



RISK MODEL



LEARNING OUTCOMES

After going through the chapter student shall be able to understand

- VAR
- Stress Testing
- Scenario Analysis
- Country and Sovereign Risk Models and Management

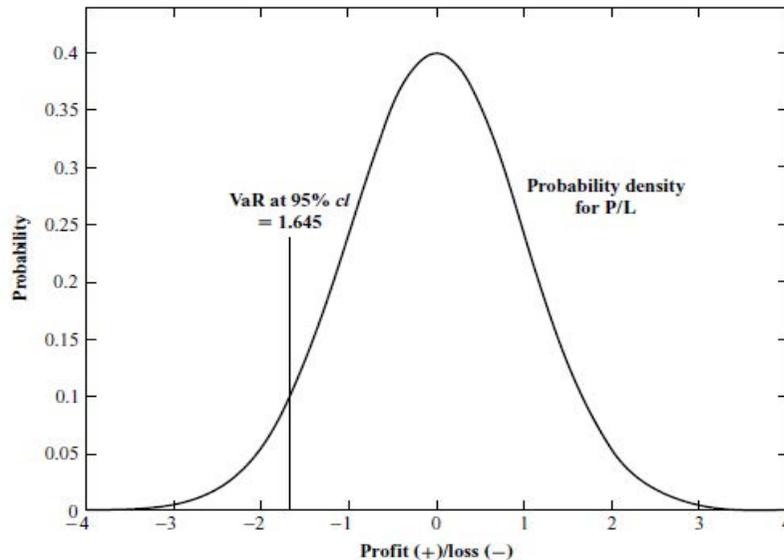
1. VALUE AT RISK (VAR)

VaR is a method of measuring the loss in the value of the portfolio over a given time period and for a distribution of historical returns. It is the percentage loss in the asset or portfolio value that will be exceeded or can be equal to only X percent of the time. A 1%, 5% and 10% VaR would be denoted as VaR (1%), VaR (5%) and VaR (10%) respectively. X percent probability of interest and the time period over which the VaR is calculated will be selected. Generally, the time period selected is one day. VaR can measure broader measures of calculating potential losses.

For example, a risk manager calculates the daily 5% VaR as \$15000. The VaR (5%) of \$15000 indicates that there is 5% chance that on any day, the portfolio will experience a loss of \$15000 or more. Also, there is 95% chance that on any given day the portfolio will experience either a loss less than \$15000 or a gain.

1.1 Calculating VaR

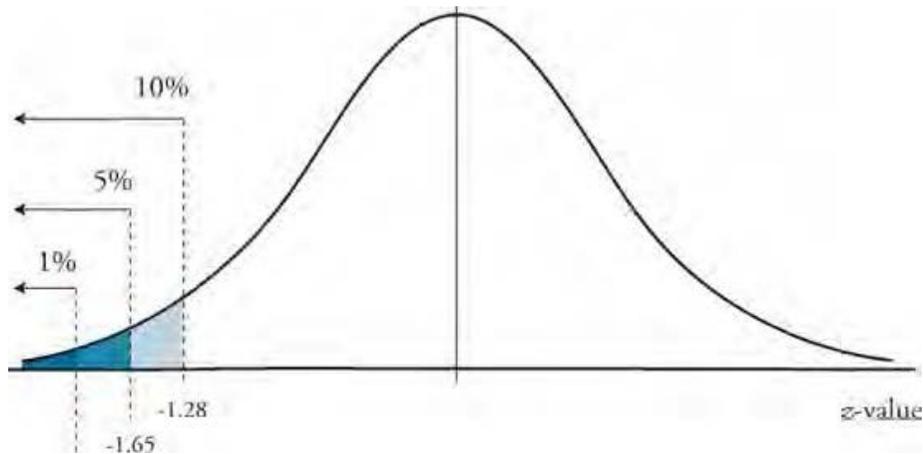
If we are calculating VaR using delta-normal method, we need to assume that it follows a standard normal distribution in which mean ($\mu = 0$) and standard deviation ($\sigma = 1$). It can be used to measure broader measures of the distribution of potential losses.



The VaR is dependent on two parameters which is holding period which is the time interval in which we measure our profit/loss and second is the confidence level which indicates the likelihood that we will get an outcome no worse than our VaR which might be 90%, 95% , 99% or indeed any fraction between 0 and 1.

The figure above shows a common probability density function over a chosen holding period. Positive P/L means profits and negative observations means losses. For VaR calculation, we need to specify the confidence levels. If the confidence interval is 95%, then the VaR will be given by the negative of the point on the X-axis that cuts off the top 95% of P/L observations from the bottom 5% of tail observations. So corresponding to that the x-axis value is -1.645 so the VaR is 1.645. The negative P/L value corresponds to a positive VaR which indicates the worst outcome at this confidence level is 1.645. So the worst outcome at this level of confidence is a loss of 1.645. If the worst outcome at this confidence level is a particular profit rather than a loss then the likely loss must be negative. If we take corresponding VaR at 99% level of confidence so it is determined by the cut-off between the top 99% and bottom 1% of the observations, so we are dealing with 1% tail rather than the earlier 5% tail. So the cut off point is -2.326 and the VaR is 2.326. The higher the confidence level, smaller the tail which leads to higher VaR.

VaR not only rises with the confidence level, but also rises at the rate which is increasing. Also, VaR depends on the choice of the holding period. It rises with the square root of the holding period. But we should recognise that VaR might rise in a different way or even fall, as the holding period rises.



In the above chart, we have the following observations i.e. probability of observing a value more than 1.28 standard deviations below the mean is 10%, the probability of observing a value more than 1.65 standard deviations below the mean is 5%; and the probability of observing a value more than 2.33 standard deviations below the mean is 1%. Thus, we have critical z-values of -1.28, -1.65, and -2.33 for 10%, 5%, and 1% lower tail probabilities, respectively. We can define VaR as:-

$$\text{VaR (X \%)} = z_{X\%} \cdot \sigma$$

where $\text{VaR(X \%)} = X\%$ probability at risk

$Z_{X\%}$ = the critical Z value based on normal distribution and the X% probability

σ (sigma) = standard deviation of daily returns on percentage basis

VaR is a one tailed test so the level of significance is entirely in one tail of the distribution

To calculate VaR on dollar basis, we multiply the percent VaR by the asset value:

$$\begin{aligned} \text{VaR(X \%)}_{\text{dollar basis}} &= \text{VaR(X \%)}_{\text{decimal basis}} * \text{asset value} \\ &= (z_{X\%} \sigma) * \text{asset value} \end{aligned}$$

(a) VaR Conversions: Finance Professionals and Risk Managers may be interested in measuring risk over long time periods such as month, quarter or year. VaR can be converted from one day basis to longer basis by multiplying daily VaR by square root of no. of days e.g to convert into monthly VaR, multiply daily VaR by square root of 20(i.e. 20 business days)

$$\text{VaR(X \%)}_{X\text{-days}} = \text{VaR(X \%)}_{1\text{ day}} * \sqrt{X}$$

VaR can also be converted to different confidence intervals.

For example, if you want to convert VaR with 95% confidence interval to VaR with 99% confidence interval. The formula will be

$$\text{VaR (1\%)} = \text{VaR (5\%)} * \frac{Z_{1\%}}{Z_{5\%}}$$

(b) VaR Parameters : VaR involves two parameters i.e. the holding period and the confidence level. The usual holding periods are one day or one month but institutions can operate on other holding periods. As per Capital adequacy rules, banks should operate with a holding period of two weeks. The factor that determines the length of the holding period is the liquidity of the markets in which institution operates. A short holding period is preferable for model validation or back testing purposes, reliable validation requires a large data set and a large data set requires a short holding period.

In case of backtesting, we would usually want low confidence levels to get a proportion of excess loss observations. For example, we might want a high confidence level if we were using our risk measures to set capital requirements. If we wish to estimate VaR, we would probably wish to use confidence levels and holding periods that are comparable to those used by other institutions which are in the range of 95%-99%.

1.2 VaR Methods

1.2.1 Delta – Normal Method (Linear Method)

In the delta normal approach, the linear approximation is assumed on the risk factor which is assumed to follow normal distribution e.g. when looking at positions in options, the linear exposure used will be delta. Also, in case of positions in bonds, the linear exposure will be duration. Both are first derivatives. In case of options, the underlying factor is the stock price and we assume that the stock price is normally distributed. In case of a bond, we would assume the yield is normally distributed. This method is best used in portfolios which has a linear position.

Change in portfolio value with respect to change in risk factor is described as:

$$dp = \Delta * dr$$

where Δ is the sensitivity of the portfolio value with respect to risk factor

dp is change in the portfolio value

dr is change in risk factor

Limitations of the delta-normal method

It is only accurate for linear exposures, non – linear exposures are not correctly captured by this VaR method. E.g. Non linear exposures like convexity, mortgage backed securities and fixed income securities with embedded options are not adequately captured by this method. For measuring non-linear exposures, delta-gamma method can be used.

1.2.2 Full Revaluation Method

It is the full re-pricing of the portfolio with the assumption that the underlying risk factors are shocked to experience a loss. This method shocks the risk factor. VaR for this method calculates the worst expected change in the risk factor given some confidence and time horizon. It prices the portfolio under the changed risk factors and for wide range of price levels. The values can be generated by:

- (a) Historical Simulation
- (b) Bootstrap Simulation
- (c) Monte Carlo Simulation

(a) Historical Simulation – In this method, the portfolio is revalued using risk factors taken from historical data. E.g. Calculation of 5% daily VaR using the historical method for the past daily returns. First we need to rank the returns from highest to lowest and then identify lowest 5% of the returns. The highest value of the lowest 5% of the returns will give 1 day 5% VaR. This method is easiest to implement and it is easy to calculate. The limitation of this method is that there may not be enough historical data. Also, the variation of risk in the past may not represent the variation of risk in the future. This method is quite slow in case of adapting to new correlations and volatilities.

(b) Bootstrap Simulation – Bootstrap Simulation is an extension of historical simulation. It draws a sample from the dataset and records its VaR. Then again it will draw another new sample and record its VaR. This procedure is repeated over and over again using various samples and from all the samples, VaR is recorded. This procedure is similar to sampling with replacement. The best VaR estimate from the data is the average of all sample VaR.

(c) Monte Carlo Simulation – This method is similar to bootstrap simulation except the movements in various risk factors are generated from distributions which are estimated. It basically refers to computer software that generates thousands of possible outcomes from the distribution of inputs which are specified by a user, e.g. distribution of monthly returns of hundreds of stocks in a portfolio. The computer will select one monthly return from each stock's distribution of returns and calculate weighted average portfolio returns. The number of runs is specified by the user. Thousands of weighted average portfolio returns are formulated which will form the normal distribution.

VaR will be calculated the same as delta normal method. The main advantage of the use of Monte Carlo simulation is that we can generate correlated scenarios based on a statistical distribution. Due to which it models multiple risk factors. Thus this approach is very powerful in understanding the risk factors. Moreover, we can specifically focus on the tails of extreme loss scenarios. So, Monte Carlo Simulation method can be used both to calculate VaR as well as to complement it. Also, it can work both for linear and non linear risks. As unlimited number of scenarios is generated, this helps in creating correct distributions.

The drawback of this method is that it may generate red flags, that it is highly subjective and that generated scenarios may not be relevant going forward. The computation time is quite high and this method is expensive due to the requirement of advanced technological skills.

1.3 Coherent Risk Measures

We want risk measures to correctly reflect diversification effects and should facilitate effective decision making. The answer to this will be found in the theory of coherent risk measures. If X and Y are the future values of two risky positions, a risk measure ρ is said to be coherent if it satisfies the following properties:

- **Subadditivity** – The risk of the portfolio is at most equal to the risk of the assets within the portfolio.

$$\rho(X) + \rho(Y) \leq \rho(X + Y)$$

- **Homogeneity** – Size of the portfolio, t will impact the size of its risk

$$\rho(tX) = t\rho(X)$$

- **Monotonicity** – Portfolio with greater future returns will likely have less risk

$$\rho(X) \geq \rho(Y), X \leq Y$$

- **Risk free condition** - The risk of a portfolio is dependent on the assets within the portfolio for all constants n

$$\rho(X + n) = \rho(X) - n$$

The second, third & fourth properties imply well behaved distributions. Homogeneity says risk of a position is always proportional to its size. Monotonicity suggests that if one risk always has greater losses than the other risk, the capital requirements should be greater. Risk free condition means that there is no additional capital requirement for an additional risk for which there is no uncertainty.

Subadditivity is the most important property for a coherent risk measure. It states that portfolios will have equal or less risk than the sum of the individual portfolios.

1.4 Expected Shortfall

It is the most attractive coherent risk measure. This measure often has different names including expected tail loss, conditional VaR, tail VaR, all of which are the same. It is the expected value of our losses if we get a loss in excess of VaR. The VaR tells us the most we can expect to lose if a bad or tail event does not occur whereas Expected Shortfall tells us what we can expect to lose if a tail event does occur.

It is a more robust risk measure that satisfies all the properties of a coherent risk measure with less restrictive assumptions. Expected Shortfall is defined as the average loss conditional on being beyond a given percentile. E.g. the expected tail loss at the 99th percentile is the probability weighted average of all losses greater than the VaR at the 99th percentile.

Despite the VaR measure being better known than the expected shortfall, the latter has more advantages:

- Expected shortfall is sensitive to the entire tail of the distribution, whereas VaR will not change even if there are large increases in some of the losses beyond the cut-off percentile at which the VaR is being measured.
- Expected Shortfall is a more stable measure than VaR in showing less sensitivity to data errors and less day to day movement due to irrelevant changes in the input data.

- With VaR, negative diversification effects can arise whereas expected shortfall never displays negative diversification effects.

1.5 Limitations of VaR

VaR has its drawbacks as a risk measure. VaR estimates can be subject to errors, model risk and implementation risk. However, such problems are common to all risk measurement systems.

(a) VaR uninformative of tail losses – VaR tells us the most we can lose if a tail event does not occur. It tells us the most we can lose 95% of the time but tells us nothing about what we can lose on the remaining 5% of the occasions. If a tail event (i.e. loss in excess of VaR) does occur, we can expect to lose more than the VaR but VaR itself does not give any indication of how much that might be.

(b) VaR can create perverse Incentives Structures – It is not feasible to use information about VaR at multiple confidence levels and where it is not, the failure of VaR to take account of losses in excess of itself can create some perverse outcomes. For example, an investor using a VaR risk measure can easily end up with perverse positions because a VaR based risk return analysis fails to take account of the magnitude of the losses in excess of VaR. If a particular investment has a higher expected return at the expense of the possibility of a higher loss, a VaR based decision will suggest that we should make that investment if the higher loss does not affect the VaR regardless of the size of the higher expected return and the size of higher expected loss. Such acceptance of any investment that increases expected return regardless of the possible loss and the investor who makes decisions in this way is asking for trouble.

(c) VaR can discourage diversification – Another drawback is that VaR can discourage diversification. The VaR of the diversified portfolio is much larger than the VaR of the undiversified one. So, a VaR measure can discourage diversification of risks because it fails to take into account the magnitude of losses in excess of VaR.

(d) VaR not sub-additive – Sub-additivity means that aggregating individual risks does not increase overall risk. Sub-additivity matters for a number of reasons. If the risks are sub-additive then adding risks together would give us an overestimate of combined risk. This facilitates decentralised decision making within a firm as we can always use the sum of the risks of the units as a conservative measure. But if the risks are not sub-additive, adding them together gives us an underestimate of combined risks, and this makes the sum of risks effectively useless as a risk measure. In risk management, we want our risk estimates to be biased or unbiased conservatively.

2. STRESS TESTING

Stress testing as a formal discipline for risk and capital management was born out of financial crises. Stress tests had previously been carried out for certain types of risk or for specific portfolios, but rarely for all the risks faced by an entire enterprise. For example, market risk stress testing was widely adopted in 1990s to supplement VaR measures, whose calculations tend to underestimate

extreme losses. While these narrow stress tests were useful for managing specific risks or portfolios, they shed light on the overall effect that a stress event would have on an institution.

2.1 Role of Enterprise wide Stress Testing

The impetus for setting up enterprise-wide stress testing in most jurisdictions was a regulatory requirement around capital adequacy assessment. As a result, the early use of stress testing was narrow, focusing on whether there was sufficient capital to survive a stress event and what capital actions such as dividend payments etc. were possible. However, financial institutions have since built up their stress testing capabilities and explored ways of using it to meet broader risk management and business objectives, specifically, for which applications or decisions will stress testing, will be a key input or a driver? Should risk appetite be articulated based upon tolerances in a stress environment? Should capital requirements from stress testing be used for performance management or loan pricing?

Various Reasons for incorporating stress testing results into a broader set of such risk and business applications.

- **Binding Constraint** – Stress test results have become the binding constraint for evaluating capital adequacy and the key driver of dividend policy for many institutions.
- **Management attention** – Given its linkage to dividend payments, as well as the governance requirements demanded by regulators, stress testing has the attention of senior management and the board of directors.
- **Intuition** – Many users find stress results to be more intuitive than other risk metrics because they are presented in an accounting framework, similar to other external communications regarding the institution's financial condition.
- **Transparency** – As outcomes are linked to casual factors in stress testing, such results are also more transparent and easier to understand than other risk metrics (such as economic capital).
- **Consistency** – The enterprise wide stress testing usually piggybacks the budgeting and planning process, which gives a degree of consistency with the inputs and approaches accepted already in a well established process.

2.2 Applications of Stress Testing

Almost all surveyed institutions use stress testing to measure capital adequacy. However, half or more also use it for risk reporting, risk appetite, limit setting and management, and various planning exercises (e.g. financial, strategic and contingency)

Examples of such extended uses of stress testing are:

- **Risk Reporting** – Stress testing results are often used to report levels of risk in business activities – for example, by reporting the credit losses by portfolio in various stress

scenarios would cause in specific portfolios, or by showing a business unit's contribution to the P&L in a stress scenario.

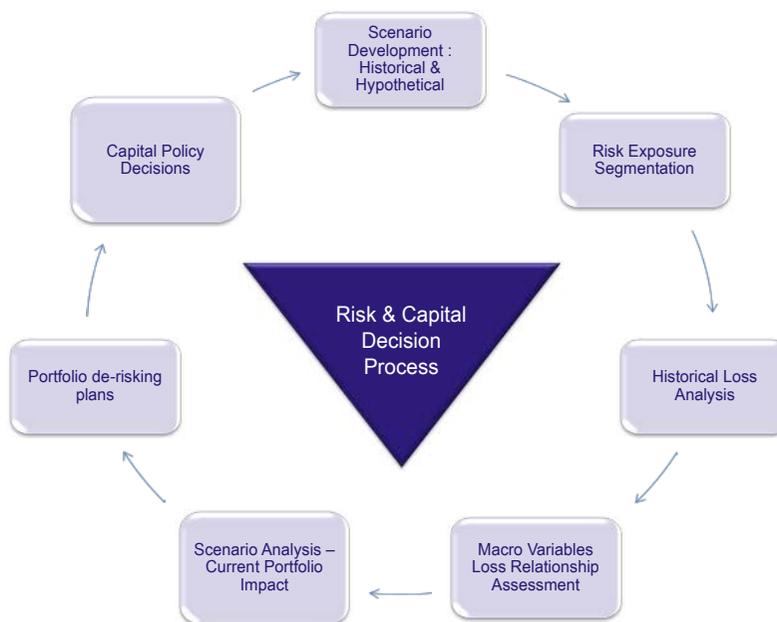
- **Strategic Planning** – These results are increasingly integrated into business planning as institutions look to understand the impact of stress scenarios on alternative strategies and especially on the ability to pay dividends.
- **Risk Appetite** – Stress testing is increasingly being integrated into risk appetite, using tolerance for outcome in a stress to set risk appetite and cascade it down to risk appetite/ tolerance to individual products/ businesses.
- **Limits** – Stress testing expressions of risk appetite are often cascaded into limits at the enterprise level.

To a lesser extent, banks are using stress testing to inform capital allocation, credit portfolio structuring, performance measurement and management, pricing and original strategy.

<i>Uses</i>	<i>Description</i>	<i>Key Challenges</i>
Capital Adequacy	Ensuring Institution maintains sufficient capital in line with risk appetite	Managing between regulatory stress testing based and economic capital views of required capital and risk
Risk Measurement and Reporting	Communicating risk exposure across the organisation	
Risk Appetite Statement	Definition of the institution's high level, risk related objectives and constraints	
Contingency Planning	Contingency measures such as capital raising and balance sheet reduction	NA
Strategic Planning	Medium term planning of strategy and targets around business units, geographies and products	Cultural shift in some cases to incorporate stress scenarios as a planning scenarios
Financial Planning and Budgeting	Annual exercise to forecast revenues and expenses, and allocate budget across businesses	Organizational challenge to achieve financial buy in on risk metrics
Limit Setting	Setting risk limits at business, product & portfolio level	Scenario severity used for establishing limits and measuring risk against limits is difficult to define objectively
Risk Measurement	Measuring and monitoring usage	

against limits	of risk limits	
Capital Allocation	Allocation of economic and regulatory capital at granular portfolio and business line level	Stress testing produces a narrow view of risk that may not be well suited to allocation and achieving consistency across exposures
Performance measurement and management	Measurement of risk/return of portfolios and business lines	Stress results are less accurate at granular levels at which capital allocation is needed for performance measurement
Pricing	Transaction level pricing and decision support	Stress results are less accurate at granular levels at which capital allocation is needed for pricing purposes

2.3 Stress Test Process



The above exhibit clearly provides a step-by-step process by which stress testing can be integrated into the decision-making system of a typical financial institution. The first step in the process is the generation of various scenarios. The scenario development incorporates both historical and hypothetical states of macroeconomic variables. It is important to select scenarios that appropriately reflect the idiosyncratic business profile of a particular financial institution.

The second step involves the segmentation of the current risk exposures with particular focus on risk concentration. It is essential to have detailed record of historical losses that correspond to the same level of granularity as the current exposure to enable temporal analysis. Historical losses in

the form of defaults, loss severities, and exposure details are explained by macroeconomic scenarios using regression based techniques.

The consequent relationships are then applied to the current portfolio to generate current assessments of income and expenses, losses and capital ratios etc. These results are then compared to the desired risk appetite of the financial institution. In case of a mismatch between actual and potential risk appetite, de-risking options could have an impact on the capital policy decisions of the financial institutions especially decisions involving dividends, share buybacks and compensation policies. The entire process is subjected to governance oversight at every level, beginning with scenario and model validation, to internal controls over data, and finally ending with clear communication and review by senior executives and the various board committees.

3. SCENARIO ANALYSIS

Scenario analysis helps firms to look at their businesses and portfolios downside movement which can either be because of a stress event or a downturn scenario. This analysis helps firms to analyse any stressful situation which may or may not have happened in the past. It has been used for years in many areas (e.g. health, economics etc.). Scenarios are basically sequence or development of events which start from one set of assumptions in order to evaluate or map various outcomes of a particular situation.

Generating scenarios can either be event based or portfolio based. In case of event based scenarios, the scenario is generated from events that will cause movements in the relative risk factors. In case of a portfolio driven scenario, first step is to evaluate the portfolio risk vulnerability. It is then translated into adverse risk factor movements.

3.1 Categories of Stress Scenarios

In scenarios, we take into account the impact of adverse and external conditions which can be a big threat to the survival of a company. There are four main categories of scenarios:

- **Normal Stress Scenarios** – The occurrence of these scenarios can be once or twice in ten-year period. This type of scenarios should be manageable within the normal structure of roles and responsibilities for daily decisions. In this scenario, the credit criteria can be made more vigorous and guidelines might need to be tightened, but these fall within the normal scope of regular policy adjustments. These types of events lead to increased loan losses and reduced earnings but they usually do not present a serious threat to the survival of a financial institution.
- **Severe Stress Scenarios** – These are scenarios that one would expect only once or twice in a professional lifetime. The two oil shocks in 1970s triggered unusually severe economic consequences. These episodes represent severe stress scenarios for many institutions. It is normally included in regular stress testing exercises and it will definitely result in declines

in earnings and some period of losses. With proper early warning indicators and timely action, institutions should be able to avoid serious risk of default in this environment.

- **Near-Default Stress Scenarios** – The global financial crises that began in late 2008 falls into this category for many institutions especially those that were involved in the creation and sale of the subprime mortgage securities. Because of this event, some institutions came close to default but were able to weather the storm without assistance from the Government. These types of stress scenarios form the basis for the development of a detailed recovery plan. Such a plan represents an institution's response to extraordinary conditions during which extraordinary actions are required.
- **Stress to Default Scenarios (Reverse Stress Test Scenarios)** – Some institutions failed during global financial crises, this period represented stress to default scenario. It involves extremely unlikely events which force the companies to think about the firm's most serious vulnerabilities and design stress to default scenarios accordingly. Broad organizational involvement is essential when defining appropriate events like failure of a major counterparty, rogue trading losses, internal fraud etc. which might contribute to institutional failure.

3.2 Scenario Selection

The identification of relevant stress events requires the opinions of all relevant experts such as risk managers, economists, business managers, and traders. Stress Testing should include business cycle stresses as well as event specific tail risks. For example, markets with low historical volatility may experience large discrete movements, the scenario in such a case should reflect the potential interaction of market risk, trading liquidity risk, and credit risk for corporate bonds. Effective scenario analysis should take into account how events unfold over time. Scenarios should also address correlations between risk factors and distinguish between static and dynamic scenarios—i.e., one-period versus multi period frameworks. Forward looking stress and scenario tests must specify length, speed and magnitudes of events and should describe dynamics between transactions. If the scenarios are well developed, they can form an integral part of the management culture and have a meaningful impact on business decisions.

3.3 Drawbacks of Scenario Analysis

With a small number of risk factors, the number of alternative scenarios is manageable. As the number of risk factors increases, the number of alternative scenarios could easily become unmanageable.

Another drawback of Scenario Analysis is that it assumes that the scenarios are equally probable. This ignores the correlations between the risk factors. Although stress testing does allow risk managers to identify major risks, it is subjective in deciding how serious the risks are. The risk manager could generate an ever larger number of scenarios and uncover more extreme events. But

these potential losses might not be significant. Implausible losses might be considered and plausible losses might not be discovered.

3.4 Basel Committee on Banking Supervision (BCBS) Principles for Sound Stress Testing Practices and Supervision*

**Source: Basel Committee on Banking Supervision*

1. Stress testing should form an integral part of the overall governance and risk management culture of the bank. Stress testing should be actionable, with the results from stress testing analyses impacting business decisions of the board and senior management. Board and senior management involvement in the stress testing programme is essential for its effective operation
2. A bank should operate a stress testing programme that promotes risk identification and control; provides a complementary risk perspective to other risk management tools; improves capital and liquidity management; and enhances internal and external communication.
3. Stress testing programmes should take into account of views from across the organization and should cover a range of perspectives and techniques.
4. A bank should have written policies and procedures governing the stress testing programme. The operation of the programme should be appropriately documented.
5. A bank should have a suitably robust infrastructure in place, which is sufficiently flexible to accommodate different and possibly challenging stress tests at an appropriate level of granularity.
6. A bank should regularly maintain and update its stress testing framework. The effectiveness of the stress testing programme, as well as the robustness of major individual components, should be assessed regularly and independently.
7. Stress tests should cover a range of risks and business areas, including at the firm-wide level. A bank should be able to integrate effectively, in a meaningful fashion, across the range of its stress testing activities to deliver a complete picture of firm-wide risk.
8. Stress testing programmes should cover a range of scenarios, including forward-looking scenarios, and aim to take into account system-wide interactions and feedback effects.
9. Stress tests should feature a range of severities, including events capable of generating the most damage whether through size of loss or through loss of reputation. A stress testing programme should also determine what scenarios could challenge the viability of the bank (reverse stress tests) and thereby uncover hidden risks and interactions among risks.
10. As part of an overall stress testing programme, a bank should aim to take account of simultaneous pressures in funding and asset markets, and the impact of a reduction in market liquidity on exposure valuation.
11. The effectiveness of risk mitigation techniques should be systematically challenged.

12. The stress testing programme should explicitly cover complex and bespoke products such as securitized exposures. Stress tests for securitized assets should consider the underlying assets, their exposure to systematic market factors, relevant contractual arrangements and embedded triggers, and the impact of leverage, particularly as it relates to the subordination level in the issue structure.
13. The stress testing programme should cover pipeline and warehousing risks. A bank should include such exposures in its stress tests regardless of their probability of being securitized.
14. A bank should enhance its stress testing methodologies to capture the effect of reputational risk. The bank should integrate risks arising from off-balance sheet vehicles and other related entities in its stress testing programme.
15. A bank should enhance its stress testing approaches for highly leveraged counterparties in considering its vulnerability to specific asset categories or market movements and in assessing potential wrong-way risk related to risk mitigation techniques.
16. Supervisors should make regular and comprehensive assessments of a bank's stress testing programme.
17. Supervisors should require management to take corrective action if material deficiencies in the stress testing programme are identified or if the results of stress tests are not adequately taken into consideration in the decision-making process.
18. Supervisors should assess and if necessary challenge the scope and severity of firm-wide scenarios. Supervisors may ask banks to perform sensitivity analysis with respect to specific portfolios or parameters, use specific scenarios or to evaluate scenarios under which their viability is threatened (reverse stress testing scenarios).
19. Under Pillar 2 (supervisory review process) of the Basel II framework, supervisors should examine a bank's stress testing results as part of a supervisory review of both the bank's internal capital assessment and its liquidity risk management. In particular, supervisors should consider the results of forward-looking stress testing for assessing the adequacy of capital and liquidity.
20. Supervisors should consider implementing stress test exercises based on common scenarios.
21. Supervisors should engage in a constructive dialogue with other public authorities and the industry to identify systemic vulnerabilities. Supervisors should also ensure that they have the capacity and skills to assess a bank's stress testing programme.



4. COUNTRY RISK

Country Risk is broader concept which covers the adverse impact of host country's economic, financial and political environment. This risk is most important in case of Multinational National

Corporations (MNCs) which establishes their business in different countries away from the country where they are registered.

4.1 Types of Country Risk

The analysis of Country Risk is not important not only because it impacts the profitability of MNCs but also important for the investors who invest their money through FPI, FDI etc. Let us now discuss the major types of Country Risk.

4.1.1 Political Risk

This risk mainly arises out of the changes in the political scenarios as well as adverse decisions by the ruling Government. The various types of political risk which ultimately affect the profit of the MNCs from the operations in the host country can be described as follows:

- (i) *Nationalisation or Expropriation Risk*: This is most common form of risk wherein host country takes over the business of MNCs without or with inadequate compensation.
- (ii) *Exchange Control Risk*: This form of risk prevents the MNCs to get converted their earning from local currency to foreign currency to repatriate the same to home country of MNCs. Due to this restrictions even investors in MNCs business also suffer a lot.
- (iii) *Taxes, Rule and Regulation Risk*: This risk arises mainly due to a sudden or dramatic change in Rule and Regulations governing the host country. These sudden changes can be in any of following type of forms:
 - ◆ Unanticipated increase tax rates applicable for MNCs operating in the host country.
 - ◆ Compulsion to hire local workforce.
 - ◆ Compliances of stricter environmental standards.
- (iv) *Inefficient Legal System*: High level of red tapism and corruption at local and higher level pose a serious risk for MNCs operating in the host country as it leads to uncertainty and high cost of operation.
- (v) *Repudiation of Contracts*: This type of risk arises on account revocation of earlier awarded turnkey projects by the Government of host country without adequate consideration and damages. This risk is also called indirect expropriation risk.

4.1.2 Financial and Economic Risk

The main risk covered in this category is the Sovereign Risk i.e. default in repayment of borrowing by the Government of host country.

Although Government of host country can easily repay the loan by printing more currency notes but it will depreciate value of its currency. The sovereign risk hamper the reputation of the country severely from investment point of view but it saves a lot of foreign exchange of the Government.

To identify such types of risk well in advance following economic variables can be used:

- Ratio of country's Import to its Official Reserve
- Ratio of Import to its Export
- Balance of Payment Surplus/ Deficit on current account.
- Country's Debt Service Ratio
- Country's external debt to its GDP

4.2 Country Risk Management Process

As discussed above Country Risk is a major issue of concern in overall management of business. Broadly speaking the country risk management process involves the following steps:

- Identification of Risk:* First and foremost, step in country risk management is identification of risk. The various quantitative and qualitative techniques can be used to identify the risks.
- Analysis of Risk:* Once the risk is identified the next step is analyse the same from various angles.
- Evaluation of Risk Management Techniques:* Evaluation of various techniques to manage the risk is carried out.
- Selection of suitable techniques:* Once various techniques have been evaluated next steps comes of selection of most suitable technique to manage the risk.
- Implementation of Techniques:* The techniques to manage the risk are implemented.
- Control:* Once the selected techniques are implemented they need to be reviewed on periodic and if required they are revised.

4.3 Country Risk Assessment Tools

Broadly Country Risk Assessment tools can be divided into following two categories:

- (1) Qualitative Tools
- (2) Quantitative Tools

Now let us discuss each of these tools one by one.

4.3.1 Qualitative Tools

This is one of the simplest techniques for country risk assessment to rank the countries. The methods employed are:

- Numeral Coding:** In this method, after considering various factors, a number is assigned to a country. While the highest number indicates lesser risk, the lowest number indicates higher risk.
- Colour Coding:** Different colours can be used to indicate the level of country risk. While Red Color indicates higher risk, Green Colour indicates a risk free zone.
- Combination of Numeral and Colour:** A combination of colour and numeral is also used to indicate relative level of country risk.

- (iv) **Other Methods:** In addition to above, other methods can also be used which are as follows:
- Grade Based Rating* – The grade can be assigned such as S & P, Moody's and Fitch assigns rating. For example, while USA been assigned rating of Aaa, AA+ and AAA by these agencies respectively of safer zone, Venezuela has been assigned rating Caa, B- and C indicating riskier zone.
 - Event Driven* – A very specific negative event such as removal of current government by military or sovereign default etc. assessed with the probability of happening.

For example, for India, due to its democratic system, the possibility of taking over of Government by military is rare and hence 0% probability can be assigned for this happening. On the other hand for same event, 70% probability can be assigned in case of Pakistan.

4.3.2 Quantitative Tools

Generally, quantitative tools are related to economic measures such as GDP, Forex rates and services, FDI etc. Other numbers include Growth in Industrial Production, Population Growth, etc. Some of the indices that can be used for Country Risk Analysis are following:

S. No.	Index	Basis
1	Corruption Perception Index	It is one of the most popular indicator published by Transparency International. The ranking is numeral based ranging from 0-10. While 0 indicate least corrupt, 10 indicate highly corrupt.
2.	Democracy Index	Published by Economic Intelligent, countries are classified into following four groups. <ul style="list-style-type: none"> • Full democracy (8 to 10) • Flawed Democracy (6 to 10) • Hybrid Regime (4 to 5.9) • Authoritarian Regime (0 to 3.9) This index is based on following 5 categories : <ul style="list-style-type: none"> ❖ Electoral process pluralism ❖ Civil liberties ❖ Functioning of Government ❖ Political Participation ❖ Political Culture
3.	Freedom in the world	This survey is conducted by Freedom House and provides on the basis of study of Political rights and civil liberties. It uses rating based on 1-7 scale indicating 1 being most free and 7 being least free.
4.	Gini Coefficient	It is one of the most popular index to gauge the rich-n-poor income countries. It measures inequality in income

		distribution. It uses scales 0 to 1, where 0 indicates total equality and 1 indicates total inequality.
5.	Global Peace Index	This index is published by Vision of Humanity and derived from key information such level of crimes, violence, military expenditure etc.
6.	Human Development Index	<p>Published by UN rates, the countries on the basis of following factors:</p> <ul style="list-style-type: none">❖ Education level❖ Literacy Rate❖ Year of Schooling❖ Income❖ Life Expectancy and❖ Standard of Living <p>It uses the scale of 0 to 1, where 0 being the least developed while 1 being the highest developed.</p>