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MIS Sustain Credit Riskmetrics Vis a Vis the Future of Indian Banking System

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ABSTRACT

The Indian Economy is booming on the back of strong economic policies and a healthy regulatory regime. The effects of this are far-reaching and have the potential to ultimately achieve the high growth rates that the country is yearning for. The banking system lies at the nucleus of a country's development robust reforms are needed in India's case to fulfill that. The BASEL III accord from the Bank of International Settlements attempts to put in place sound frameworks of measuring and quantifying the risks associated with banking operations by 2019.

The paper seeks to showcase the changes that will emerge as a result of banks adopting the international norms and whether they will be able to sustain the pressures and shocks of the changing scenarios. This enables one to discern the complete scenario that will emerge in the years ahead. The Risk Management scenario will strengthen owing to the liberalization, regulation and integration with global markets. Management of risks will be carried out proactively and quality of credit will improve, leading to a stronger financial sector.
The authors have emphasized the dire need of Altmann Z Score, Merton Model, KMV Model and Value at Risk Model for the Banks in a more sophisticated manner through caselets.

Thus the Banks would evolve to be a complete and pure financial services provider, catering to all the financial needs of the economy in the Vision 2020. Flow of capital will increase and setting up of bases in foreign countries will become commonplace.

KEYWORDS

Risk metrics	KMV Model
Banking System	EAD – Exposure at default
Expected Loss [EL]	Probability of Default [PD]
Capital Adequacy Requirement [CAR]	Loss given default [LGD]

PREAMBLE

Risk management has assumed increased importance from the regulatory compliance point of view. Credit Risk being an important component of risk, can be viewed at two levels - at the level of an individual asset or exposure and at the portfolio level. Credit risk management tools therefore have to work at both individual and portfolio levels. Traditionally the tools of credit risk management include loan policies, standards for presentation of credit proposals, delegation of loan approving powers, multi-tier credit approving systems, prudential limits on credit exposures to companies and groups, stipulation of financial covenants, standards for collaterals, limits on asset concentrations and independent loan review mechanisms. Monitoring of non-performing loans has however a focus on remedy rather than advance warning or prevention. Banks assign internal ratings to borrowers, which will determine the interest spread charged over PLR. These ratings are also used for monitoring of loans. Some central banks like the Reserve Bank of India have suggested the use of rating models like Altman's Z score models at individual loan/company level and risk models like Credit Metrics and Credit Risk+ at the portfolio level.

OVERVIEW

Credit Risk is defined as "The inability or unwillingness of the customer or counter party to meet commitments in relation to lending, hedging, settlement and other financial transactions." Hence Credit Risk emanates when the counter party is unwilling or unable to meet or fulfill the contractual obligations / commitments thereby leading to defaults. Risk management activities will be more pronounced in future banking because of liberalization, deregulation and global integration of financial markets. This would be adding depth and dimension to the banking risks. As the risks are correlated, exposure to one risk may lead to another risk, therefore management of risks in a proactive, efficient & integrated manner will be the strength of the successful banks. In the current norms of Basel II accord, under Pillar 1, the framework offers three distinct options for computing capital requirement for credit risk. These approaches for credit risks are based on increasing risk sensitivity and allow banks to select an approach that is appropriate to the stage of development of bank's operations. The approaches available for computing capital for credit risk are Standardized Approach, Foundation Internal Rating Based Approach and Advanced Internal Rating Based approach.

Standardized Approach is the basic approach which banks at a minimum have to use for moving to Basel II implementation. It is an extension of the existing method of calculation of capital charge for credit risk. The existing method is refined and made more risk sensitive by:

- Introducing more number of risk weights thus aiding finer differentiation in risk assessment between asset groups.

- Assignment of Risk weights based on the ratings assigned by External Credit rating agencies recognized by RBI, in case of exposures more than Rs.5 crores.

- Recognizing wide range of collaterals (securities) as risk mitigants and netting them off while determining the exposure amount on which risk weights are to be applied.

- Introducing Retail portfolio with total exposure up to Rs.5 crores and yearly turnover less than Rs.50 crores as a separate asset group with clear cut definition and criteria.

- Assignment of Risk weight for NPA accounts. The rating assigned by the eligible external credit rating agencies will largely support the measure of credit risk. Unrated exposures will normally carry 100% risk weight. But for the financial year 2008-09, all fresh sanctions or renewals in respect of unrated borrowers in excess of Rs.50 crores will attract a risk weight of 150%. From 2009-

10 onwards, unrated borrowings in excess of 10 crores will attract risk weight of 150%.

The standardized approach was implemented by 31st March 2010, and the forward-looking banks would be in the process of placing their MIS for the collection of data required for the calculation of Probability of Default (PD), Exposure at Default (EAD) and Loss Given Default (LGD). The banks are expected to have at a minimum PD data for five years and LGD and EAD data for seven years.

CRM{ Credit Risk Mitigation} refers to permitted methods of netting the exposure value for computing Risk Weights by using Collateral, Third party guarantee (Guarantee) and On-balance sheet netting. CRM is available subject to several conditions. Before netting, Exposure Value (EV) and Collateral Value (CV) are to be adjusted for volatility and possible future fluctuations. EV to be increased for volatility (premium factor) and CV to be reduced for volatility (discount factor). These factors are termed as 'Haircuts' (HC).

Therefore,

EV after risk mitigation
=
(EV After HC – CV After HC)

EV after Risk mitigation will be multiplied by the Risk Weight of the customer to obtain Risk-weighted asset amount for the collateralized transaction.

Presently most Indian banks do not possess the data required for the calculation of their LGDs. Also the personnel skills, the IT infrastructure and MIS at the banks need to be upgraded substantially if the banks want to migrate to the IRB Approach.

However, for banks and financial institutions, credit risk is the most important factor to be managed. Credit risk may take various forms, such as:

- ✓ **In the case of direct lending, that funds will not be repaid;**
- ✓ **In the case of guarantees or letters of credit, that funds will not be forthcoming from the customer upon crystallization of the liability under the contract;**
- ✓ **In the case of treasury products, that the payment or series of payments due from the counterparty under the respective contracts is not forthcoming or ceases;**
- ✓ **In the case of securities trading businesses, that settlement will not be effected;**
- ✓ **In the case of cross-border exposure, that the availability and free transfer of currency is restricted or ceases.**

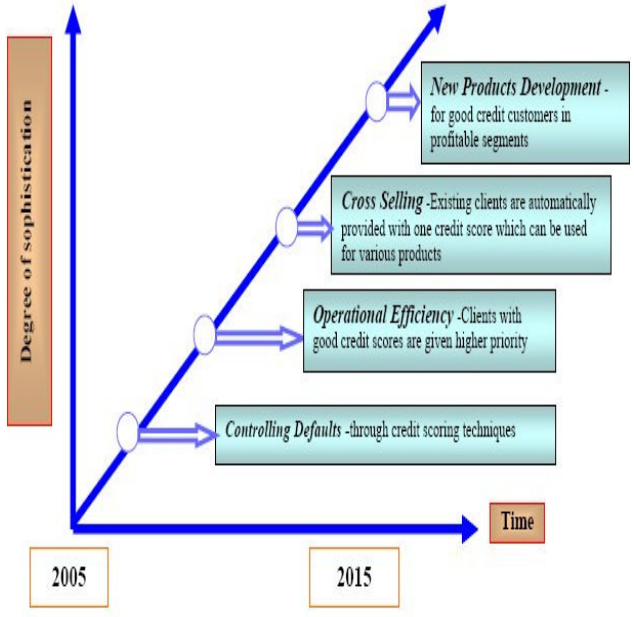

Figure 1: Strategic Continuum of Risk Scoring Models

Source:- http://www.moodyskmv.com

Figure-1: Strategic Continuum of Risk Scoring Models

The more diversified a banking group is, the more intricate systems it would need, to protect itself from a wide variety of risks. These include the routine operational risks applicable to any commercial concern, the business risks to its commercial borrowers, the economic and political risks associated with the countries in which it operates, and the commercial and the reputational risks concomitant with a failure to comply with the increasingly stringent legislation and regulations surrounding financial services business in many territories. Comprehensive risk identification and assessment are therefore very essential to establishing the health of any counterparty.

COMPONENTS OF CREDIT RISK

As per the existing Standardized approach, Risk Weight (RW) is assigned based on the "External Rating" of the borrowers for "Corporate" asset class and differential (concessional) risk weight of 75% is applicable for "Retail" exposures. Basel Committee taking into account the following elements has determined the risk weights:

- **Frequency of Default (Probability of Default – PD)**
- **Severity of Default (Loss Given Default – LGD)**
- **Outstanding/modifiers for off balance sheet items (Exposure at Default)**
- **Maturity adjustment (M)**

More advanced approaches provide banks with the following two options for measurement of credit risk:

1. Foundation – Internal Rating Based (FIRB) - Under the **foundation approach**, as a general rule, banks provide their own estimates of PD and rely on supervisory estimates for other risk components.
2. Advanced – Internal Rating Based (AIRB) - Under the **advanced approach**, banks provide more of their own estimates of PD, LGD and EAD, and their own calculation of M, subject to meeting minimum standards.

Ideally, the more suited approach shall be AIRB as under FIRB, the regulator provides LGD and EAD and it may not be appropriate to calibrate and benchmark these risk components to our portfolios.

AIRB is a highly data intensive approach and requires granular level information on all the aforesaid risk elements. The minimum number of years for which the historical data is to be collected, analysed, calibrated and validated for measurement of capital adequacy is specified below:

- **PD: 5 yrs**
- LGD and EAD: 7 yrs
- Maturity: Effective maturity based on cash flows

Basel II guidelines stipulates that the risk elements shall cover one full economic cycle so as to iron out the fluctuations in its measurement and computing capital adequacy in a more meaningful manner while possibly covering the economic downturn.

SUMMARIZING THE CREDIT RISK MODELS

1. KMV MODEL

This model was developed by KMV Corporation based on Merton's (1973) analytical model of firm's value. This model uses stock prices and the capital structure of the firm to estimate its probability. The starting point of this model is the proposition that a firm would default only if its asset value falls below certain level (default point), which is a function of its liability. It estimates the asset value of the firm and its asset volatility from the market value of equity and the debt structure in the opinion theoretic framework. Using these two values, a metric (distance from default or DFD) is constructed that represents the number of standard deviation that the

firm's asset value is away from the default point. Finally, a mapping is done between the default values and actual default rate, based on historical default experience. The resultant probability is called Expected Default Frequency (EDF). Thus EDF is calculated in the following three steps:

i.	**Estimation of asset value and asset volatility from equity value and volatility of equity return.**
ii.	**Calculation of DFD as (Asset value – Default point) / (Asset value * Asset volatility)**
iii.	**Calculation of expected default frequency.**

2. CREDIT METRICS MODEL

Credit Metrics is a statistical model developed by J.P Morgan, the investment bank, in the year 1995 for internal use, but now it's being used all around the world by hundreds of banks including Indian banks like the ICICI bank. This model works on the statistical concepts like probability, means, and standard deviation, correlation, and concentrations.

Credit Metrics is a tool for assessing portfolio risk due to changes in debt value caused by changes in obligor credit quality. This model includes the changes in value caused not only by possible default events, but also by upgrades and down grades in credit quality, because the value of a particular credit varies with the corresponding credit quality. Credit Metrics also assess the Value- at – risk (VAR) – the volatility of value- not just the expected losses. The model assesses the risk within the full context of a portfolio addressing the correlation of credit quality moves across obligors. This allows to directly calculating the diversification benefits or potential over concentrations across the portfolio.

The transition table for the various categories of bonds is determined and then joint probability for both these under different combinations. Then the NPV of the portfolio is determined for all the combinations and a probability distribution is constructed. These probabilities are actually an analysis of past migrations and same is the case with default probability. In the case of default a recovery rate is taken as the portfolio value. This distribution gives us 2 measures of credit risk: standard deviation and percentile level. This model has some limitations regarding the data availability but it doesn't require any changes as such for application in the Indian scenario.

3. VAR MODEL

This model is being used in some of the banks currently in India. Value at risk (VAR) is a statistical risk measure, which is used extensively for measuring the market risk of portfolios of assets and/or liabilities. Suppose a portfolio's value at risk is 2Mn$ with a 95% confidence level, then it means that the portfolio is expected to loose a maximum of 2Mn$ 95% of the times. The Value at risk is calculated by constructing a probability distribution of the portfolio values over a given time horizon. The values may be calculated on the daily, weekly or monthly basis.

4. ALTMANN Z SCORE

Altman's Z score predicts whether or not a company is likely to enter into bankruptcy within one or two years. Edward Altman developed the model by examining 85 manufacturing companies in the year 1968. Later, additional "Z-Scores" were developed for private manufacturing companies (Z-Score - Model A) and another for general/service firms (Z-Score - Model B). The Z-Score combination. The algorithm has been consistently reported to have a 95 % accuracy of prediction of bankruptcy up to two years prior to failure on nonmanufacturing firms as well. There have been many other bankruptcy predictors developed and published. However, none has been so thoroughly tested and broadly accepted as the Altman Z-Score. The Altman Z-Score variables influencing the financial strength of a firm are: current assets, total assets, net sales, interest, total liability, current liabilities, market value of equity, earnings before taxes and retained earnings.

The model can be used for a quick check about the health of a company. It however cannot be used for individuals. The value of Z is given by the following equation:

$$Z = 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5$$

Where,

X1 = working capital/Total assets

X2 = Retained earnings/Total assets

X3 = Earnings before interest and taxes/Total assets

X4 = Market value of equity/Book value of total liabilities

X5 = Sales/Total assets

A "Z" value above 1.8 is supposed to be quite safe, while the value below 1.8 indicates a high probability of bankrupt

CREDIT STRATEGY, POLICIES AND PROCEDURES

The credit risk strategy should provide continuity in approach, and will need to take into account the cyclical aspects of any economy and the resulting shifts in the composition and quality of the overall credit portfolio. This strategy should be viable in the long run and through various credit cycles. An organisation's risk appetite depends on the level of capital and the quality of loan book and the magnitude of other risks embedded in the balance sheet. Based on its capital structure, a bank will be able to set its target returns to its shareholders and this will determine the level of capital available to the various business lines.

Keeping in view the foregoing, a bank should have the following in place: -

i. Dedicated policies and procedures to control exposures to designated higher risk sectors such as capital markets, aviation, shipping, property development, defence equipment, highly leveraged transactions, bullion etc.
ii. Sound procedures to ensure that all risks associated with requested credit facilities are promptly and fully evaluated by the relevant lending and credit officers.
iii. Systems to assign a risk rating to each customer/borrower to who credit facilities have been sanctioned.
iv. A mechanism to price facilities depending on the risk grading of the customer, and to attribute accurately the associated risk weightings to the facilities.
v. Efficient and effective credit approval process operating within the approval limits authorized by the Boards.
vi. Procedures and systems which allow for monitoring financial performance of customers and for controlling outstanding within limits.
vii. Systems to manage problem loans to ensure appropriate restructuring schemes. A conservative policy for the provisioning of non-performing advances should be followed.
viii. A process to conduct regular analysis of the portfolio and to ensure on-going control of risk concentrations.

The credit policies and procedures should necessarily have the following elements: -

i. Banks should have written credit policies that define target markets, risk acceptance criteria, credit approval authority, credit origination and maintenance procedures and guidelines for portfolio management and remedial management.
ii. Banks should establish proactive credit risk management practices like annual / half yearly industry studies and individual obligor reviews, periodic credit calls that are documented, periodic plant visits, and at least quarterly management reviews of troubled exposures/weak credits.
iii. Business managers in banks will be accountable

	for managing risk and in conjunction with credit risk management framework for establishing and maintaining appropriate risk limits and risk management procedures for their businesses.
iv.	Banks should have a system of checks and balances in place around the extension of credit which are:
v.	An independent credit risk management function
vi.	Multiple credit approvers
vii.	An independent audit and risk review function
viii.	The Credit Approving Authority to extend or approve credit will be granted to individual credit officers based upon a consistent set of standards of experience, judgment and ability.
ix.	The level of authority required to approve credit will increase as amounts and transaction risks increase and as risk ratings worsen.
x.	Every obligor and facility must be assigned a risk rating.
xi.	Banks should ensure that there are consistent standards for the origination, documentation and maintenance for extensions of credit.
xii.	Banks should have a consistent approach toward early problem recognition, the classification of problem exposures, and remedial action.
xiii.	Banks should maintain a diversified portfolio of risk assets in line with the capital desired to support such a portfolio.
xiv.	Credit risk limits include, but are not limited to, obligor limits and concentration limits by industry or geography.
xv.	In order to ensure transparency of risks taken, it is the responsibility of banks to accurately, completely and in a timely fashion, report the comprehensive set of credit risk data into the independent risk system.

TYPICAL ORGANISATIONAL STRUCTURE

At organizational level, overall risk management should be assigned to an independent Risk Management Committee or Executive Committee of the top Executives that reports directly to the Board of Directors. The purpose of this top level committee is to empower one group with full responsibility of evaluating overall risks faced by the bank and determining the level of risks which will be in the best interest of the bank. The function of Risk Management Committee should essentially be to identify, monitor and measure the risk profile of the bank. The Committee should also develop policies and procedures, verify the models that are used for pricing complex products, review the risk models a development takes place in the markets and also identify new risks. Internationally, the trend is towards assigning risk limits in terms of portfolio standards or Credit at Risk (credit risk) and Earnings at Risk and Value at Risk (market risk).

A prerequisite for establishment of an effective risk management system is the existence of a robust Management Information System (MIS), consistent in quality. The existing MIS, however, requires substantial up gradation and strengthening of the data collection machinery to ensure the integrity and reliability of data. The risk management is a complex function and it requires specialized skills and expertise. Banks have been moving towards the use of sophisticated models for measuring and managing risks. Large banks and those operating in international markets should develop internal risk management models to be able to compete effectively with their competitors.

As the domestic market integrates with the international markets, the banks should have necessary expertise and skill in managing various types of risks in a scientific manner. At a more sophisticated level, the core staff at Head Offices should be trained in risk modeling and analytical tools. It should, therefore, be the endeavor of all banks to upgrade the skills of staffs.

Given the diversity of balance sheet profile, it is difficult to adopt a uniform framework for management of risks in India. The design of risk management functions should be bank specific, dictated by the size, complexity of functions, the level of technical expertise and the quality of MIS. The proposed guidelines only provide broad parameters and each bank may evolve their own systems compatible to their risk management architecture and expertise.

Internationally, a committee approach to risk management is being adopted. While the **Asset-Liability Management Committee (ALCO)** deals with different types of market risk, **the Credit Policy**

Committee (CPC) oversees the credit/counterparty risk and country risk.

Banks could also set up a single Committee for integrated management of credit and market risks. Generally, the policies and procedures for market risk are articulated in the ALM policies and credit risk is addressed in Loan Policies and procedures.

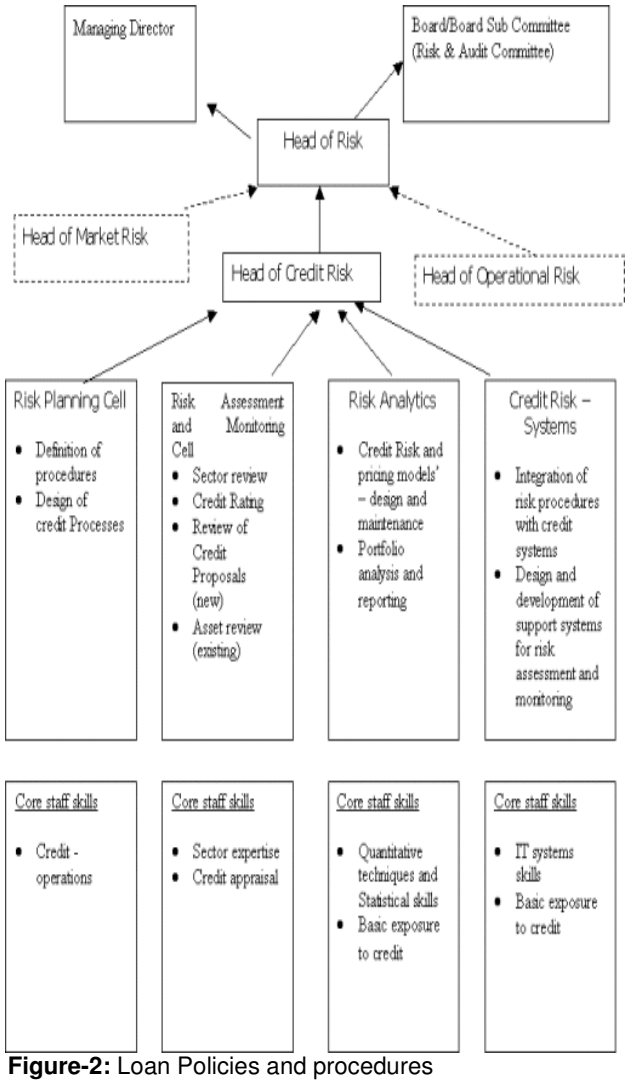

Figure-2: Loan Policies and procedures

Currently, while market variables are held constant for qualifying credit risk, credit variables are held constant in estimating market risk. The economic crises in some of the countries have revealed a strong correlation between unhedged market risk and credit. Forex exposures, assumed by corporate whi have no natural hedges, will increase the credit risk which banks run vis-à-vis their counterparties. The volatility in the prices of collateral also significantly affects the quality of the loan book. Thus, there is a need for integration of the activities of both the ALCO and the CPC and consultation process is established to evaluate the impact of market and credit risks on the financial strength of banks. Banks may also consider integrating market risk elements into their credit risk assessment process.

MEASUREMENT OF RISK THROUGH CREDIT RATING/SCORING:

a. Quantifying the risk through estimating expected loan losses i.e. the amount of loan losses that bank would experience over a chosen time horizon (through tracking portfolio behavior over 5 or more years) and unexpected loss (through standard deviation of losses or the difference between expected loan losses and some selected target credit loss quantile);
b. Risk pricing on a scientific basis; and
c. Controlling the risk through effective Loan Review Mechanism and portfolio management.

The credit risk management process should be articulated in the bank's **Loan Policy**, duly approved by the Board. Each bank should constitute a high level **Credit Policy Committee**, also called Credit Risk Management Committee or Credit Control Committee etc. to deal with issues relating to credit policy and procedures and to analyze, manage and control credit risk on a bank wide basis. The Committee should be headed by the Chairman/CEO/ED, and should comprise heads of Credit Department, Treasury, Credit Risk Management Department (CRMD) and the Chief Economist. The Committee should, *inter alia*, formulate clear policies on standards for presentation of credit proposals, financial covenants, rating standards and benchmarks, delegation of credit approving powers, prudential limits on large credit exposures, asset concentrations, standards for loan collateral, portfolio management, loan

review mechanism, risk concentrations, risk monitoring and evaluation, pricing of loans, provisioning, regulatory/legal compliance, etc.

Concurrently, each bank should also set up Credit Risk Management Department (CRMD), independent of the Credit Administration Department. The CRMD should enforce and monitor compliance of the risk parameters and prudential limits set by the CPC. The CRMD should also lay down risk assessment systems, monitor quality of loan portfolio, identify problems and correct deficiencies, develop MIS and undertake loan review/audit. Large banks may consider separate set up for loan review/audit. The CRMD should also be made accountable for protecting the quality of the entire loan portfolio. The Department should undertake portfolio evaluations and conduct comprehensive studies on the environment to test the resilience of the loan portfolio.
Credit Risk may be defined as the risk of default on the part of the borrower. The lender always faces the risk of the counter party not repaying the loan or not making the due payment in time. This uncertainty of repayment by the borrower is also known as default risk.

The credit approval process should aim at efficiency, responsiveness and accurate measurement of the risk. This will be achieved through a comprehensive analysis of the borrower's ability to repay, clear and consistent assessment systems, a process which ensures that renewal requests are analyzed as carefully and stringently as new loans and constant reinforcement of the credit culture by the top management team.

Banks must have a MIS, which will enable them to manage and measure the credit risk inherent in all on- and off-balance sheet activities. The MIS should provide adequate information on the composition of the credit portfolio, including identification of any concentration of risk. Banks should price their loans according to the risk profile of the borrower and the risks associated with the loans.

The broad objectives of studying the Credit risk Management evolving the Bank's credit risk policy are:

OBJECTIVES OF THE STUDY

- To build a high quality portfolio in line with the Bank's risk appetite and strategy.
- To identify, measure, monitor, manage and control risk effectively and to ensure that the Bank gets compensated for the risk assumed
- To maximize Bank's Risk-Adjusted Return by maintaining credit risk exposure within acceptable parameters.
- To develop a greater ability to recognize and avoid potential problems.
- To support sustainable business growth within the overall Risk appetite of the Bank.
- Diversifying the risk profile among different segments of Products, Geographies, Group etc in order to minimise the concentration risk and maximise returns.

SCOPE

The scope of our study is to build a high quality portfolio in line with the Bank's risk appetite and strategy and to support sustainable business growth within this appetite. By building upon the model of transition matrix we have tried to identify measure, monitor, manage and control risk effectively and to ensure that the Bank gets compensated for the risk assumed. Diversifying the risk profile among different segments of Products, Geographies, Group etc in order to minimise the concentration risk and maximise returns and to maximize Bank's Risk-Adjusted Return by maintaining credit risk exposure within acceptable parameters.

METHODOLOGY

The authors have devised Credit Risk Transition matrix in a New Generation Private Sector Bank

{IndusindBank} which can help as against qualitative/ structural approaches as follows:

TRANSITION MATRIX

Default probability is measured using risk factors. The change in the default probability or the volatility in PD is measured through Transition Matrix (TM) While PD measurement helps in measuring risk at the instrument level, PD volatility helps in measuring risk at the portfolio level. The likelihood of a customer migrating from its current risk-rating category to any other category within the time horizon is frequently expressed in terms of rating TM. TM is expressed in a Matrix form.

The transition matrix including probabilities to move from one rating to another rating represents the kernel of many credit risk and rating calculations. Following the requirements of Basel II financial engineers need software tools allowing for adjustment of transition matrices provided by rating agencies to the economic cycles and to generate transition matrices according to the local financial and economic conditions. The generated transition matrixes are the basis for calculation of credit risk of counterparts using a set of internal (Credit Metrics, Credit Risk and Basel II Standard, Foundation and Advanced Approaches) evaluation models. The estimation of credit risk involve cumulative and marginal default probabilities for future periods used to calculate expected and unexpected losses (Credit VAR) within a multi-period credit exposure model. The results of transition matrix estimation of Data Supporter Module are used by Risk Evaluator to calculate credit risk of single counterparts and various aggregates based on sub portfolios, concern structures and other grouping criteria such as branches and countries.

One limitation of this method is the size of the pools. Most banks do not have large enough credit portfolios to be able to estimate PDs with accurate granularity. The smaller number of obligors, the more volatile the PD estimation will be.

Another limitation is given if PDs are calculated once a year (at year end); changes in the PDs cannot be foreseen in time. A monthly estimation and comparison of PDs on a year-to-year basis is therefore helpful to extend the time series and calculate the credit risk and expected losses on current data.

Using the method of pseudo-pooling, banks can compute transition probabilities or cumulated multi-year PD. For multi-year estimations, it is crucial that the pool remains "static" or "frozen" with respect to the obligors in it, so that the time period is equal for all the obligors in the respective pool. In other words, it will be incorrect – say 5-year PDs, if some obligors have been in the pool for 5 years and some for only 4 or 3 years. However to overcome this problem two types of pools are used-

1. Dynamic pool

A dynamic pool of a year is a set of pool of companies where in the membership of the pool does not remain static/constant but keeps on changing based on additions and withdrawals from the pool. Here the companies which withdraw or default in between will be considered and not be taken as addition or outstanding. That is why it is known as dynamic pool.

Unlike the static pool the ratings are not constant throughout the period. It will be dynamic or flexible in nature

2. Static pool

A static pool of a year is a set or pool of companies having an outstanding rating at the beginning of the year. The membership of the pool remains static /constant over a period of time. For a company to be

included in an n year static pool, it has to be outstanding throughout those entire n years. Companies that withdraw or default in between will remain withdrawn of defaulted for the remaining years. A company that gets a rating subsequently, or recovers from default, is considered a new company in that static pool. A company that remains rated for more than one year is counted as many times as number of years over which it was rated. This assumes all ratings are kept current through an on going surveillance process.

Process of Static Pool

- The no of columns for static pools will depend upon the start year, end year and the minimum horizon.
- The software should count the number of rated accounts under each category, for a finalized assessment done between two particular dates.
- If there is any case, which has be clicked for "Default" the ratings of those accounts should not be included in the static pool. Similarly any withdrawn cases should also be excluded from the count.
- If there are more than 1 finalized assessment for a particular case the rating of that assessment which has
  the latest Assessment date should be considered for counting.
- After Static Pool we have to observe the behavior of the company i.e. the Transition of the company for the defined horizon.

Table 1. Rating migrations over a period of 4 years for capital broker model

Customer ID	Year 1	Year 2	Year 3	Year 4
CAPITAL 1	B 2	B 3	B 3	B 3
CAPITAL 2	B 5	D	D	D
CAPITAL 3	B 1	B 1	B 1	B 1
CAPITAL 4	B 2	B 2	B 2	B 2
CAPITAL 5	B 3	B 2	B 2	B 2
CAPITAL 6	B 2	B 2	B 2	B 2
CAPITAL 7	B 7	B 7	B 6	B 7
CAPITAL 8	B 1	B 1	B 2	B 2
CAPITAL 9	B 2	B 2	B 2	B 2
CAPITAL 10	B 3	B 3	B 2	B 2
CAPITAL 11	B 7	B 7	B 7	B 7
CAPITAL 12	B 2	B 2	B 3	B 3
CAPITAL 13	B 4	W	W	W
CAPITAL 14	B 3	B 3	B 3	B 3
CAPITAL 15	B 2	B 2	B 2	B 2
CAPITAL 16	B 2	B 2	B 2	B 2
CAPITAL 17	B 8	B 8	B 8	B 8
CAPITAL 18	B 4	B 4	B 3	B 3
CAPITAL 19	B 2	B 2	B 2	B 2
CAPITAL 20	B 5	B 5	B 5	B 5
CAPITAL 21	B 3	B 3	B 3	B 3
CAPITAL 22	B 4	B 4	B 4	B 4
CAPITAL 23	B 2	B 2	B 2	B 3
CAPITAL 24	B 3	B 3	B 3	B 2
CAPITAL 25	B 4	B 4	B 3	B 3
CAPITAL 26	B 1	B 1	B 1	B 1
CAPITAL 27	B 4	B 5	B 5	B 5
CAPITAL 28	B 6	B 6	W	W
CAPITAL 29	B 5	B 5	B 4	B 4
CAPITAL 30	B 6	B 6	B 6	B 6
CAPITAL 31	B 3	B 3	B 3	B 3
CAPITAL 32	B 7	B 7	B 7	B 7
CAPITAL 33	B 1	B 1	B 1	B 1
CAPITAL 34	B 5	B 5	B 5	B 5
CAPITAL 35	B 4	B 4	B 4	B 5
CAPITAL 36	B 3	B 3	B 4	B 4
CAPITAL 37	B 6	B 7	D	D
CAPITAL 38	B 5	B 5	B 5	W

CAPITAL 39	B 8	D	D	D
CAPITAL 40	B 6	B 6	B 6	B 6
CAPITAL 41	B 6	B 6	B 6	B 6
CAPITAL 42	B 8	B 8	B 8	D
CAPITAL 43	B 3	B 3	B 3	B 3
CAPITAL 44	B 4	B 4	B 4	B 4
CAPITAL 45	B 1	B 1	B 1	B 1
CAPITAL 46	B 5	B 5	B 6	B 6
CAPITAL 47	B 7	D	D	D
CAPITAL 48	B 1	B 3	B 3	B 3
CAPITAL 49	B 1	B 1	B 1	B 1
CAPITAL 50	B 1	B 1	B 1	B 1
CAPITAL 51	B 1	B 1	B 1	B 1
CAPITAL 52	B 1	B 1	B 1	B 1
CAPITAL 53	B 1	B 1	B 1	B 1
CAPITAL 54	B 4	B 4	B 4	B 4
CAPITAL 55	B 4	B 4	B 4	B 4
CAPITAL 56	B 4	B 4	B 4	B 5
CAPITAL 57	B 4	B 4	B 4	B 4
CAPITAL 58	B 4	B 4	B 4	B 4
CAPITAL 59	B 4	B 4	B 4	B 4
CAPITAL 60		B 7	B 7	B 7
CAPITAL 61		B 7	B 7	B 8
CAPITAL 62		B 8	D	D
CAPITAL 63		B 5	B 5	B 5
CAPITAL 64			B 3	B 4
CAPITAL 65			B 8	B 8

TABLE II VALUES

Values Year 1 and Year 2

Count of Year 1	Year 2										
Year 1	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	W	D	Grand Total
B 1	10		1								11
B 2		8	1								9
B 3		1	7								8
B 4				11	1				1		13
B 5					5					1	6
B 6						4	1				5
B 7							3			1	4
B 8								2		1	3
Grand Total	10	9	9	11	6	4	4	2	1	3	59

Values Year 2 and Year 3

Count of Year2	Year 3										
Year 2	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	W	D	Grand Total
B 1	9	1									10
B 2	1	8									9
B 3		1	7	1							9
B 4			2	9							11
B 5				1	5	1					7
B 6						3			1		4
B 7						1	4			1	6
B 8								2		1	3
Grand Total	10	10	9	11	5	5	4	2	1	2	59

Values Year 3 and Year 4

Count of Year3	Year 4										
Year 3	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	W	D	Grand Total
B 1	9										9
B 2		9	1								10
B 3		1	9	1							11
B 4				9	2						11
B 5					4				1		5
B 6						4	1				5
B 7							3	1			4
B 8								2		1	3
Grand Total	9	10	10	10	6	4	4	3	1	1	58

Count of Year3	Year4										
Year 3	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	W	D	Grand Total
B 1	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100
B 2	0.00	90.00	10.00		0.00	0.00	0.00	0.00	0.00	0.00	100
B 3	0.00	9.09	81.82	9.09	0.00	0.00	0.00	0.00	0.00	0.00	100
B 4	0.00	0.00	0.00	81.82	18.18	0.00	0.00	0.00	0.00	0.00	100
B 5	0.00	0.00	0.00	0.00	80.00	0.00	0.00	0.00	20.00	0.00	100
B 6	0.00	0.00	0.00	0.00	0.00	80.00	20.00	0.00	0.00	0.00	100
B 7	0.00	0.00	0.00	0.00	0.00	0.00	75.00	25.00	0.00	0.00	100
B 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.67	0.00	33.33	100
Grand Total	100.00	99.09	91.82	90.91	98.18	80.00	95.00	91.67	20.00	33.33	800.00

Count of Year1	Year2										
Year 1	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	W	D	Grand Total
B 1	90.91	0.00	9.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100
B 2	0.00	88.89	11.11		0.00	0.00	0.00	0.00	0.00	0.00	100
B 3	0.00	12.50	87.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100
B 4	0.00	0.00	0.00	84.62	7.69	0.00	0.00	0.00	7.69	0.00	100
B 5	0.00	0.00	0.00	0.00	83.33	0.00	0.00	0.00	0.00	16.67	100
B 6	0.00	0.00	0.00	0.00	0.00	80.00	20.00	0.00	0.00	0.00	100
B 7	0.00	0.00	0.00	0.00	0.00	0.00	75.00	0.00	0.00	25.00	100
B 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.67	0.00	33.33	100
Grand Total	90.91	101.39	107.70	84.62	91.03	80.00	95.00	66.67	7.69	75.00	800.00

Count of Year2	Year 3										
Year 2	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	W	D	Grand Total
B 1		10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100
B 2	11.11	88.89	0.00		0.00	0.00	0.00	0.00	0.00	0.00	100
B 3	0.00	11.11	77.78	11.11	0.00	0.00	0.00	0.00	0.00	0.00	100
B 4	0.00	0.00	18.18	81.82	0.00	0.00	0.00	0.00	0.00	0.00	100
B 5	0.00	0.00	0.00	14.29	71.43	14.29	0.00	0.00	0.00	0.00	100
B 6	0.00	0.00	0.00	0.00	0.00	75.00	0.00	0.00	25.00	0.00	100
B 7	0.00	0.00	0.00	0.00	0.00	16.67	66.67	0.00	0.00	16.67	100
B 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.67	0.00	33.33	100
Grand Total	101.11	110.00	95.96	107.22	71.43	105.95	66.67	66.67	25.00	50.00	800.00

Count of Year	Year										
Year	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	W	D	Grand Total
B 1	95.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
B 2	34.01	59.63	6.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
B 3	0.00	36.36	56.90	10.10	0.00	0.00	0.00	0.00	0.00	0.00	100.00
B 4	0.00	4.17	35.23	54.55	6.06	0.00	0.00	0.00	0.00	0.00	100.00
B 5	0.00	0.00	0.00	32.97	53.04	4.76	0.00	0.00	9.23	0.00	100.00
B 6	0.00	0.00	0.00	0.00	27.78	51.67	6.67	0.00	8.33	5.56	100.00
B 7	0.00	0.00	0.00	0.00	0.00	32.22	53.89	8.33	0.00	5.56	100.00
B 8	0.00	0.00	0.00	0.00	0.00	0.00	25.00	44.44	0.00	30.56	100.00
Grand Total	67.04	69.70	62.59	66.04	56.54	61.98	53.89	75.00	15.00	38.89	566.67

OBSERVATIONS

The main findings of the project are-

- IndusInd Bank uses a robust Risk rating framework for evaluating credit risk of the borrowers. The bank uses segment specific rating models equipped with transition matrix capabilities.
- The Bank manages credit risk comprehensively; both at transaction level and portfolio level.
- Risks on various counter parties such as corporate, banks are monitored through counter-party exposure limits, governed by country risk exposure limits also in the case of international trades.
- The bank manages risk at the portfolio level too, with portfolio level prudential exposure limits to mitigate concentration risk.
- The bank has a well-diversified portfolio across various industries and segments.
- Retail and schematic exposures (which provide wider diversification benefits) account for as much as 45% of the total fund based advances
- The bank's corporate exposure is fully diversified across 85 industries, thus insulated from individual cycles.

CONCLUSION

Banks and financial institutions are lending to individual borrowers on an ongoing basis. Credit risk management is a vital link between the borrowers and the institution. Identifying, measuring, monitoring and control lead to credit risk mitigation. Correlation and volatility of credit portfolio have a direct effect on one or the other. Transition matrix for probability of default helps top to bottom approach of the ratings calculations. It includes using credit risk, Basel II standards, foundation and advanced approaches and evaluation models. This model is a better model than value at risk (VAR) and it overlooks the limitations of VAR model (Delta method, historical simulation, Monte-Carlo method).

This paper raises the awareness of VAR versus transition matrix in a heteroscedastic world within the framework for Basel II, accounting issues, tax issues. In case the limitations of this transition matrix can be improvised and the value of the credit event can be maximized it is worthwhile proposition to adopt transition matrix.

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