To rationalise approaches to capital adequacy that is appropriately sensitive to degree of risks involved in a Bank's position and activities
- To give greater emphasis on Bank's own assessment of risks to which they are exposed
- To ensure that the Bank's management remain responsible for managing risks and ensuring that CAR is consistent with Bank's profile
- To focus on internationally active Banks, although its underlying principles can be applied suitably to all types of Banks

STRUCTURE OF NEW CAPITAL ACCORD

Basel II is intended to be more sophisticated. This is where the complexities start. It consists of three mutually reinforcing pillars aimed at attaining the above said objectives:-

i) Minimum capital requirements
ii) Supervisory review process
iii) Market discipline

I. MINIMUM CAPITAL REQUIREMENTS

One of the three reinforcing pillars of the new Basel accord, the minimum capital requirement lays emphasis on regulatory capital requirements for credit, market and operational risk.
Capital Adequacy Ratio = Total regulatory capital (Tier I + Tier II + Tier III)
-----------------------------------------------
Risk weighted assets (Credit + Market + Operational)

Three approaches have been proposed to deal with credit risk:

a) **Standardised approach** with risk weights based on external credit assessments, and two internal ratings-based approaches

b) **Foundation Internal Rating Based (IRB)** approach, and

c) **Advanced Internal Rating Based (IRB)** approach

The standardised approach is risk sensitive and requires allocation of risk weight to each of the assets and of balance-sheet positions. For determining risk weights, banks may use assessment by External Credit Assessment Institutions (ECAs). The Committee has modified the treatment of Bank's exposures to Sovereigns, Banks and Corporates by providing more than one risk bucket unlike one earlier for each category of exposure. Unlike the 1988 Capital Accord, wherein banks are required to adopt the approach of applying a consistent risk weighting factor of 100% for all corporate credits, the new Accord calls for a more risk-sensitive and balanced portfolio.

The latter two approaches would be open to sophisticated Banks, if authorised by supervisors. The IRB approaches require assessment of risk in the credit portfolio, internally by Banks, subject to strict methodological and disclosure standards. The estimated credit worthiness of the borrower will be translated into a potential future loss amount, which would form the basis of minimum capital requirement. In the case of **Foundation IRB**, the Banks estimate the probability of default (PD) of each borrower, while the supervisor supplies the other inputs. The Advanced IRB approach requires the Banks to be permitted to supply other necessary inputs as well, considering its sufficiently developed internal capital allocation process.
As per the Quantitative Impact Study (QIS3) published by the Basel Committee in May, 2003, the impact of new regulatory capital requirements for the Banks operating in the different part of the globe would be as under:

### TABLE 1.1

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<th>Group</th>
<th>Standardised</th>
<th>IRB Foundation</th>
<th>IRB Advanced</th>
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OVERALL CHANGE IN CAPITAL REQUIREMENTS (INCLUDING IMPACT OF THE OPERATIONAL RISK CHARGE)

Group 1 Banks are large internationally active Banks; Group 2 Banks are more domestically focused Banks, and tend to be smaller in size than Group 1; Other represents Banks from G10 and non-EU countries and they include Australia, China, Hong Kong, Singapore, South Korea and a number of Latin American, Asian and Central and Eastern countries. In this case Group 1 and Group 2 Banks are combined. Source: BIS

- In developing countries, the impact of Basel II will be mainly via the standardised approach, at least in the initial stages of implementation of the New Accord.
The standardised approach is estimated to increase capital requirements by 12 per cent in a group largely comprising of developing countries.

To the extent that regulatory capital is a binding constraint, Banks in the developing countries will:—
- either have to raise new capital, which may be difficult / costly (particularly for the weaker Banks) or
- reduce their lending, and / or
- increase the cost of lending, especially to lower rated borrowers

Pricewaterhouse Coopers (PwC), have noted that in strategy terms, the average results suggests that the biggest and most diversified institutions should seek to move to the more sophisticated approaches as soon as possible. The real capital savings can be made on credit risk and that the Banks with the largest exposure to the retail market have the opportunity to make the most significant gains.

Mercer predicts that the shake-out will result in a banking market dominated by five types of institutions:
- large global Banks
- super-monolines
- asset gatherers and packagers
- relationship Banks and
- non-Bank specialists

Basel II would play a major role of differentiation among Banks. Successful Banks are expected to stand out more clearly as transparency increases and capital is used more economical.

Banks will be forced to appropriate some percentage of capital to cover the unidentified but perceived operational risks. This additional commitment will certainly add to the pressures of a Bank in terms of committing an additional funds to capital, collating the necessary data, building the right framework, understanding the technology issues and the like.
Basel II, would undoubtedly bring better risk management. At the same time, the prospect of possible capital increases and declining profitability may trigger consolidation and merger and acquisition activity, which again in the long run may prove good for the Banking industry.

II. PILLAR 2 OF NEW BASEL ACCORD: SUPERVISORY REVIEW PROCESS

The objective of Supervisory Review Process is to ensure that Banks have adequate capital to support all the risks in their business. It entails an accurate risk profile for each Bank viz. assessment of financial, non-financial risks as also effectiveness of the Bank’s structure, its management and control system. Continuous monitoring and evaluation of risk profile in tune with the business strategy and exposure will become imminent.

Supervisory review process will, therefore, involve the principles of supervisory review, supervisory transparency and accountability in risk management guidance. The four key principles of supervisory review identified by Basel Committee are:

- Having a process for assessment and maintaining capital adequacy levels in relation to risk profile of the individual Bank
- Appropriate supervising actions be taken by supervisors if they are not satisfied with the result of this process
- Supervisors should expect that the Banks operate above the minimum regulatory capital adequacy ratio and have the ability to hold capital in excess of the minimum
- Supervisor’s intervention at an early stage to prevent capital falling below the minimum levels required to support risk profile of a particular Bank and remedial action if capital not maintained / restored

Banks are grappling with how to ensure that the substantial investment being made in Basel II preparation, can be made to yield a positive return.
III. PILLAR 3 OF NEW BASEL ACCORD: MARKET DISCIPLINE

The new Basel guidelines on market discipline entail enhanced disclosure requirements for Banks, aimed at providing to the market participants, a better understanding of the Bank's profile, risk assessment methods and adequacy of their capital.

The Committee has developed a set of specific quantitative and qualitative disclosures in four keys: scope of application, composition of capital, risk exposure assessment and measurement processes, and capital adequacy.

Given the influence of internal methodologies on the capital requirements established, the Committee believes that comprehensive disclosure is important for market participants to understand the relationship between the risk profile and capital of an institution, and hence its soundness. The Committee expects all institutions to disclose basic information, subject to materiality.

Basel II framework has evolved to reflect greater risk sensitivity through improved risk measurement and management techniques. The hallmark of Basel II lies in its alignment of minimum regulatory capital to be held against credit risk with formal risk assessment of individual counter parties and also for the first time capital allocation against operational risk has been proposed.

The Committee has recommended that sophisticated, internationally active Banks make the full range of core and supplementary information publicly available, while generally, the concept of materiality will guide the necessity for supplementary disclosures to be made.
Building up a proper Asset Liability Management structure would be crucial for the banks in the future. The need for the banks is to develop technology based risk management tools—the complex mathematical models programmed into risk engines to enable risk analysis, measurement, computation of risk adjusted returns on capital and active management of bank's risk portfolio.

REFERENCES


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