

Internal Rating Based (IRB) Approach – Regulatory Expectations and Challenges



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Introduction

- Credit risk, along with liquidity risk, are the primordial risks faced by banks
- Management of credit risk is important
 - Traditional approach
 - Selection
 - Limitation
 - Diversification
 - Provision
 - Capitalisation

□ Deficiencies of traditional approach

- Selection - information asymmetry

- Limitation – to the second...best? to what extent?

- Diversification – at the cost of specialisation -
“credit paradox” – helpful if negatively correlated
– large banks have advantage over small banks

- Provision – “curative” approach – not forward
looking – pro-cyclical

- Capitalisation – non-discriminatory of riskiness

□ Modern approach or “models” approach

□ Internally banks were extending market risk VaR approach to credit risk – Credit VaR or CaR – portfolio approach based on statistical normal probability distribution, correlation, etc.

□ J.P. Morgan’s CreditMetrics, 1997 (for market risk - RiskMetrics, 1994)

□ Statistical calculation of economic capital based on “expected loss” and “unexpected loss”

□ Difficulty in “modelling” credit risk – not amenable to normal distribution?

- The traditional regulatory approach to capital for credit risk:
 - Basel I (1988) – one-size-fits-all approach
 - Four broad risk weighting categories – 0, 20, 50, and 100 %
 - Not alive to market developments

- Basel II (July 2006) recognised the new developments and also the deficiencies of Basel I (i.e., less risk sensitive)
- Basel II provided a menu of approaches for credit risk capital calculation
- Remember that credit risk constitutes the maximum proportion of RWA of a bank - 65 – 85%

□ The menu includes:

- Simplified standardised approach – like Basel I
- Standardised approach – risk weights based on external ratings and credit risk mitigation (CRM)
- Advanced approach - Internal Rating Based (IRB) approach for Banking Book
 - Foundation IRB (F-IRB) – Probability of Default (PD) and Maturity (M) based on bank's own assessment
 - Advanced IRB (A-IRB) – PD, LGD (Loss Given Default), EAD (Exposure at Default) and M based on bank's own assessment

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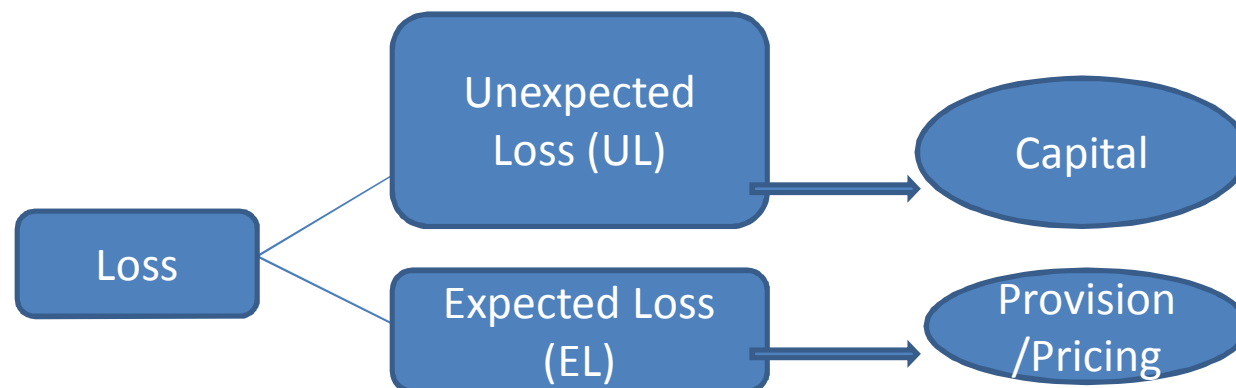
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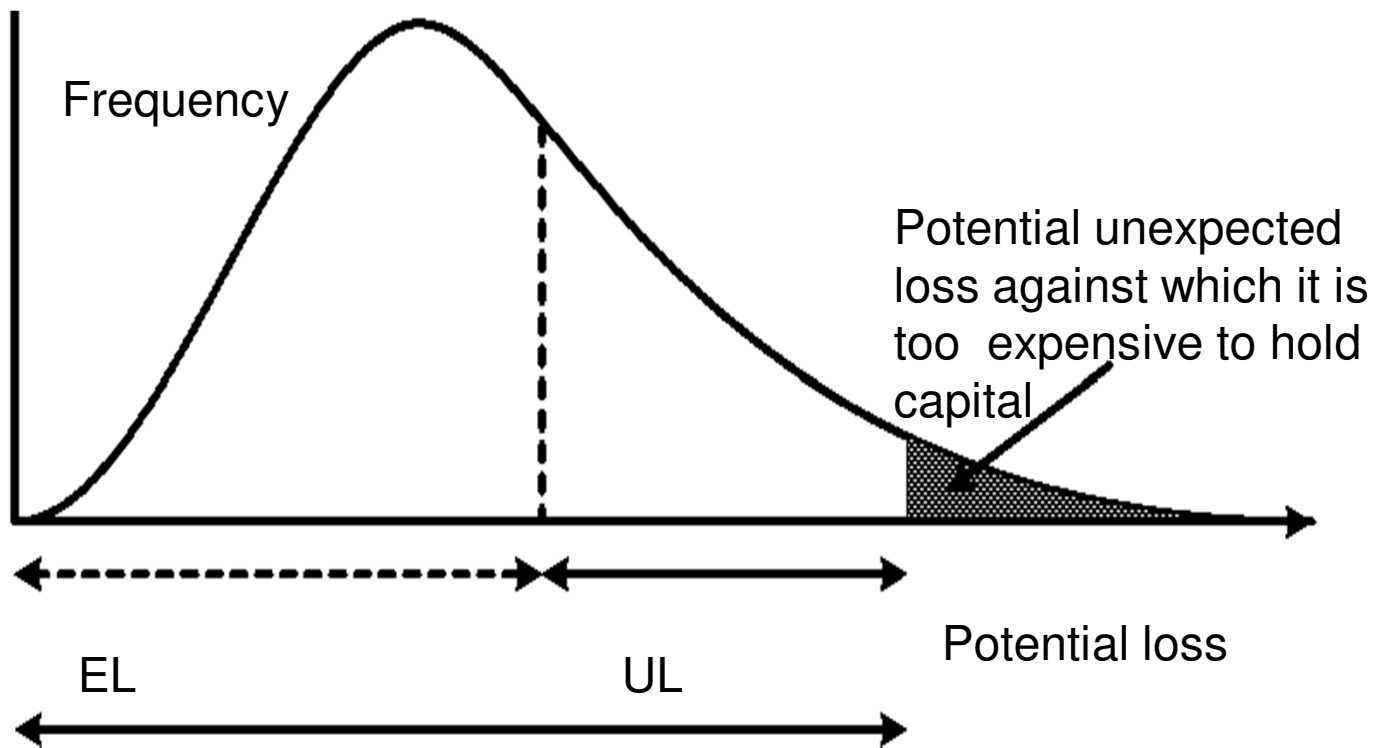
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Concepts

- IRB approach is based on measures of Expected Loss (EL) and Unexpected Loss (UL)
- IRB approach tries to ensure that banks have adequate capital against unexpected loss portion of Credit VaR at 99.9% confidence level with 1 year horizon





- The IRB approach allows banks, subject to regulatory approval, to use their own internal estimates of some or all of the credit risk components in determining the regulatory capital requirement for a given credit exposure (credit RWA are 65-85% of total)

- The “self-assessment” of capital regulation?

- Therefore, a lot of expectations and responsibilities are cast on the bank and their management that they will develop better risk management systems and practices

Asset Classes – Categorisation of Exposures

- The first step is to define asset classes
- Broadly into 5 categories with different risk characteristics:
 - Corporate – 5 sub-classes of specialised lending
 - Sovereign
 - Bank
 - Retail – 3 sub-classes
 - Equity
- Can be flexible

□ For each asset class, there are 3 key elements:

□ Determination of risk components

□ Risk weight functions / formula

□ Minimum capital requirements (K)

Risk Components

- The credit risk determination components are:
 - Probability of Default (PD)
 - Loss Given Default (LGD)
 - Exposure at Default (EAD)
 - Effective Maturity (M)

Probability of Default (PD)

- Borrower specific with 1 year time horizon
- Minimum value of 0.03 for corporate, retail and bank exposures. No minimum prescribed for sovereign
- Underlying minimum historical observation period is five years
- For both foundation and advanced approaches the bank has to calculate the PD on its own

Loss Given Default (LGD)

- Facility specific
- Loss in economic sense and not in accounting sense
- For F-IRB, LGD prescribed by supervisor
- For A-IRB banks to calculate own LGD

Exposure at Default (EAD)

- EAD calculation depend on whether an exposure is:
 - On Balance Sheet (straight forward calculation)
 - Off Balance Sheet but not market related – LC/BG, etc.
 - Off Balance Sheet market related items like Forex, Interest rate contracts, etc.

Effective Maturity (M)

For F-IRB

□ $M=2.5$ yrs.

For A-IRB

□ Barring with certain exemptions (based on size of borrower)
 $M=\max(1 \text{ year, remaining effective maturity in years})$

But in all cases, $M \leq 5$ years.

IRB Risk Weight Function /Formula

□ Assumptions of the model:

□ Large number of diversified borrowers with each representing a very small portion of total exposures

□ All idiosyncratic risk (Alpha) is completely diversified away and the IRB model is portfolio invariant

□ Only one systematic risk factor (Beta)

□ Expected Loss = $PD * LGD * EAD$

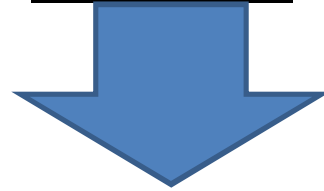
□ Probability of Default (PD) - Percentage of borrowers that default in a rating grade in one year (in %)

□ Loss Given Default (LGD) - Percentage of exposure the bank might lose in case borrower defaults (in %)

□ Exposure at Default (EAD) - Estimate of the amount outstanding in case of borrower defaults (in Rs.)

Calculation of Unexpected Loss – The Minimum Capital Requirement (K)

$$UL = \underline{(EL+UL)} - EL$$



Conditional expected loss



appropriate conservative value of systematic risk factor

Foundations of the IRB Risk Weight Formula – The Minimum Capital Requirement (K)

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

Stressed PD
Full maturity adj.

- N signifies normal distribution
- R represents the correlation of a borrower to the macro-economy
- G(PD) signifies normal inverse value of PD – the default threshold (value of assets – value of liabilities)

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

\uparrow
 \uparrow
 \uparrow
 \uparrow

Downturn LGD
Stressed PD
Expected loss
Full maturity adj.

□ $G(0.999)$ is normal inverse of the confidence level of 99.9%. This ensures that stressed PD is being calculated

□ Maturity adjustment ensures exposures with higher maturity will be assigned higher risk weight and vice versa. If Maturity is 1 year, Maturity Adjustment Factor becomes 1 and for maturity below 1 year, MAF is < 1 , hence low RW

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

\uparrow
 \uparrow
 \uparrow
 \uparrow

Downturn LGD
Stressed PD
Expected loss
Full maturity adj.

Asset Value Correlation (R)

$$= 0.12 * \left\{ \frac{1 - e^{(-50 * PD)}}{1 - e^{(-50)}} \right\} + 0.24 * \left[1 - \left\{ \frac{1 - e^{(-50 * PD)}}{1 - e^{-50}} \right\} \right]$$

R represents the correlation of a borrower to the macro-economy

R will be high for a strong/big corporate, but PD will be low

- Lowest PD=0 implies highest R of 0.24

R will be low for a small corporate, but PD will be high

- Highest PD=1 implies lowest R of 0.12

Inverse relationship between PD and R

With lowest possible PD of 0.03 correlation will be 23.82

Full Maturity Adjustment

$$\left[\frac{1 + (M - 2.5) * b}{1 - 1.5 * b} \right]$$

Where $b = \{.11852 - .05478 * \ln(\text{PD})\}^2$

If $M = 1$, there will be no impact

If $M < 1$, impact will be less

If $M > 1$, impact will be more

Illustrative IRB Risk Weights for UL

Asset Class:	Corporate Exposures		Residential Mortgages		Other Retail Exposures		Qualifying Revolving Retail Exposures	
LGD:	45%	45%	45%	25%	45%	85%	45%	85%
Maturity: 2.5 years								
Turnover (millions of €)	50	5						
PD:								
0.03%	14.44%	11.30%	4.15%	2.30%	4.45%	8.41%	0.98%	1.85%
0.05%	19.65%	15.39%	6.23%	3.46%	6.63%	12.52%	1.51%	2.86%
0.10%	29.65%	23.30%	10.69%	5.94%	11.16%	21.08%	2.71%	5.12%
0.25%	49.47%	39.01%	21.30%	11.83%	21.15%	39.96%	5.76%	10.88%
0.40%	62.72%	49.49%	29.94%	16.64%	28.42%	53.69%	8.41%	15.88%
0.50%	69.61%	54.91%	35.08%	19.49%	32.36%	61.13%	10.04%	18.97%
0.75%	82.78%	65.14%	46.46%	25.81%	40.10%	75.74%	13.80%	26.06%
1.00%	92.32%	72.40%	56.40%	31.33%	45.77%	86.46%	17.22%	32.53%
1.30%	100.95%	78.77%	67.00%	37.22%	50.80%	95.95%	21.02%	39.70%
1.50%	105.59%	82.11%	73.45%	40.80%	53.37%	100.81%	23.40%	44.19%
2.00%	114.86%	88.55%	87.94%	48.85%	57.99%	109.53%	28.92%	54.63%
2.50%	122.16%	93.43%	100.64%	55.91%	60.90%	115.03%	33.98%	64.18%
3.00%	128.44%	97.58%	111.99%	62.22%	62.79%	118.61%	38.66%	73.03%
4.00%	139.58%	105.04%	131.63%	73.13%	65.01%	122.80%	47.16%	89.08%
5.00%	149.86%	112.27%	148.22%	82.35%	66.42%	125.45%	54.75%	103.41%
6.00%	159.61%	119.48%	162.52%	90.29%	67.73%	127.94%	61.61%	116.37%
10.00%	193.09%	146.51%	204.41%	113.56%	75.54%	142.69%	83.89%	158.47%
15.00%	221.54%	171.91%	235.72%	130.96%	88.60%	167.36%	103.89%	196.23%
20.00%	238.23%	188.42%	253.12%	140.62%	100.28%	189.41%	117.99%	222.86%

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Variation in Credit RWA – Recent Study

□ Analysis of RWA for credit risk in Banking Book
– BCBS - July 5, 2013

□ Objective - Evaluate drivers of material differences in Banking Book RWAs under IRB framework across banks (100) in various jurisdictions (13)

Methodology

- Top down analysis - Supervisory data at country, bank and portfolio level from 100 major banks
- Bottom up analysis - Benchmarking study among 32 major international banks in respect of hypothetical wholesale portfolio

Causes of Variation in RWA

Based on actual inherent risk

- Underlying differences in the risk composition of banks' assets (75%)

Based on quantification of inherent risk

- Diversity in supervisory and bank practices (25%)

Some Observations

- Credit risk contributes most towards RWA amount as well as variation across all risk types
- Corporate and retail asset classes contribute the most towards differences in RWA
- High consistency among banks in assessing relative riskiness of borrowers
- Inconsistency among banks in quantification of the risk of borrowers/exposures in terms of PD and LGD
- LGD estimation was found to be one of the most significant sources of difference in RWA across the AIRB banks.

Sources of practice based variations from Top down analysis

1. Capital floor adjustments
2. Partial use of IRB along with standardised approaches
3. Difference between FIRB and AIRB risk parameter estimates
4. Different capital requirement of defaulted exposures
5. Securitisation exposures under Basel 2.5 and Basel III

Practice based differences found from HPE (Hypothetical Portfolio Exercise)

1. *Difference in RWA between standardised (SA), FIRB and AIRB approaches arising from*

- Partial migration from SA to IRB
- Internal estimates of EAD and LGD under FIRB and AIRB respectively
- Unconditionally cancellable credit lines will have '0' CCF under SA and FIRB but mostly positive under AIRB

2. Definition of default

- For retail and PSEs 'Days Past Due' vary from 90-180 days
- Differential treatment regarding consideration of 'unlikely to pay' signs

3. Margin of conservatism

- Subjectivity involved in applying conservative factors for risk estimates to compensate for data and model deficiencies

4. Adjustments for cyclical effects

- Long term PD calibration
- Downturn LGD and EAD calibration

5. Risk quantification for low default portfolios

- Choice of data sources and calibration techniques

Road ahead

Short term policy option as suggested in the paper

- Enhanced disclosures (asset class mix, risk parameter estimates, distribution of rating grades, sources of change in RWA)
- Additional guidance and clarifications of unspecified or less than fully specified areas (downturn estimates) of Basel framework

Mid term policy options as suggested in this paper

- Harmonise national implementation requirements (capital floor adjustments, partial use of standardised approach, definition of default)
- Constraints on IRB parameter estimates (benchmarking of risk parameters)

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- Greater emphasis on banks' own models and methods of risk measurement techniques
- Encourages improvement of risk management which also includes focused collation and analysis of data - data quality improves when used for decision making
- Creates a risk sensitive framework to align regulatory capital more closely with economic capital

Regulatory Requirements

- Twelve minimum requirements with the overarching principle that:
 - Rating and risk estimation systems and processes provide for a meaningful assessment of borrower and transaction characteristics and a meaningful differentiation of risk
 - Reasonably accurate and consistent quantitative estimates of risk
 - Systems and processes must be consistent for internal use of these estimates

Expectations about Rating System

□ **Two-dimensional rating systems** – Two dimensional with separate borrower rating (PD) and facility rating (LGD)

□ **Meaningful assessment and differentiation of risk** - IRB ratings/risk estimates (7+1) must be able to rank risk and do so consistently throughout the institution and through time. Balance between concentration and granularity

□ **Intuitively sensible** - IRB rating models and risk estimates must be intuitively sound

□ **Information intensive** - All relevant, material and available information and methods should be taken into account in review/refresh ratings/risk estimates

Expectations about Risk Estimates

Calibration of risk estimates

- PD - Long term average
- LGD and EAD - Max(default weighted long term average estimate, downturn estimate)

Estimation with margin of conservatism in case of, inter alia,

- Estimation methods are yet to be fully satisfactory
- Data proves to be less than sufficient

IRB Risk estimates

- Should be forward looking
- Should be based on empirical evidence
- Should not usually be based purely on judgment or expert opinion

Expectations about Models

Understanding of

- ✓ Assumptions, equations and logic of the same
- ✓ Interpretation of output
- ✓ Relevance, reliability and stability
- ✓ Potential and limitation

Risk Management Models

- Model refers to a quantitative method, system, or approach that applies statistical, economic, financial, or mathematical theories, techniques and assumptions to process input data into quantitative estimates of real world
- Model consists of 3 components:
 - Information input – inputs assumptions and data
 - Processing – transforms inputs into estimates
 - Reporting or output – translates estimates into business information

Model Development and Implementation

- Clear statement of purpose – align with intended use
- Documentation of design, theory, and logic – supported by research and industry practice
- Data and other information used – rigorous assessment of data quality and relevance and suitability and consistent with the theory and methodology
- Proxy data – properly analysed for relevance before use

- Integral part of model development is model validation – whether performing as intended
 - Accuracy
 - Robust and stable
 - Impact of assumptions and where performing poorly or unreliably
 - Flow of feeder information
 - Properly documented
- Model use test feedback – whether model is functioning effectively

□ Therefore, important to understand model risks

□ Model may have fundamental errors

□ In design and implementation

□ In simplifying or approximating real world problems, the integrity and reliability of outputs may be compromised

□ In quality of input data and assumptions leading to incorrect outputs

□ Model may be used incorrectly or inappropriately

□ By using existing models to new products or markets

Expectations on Corporate Governance

Engagement at Board level:

- Reasonable level of understanding of the IRB framework
- Thrust and decision to apply for adoption of IRB
- Involvement in initial application and self assessment
- Ultimate responsibility for performance of the rating system and IRB risk estimates

Independence

- Functional independence of business units responsible for rating systems and those responsible for loan origination
- Reporting line of these two units may converge at the highest level possible
- Independence of maker-checker at all the levels

Transparency

- Documentation and**
- Audit trail**

Documentation :

- must be current and consistent with actual practice**
- must undergo a regular and effective review process**
- should help the bank avoid reliance on any particular person/s**

Audit trail will involve

- Record of all transactions done in the system by relevant officials
- Record of any change done in the system which may affect risk parameter estimation (e.g. overruling credit rating)

Accountability

- A bank's policy should**
 - ✓ identify people responsible for the performance of its IRB system and**
 - ✓ establish performance standards**
- The responsibilities should be clearly defined and documented**
- People should also have the knowledge, skills, tools and resources necessary to carry out their responsibilities**

Regulatory Expectations on Data Management

- Applicant banks must be able to segment their IRB credit portfolios into IRB asset classes and sub-asset classes defined under the Basel II Framework
- Probability of default (PD) estimates must be assigned to all obligors and loss given default (LGD) and exposure at default (EAD) estimates must be assigned to all credit facilities within the corporate, sovereign, bank and retail asset classes
- Effective maturity (M) must also be correctly calculated and assigned to all facilities within the non-retail (i.e. corporate, sovereign and bank) asset classes

- PD and LGD ratings must be reviewed/refreshed at least annually; more frequently in the case of higher risk/problem exposures or if new material information comes to light**

- Institutions must gather and retain data, including on key borrower and facility characteristics, of sufficient detail, scope, reliability and consistency – may also help in on-going improvement in the bank’s IRB system**

- Reconciliation of capital calculation and accounting data**

- Third party data management sign-off**

Regulatory Expectations from Indian Banks

Scope of IRB

☐ Preferably for whole of the banking book portfolio

However, possibility of phased roll out, provided

☐ Acceptable rationale for any requested carve outs

☐ Carve out is not for minimising regulatory capital charge

☐ The implementation plan for carved out portion should be exacting, yet realistic, and the roll out period should not be more than 24 months

- Permanent exemptions may be given to non-significant business units that are immaterial in size and perceived risk. Capital requirements for such portfolios will be determined according to standardised approach
- The temporary or permanent exemptions should not be more than 15% of assets/net revenue, of the applicant bank
- A parallel run of at least 12 months are expected

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Challenges in Implementation

- Robust data management process and structure
- Internal model development
- Model and process validation
- Incorporating model outputs in business decision making

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Indian Experience

- **All the scheduled commercial banks in India have been Basel II compliant as per the standardised approach with effect from April 1, 2009.**
- **In July 2009, the time table for the phased adoption of advanced approaches had also been put in public domain.**
- **Banks desirous of moving to advanced approaches under Basel II were advised that they could apply for migrating to advanced approaches of Basel II for capital calculation on a voluntary basis based on their preparedness and subject to RBI approval.**
- **The appropriate guidelines for advanced approaches of market risk (IMA), operational risk (AMA) and credit risk (Internal Rating Based Approach) were issued in April 2010, April 2011 and December 2011 respectively.**

Basel II Advanced Approaches - from Indian banks perspective

- A journey to strive for continuous betterment of risk management system
- Intrinsic organisational risk management culture
- Downsizing capital should **not** be the sole aim

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- Calculation of regulatory capital largely depend on banks' internal models
- Outcomes of models can differ across banks at a given point in time and within a bank across time for reasons other than changes in underlying risk

Five reasons for the variability:

- Differences in what risk models actually measure – risk parameters, e.g., point in time PD or average PD, etc.
- Structure of the model – based on different assumptions of real world. Such diversity may be desirable from financial stability point of view
- Statistical noise – depending on underlying risk characteristics and size of the sample. May be unavoidable

- Bankers' incentives – which favours optimistic views on risk and low regulatory capital. Low regulatory capital increases bank's RoE, better capital ratios, better projection of image of a safe and sound bank, and less regulatory constraints.
 - While diverse structure of the model and statistical noise in the model serve some useful purpose, this strategic view by bank management is unwelcome – it undermines regulatory efforts. There was a secular decline in ratio of RWA to total assets prior to the recent financial crisis

□ Supervisory intervention – due to model weaknesses of banks in different jurisdictions at different points in time. If not transparent, difficult for market analysts to judge.

Question Raised

- Does the prudential regulatory framework of capital calculation puts too much emphasis on internal measures of risk? Answer is Yes / No
 - Yes, therefore have a simple leverage ratio
 - No, leverage ratio is risk insensitive to solvency risk
- The real world is between these two ends of the spectrum
- Therefore, both Common Equity (CE) / RWA and CE/TA ratios are complementary

□ Regulatory initiatives:

- Basel III leverage ratio to complement capital ratio and model risk
- Improving reliability of banks' internal models – more stringent requirements for model approvals by supervisors / regulators
- Enhancing market discipline – by disclosures - improving outsiders understanding of risk weight calculations, historical model performance, risk measurement/calibration techniques used by banks, standardisation of information, etc.

Thank you