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Growth of Renewable Energy Sector in India

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From the Editor's Desk

India's economic and human development is one of the most significant global achievements of recent times. Between 2005 and 2010, India's share of global GDP increased from 1.8 percent to 2.7 percent, and 53 million people were lifted out of poverty. While India has made significant progress in reducing absolute poverty, it remains home to one third of the global poor.

It is in this context one should consider India's Monetary Policy as RBI has been under a huge amount of pressure from the government to cut the monetary policy rate. There will always be a difference of opinion on policy matter. India's monetary history of recent times is full of such events. A high interest rate ends up controlling inflation but remains bad for growth. On the contrary, a low interest rate regime is good for overall economic growth but may cause injustice to the poor.

A continued rapid economic growth is a precondition for poverty reduction and shared prosperity. As per RBI's report, the average growth in sales for Indian companies halved to 9% in FY12-13 from 18.5% the previous fiscal and 21.6% in FY07-08. Rising interest payments have led to a fall in profits too. The net profit as a percentage of sales stood at 5.9% for 2012-13, nearly half of the 11% in 2007-08.

The difference of opinion regarding the conduct of monetary policy between the RBI and the finance ministry may have come out with long run solutions very soon. Till then let us hope for the best.

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Basel Norms for Risk Measurement – A review from Indian perspective

Swapna Sen
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Abstract

Basel capital adequacy norms have been introduced in India in the early nineties following their adoption by G-10 countries. The capital adequacy norms have also undergone radical changes during the last two decades. This paper revisits the different approaches of calculation of the regulatory capital for credit, market and operational risk in details and tries to explore the technical hitches of migration to the advanced approaches from the existing ones.

1. Introduction

Banks are financial intermediaries. They are bridges between assurances and uncertainties. So the banking business is intensely risk prone. Some of the important types of risks faced by the banks include credit risk or the risk of loss arising from a borrower who does not make payments as promised, market risk or the risk that the value of a portfolio, either an investment portfolio or a trading portfolio, will decrease and operational risk or the risk arising from execution of a bank's business functions.

Banking risk is all the more critical for its spill over effect. If one banking institution is affected, like a contagious disease, it spreads all over the economy. Under the shade of National umbrella, the heat is often not perceived, with only some resentment from the taxpayers. But when it comes to cross border implication – the issue becomes all the more critical. The chaotic liquidation of the German Bank Herstatt in 1974 gave the motivation behind formation of the Basel committee on Banking Supervision.

BCBS is formed in 1974 by the central bank governors of the G10 countries under the auspices of Bank of International Settlement. The committee operates at international level. Their policy guidelines, popular as Basel norms, are recommendatory but not mandatory. But the central banks of more than 100 member and non member countries accept those guidelines and make their own prescriptions to be followed by the banks in their respective countries.

The main objective of the Committee is to ensure financial stability of banks and provide internationally active banks a level playing field.

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The entire gamut of Basel norms are pivoted about one single ratio the CAR or CRAR given as:

$$\text{Capital Adequacy Ratio (CAR)} = \frac{\text{Tier I Capital} + \text{Tier II Capital}}{\text{Risk Weighted Assets}}$$

expressed as a %. Also known as "Capital to Risk-Weighted Assets Ratio (CRAR)."

The Tier I Capital is also known as core capital with maximum loss absorbing capacity. It comprises mainly of Common Equity and other perpetual instruments like IPDI and NCPS which cannot be redeemed at the discretion of its providers.

Tier II capital has much less loss absorbing capacity, includes subordinated debts with maturity more than 5 years, CPSs etc.

The Basel norms are being implemented in India since 1992. Basel norms are supposed to be a very efficient system for risk measurement and risk protection. Basel has provided a range of approaches with varying degree of sophistication and encourages self surveillance. But here only simplest approaches are adopted. These are very easy to implement but not much profitable and effective. So the real benefits are grossly not perceived. Instead high capital requirements and liquidity requirements, particularly under Basel III, are exerting immense pressure on banks.

The Basel norms are not adding any remarkable value to the risk management process. The reason being the methodologies adopted are over simple and not measuring the actual risk exposure. Basel implementation is only for the sake of compliance, because non compliance would eliminate the Indian banks from the International Banking, thus not possible. So, Indian banks as well as their supervisor have accepted the norms by brain and not from heart. Indian banks do have their risk management procedures, but they are not aligned with Basel requirements. Unless Basel norms are viewed as an integral part of the risk measurement process, true benefits of Basel norms cannot be reaped. Basel emphasises and incentivises self surveillance. Their aim is a convergence between economic capital and regulatory capital. Proper measurement of risk is not only necessary for the calculation of the regulatory capital but also a good control over all the activities of the bank.

Indian banks were keeping capital over and above the required minimum. So, optimum capital level was not achieved. Half hearted implementation is neither effective nor sustainable.

The risk measurement methodologies prescribed by the Basel norms are primarily of two categories – simple ones which are the standardised methods and advanced ones which are the customized ones. The standard methods are easy to implement but are least effective also in the sense that they are very broad-brush approaches and lead to a very approximate

calculation of the capital requirement. Capital reserve more than the optimum level makes the banks unprofitable and less than the same renders them unsafe. So, either is not desirable. This paper revisits the different approaches of calculation of the regulatory capital for credit, market and operational risk in details and tries to explore the technical hitches of migration to the advanced approaches from the existing ones. The study is organised into five sections; the present introduces the topic, the second provides a review of studies on the Basel norms, the third deals with the methodologies of calculation of capital requirement in details, the fourth gives a brief overview of the International scenario in association with Basel norms, the fifth tests the preparedness of Indian banks to accept those changes and the sixth draws the conclusion of this study.

2. Literature Review

There are numerous studies on the Basel norms both in India and abroad. A few are discussed here.

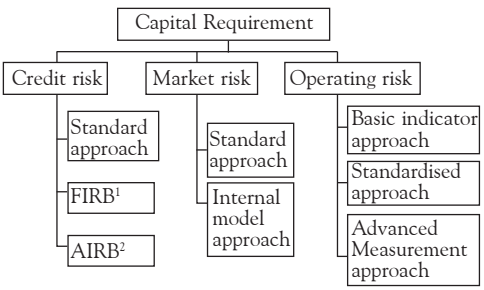
The Banking Association, South Africa (2005) has published a paper to provide a basic insight into the Basel II document for persons, e.g. new financial market analysts and financial journalist needing a basic understanding or introduction to the current bank supervision and regulation. Bailey R. (2005) has stated that Basel II represents something of a "Catch – 22" for developing countries as Basel compliance would mean local banks becoming vulnerable to acquisition by their international counterparts while non-compliance will avoid this, but exclude local banks from overseas markets. Bryan J. Balin (2008) has discussed the Basel accords in simple language and brought out the disharmony of the accords once applied in the emerging market economies. Balthazar (2006) has given a practical overview of the Basel accords and also outlined the challenges that would have to be met to reach the new regulatory standards. Chacko (2012) has studied the impact of Basel III on the Indian Banking System and ended up with a glorious picture. Aashika Agarwal & Sudhir Sirohy (2010) have showcased the changes that will emerge as a result of Indian banks adopting the international norms. They are of the opinion that scientific risk management will change the face of banking in India. Small banks will not be able to sustain the pressure and will eventually disappear. Large banks will be able to control the defaults with efficient credit scoring techniques. Good credit customers would be given high scores. These scores would be monitored through a centralised system and the same score could be used for various products of the same bank. Eventually, new products would be developed for good credit customers in the profitable segment. The economy will stand to benefit as the banking sector develops. Savings will be mobilized in the right direction and the required funds needed for the country's development will be made available.

The surveyed literature has brought out the challenges as well as the

positivities of Basel norms, particularly when applied to the emerging economy markets. With this background, the present study looks into the prescriptions of the Basel norms in details and reviews how these norms could be applied beneficially to the Indian banks.

3. Basel methodologies for Calculation of Minimum Capital Requirements

The following chart shows the array of approaches prescribed in the Basel norms. The paper subsequently deals each of them in re Ln Y_t is the log value of real output and t is time period. Our estimates of the CARG for the GDP and the PSGDP over the period 1960-61 – 2011-12 and sub periods are shown in Table 2 below:



1 – Foundation Internal Rating Based Approach

2 – Advanced Internal Rating Based Approach

3.1. Credit Risk

Standardised Approach

The term standardised approach refers to a set of credit risk measurement techniques proposed under Basel II capital adequacy rules for banking institutions.

Under this approach the banks are required to use ratings from External Credit Rating Agencies to quantify required capital for credit risk. In many countries including India this is the only approach adopted in the initial phase of Basel II Implementation.

Calculation of capital requirement

Step I – Calculation of Credit Risk Exposure given as:

$E^* = \max \{0, [E \times (1 + He) - C \times (1 - Hc - Hfx)]\}$

where:

E*= the exposure value after risk mitigation

E = current value of the exposure

He= haircut appropriate to the exposure

C= the current value of the collateral received

Hc= haircut appropriate to the collateral

Hfx= haircut appropriate for currency mismatch between the collateral and Exposure

Standard supervisory haircuts

These are the standard supervisory haircuts (assuming daily mark-to-market, daily remargining and a 10-business day holding period), expressed as percentages in Table 1 below:

Table 1: Standard Supervisory Haircuts

Issue rating for debt securities	Residual Maturity	Sovereigns	Other issuers
AAA to AA-/A-1	≤ 1 year	0.5	1
	>1 year, ≤ 5 years	2	4
	> 5 years	4	8
A+ to BBB-/A-2/A-3/P-3 and unrated bank securities	≤ 1 year	1	2
	>1 year, ≤ 5 years	3	6
	> 5 years	6	12
BB+ to BB-	All	15	
Main index equities (including convertible bonds) and Gold		15	
Other equities (including convertible bonds) listed on a recognised exchange		25	
UCITS/Mutual funds		Highest haircut applicable to any security in which the fund can invest	
Cash in the same currency		0	
Source: BIS			

The standard supervisory haircut for currency risk where exposure and collateral are denominated in different currencies is 8% (also based on a 10-business day holding period and daily mark-to-market)

For transactions in which the bank lends non-eligible instruments (e.g. noninvestment grade corporate debt securities), the haircut to be applied on the exposure should be the same as the one for equity traded on a recognised exchange that is not part of a main index.

Eligible collateral

- The following collateral instruments are eligible for recognition:
- Cash (as well as certificates of deposit or comparable instruments issued by the lending bank) on deposit with the bank which is incurring the counterparty exposure
- Gold,
- Debt securities issued by sovereigns rated category 4 or above,
- Debt securities issued by PSE that are treated as sovereigns by the national supervisor and that are rated category 4 or above.

Credit conversion factors for off-balance-sheet items

The framework takes account of the credit risk on off-balance-sheet exposures by applying credit conversion factors to the different types of off-balance-sheet

instrument or transaction. With the exception of foreign exchange and interest rate related contingencies, the credit conversion factors are set out in the Table 2 below.

Table 2: Credit Conversion Factors for Off Balance Sheet Items

Instruments	Credit conversion factors
1. Direct credit substitutes, e.g. general guarantees of indebtedness (including standby letters of credit serving as financial guarantees for loans and securities) and acceptances (including endorsements with the character of acceptances)	100%
2. Certain transaction-related contingent items (e.g. performance bonds, bid bonds, warranties and standby letters of credit related to particular transactions)	50%
3. Short-term self-liquidating trade-related contingencies (such as documentary credits collateralised by the underlying shipments)	20%
4. Sale and repurchase agreements and asset sales with recourse, where the credit risk remains with the bank	100%
5. Forward asset purchases, forward deposits and partly-paid shares and securities, which represent commitments with certain drawdown	100%
6. Note issuance facilities and revolving underwriting facilities	50%
7. Other commitments (e.g. formal standby facilities and credit lines) with an original maturity of over one year	50%
8. Similar commitments with an original maturity of up to one year, or which can be unconditionally cancelled at any time	0%

Step II - Capital Requirement = Adjusted Exposure * Risk Weight

The summary of risk weights in standardised approach

- Claims on sovereigns

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	unrated
Risk Weight	0%	20%	50%	100%	150%	100%

- Claims on the BIS, the IMF, the ECB, the EC and the MDBs

Risk Weight: 0%

- Claims on banks and securities companies

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	unrated
Risk Weight	20%	50%	100%	100%	150%	100%

- Claims on corporates

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BB-	Below BB-	unrated
Risk Weight	20%	50%	100%	150%	100%

- Claims on retail products
  This includes credit card, overdraft, auto loans, personal finance and small business.

  Risk weight: 75%

- Claims secured by residential property
  Risk weight: 35%

- Claims secured by commercial real estate
  Risk weight: 100%

- Overdue loans
  more than 90 days other than residential mortgage loans.

Risk weight:

150% for provisions that are less than 20% of the outstanding amount

100% for provisions that are between 20% - 49% of the outstanding amount

100% for provisions that are no less than 50% of the outstanding amount, but with supervisory discretion are reduced to 50% of the outstanding amount

- Other assets
  Risk weight: 100%

- Cash
  Risk weight: 0%

Foundation Internal Rating Based (F-IRB) Approach

Under this approach the banks are allowed to develop their own empirical model to estimate the PD (probability of default) for individual clients or groups of clients. Banks can use this approach only subject to approval from their local regulators.

Under F-IRB approach banks are required to use regulator's prescribed LGD (Loss Given Default) and other parameters required for calculating the RWA (Risk Weighted Assets). Then total required capital is calculated as a fixed percentage of the estimated RWA.

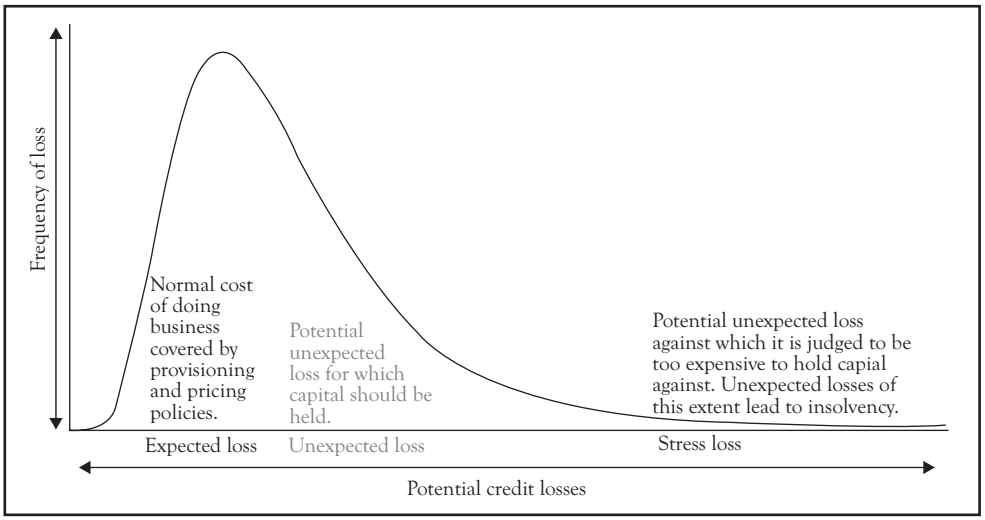
Advanced Internal Rating Based A-IRB Approach

Under this approach the banks are allowed to develop their own empirical model to quantify required capital for credit risk. Banks can use this approach only subject to approval from their local regulators.

Under A-IRB approach banks are supposed to use their own quantitative models to estimate PD (probability of default), EAD (exposure at default), LGD (loss given default) and other parameters required for calculating the RWA (risk-weighted asset). Then total required capital is calculated as a fixed percentage of the estimated RWA.

Rationale behind Internal-Ratings-Based Approach

Banks can settle on their own estimation for some components of risk measure: the probability of default (PD), exposure at default (EAD) and effective maturity (M). The goal is to define risk weights by determining the cut-off points between and within areas of the expected loss (EL) and the unexpected loss (UL), where the regulatory capital should be held (Fig.1), in the probability of default. Then, the risk weights for individual exposures are calculated based on the function provided by Basel II.



The underlying concept is to keep regulatory capital for the differential between expected and unexpected losses. The Expected Loss (in currency amounts) can then be written as

$$EL = PD * EAD * LGD$$

or, if expressed as a percentage figure of the EAD, as

$$EL = PD * LGD$$

Where,

EAD= Exposure at Default

LGD= Loss Given Default of the exposure

PD= One year Probability of Default of the borrower

The model used here is "Asymptotic Single Risk Factor" Model, where a single risk factor or correlation R is used to determine the unexpected loss, also called as credit VAR or conditional expected loss and the confidence interval is assumed to be 99.99%.

In the formula

It is visible for R = 0, i.e., if there is no systemic risk attached to the asset, the capital requirement is zero.

Capital requirement

$$K = \left[LGD * N\left\{ \frac{G(PD)}{(1-R)^{0.5}} + \frac{(R)^{0.5}}{(1-R)^{0.5}} * G(0.999) \right\} - LGD * PD \right] * \left[\frac{1+(M-2.5)*b}{1-1.5*b} \right]$$

The expression for R is given by the formula:

Correlation (R) = 0.12 × (1 – EXP (-50 × PD)) / (1 – EXP (-50)) + 0.24 × [1 - (1 - EXP(-50 × PD))/(1 - EXP(-50))]

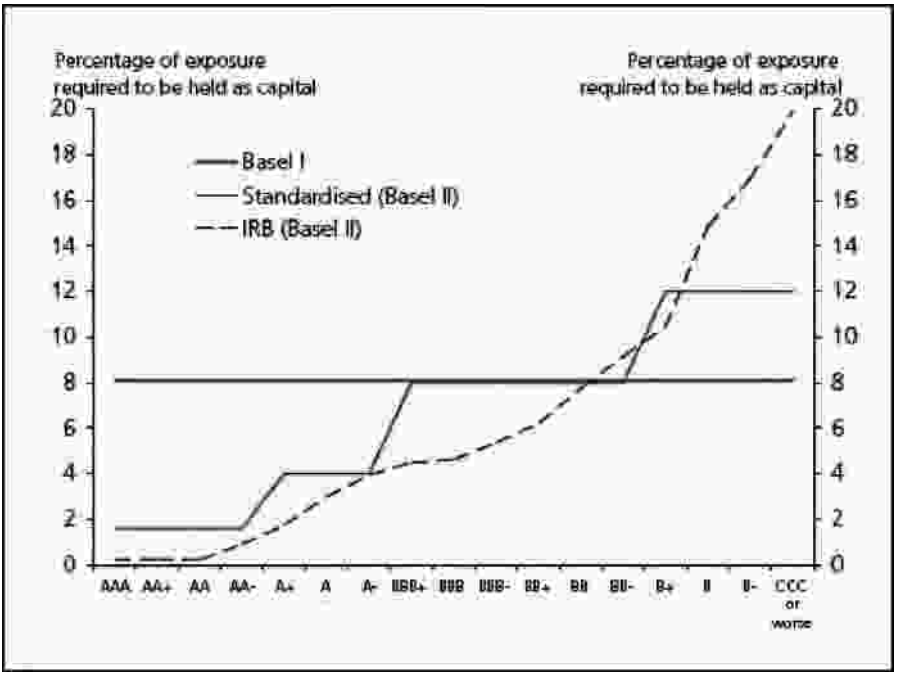
Finally the difference between EL and UL is adjusted for maturity, b being the factor given as:

Maturity adjustment (b) = (0.11852 – 0.05478 × ln (PD)) ^ 2

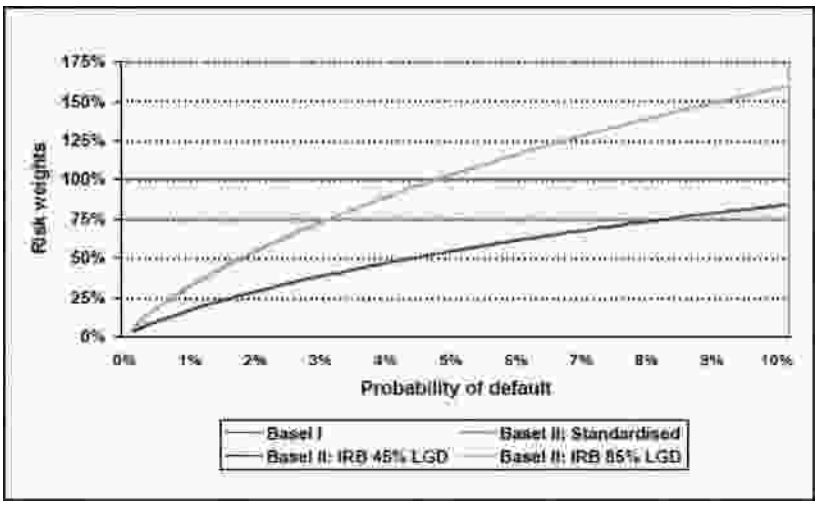
The advantages

IRB approach

- benefits customers with lower probability of default.
- benefits banks to hold lower capital requirement as having corporate customers with lower probability of default w.r.t. the standardised approach (Fig. 2).



- benefits banks to hold lower capital requirement as having credit card product customers with lower probability of default w.r.t. the standardised approach (Fig. 3).



3.2. Operational Risk

The Basic Indicator approach

The Basic Indicator Approach is the simplest, but it will charge the capital most generally. It's based on a straight percentage of gross income, which includes net interest income and net non-interest income but excludes extraordinary or irregular items. While this approach may roughly capture the scale of an institution's operations, it surely has only the most questionable link to the risk of an expected loss due to internal or external events.

Banks that uses the Basic Indicator Approach must hold capital for operational risk equal to the average over the previous three years of a fixed percentage (denoted alpha) of positive annual gross income. Figures for any year in which annual gross income is negative or zero, should be excluded from both the numerator and denominator when calculating the average. The charge may be expressed as follow:

$$K_{\text{BIA}} = \frac{\sum_{i=1}^{n} (GI_i * \alpha)}{n}$$

Where:

= The capital charged under the Basic Indicator Approach.

= Gross income, where positive, over the previous three years.

= Number of the previous three years for which gross income is positive.

= 15% (which is set by the committee, relating the industry wide level of required capital to the industry wide level of the indicator).

GI, the Gross income, will be defined as net interest income plus net non-interest income, as is defined by national supervisors and/or national accounting standards.

The Standardized Approach

The concept for applying the Standardized Approach is basically the same as the Basic Indicator Approach. The main difference between the two is that "The Standardized Approach" must divide the bank's business operations into 8 business lines: corporate finance, trading & sales, retail banking, commercial banking, payment & settlement, agency services, asset management, and retail brokerage.

Within each business line, gross income is a broad indicator that serves as an approximated scale for the business operations and thus the likely scale of operational risk exposure within each of these business lines. The capital charge for each business line is calculated by multiplying gross income by a factor (denoted beta) assigned to that business line. Beta serves as a proxy for the industry-wide relationship between the operational risk loss experience for a given business line and the aggregate level of gross income for that business line. The Beta factors are displayed in Table 3 below:

Table 3: Percentage of the relative weighting of the business lines

Business Lines	**Beta Factors**
Corporate finance ($ß_1$)	18%
Trading and sales ($ß_2$)	18%
Retail Banking ($ß_3$)	12%
Commercial Banking ($ß_4$)	15%
Payment and Settlement ($ß_5$)	18%
Agency Services ($ß_6$)	15%
Asset Management ($ß_7$)	12%
Retail Brokerage ($ß_8$)	12%

In the Standardized Approach, the gross income is measured for each business line, not the whole institution. For example: in corporate finance, the indicator is the gross income generated in the corporate finance business line.

Furthermore, the total capital charge will be calculated with the three-year average of "the simple summation of the regulatory capital charges" for each of the business lines in each of those three years where the gross income is non-zero. However, where the aggregate capital charge across all business lines within a given year is negative, then the input to the numerator for that year will be zero.

The calculation of the Standardized Approach to determine the total capital charge is as follows:

$$K_{TSA} = \frac{\sum_{j}^{3} \max\left[\left(\sum_{i}^{8}\left(GI_i * \beta_i\right)\right), 0\right]}{3}$$

= The capital charge under the Standardized Approach.

= Annual gross income in a given year, as defined above in the Basic Indicator Approach, for each of the eight business lines.

= A fixed percentage set by the Committee, relating the level of required capital to the level of the gross income for each of the eight business lines.

The Advanced Measurement Approach

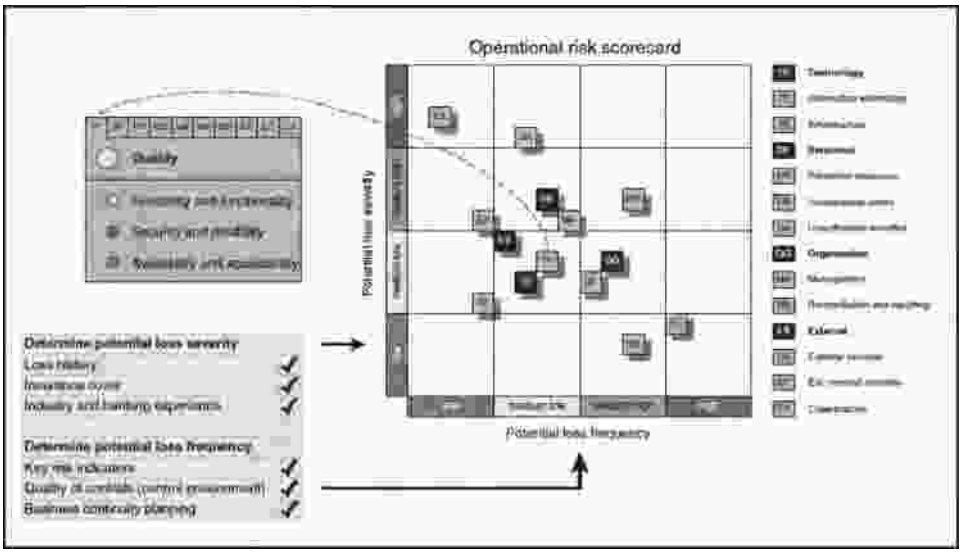
Under this there are three sub approaches:

- Scorecard Approach
- Internal Measurement Approach
- Loss Distribution Approach

Scorecard Approach

In the scorecard approach, banks initially determine a level of operational risk capital at the firm's business line and over time these amounts will be modified according to the Scorecard. Banks aims to improve the risk control environment that will reduce both the frequency and severity of future operational risk losses. By identifying a number of risk indicators for particular risk types within business lines, one can capture the underlying risk profile of the various business lines. These risk indicators represents indirectly the altitude of the operational risk. A combination of risk indicator will be combined into a score, to allocate the altitude of the operational risk. After a certain time, the performance of these indicators will be assessed. Based on these assessments one can decide which point must still be improved. Also, based on the scorecard, one can analyze what was effectively the indirect influence of the indicators of eventual operational risk losses.

Where the Scorecard approach differs from other approaches (Internal Measurement Approach and Loss Distribution Approach) is that it relies less exclusively on historical loss data in determining capital amounts. Instead of this, after the size of the regulatory capital is determined, its overall size and its allocation across business lines will be modified on a qualitative basis. However, historical operational risk loss data must be used to validate the results of scorecards.



The result of an assessment of operational risk and quality for any particular set of business processes is input into a report called a scorecard report. As operational risk is broken down into the risk categories, each risk category has its own individual risk assessment, which is based on scenario analyses. The scorecard (Fig. 4) therefore shows the risks caused by the failure of risk factors scored into a risk matrix in the dimensions of severity (in national currency) as well as frequency (in number of times per year). The quality of each risk factor is scored by assessing the quality dimensions of the risk factor (in the form of a rating). This means it reveals: (a) how much is lost in the event that the corresponding risk factor breaks down, is inadequate or is unavailable so that the processes dependent upon it fail or are only able to function with significant limitations; (b) how frequently that will occur; and (c) how good the risk factor for the process is in quality.

To generate a scorecard, the necessary information must be collected from within the organisation. Historic loss data or key risk indicators alone do not seem to be adequate choices for the assessment of operational risk in business processes. Historic loss data is usually insufficient and not forward-looking. Key risk indicators need to be interpreted subject to the local context they stem from, and therefore do not possess a simple translation into risk.

The better choice seems to be to make the organisation's experts responsible for evaluating the internal risks based on their understanding of their business processes, their banking and industry experience, their knowledge of embedded controls, insurance cover and loss history, and existing key risk indicators. The way to make the experts responsible is via a self-assessment exercise. This is not a

simple task, since a lot of effort needs to go into debriefing the experts so that their evaluations are consistent, are comparable, can be validated and are as reliable as possible. The exercise therefore has the following prerequisites:

- If the self-assessment is supposed to be an exercise across the whole organisation, it needs to be applied to all essential business processes within the organisation. For this, there has to be a process collection exercise.
- The experts who will assess the business processes need to be identified. They are selected according to their knowledge of these processes and according to their responsibility for certain products, locations or organisational units. The experts are then trained in workshops or presentations about how to fill in the self-assessment questionnaire. Additionally, they must be guided when filling in the questionnaire by means of help texts, interviewers or through a helpdesk. Once the experts have completed the questionnaire, the answers usually need to be approved by another person. The workflow of the self-assessment is presented in part two of this article next month.
- Since a self-assessment is usually applied to a wide range of processes, the self-assessment logic needs to be well thought through. It is the basis for the questionnaire design, where the questionnaire must measure what it is supposed to measure, and the questions in the questionnaire must be easy to understand. The answering schemes must also be well explained, otherwise consistent results cannot be expected.
- Once the self-assessment has been completed and approved, the results of the self-assessment need to be validated. This is performed by an independent operational risk oversight function. The quality of the overall operational risk process is additionally reviewed by the internal audit function.

Internal Measurement Approach

The Internal Measurement Approach provides discretion to individual banks in the use of internal loss data. In this approach banks estimate the operational risk capital based on the measurement of the total expected losses. The IMA approach assumes a fixed, direct relationship between expected loss (the mean of the loss distribution) and the unexpected loss (the tail of the distribution).

The relationship can be linear; this implies that the capital charge is a simple multiplication of the expected loss with a fixed number. Or non-linear, implying that total capital charge will be a more complex function of expected losses.

The IMA approach calculates the capital charge based on a framework that divides a bank's operational risk exposure into a series of business lines and events.

In such a framework separate expected losses are calculated for each business line and event type combination. Such an approach, calculates the expected losses generally by estimating the loss frequency and the size of the amount for various business line and event combination by using internal loss data and, where appropriate, relevant external loss data, along with a measure of the scale of business activities for the particular business line in question.

While these elements can be specified in a variety of ways, in general they can be described as follow:

- PE: The probability that an operational risk event occurs over some future horizon.
- LGE: The average loss given that an event occurs.
- EI: An exposure indicator that is intended to capture the scale of the bank's activities in a particular business line.

The EI exposure indicator is specified by the supervisor for each type of business line and event combination. EI is a proxy for the size or amount of risk of each business line's operational risk.

The Expected loss (EL) for each business line and event combination will be calculated with the following formula:

$$EL = EI * PE * LGE$$

Combining these parameters, the IMA capital charge for each business line and event type combination K_{ij} would be:

$$K_{ij} = \gamma_{ij} * EI_{ij} * PE_{ij} * LGE_{ij} = \gamma_{ij} * EL_{ij}$$

In this formula a linear relationship is assumed between expected losses and the tail of the distribution. The parameter γ_{ij} translates the estimates of expected losses, EL for the business line and event type combination into a capital charge. The γ_{ij} for each business line and event type combination would be specified by the supervisor.

Loss Distribution Approach (LDA)

The LDA involves modeling the loss severity and the loss frequency separately and then combining these distributions via Monte Carlo simulations or other statistical techniques to form an aggregated loss distribution for each loss type/business line combination, for a given time horizon.

The main issue is to fit the distribution of observed total loss points to a curve of total loss occurrences. It is this curve that will allow extrapolation from data points to determine the likely amount of total maximum losses or minimum capital required at any given percentile. The biggest challenge when dealing with fitting the distribution, is selecting the distribution that fits the tail of the observed data for 99.9% confidence interval.

The loss frequency distribution

The Poisson distribution is most commonly used to model the number of random occurrences of some phenomenon in a specified unit of space or time. For the LDA approach, it will be used to model the number of loss events in a period. The Poisson distribution has only one parameter, , which is the mean and the variance of a Poisson distribution. Assuming different probability distribution for every business line and event type combination, different parameters will be applied.

The loss severity distribution

The loss severity distribution describes the size of the loss amounts for a given event. Dealing with the severity is a lot more complicated than, dealing with the frequency, due to the unpredictable size of high severity events.

There are three kinds of operational severities, taken into account.

1. Low severity, which occurs more frequently
2. High severity, which occurs sporadically
3. Catastrophic severity, which occurs a few times in decades, i.e. earthquakes.

By fitting the operational severity data, one must take account of the three kinds severities enumerated here above. The main issue here is to choose a distribution that can cover all losses, which can occur in a certain period. Just fitting the historical data into a distribution is not enough, because banks assume that there are a lot of operational risk losses out there, which are not reported. These losses are not registered into the database.

There are several fat-tailed distributions from which one can be chosen for the purpose. Several examples are displayed in Table 4 below.

Table 4: Fat tailed distributions

	Distribution	Expression	Parameters
LN	Log-Normal	$F(x)= \Phi\left(\frac{\ln x-\mu}{\sigma}\right)$	$(\mu,\sigma>0)$
GEV	Generalized extreme value	$F(x)= \exp\left(-\left(1+\zeta\frac{x-\sigma}{\beta}\right)_+^{-\frac{1}{\zeta}}\right)$	$(\alpha,\beta>0,\zeta)$
GDP	Generalized Pareto	$F(x)= 1-\left(1+\zeta\frac{x-\alpha}{\beta}\right)_+^{-\frac{1}{\zeta}}$	$(\alpha,\beta>0,\zeta)$
W	Weibull	$F(x)= 1-\exp\left(-\left(\frac{x-\alpha}{\beta}\right)_+^{\zeta}\right)$	$(\alpha,\beta>0,\zeta)$

The selection criterion for the best distribution to fit the loss severity is to select the distribution, which fits the upper tail the most. It means that the best distribution should overestimate extreme risks events, to take the extreme risk events into account in the capital charge.

The aggregated loss distribution

After the loss frequency distribution and the loss severity distribution are determined, these two distributions are combined with Monte Carlo simulation to calculate the aggregated loss distribution (Fig. 5) for each business line and event type combination for a given time horizon.

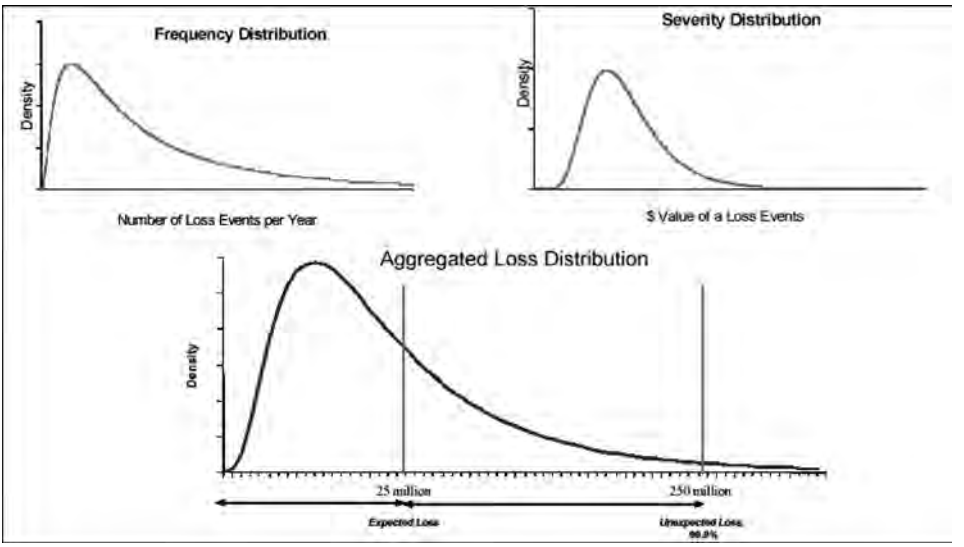


Fig. 5

After the determination of the Value at risk for the business line and event types combination, one can calculate the unexpected loss by subtracting the amount of the expected loss from the Value at Risk, for a given . The VaR is calculated separately for every combination business line and event type. The indices i is used to denote a "given business line" and j to denote a "given event type".

$$VaR(i, j) = EL(i, j) + UL(i, j)$$

Calculating the expected loss

The expected loss $EL(i, j)$ can be calculated with the following distribution:

$$EL(i, j) = E[v(i, j)]$$

$v(i, j)$ is the distribution of the total loss for the business line i/event type j. The $EL(i, j)$ is to be calculated by the expected value of the loss $v(i, j)$.

Calculating the unexpected loss

After $EL(i, j)$ the has been determined, the unexpected loss $UL(i, j)$ can be calculated as following:

$$UL(i, j, \alpha) = G_{i,j}^{-1}(\alpha) - EL(i, j)$$

- *UL(i, j α)* = The unexpected loss for a business line and event type combination for a given confidence interval represented by α.
- $G_{i,j}^{-1}(\alpha)$ = The inverse of the aggregated loss distribution $G_{i,j}(x)$, where x is the total loss amount.
- *EL(i, j)* = The expected loss amount for a business line and event type combination.

3.3. Market Risk

Standardised Method

The standard method distinguishes four different risk types:

- interest risk
- equity risk
- foreign exchange risk
- commodity risk

Specific position risk and general position risk

Capital must be maintained for the specific position risk as well as general position risk. General position risks refer to the risk related to the general price movement, such as a drop of the stock exchange index or a rise in the yield curve, whereas a specific risk position refers to the risk that is typical of the instrument being traded, e.g. the risk that an individual share price falls as a result of an enterprise-specific or sector-specific development.

Interest rate risk

Interest rate risk refers to the risk of declines in positions in debt instruments or derivatives thereof. These instruments may be both on and off-balance sheet items. The standard method for market risks provides for a separate treatment of fixed and variable rate instruments, swaps, forwards and futures. The capital requirement comprises both general and specific position risks.

General position risk

The calculation of the capital requirement for general position risk consists of two steps: 1) the mapping of the positions in different maturity categories and zones, and 2) the calculation of the capital requirement. To map the positions, a financial enterprise can choose from two approaches:

- the maturity method
- the duration method

A financial enterprise must choose one of these methods and, subsequently, apply the method chosen consistently.

The maturity method

The maturity method requires that the instruments are classified by residual maturity and coupon size. A distinction being made between instruments with a coupon lower than 3% and that higher than 3% (Table 5 below). For instruments with a small coupon, which are usually more sensitive to interest rate fluctuations, a more refined maturity classification has been developed. It should be noted that fixed rate instruments are classified on the basis of their residual maturity, whereas variable rate instruments are classified on the basis of their maturity until the following rate change. To determine a risk-weighted position, a position is multiplied by the risk weight

corresponding with its maturity class.

The duration method

By the duration method, instruments are classified into zones on the basis of the modified duration of the instrument (Table 6 below). The modified duration is the average weighted maturity of the instrument, and a measure of the instrument's price sensitivity to interest rate fluctuations. To determine the risk-weighted position, the modified duration of the instrument is multiplied by the assumed interest rate shock from the table and the instrument's market value. The duration method enables a more risk-sensitive estimate of the interest rate risk than does the maturity method.

Calculation of capital requirement

The second step comprises the calculation of the capital requirement. The required capital is the sum total of the three individual calculations:

1) capital requirement for the total net open position,
2) a vertical disallowance requirement, and
3) a horizontal disallowance requirement.

The three calculations are explained below.

Total net open position

The total net position is the sum total of all short and long risk-weighted positions across all zones (Table 5). The capital requirement for the total net open position is 100%.

Vertical disallowance

The capital requirement for vertical disallowance is based on the weighted compensated position per maturity class, being the sum total of the weighted long positions within each maturity class (in the event of the maturity method) or zone (in the event of the duration method), which is equal to the sum total of the weighted short positions in the same maturity class or zone. In other words, the weighted compensated position is equal to the short or long position with the smallest value (both measured in absolute values). The capital requirement to be met for vertical disallowance is 10% for institutions employing the maturity method, and 2% for institutions employing the duration method.

The vertical disallowance is a capital requirement covering the basis risk, or the risk of an incomplete or defective hedge between different instruments in the same maturity class or zone. Another way to say, it is the adjustment to absorb the shock due to the vertical shift of the yield curve. For example, if a risk-weighted short position in a corporate bond exactly compensates for a risk-weighted long position in a government bond in the same maturity class, there is a risk that a change in the corporate bond's price does not fully compensate for a change in the government bond's price.

Horizontal disallowance

The horizontal disallowance is determined by calculating the compensated weighted position between the different maturity classes and zones. The calculation is

performed in several rounds. The first round concerns the determination of the horizontal disallowance for each zone by calculating the compensated weighted position across the various maturity classes per zone (this only apply for the maturity method, as the duration method does not distinguish between maturity classes). The capital requirement for the compensated weighted position within zone 1 is 40%, and for the compensated weighted positions within zones 2 and 3, 30% (Table 7). Subsequently, the institution calculates the compensated weighted positions between zones 1 and 2 and zones 2 and 3, on the basis of the non-compensated weighted positions remaining after the first round. The last round concerns the calculation of the compensated weighted position between zones 1 and 3, based on the non-compensated weighted positions remaining after the second round. For this last round, a capital requirement of 100% applies to the compensated weighted position, for both the maturity method and the duration method.

Just like the vertical disallowance, the horizontal disallowance serves to hedge the basis risk of weighted compensated positions. In other words, this is meant to adjust for the possible horizontal shift of the yield curve. For example, an institution may compensate a long position in zone 2 with a short position in zone 1. However, owing to the differences in maturity and duration, a general interest rate shock will bring about different changes in price and not be fully compensated as a consequence. Since the basis risk of hedges between zones is higher, the capital requirement for horizontal disallowance is higher than for vertical disallowance. The non-compensated weighted position remaining after calculation of the horizontal and vertical disallowances is equal to the total net open position.

Table 5: Time Bands and Weights for the maturity method

Table 5: Time Bands and Weights for the maturity method

Coupon 3% or more	Coupon less than 3%	Risk Weight	Assumed changes in yield
1 month or less	1 month or less	0.00%	1.00
1 to 3 months	1 to 3 months	0.20%	1.00
3 to 6 months	3 to 6 months	0.40%	1.00
6 to 12 months	6 to 12 months	0.70%	1.00
1 to 2 years	1.0 to 1.9 years	1.25%	0.90
2 to 3 years	1.9 to 2.8 years	1.75%	0.80
3 to 4 years	2.8 to 3.6 years	2.25%	0.75
4 to 5 years	3.6 to 4.3 years	2.75%	0.75
5 to 7 years	4.3 to 5.7 years	3.25%	0.70
7 to 10 years	5.7 to 7.3 years	3.75%	0.65
10 to 15 years	7.3 to 9.3 years	4.50%	0.60
15 to 20 years	9.3 to 10.6 years	5.25%	0.60
over 20 years	10.6 to 12 years	6.00%	0.60
	12 to 20 years	8.00%	0.60
	over 20 years	12.50%	0.60
Source: BIS			

Table 6 : Duration method: time-bands and assumed changes in yield

Zone 1	Assumed change in yield
1 month or less	1.00
1 to 3 months	1.00
3 to 6 months	1.00
6 to 12 months	1.00
Zone 2	
1.0 to 1.9 years	0.90
1.9 to 2.8 years	0.80
2.8 to 3.6 years	0.75
Zone 3	
3.6 to 4.3 years	0.75
4.3 to 5.7 years	0.70
5.7 to 7.3 years	0.65
7.3 to 9.3 years	0.60
9.3 to 10.6 years	0.60
10.6 to 12 years	0.60
12 to 20 years	0.60
o ver 20 years	0.60

Source: BIS

Table 7: risk weights pertaining to the calculation of the horizontal disallowance

Zones	Time Band	Within the Zone	Between Adjacent Zones	Between Zones 1 and 3
	0 - 1 month			
	1 - 3 months			
Zone 1	3 - 6 months	40%		
	6 - 12 months			
	1 - 2 years			
			40%	
	2 - 3 years			
	3 - 4 years			100%
Zone 2	4 - 5 years	30%		
	5 - 7 years			
			40%	
	7 - 10 years			
	10 - 15 years			
Zone 3	15 - 20 years	30%		
	over 20 years			

Source: BIS

Specific position risk

The capital requirement for the specific interest rate position is based on the net position per instrument, being the balance of the long and short trading book positions in the instrument concerned. This is linked to the type and creditworthiness of the instrument, meaning that for instruments with lower ratings the capital requirements for the specific position risk are higher. The capital requirements are also related to the maturity of the instrument.

Table 8 : Specific risk capital charges for issuer risk

Categories	External Credit Assessment	Specific Risk Capital Charge
Government	AAA to AA-	0%
	A+ to BBB-	0.25% (residual term to final maturity 6 months or less)
		1.00% (residual term to final maturity greater than 6 months and upto and including 24 months)
		1.60% (residual term to final maturity exceeding 24 months)
	BB+ to B-	8.00%
	Below B-	12.00%
	Unrated	8.00%
Qualifying		0.25% (residual term to final maturity 6 months or less)
		1.00% (residual term to final maturity greater than 6 months and upto and including 24 months)
		1.60% (residual term to final maturity exceeding 24 months)
Others	BB+ to B-	8.00%
	Below B-	12.00%
	Unrated	8.00%

The category "government" will include all forms of government paper.

The *"qualifying"* category includes securities issued by public sector entities and multilateral development banks, plus other securities that are:

- rated investment-grade by at least two credit rating agencies specified by the national authority; or
- rated investment-grade by one rating agency and not less than investment-grade by any other rating agency specified by the national authority (subject to supervisory oversight); or subject to supervisory approval, unrated, but deemed to be of comparable investment quality by the reporting bank, and the issuer has securities listed on a recognised stock exchange.

Treatment of interest rate derivatives

To determine the capital requirement for the general position risk, the underlying position of the interest rate derivatives is taken into account. Subsequently, the position in the maturity classes and zones concerned is mapped. For example, an interest rate swap on which a financial institution receives a variable interest and pays a fixed interest rate, is treated as a long position in a variable interest rate instrument with a maturity that is equal to the period until the next interest reset date, and a short position in a fixed rate instrument with a maturity equal to that of the swap.

For most interest rate derivatives no capital requirement for specific position risk applies, as they are not exposed to instrument-specific risks. This does not apply, however, to derivatives like interest rate futures or forward rate agreements which lead to the buying or selling of debt instruments.

Table 9 : Summary of treatment of interest rate derivatives

Instrument	Specific risk charge	General market risk charge
Exchange-traded future		
Government debt security	No	Yes, as two positions
Corporate debt security	Yes	Yes, as two positions
Index on interest rates (e.g. LIBOR)	No	Yes, as two positions
OTC forward		
Government debt security	No	Yes, as two positions
Corporate debt security	Yes	Yes, as two positions
Index on interest rates	No	Yes, as two positions
FRAs, Swaps	No	Yes, as two positions
Forward foreign exchange	No	"Yes, as one position in each currency"
Options		Either
Government debt security	No	(a) Carve out together with the associated hedging positions - simplified approach - scenario analysis - internal models (Part B)
Corporate debt security	Yes	(b) General market risk charge according to the delta-plus method (gamma and vega should receive separate capital charges)
Index on interest rates	No	
FRAs, Swaps	No	

Equity risk

The capital requirements for equity risk relate to shares and their derivatives, including equity-like debt instruments convertible into shares. To calculate the capital required for its equity risk, a financial firm determines the sum total of all short positions and the sum total of all long positions in all shares. The sum total of both totals equals the total gross position and the difference between the two totals equals the total net position. The capital requirement for the specific risk applies to the total gross position, while that for general risk applies to the total net position.

The capital charge for specific risk is 8%, unless the portfolio is both liquid and well-diversified, in which case the charge is 4%. Given the different characteristics of national markets in terms of marketability and concentration, national authorities will have discretion to determine the criteria for liquid and diversified portfolios. The general market risk charge is 8%.

Treatment of equity derivatives

The derivatives are to be converted into positions in the relevant underlying.

Calculation of positions

In order to calculate the standard formula for specific and general market risk, positions in derivatives should be converted into notional equity positions:

- Futures and forward contracts relating to individual equities should in principle be reported at current market prices;
- Futures relating to stock indices

should be reported as the marked-to-market value of the notional underlying equity portfolio;

- Equity swaps are to be treated as two notional positions;
- Equity options and stock index options should be either "carved out" together with the associated underlyings or be incorporated in the measure of general market risk according to the delta-plus method.

Measurement of specific and general market risk

Matched positions in each identical equity or stock index in each market may be fully offset, resulting in a single net short or long position to which the specific and general market risk charges will apply. For example, a future in a given equity may be offset against an opposite cash position in the same equity. Besides general market risk, a further capital charge of 2% will apply to the net long or short position in an index contract comprising a diversified portfolio of equities.

The above approach to equity risk also applies to equity derivatives, with the exception of share options, for which a separate method is employed. To determine the capital requirement, for general position risk, the position is determined on the basis of the market value of the underlying position. In the event of, e.g. an equity swap, in which the institution receives an amount based on equity index changes and pays an amount depending on another stock market index, the institution must treat this position as a long position in the one index and as a short position in the other index.

The capital requirement for specific position risk in share index futures is not needed if the futures concerned are traded on the stock exchange and relates to a broadly diversified index. However, in order to hedge divergence and settlement risks, the minimum capital requirement will be 2% of the gross value of the positions concerned.

Table 10 : Summary of treatment of equity derivatives

Instrument	Specific risk charge	General market risk charge
Exchange-traded or OTC future		
Individual Equity	Yes	Yes, as underlying
Index	2%	Yes, as underlying
Options		
Individual Equity	Yes	(a) Carve out together with the associated hedging positions - simplified approach - scenario analysis - internal models (Part B)
Index	2%	(b) General market risk charge according to the delta-plus method (gamma and vega should receive separate capital charges)

Currency risk

The capital requirements for currency risk only comprise criteria for the general position risk. The calculation of the solvency requirement is made in two steps. First of all, the net position per currency is determined and, subsequently, the total net currency position. This procedure is also followed for positions in gold.

Calculation of the net position per currency unit

To determine the institution's net currency position the following data related to the currency in question are taken into account:

- net cash position;
- net term position;
- irrevocable guarantees and similar instruments;
- net position in future income and expenditure, gains and losses, respectively, that have not yet matured, but are already fully secured by forward currency contracts;
- the delta-based equivalent of the total portfolio of currency options and gold options.

Calculation of the total net Currency position

The net position per currency unit as calculated by the method described in the previous paragraph is converted into national currency on the basis of the exchange rate. Subsequently, the financial institution calculates the total net short position and the total net long position, the higher of the two being the total net currency position of the institution. The capital requirement is 8% of the total net currency position, as well as 8% of the net position in gold.

Commodity risk

Commodities are defined as physical products that are traded on secondary markets. Under this category, fall easily tradable agricultural products, minerals, and metals. An exception to this rule is gold, which falls under the currency risk.

The risks entailed by commodity markets are usually more complex than those entailed by currency markets or interest markets. This is partly due to the lower market liquidity inherent in commodity products, as a result of which changes in demand and supply usually impact pricing more appreciably. Also, commodity market are more emphatically exposed to risks attached to natural elements, such as – in the case of agricultural products – draughts and diseases. Besides, institutions trading in commodities often run additional risks, such as risks entailed by the cost of carry (the costs of storing and managing commodities). The capital requirement for commodity risk only comprises a requirement for general position risk. For the calculation of these costs, two methods are available:

- the simplified method
- the method based on maturity classes

The simplified method

The simplified method consists of two steps: first the institution determines

the net position per commodity, using the unit of account employed for the commodity concerned. Subsequently, the institution converts the values found to the own currency unit.

The net position per commodity is determined on the basis of long and short positions in the commodity concerned. Positions in different sub-categories of commodities may be set off, provided they are fully replaceable. Positions in similar commodities may also be set off if they are largely mutually replaceable and if, during a period of at least one year, a correlation of 90% can be established between the price movements of the commodities concerned. It is not permitted to set off positions in difference commodities. Every position in raw materials is expressed in a fixed unit of calculation and, if necessary, converted against the prevailing cash rate of exchange of the national currency.

The second step concerns the calculation of the capital requirement, which consists of two elements: a capital requirement per commodity of 15% for the net commodity position, plus that of 3% for the absolute sum of all positions in the commodity concerned. The total capital requirement for commodities is the sum total of the capital requirements for the individual commodities.

Method based on maturity classes

In calculating the capital charges under this approach banks will first have to express each commodity position (spot plus forward) in terms of the standard unit of measurement (barrels, kilos, grams etc.). The net position in each commodity will then be converted at current spot rates into the national currency.

Then the institution classifies the short and long positions per commodity using the following table. Insofar as applicable, physical supplies are placed in the first maturity class.

Table 11: maturity class method

0 to 1 month
1 to 3 months
3 to 6 months
6 to 12 months
1 to 2 years
2 to 3 years
More than 3 years

The capital requirement is calculated per individual commodity (including any netting as described above) and is based on three components:

- spread risk
- positions that will be transferred to the following maturity class
- the total net position per commodity

Capital requirement for spread risk

Calculation of the capital requirement for spread risk starts with the first maturity class and represents 1.5% of the compensated positions, being the total amount of the long positions which equals the total amount of the short positions. The residual position is the non-compensated position for that maturity class, which is transferred to the following maturity class. Subsequently, the institution again calculates the capital requirement for

spread risk on the basis of the position already available and the position transferred to the second maturity class. Subsequently, the calculation is repeated for all maturity classes. A position need not be transferred to a higher maturity class if there is no position in that class.

Capital requirement for transferred positions

The solvency requirement for the transferred positions is calculated using a transfer coefficient of 0.6%, which for each maturity class is multiplied by the transferred position and the cash price of the commodity.

Capital requirement for the total net position

The total net position equals the residual non-compensated position, which cannot be transferred further. The capital requirement calculated for this position is 15%.

The total capital requirement for covering commodity risks are the sum total of the capital requirements calculated for each individual commodity.

Treatment of commodity derivatives

Commodity derivatives are included in the above described calculation of the capital requirement for commodities, with the exception of gold derivatives which fall under the currency risk. To this end, derivatives are converted to underlying positions in commodities and maturities are assigned. If a derivative derives from several commodities, it is included in the maturity ladder of the commodities concerned. Setting off positions is only permitted with comparable commodities or with subcategories of commodities.

Internal Models Approach

The internal models methodology for measuring exposure to market risks is based on the concept of Value at Risk (VAR). This measure represents an estimate of the likely maximum amount that could be lost on a bank's portfolio with a certain degree of statistical confidence.

The models commonly used for VAR estimation are:

- Historical Simulation Method
- Variance Covariance Method
- Monte Carlo Simulation Method

Historical Simulation Method

Historical simulation is a procedure for predicting the value at risk by 'simulating' or constructing the cumulative distribution function (CDF) of assets returns over time. Unlike parametric VaR models, historical simulation does not assume a particular distribution of the asset returns. Also, it is relatively easy to implement. This involves using historical day to day changes in the values of all the market variables in a direct way to estimate the probability distribution of the change in the value of the current portfolio between today and tomorrow. The method simply re-organizes actual historical returns, putting them in order from worst to best. It then assumes that history will repeat itself, from a risk perspective.

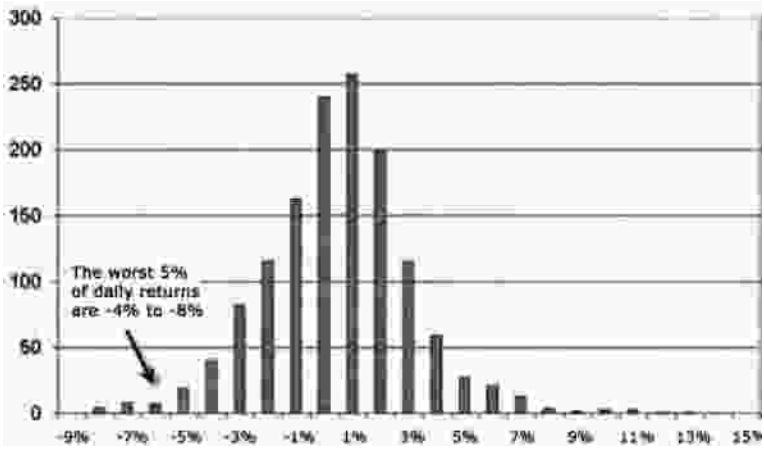


Fig. 6 : Historical Simulation Method for VaR Calculation

The Variance-Covariance Method

This method assumes that stock returns are normally distributed. In other words, it requires estimation of only two factors - an expected (or average) return and a standard deviation - to plot a normal distribution curve. The idea behind the variance-covariance is similar to the ideas behind the historical method - except that this uses the familiar curve instead of actual data. The advantage of the normal curve is that one automatically knows where the worst 5% and 1% lie on the curve. They are a function of the confidence level and the standard deviation.

Thus in this approach a model is assumed for the joint distribution of changes of all the market variables, commonly a normal distribution, and historical data is used to estimate the model parameters (μ and α in normal distribution). The change in value of the portfolio is assumed to be linearly dependent on the daily percentage change of market variables, and thus VAR is easily estimated.

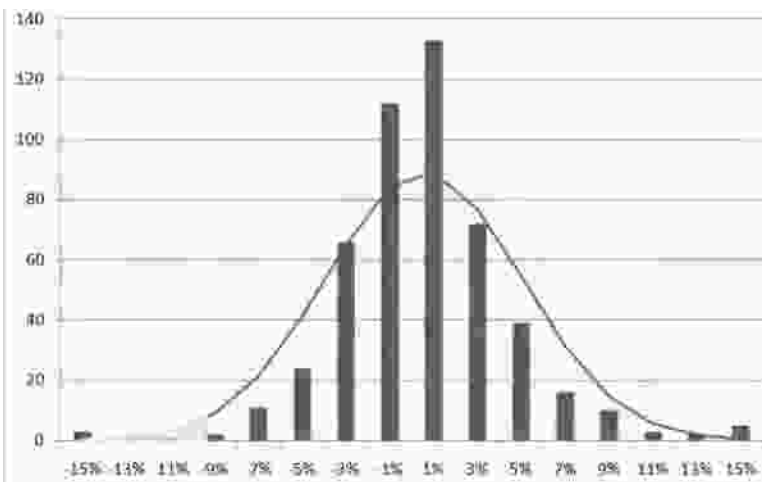


Fig. 7: Variance - Covariance Method for VaR Calculation

Monte Carlo Simulation

The third method involves developing a model for future stock price returns and running multiple hypothetical trials through the model. A Monte Carlo simulation refers to any method that randomly generates trials. Computing VaR with Monte Carlo Simulations is very similar to Historical Simulations. The main difference lies in the first step of the algorithm – instead of using the historical data for the price (or returns) of the asset and assuming that this return (or price) can re-occur in the next time interval, a random number is generated that will be used to estimate the return (or price) of the asset at the end of the analysis horizon. Drawing random numbers over a large number of times (a few hundred to a few million depending on the problem at stake) will give a good indicationof what the output of the formula should be.

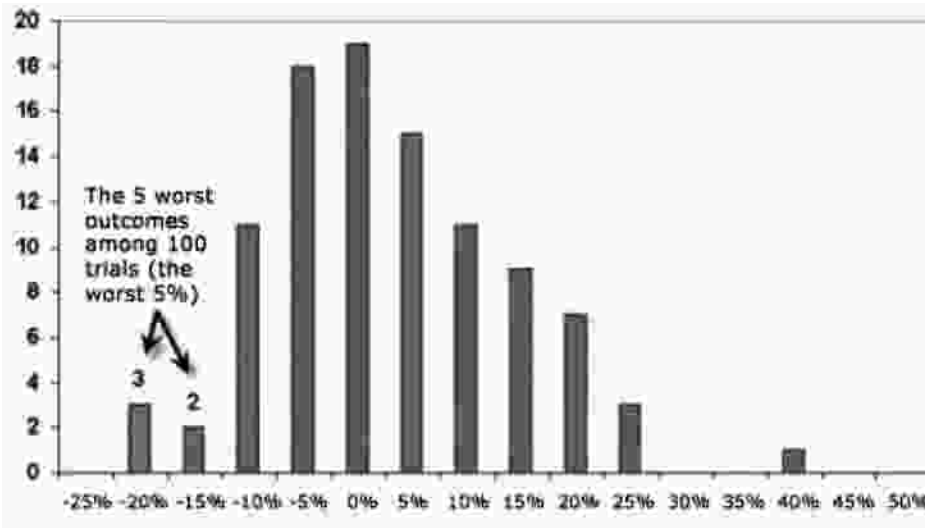


Fig. 8: Monte Carlo Simulation Method for VaR Calculation

The Holding Period

The holding period used to measure Value at Risk for market risk capital purposes should be two weeks (ten business days), taking the bank's trading positions as fixed for this interval. The above methods that calculated a daily VAR is converted to a 10 day VAR by multiplying factor of √10 and that calculated a monthly VAR by the factor 1/√3.

Confidence Interval

It is specified that all banks using the models approach employ a 99% one-tailed confidence interval. A confidence level of 99% means that there is a 1% probability based on historical experience that the combination of positions in a bank's portfolio would result in a loss higher than the measured value-at-risk.

Specific risk for IMA

For banks using models, the total specific risk charge applied to debt securities or to equities should in no case be less than half the specific risk charges calculated according to the standardised methodology. Banks are invited to express their views on how to calculate the extent to which a model is measuring specific risk in order to avoid possible double-counting.

Multiplication Factor

The multiplication factor to convert VaR to capital requirement will be set by individual supervisors on the basis of their assessment of the quality of the bank's risk management system, subject to an absolute minimum of 3 (although this minimum number may be reviewed in light of additional experience). The Committee has agreed that banks should be required to add to this factor a "plus" directly related to the ex-post performance of the model, thereby introducing a built-in positive incentive to keep high the predictive quality of the model.

Capital Requirement

The market risk capital requirement for banks when they use the internal model based approach is calculated at any given time as

$$K = a * VaR + SRC$$

Where "a" is the multiplication factor and SRC is the Specific Risk Charge. The VaR is greater of previous day's Value at Risk and the average Value at Risk over the last 60 days. The minimum value of "a" is 3. SRC is the capital charge for the idiosyncratic risks related to individual companies.

4. International Scenario of Application of Basel Methodologies

This section tries to portray a worldwide scenario of Basel implementation. The study mainly resorts to the secondary data published by the Basel Committee itself. The Basel Committee on Banking Supervision (BCBS) undertook a series of Quantitative Impact Study (QIS) including a range of banks across various countries. The objective of such study was to gather data necessary to allow the Committee to gauge the impact of its proposals for capital requirements. The survey was completed by banks in the G10 and non-G10 countries and involved both large, internationally active, diversified institutions, as well as smaller more specialized banks.

In analyzing the results, geographically, banks are classified as banks from countries that are members of the Basel Committee (hereinafter referred to as "G10 banks"), banks under Committee of European Banking Supervisors (CEBS), and other non G10 banks. They have been split into two groups – *Group 1,* comprising diversified, internationally active banks with Tier 1 capital of at least Euro 3bn, and *Group 2,* consisting of smaller or more specialized banks.

Impact of Basel II

Some important observations from results of the fifth quantitative impact study (QIS 5), published in June 2006, are discussed below with an objective to bring out the influence of the newly implemented Basel II.

Variations in Credit Risk Management Approaches

Of the G10 Group 1 banks in the QIS sample, 72% plan to implement the advanced IRB approach, 28% are most likely to adopt the foundation IRB approach, and none intend to use the standardized approach. Of the G10 Group 2 banks, 7% are likely to adopt the advanced IRB approach, 70% plan to implement the foundation IRB approach, and 23% intend to use the standardized approach. The non-G10 Group 1 banks are split between the IRB approaches, while most of the non-G10 Group 2 banks intend to use the standardized approach. The following Table 12 gives the frequency of use of approaches.

Table 12: Frequency of use of the most likely Credit Risk Management Approaches

	Group 1				Group 2			
	Total	SA*	FIRB*	AIRB*	Total	SA*	FIRB*	AIRB*
G10	82	0	23	59	146	33	102	11
CEBS non-G10	8	2	4	2	86	78	7	1
Other non-G10	6	0	2	4	54	49	3	2
Total	**96**	**2**	**29**	**65**	**286**	**160**	**112**	**14**

*SA - Standardized Approach; FIRB - Foundation Internal Rating Based Approach; AIRB - Advanced Internal Rating Based Approach.

The above Table 2 indicates the predominance of advanced approaches (IRBs) in the Group 1 banks of the G10 countries and that of standardized approach (SA) in Group 2 banks of non G10 countries.

Variations in Operational Risk Management Approaches

Data are available only for G10 countries, except USA. The following table gives the distribution.

Table 13: Frequency of use of Operational Risk Management Approaches

Approach	Group 1	Group 2
Basic Indicator Approach	2	81
Standardised Approach	32	65
Advanced Measurement Approach	22	0
Total	**56**	**146**

The figures in the above table do not include US banks.

The advanced measurement approach (AMA) is still a challenge for many institutions, with less than half of the G10 Group 1 banks and none of the Group 2 banks are able to provide an AMA estimate.

Change in the Minimum Capital Requirement with respect to Basel I

The QIS results for the G10 countries show that minimum required capital under Basel II decrease relative to Basel I. For Group 1 banks, minimum required capital under the most likely approaches to credit and operational risk decrease on average by 6.8%. Among the two IRB approaches, the advanced approach shows more reduction in minimum required capital (-7.1%) than the foundation approach (-1.3%). Minimum required capital under the standardized approach increase by 1.7% for Group 1 banks. However, only very few G10 Group 1 banks are expected to adopt this approach. Group 2 banks show a larger reduction in minimum required capital under the internal ratings-based approaches, and minimum required capital decrease by 1.3% under the standardized approach, with retail exposures being the primary contributors to this decline. In general, results for the CEBS countries are broadly in line with the figures which are obtained on the G10 level.

Results for banks in the rather small sample of other non-G10 countries show substantial dispersion both within and between countries, mostly due to the specialized business profile of certain banks and particularities of national implementation. The wide range of bank- and country-specific circumstances suggest that supervisory discretion is particularly important in these countries, and the results might therefore not be representative for all non-G10 countries. Although data quality is an issue for some banks in other non-G10 countries, the results appear to be broadly in line with results for G10 banks to the extent that the risk profiles are similar.

Among the other non-G10 countries, capital ratios are on average higher than in the G10. The high capital ratios suggest that judgement by bank management, market pressures or Pillar 2-type supervisory discretions may be acting as drivers to maintain higher levels of capital than are explicitly required under the current Accord. These elements will likely continue to have significant impact for these countries under the Basel II Framework.

The following Table 14 gives the contribution of each of the credit risk management approaches to change in minimum capital requirement.

Table 14: Change in Minimum Capital Requirement relative to Basel I, in per cent

	SA	FIRB	AIRB	Most likely approach
G10 Group 1	1.7	-1.3	-7.1	-6.8
G10 Group 2	-1.3	-12.3	-26.7	-11.3
CEBS Group 1	-0.9	-3.2	-8.3	-7.7
CEBS Group 2	-3.0	-16.6	-26.6	-15.4
Other non G10 Group 1	1.8	-16.2	-29.0	-20.7
Other non G10 Group 2	38.2	11.4	-1.0	19.5

The cross country evidences show that under Basel II, capital requirements rise with the use of Standardized approach. In India, this is the only approach followed till date. So, there is a possibility that capital requirement might fall with the migration to the advanced approaches.

5. The Indian Scenario of Basel Implementation

The Indian banks, as well as its regulators, have over-simplified the Basel accords. In India, the "Standardised Method" for credit risk mitigation, the "Basic Indicator Approach" for operational risk mitigation and the "Standardised Duration Approach" for market risk mitigation are adopted. These methods are most conservative and least profitable as mentioned earlier. In fact, Smt Shyamala Gopinath, the Deputy Governor (2004–2009), RBI at the Indian Banks' Association briefing session on "Emerging Paradigms in Risk Management" at Bangalore on May 12, 2006 admitted, "*Though the Basel II framework provides various options for implementation, special attention was given to the differences in degrees of sophistication and development of the banking system while considering these options and it was decided that banks in India will initially adopt the Standardised Approach (SA) for credit risk and the Basic Indicator Approach (BIA) for operational risk. The prime considerations while deciding on the likely approach included the cost of implementation and the cost of compliance.*" After adequate skills are developed, both by the banks and also by the supervisors, some of the banks may be allowed to migrate to the better risk management approaches by RBI. However till date, the Indian Banking Sector could not come out of this initial phase.

It is proposed by RBI to lay down the following time schedule for implementation of the advanced approaches for the regulatory capital measurement:

Table 15: time schedule for implementation of the advanced approaches of Basel II

Approach	The earliest date of making application by banks to the RBI	Likely date of approval by the RBI
Internal Models Approach (IMA) for Market Risk	April 1, 2010	March 31, 2011
The Standardised Approach (TSA) for Operational Risk	April 1, 2010	September 30, 2010
Advanced Measurement Approach (AMA) for Operational Risk	April 1, 2012	March 31, 2014
Internal Ratings-Based (IRB) Approaches for Credit Risk (Foundation- as well as Advanced IRB)	April 1, 2012	March 31, 2014

As per the RBI guidelines, the banks are advised to undertake an internal assessment of their preparedness for migration to advanced approaches, in the light of the criteria envisaged in the Basel II document, as per the aforesaid time schedule, and take a decision, with the approval of their Boards, whether they would like to migrate to any of the advanced approaches. The banks deciding to migrate to the advanced approaches may approach RBI for necessary approvals, in due course, as per the stipulated time schedule. If, the result of a bank's internal assessment indicates that it is not in a position to apply for implementation of advanced approach by the above mentioned dates, it may choose a later date suitable to it based upon its preparation. The banks, at their discretion, would have the option of adopting the advanced approaches for one or more of the risk categories, as per their preparedness, while continuing with the simpler approaches for other risk categories, and it would not be necessary to adopt the advanced approaches for all the risk categories simultaneously.

It appears from the above guidelines, and as well from the attitude of the banks, that the Indian banks do not have any pressing need or urge to migrate to the sophisticated risk management techniques. Basel has taken the shape of a stereotyped process and most bank officials are unaware of the intricacies of the Basel accords. Risk management has boiled down to only some inputs and outputs of some standard risk management software. No effort is taken to customize the process depending on the specific portfolio that the particular bank is holding.

6. Conclusion

The Basel norms are supposed to be very effective risk measurement and protection system. They need to be properly assimilated with the Indian banking system. In order to facilitate smooth fund mobilisation, the cooperative banks, rural banks, post office banks are to be brought under the purview of the Basel norms. Agriculture business, SMEs should be treated separately for their risk assessment. The collaterals should be redefined. These are some of the steps towards customisation of the Basel norms. It is not that the PSBs are only burdened with bad loans. But the main issue is that their presence is more prominent in rural India. They have higher obligation towards priority sector lending. But the profile of their borrowers is such that they are not getting a just treatment under Basel norms. Most of the borrowers are unrated, and so attracting very high risk weights under the standardised approach even if they have lower probabilities of default. So, RBI can take the necessary action. The advanced approaches in fact are the meeting points of standardisation and customisation. System failure, data loss, fraud etc. has now become serious issues. The measurement of quantum and probability of losses caused by such events is really a challenging task and has to be undertaken with seriousness.

Indian banks are pessimistic about the advanced approaches mainly because of the difficulty in implementation. The critical success factors are a comprehensive database, technically sound workforce both among bankers and supervisors and sophisticated technological infrastructure. So, implementation is costly and time consuming –worse yet, the end results are not known. Rather the probability is high that the capital requirement would go up under the advanced approaches.

Basel norms failed to add any significant value to the risk management process in Indian banks. Here these norms are adopted only for the sake of compliance. It is only with the help of the advanced approaches the Basel norms can be made to percolate through the entire banking system of the country. The rural banks, the cooperative banks, the post office banks all have to be brought under the purview of the Basel norms.

The Basel norms need to be customised according to the needs of Indian customers. The collaterals need to be redefined too. Basel norms incentivise self surveillance. They say measure your own risk, build your own model, and get it approved by your supervisor. Only cost you pay is transparency. Disclose every step you are taking.

Basel compliance is a comparatively recent phenomenon in Indian Banking Scenario. So, the banks do not have the requisite data for implementation of the advanced approaches. But India is still in an advantageous position in the sense that very old historical data might be absent, but due to growing number of banks and their huge customer base, there is a rich source of cross sectional data which is growing exponentially with every passing day. Database management has now taken a new dimension. Data warehousing and data mining are helping to unearth newer and newer patterns and information from the existing data. The corporate are very much in this process in their marketing research activities. So, why not the banks? Banks should cooperate with each other, and share their database. Banks should train their personnel, should hire experts, invest towards technological up gradation to develop new models and improve the process of risk measurement. This will not only help to bring about a convergence between economic capital and regulatory capital but also help the banks as well as supervisors to have a much better control on the entire activities of the bank. Also this will help the banks to develop various financial and non financial products which will increase the profitability of the banks and also benefit the customers.

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Growth of Renewable Energy Sector in India

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Energy is one of the most important elements of our universe. Energy is a strategic commodity and any uncertainty about its supply can threaten the functioning of the entire economy, particularly in developing economies. India's substantial and sustained economic growth is placing enormous demand on its energy resources.

Around 300 million people in India lack access to electricity, perhaps the largest energy access crisis anywhere in the world. India also has the highest number of people around 705 million, without access to non-solid fuels. The development of any nation is directly related to its energy use and access. Energy poverty is an indicator of low levels of overall development. It has been established that energy access and development are closely interlinked as per the United Nations Development Program's Human Development Reports.

Issues relating to climate change, energy security, sustainable development and economic growth in developing countries can be addressed by lower cost of capital to set up renewable energy projects by providing incentives and making positive regulatory changes.

For sustainable development, governments need to take action to encourage and facilitate renewable energy financing. In developing countries, national policy plays important role in shaping renewable energy markets so that investors find them attractive. Over-regulation can be a major impediment for growth of renewable energy markets which can be resolved by carefully planned deregulation. Credible policies are required to generate investor interest. Lack of supportive, consistent and stable policies is a barrier to investment in the sector.

Problems faced in financing and development of renewable energy projects:

- In the developing world, due to macroeconomic instability, there is a perception of higher risk which leads to higher borrowing costs, shorter loan tenors, and lower debt to equity requirements. Higher borrowing costs, short term loans and lack of leverage deter financial investors.
- Developing countries also face currency risks which is a deterrent to growth of the renewable energy markets. Although currency risks

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can be hedged using derivative instruments, it is difficult to find instruments for currencies that are less frequently traded. Further, hedging is very expensive as the tenure of the funding for renewable projects is around 15 years. Foreign funding will not be a viable option if the currency of the country is not stable and there is an inflationary environment.

- The financial responsibility of the off-taker for contracts such as power purchase agreements is a major concern for renewable energy projects. Utilities which purchase the power may be unable to pay for power at agreed tariffs which can lead to project being written off, if not supported by the government.
- There are few infrastructural challenges that are required to be overcome such as lack of grid access, high grid connection costs, limited grid coverage and capacity, lack of operation and maintenance facilities. Construction and financing of new transmission networks will continue to be a barrier as capacity increases.
- Public administrators, government officials often lack the capacity to streamline approval processes and implement renewable energy laws.

New Options for Financing Renewable Energy

The Reserve Bank of India's decision to grant priority sector lending status to renewable energy has given a boost to sector. The categorization of renewable energy as a priority sector makes it eligible for 40 per cent compulsory lending target of adjusted net bank credit, which is available to only select sectors. Borrowers can now avail bank loans with a ₹ 150 million limit for projects based on solar, biomass, wind, micro-hydel power and for non-conventional energy based public utilities dealing with street lighting systems and remote village electrification. For individual households, the loan limit is ₹ 1,00,000 per borrower. The decision also reiterates the government's intention to provide a fillip to the offgrid or decentralized renewable energy segment, which has been struggling due to lack of access to finance.

The government's plan of renewable energy capacity addition will require an estimated outlay of $120 billion and equity investments of $40 billion. As of March 2014, the banking sector's total exposure to the power sector is approximately $80 billion. However, government's capacity addition targets for solar alone require $84 billion. Moreover, the government aims to provide green power at less than ₹ 4.50 per kWh, calls for cheaper financing options. There is a need to look beyond domestic bank loans and access alternative sources of debt such as international capital, domestic bond and debenture markets, as well as new

financing models like Yieldcos. As the industry reaches higher growth levels, indications of these financing trends can be seen emerging.

Renewable energy projects have not been able to tap the bond market because of their low credit ratings. But with the recent credit risk enhancement of the economy as well as the clean energy sector, a new type of bond called the 'Green Bond' has emerged. These bonds can be issued by financial institutions as well as corporates for financing projects that contribute directly to climate change mitigation. According to reports, the government has approached atleast eight lenders to raise low-cost long term funds through this route for financing India's renewable energy production aims, while making it economically viable for debt-laden discoms to buy clean power. Green Bonds will play an important role in the Indian market. Green Bonds can be issued under three types of models: renewable energy developer owned bond issues, infrastructure debt fund bonds, and trust owned bonds. However, these bonds have limitations. They are limited to large players, and insurance companies are not allowed to invest in private companies in India. In case of trust owned bonds, loans must be first booked by banks and held by them for a minimum length of time.

There are an increasing number of international financial institutions such as International Finance Corporation (IFC), Asian Development Bank (ADB) and German Development Bank (KfW), European Investment Bank, Japan International Cooperation Agency, which are looking to partner with Indian banks and organizations to help finance the government's renewable energy targets. With improving in market dynamics and ease of financing, more international companies are planning to enter the Indian renewable energy sector now than ever before as it presents a previously unseen growth opportunity.

Several foreign companies, including developers and equity investors, have either invested in Indian renewable energy developers or set up local subsidiaries for participating actively in the project development market.

Renewable energy projects face uncertainties at development stage, but once they become operational, the risk element associated with cash flows reduce. Yieldcos are rapidly gaining popularity among developers and investors. A new corporate model, Yieldcos facilitate stable cash flows and distribute them as dividends, thus offering a low-cost source of capital for renewable energy projects. A key factor for any Yieldco structure is steady pipeline of projects under development or available for purchase that will afford the vehicle a steady stream of stable contracted cash flow, tax benefits and growth. Other factors in contributing to the success of Yieldco model in development

markets has been its large project portfolio, which has helped diversify risks and enhance returns. In India, most developers do not have large portfolios at present, and renewables account for only a small share of the portfolio of power companies. Until a few developers reach a certain scale, this model may not see direct uptake by Indian players.

Effective Policies will lead to Growth in Renewable Energy Sector

- Effective national policy is critical to create a market that financiers will find attractive. In particular, attention should be paid to whether the regulation supports price discovery to drive down renewable energy costs. Where regulation inhibits this process, deregulation or regulatory reform may be appropriate to enable entry and exit of new renewable energy providers into (and out of) the markets.
- In general, governments should seek to mobilize renewable energy finance in two comprehensive ways; first, by setting regulatory and incentive frameworks that shift investment into renewable energy on a macro level, and, second, by using targeted public funding to overcome specific financing gaps and barriers. Regulatory frameworks can employ both energy policy mechanisms (e.g. feed in tariffs, tax incentives) and finance policy mechanisms (e.g. banking regulations, interest rates).
- It is important to embed renewable energy support and other specific policies into the broader energy policy. Feed in tariffs and other supports, while very important, are not enough for renewable market policy. Issues like planning, grid connection and capacity and PPA's are an important part of the investment decision that the overall policy frameworks must address.
- Renewable energy finance strategies should align themselves with local policy priorities in order to secure government support and engagement. Programs should seek to emphasize the employment, regional development, poverty alleviation and energy access potential of the renewable energy sector.
- An effective renewable energy finance strategy requires a holistic approach that is tailored to the local context. This is exemplified by India, where a large range of policy measures and financial mechanisms have been differentiated according to local needs across different regions. The overall policy and financing mix, combining national and local strategies, has helped India to

position itself as one of the most important markets for renewable energy technologies.

Development of renewable energy has been one of main agendas of the Indian Government's strategy to improve energy access to tackle energy poverty. India's Integrated Energy Policy, formulated in 2006, lays down a roadmap for harnessing renewable energy sources. The extant policy framework for promoting renewable energy follows from this, with a target of adding 30 gigawatts (GW) by 2017 as per the 12th Five Year Plan. The renewable sector specific developments are:

- *Solar Energy*: The Jawaharlal Nehru National Solar Mission, being implemented by the Ministry of New and Renewable Energy, is aimed to increase development of solar energy. The goal is to generate 100 GW of grid connected solar power by 2022. The 100 GW solar power target is split between 60 GW of utility scale projects and 40 GW of rooftop and other small grid connected projects. The biggest challenge to achieve this target is enforcement of renewable purchase obligations (RPO's) and the poor bankability of India's distribution companies.
- *Wind Energy:* Wind energy is the largest source of renewable energy in the country. According to the meso-scale Wind Atlas (yet to be validated through field measurements), India has a potential of generating around 102 GW of wind power at 80 meters above sea level. Around 22 GW of wind power capacity had been installed by November 2014. Fiscal incentives in the form of a Generation Based Incentives (GBIs) on a per unit generated basis and Accelerated Depreciation (AD) that allow greater tax deductions early on in the project cycle have been reinstated recently. In the latest Union Budget, the Government has specified a 2022 target of 60,000 MW on wind energy capacity.
- *Biomass*: The government has been supporting grid-interactive biomass power and bagasse co- generation in sugar mills in India, with a target of 400 megawatts (MW) between 2012 and 2017. A 2022 target of 10,000 MW of installed biomass capacity has been announced recently.
- *Waste to Energy*: The Indian government, through the "Swachh Bharat Mission," under the Ministry of Urban Development, has provided support for up to 20 percent of project costs linked 'Viability Gap Funding' for waste processing technologies.
- *Small Hydropower*: Hydropower units of less than 25 MW are

classified as "Small Hydropower" projects by the government. As of December 2014, a total capacity of around 3,946 MW was available from such projects in India. The government is targeting an installed capacity of 5000 MW by 2022.

Wind power and solar photovoltaics are crucial to meeting future energy needs while de-carbonising the power sector. Deployment of both wind and solar power technologies has expanded rapidly in recent years. Today, renewable energy technologies are viewed not only as tools for improving energy security and mitigating and adapting to climate change, but are also increasingly recognised as investments that can provide direct and indirect economic advantages by reducing dependence on imported fuels; improving local air quality and safety; advancing energy access and security; propelling economic development; and creating jobs.

Several renewable energy technologies are today cost-competitive with conventional generation technologies, even before the environment and other externalities are taken into consideration. Declining costs have also played a significant role in the expansion of renewable energy deployment in recent years.

Extraordinary growth in renewable energy markets and their global spread has also led to a significant rise in the number of manufacturers, the scale of manufacturing, an overall increase in number of jobs installing and servicing renewable energy technologies, as well as expansion into new markets. This is particularly true for the solar PV and wind power industries, despite experiencing industry consolidation, driven by decreasing costs.

The global policy landscape has largely driven the expansion of renewable energy technologies by attracting investment and creating markets that have brought about economies of scale and supported technology advances, in turn, resulting in decreasing costs and fuelling sustained growth in the sector. A handful of countries, particularly, Germany, Denmark, the US and Spain, have led the way, developing innovative policies that have driven much of the change witnessed over the past decade.

India is one of the most important markets of renewable energy worldwide and has demonstrated that policy can play a major role in developing national renewable energy markets. Although India has achieved success in increasing its share of renewable energy, there is still lot of work to be done by the Indian government for development of the market. The renewable energy policies and incentives introduced by the states face challenges in terms of creating an environment of investor confidence. Despite the challenges, India continues to be among the fastest growing clean energy markets in the world. The Central Government and the State Governments need to continuously monitor its regulatory policies and bring in effective changes from time to time in order to

reach its goals and providing electricity access to all its citizens.

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Bombay Chamber of Commerce and Industry Trust for Economic and Management Studies

The Bombay Chamber of Commerce and Industry Trust for Economic and Management Studies was constituted in 1996 by the Bombay Chamber of Commerce and Industry to undertake independent research activities on various economic and management issues and for providing analytical views on macro-economic scenario, industrial performance and other issues of topical interest.

The Trust started publishing the quarterly magazine 'AnalytiQue' for the quarter October-December in the year of 1999 to serve as an effective vehicle of communication between the government, industry, economists, thinkers, management consultants and scholars. In its short journey the magazine had some trying spells and after the issue of January-March, 2006 there has been no issue. However, after four years, the Trust published the next issue as Journal in March, 2010. While retaining its basic purpose and character, AnalytiQue now continues to serve members, who are drawn mainly from the world of business and commerce and deals with contemporary economic issues while documenting some of the important developments of the Indian economy.

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