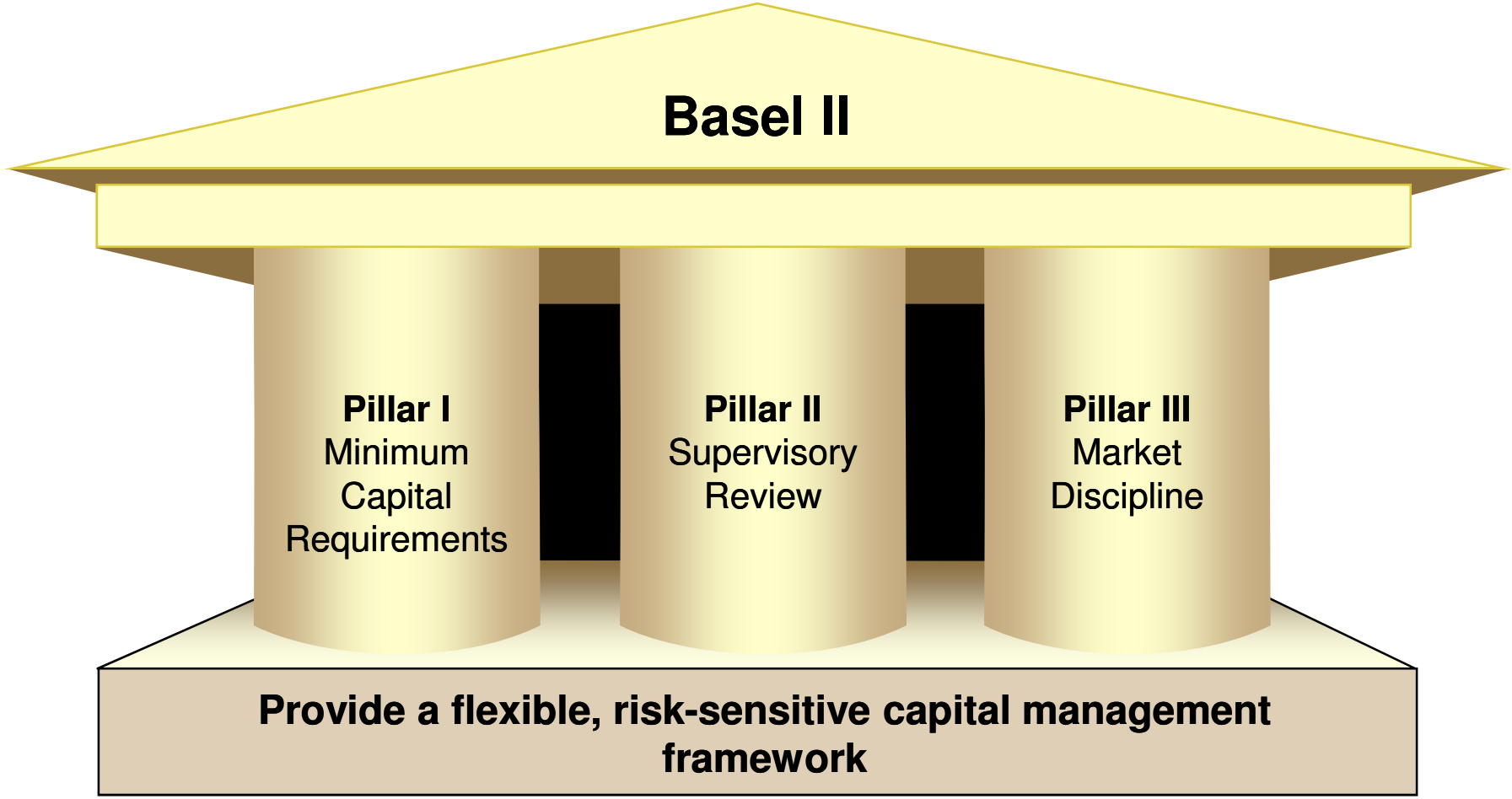
# Basel II: Pillar I

## An Analytics framework for Action

# Basel II : Marketelligent Expertise & Offerings

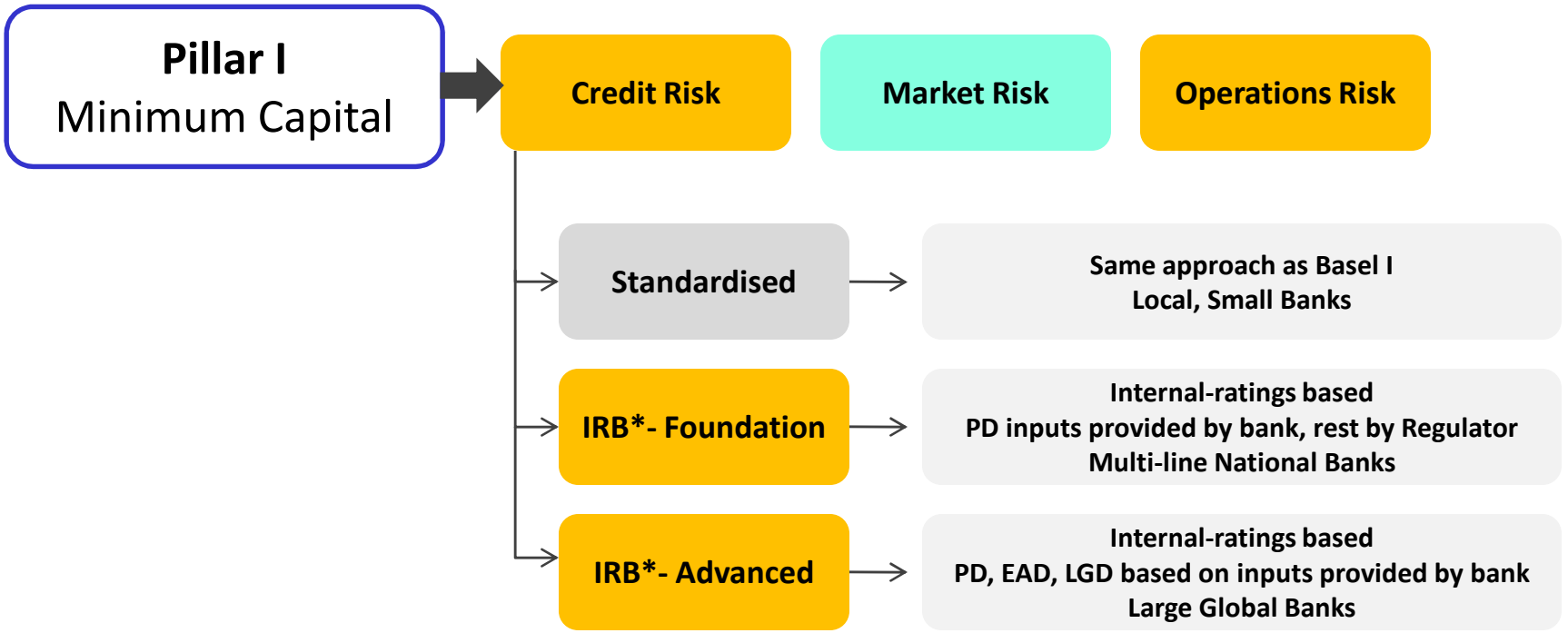
- **The Basel II Accord requires measurement of Credit Risk, Market Risk & Operations Risk for computation of minimum capital**
- **Building models, validating models and stress testing calls for sound statistical techniques and in-depth knowledge of key drivers of default in consumer finance portfolios**
- **Sound techniques can overcome the challenges in modeling and in-depth knowledge of banking can ensure that predictor variables used are intuitive and make business sense**
- **The framework for ongoing compliance with Basel II can be resource intensive, especially for banks that operate multiple geographies and offer a wide range of lending products**
- **Marketelligent can help you deliver compliance with Basel II Credit Risk and Operations Risk through our strong analyst teams and banking industry expertise**

# Basel II: The Three Pillars



# Marketelligent has expertise in Pillar I : measuring Credit Risk & Operations Risk for Minimum regulatory Capital computations

Our experience in Basel II




* IRB - Internal Ratings Based Approach

# Our analytics framework for Basel II : Credit Risk focuses on 3 key areas

**Model Development**

**Model Validation**

**Stress Testing**

# An internal ratings based system to measure credit risk can be enhanced through statistically significant predictive models

**Directives from Basel II**

There are three main dimensions with regard to model development for Basel II

- Probability of default (PD) by the borrower.
  - PD is usually defined as 90-plus days delinquent, or in foreclosure, bankruptcy, charge-off, repossession, or restructuring.
- Loss given default (LGD) associated with a particular loan
  - LGD is 1 - Recovery Rate. The recovery rate is the amount of dollars recovered after default divided by the dollars owed at the time of default, after considering agency costs or cost of collections or cost of debt sale
- Exposure at Default (EAD) reflecting the extent of credit line drawn down at default
  - EAD=Balance +(X*Credit Line) where X is the proportion of the committed amount likely to be drawn prior to default.
- Expected Loss is the product of EAD * PD * LGD

Basel II also requires estimates, which are cyclical, to be based on a time period covering a complete economic cycle, i.e., five years for consumer finance portfolios

# IRB approaches allow PD's to be estimated in one of three ways

| 1. Historical Default experience | 2. External Mapping | 3. Statistical Models |
|---|---|---|
| • Uses historical data on the frequency of observed defaults among obligors assigned to a particular internal risk segment | • relevant when there is limited internal data<br>• map each of a bank's internal risk segments to an external rating grade and use the external grade's estimated PD as the basis for internal segment's PD | • estimate a Default probability for each borrower based on its then-known attributes.<br>• the mean or median of the borrower-specific PD's within an internal risk segment is used as the segment-level PD |

# We have a rigorous process for developing statistically sound PD Models and managing the associated challenges

## PD Models - Process

Step 1: Define the dependent variable and outcome window, say, **90+ days delinquent over the next 12 months**

Step 2: Extract dataset of **accounts with non-default status** and track **default** performance for following **12 months**

Step 3: Identify variables that are predictive of future recovery, through correlations. Also determine strategies to handle missing data, multicollinearity and heteroscedascity

Step 4: Estimate your model by running a **logistic regression** with a stepwise option, to remove any variables that are not statistically significant.

Step 5: Examine the parameter estimates and evaluate any counter intuitive signs. Produce the predicted probabilities from the model and measure effectiveness through tests such as KS Statistics, Gini Coefficients and ROC Curves

## Challenges

Segmentation

- Identify homogenous groups to enhance risk splitting power
- Techniques such as CART Analysis, CHAID

Determining the right predictors

- Forward step-wise, Backward step-wise, Best fit procedures
- Transforming variables, binning
- Identifying Interactions to enhance power

Severe historical events

- Severe unexpected events impacting portfolio performance in historical data
- Incorporating macroeconomic variables in predictions

# EAD requires an estimate of credit lines at default, and regression techniques can be used to determine this

## EAD Models - Process

Step 1: Define your dependent variable and outcome window, EAD=Balance +(X*Credit Line) X is the proportion of the committed amount likely to be drawn prior to default. EAD model equivalent to predicting X

Step 2: Extract dataset of accounts with non-default status and track X at default for following 12 months

Step 3: Identify variables that are predictive of X, through correlations.

Step 4: Estimate your model by running regression techniques

Step 5: Examine the parameter estimates and evaluate any counter intuitive signs. Produce the predicted probabilities from the model and measure effectiveness

## Challenges

- Normal utilization rates for revolving credits probably differ from non-revolving credits.
- Credit restructuring may result the borrower being less likely to use the unused portion of a credit line.
- EAD may be also be driven by borrower - specific characteristics
  - The longer the time to maturity, the larger the probability that the credit quality will decrease and therefore the drawdown will increase
  - The more the borrower has access to alternative sources and forms of credit, the lower the expected EAD.
- Understanding the dependence between PD and EAD

# We are well equipped to address the challenges posed by LGD Models

## LGD Models - Process

Step 1: Define the dependent variable and the outcome window, say, **% of dollars recovers 2 years from date of default (net of costs), RR%**

Step 2: Extract dataset of **accounts which have defaulted** status and track **recoveries** performance for following **24 months**.

Step 3: Identify variables that are predictive of future recovery, through correlations. Also determine strategies to handle missing data, multicollinearity and heteroscedascity

Step 4: Estimate your model by running a l**inear regression or tobit regression** with a stepwise option, to remove any variables that are not statistically significant.

Step 5: Examine the parameter estimates and evaluate any counter intuitive signs. Produce the predicted probabilities from the model and measure effectiveness through tests such as MSE/MSA. LGD = 1-RR%

## Challenges

- Capturing non-cash recoveries
- Determining the discount rate used to discount recovery cash flows
- Allocating recovery costs
- Understanding the dependence between PD and LGD
- Advanced IRB requires estimating Downturn LGD (which can further be used for Stress Testing)

# Our analytics framework for Basel II : Credit Risk focuses on 3 key areas

**Model Development**

**Model Validation**

**Stress Testing**

# Basel II also requires that the models built be validated on an ongoing basis

**Directives from Basel II**

302. Banks must have a robust system in place to validate the accuracy and consistency of rating systems, processes, and the estimation of PDs. A bank must demonstrate to its supervisor that the internal validation process enables it to assess the performance of internal rating and risk quantification systems consistently and meaningfully.

305. The process cycle of model validation must also include:

- ongoing periodic monitoring of model performance, including evaluation and rigorous statistical testing of the dynamic stability of the model and its key coefficients;
- identifying and documenting individual fixed relationships in the model that are no longer appropriate;
- periodic testing of model outputs against outcomes on an annual basis, at a minimum; and
- a rigorous change control process, which stipulates the procedures that must be followed prior to making changes in the model in response to validation outcomes.

# Validations can be done in a variety of ways, ranging from the simple to the complex

| How to measure | What to measure |
|---|---|
| • Performing the validation only on your model development sample<br>• Performing the validation on a sample of accounts that were not used to develop the model, but were taken from the same period of time<br>• Performing the validation on a single holdout sample from time periods outside your model development window<br>• Performing a step-through simulation process across multiple time periods while recalibrating the model | • PD Models:<br>- KS Statistics measure separation between predicted good and default accounts;<br>- Gini Coefficients measure how well a scorecard is able to distinguish between good and default accounts.<br>- ROC or the Receiver operating characteristic curve plots (i) sensitivity-percentage of defaults correctly identified as defaults and (ii) 1-specificity<br>- percentage of goods incorrectly classified as defaults.<br>• LGD Models<br>- Mean Squared Error or Mean Squared Absolute Error measure the deviation between observed and predicted values on RR%. The closer the value to 0, the better the model |

# Our analytics framework for Basel II : Credit Risk focuses on 3 key areas

**Model Development**

**Model Validation**

**Stress Testing**

# Basel II requires that banks institute a risk management process that is able to assess and provide for volatility in market conditions

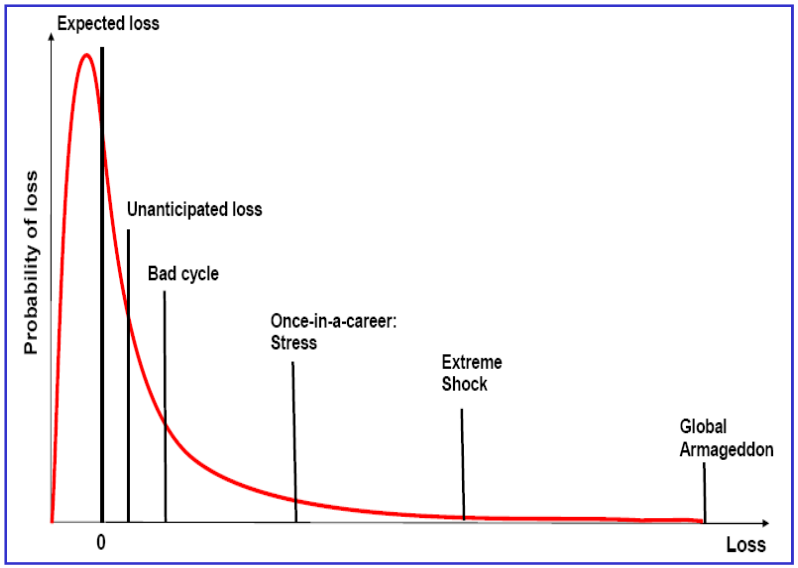
**Directives from Basel II**

297. A bank must have in place sound stress testing processes for use in the assessment of capital adequacy. Stress testing should involve identifying possible events or future changes in economic conditions that could have unfavorable effects on a bank's credit exposures and assessment of the bank's ability to withstand such changes.

# Stress testing assesses the vulnerability of a portfolio to major changes in the economic environment or to exceptional but plausible events

## Typical Qs Stress Testing Aims to Answer

- What would happen to our risk level if we went into a deep recession?
- Would the recession affect us immediately, or would there be a delay?
- How do differences in local economies affect our risk?
- What would happen to our risk level if interest rates went up significantly?
- What impact do new accounts have on our portfolio risk level?
- If we were to enter a major recession, could we mitigate its impact by focusing on specific geographies? Would it be better to loosen lending policies in some areas while tightening them in others?
- What would be the effect of a significant increase in property values in an area?




Source: RMA Journal

**Stress tests make risks more transparent by estimating the potential losses on a portfolio in abnormal market conditions**

# A flexible stress-test approach should have dials not only to adjust external recessionary factors but also internal factors, reflecting efforts to mitigate risk

## Stress Testing Models - Process

Step 1: Collect and aggregate historical data into segments or cross-sections. This includes internal loan data and external data such as economic or credit bureau information.

Step 2: Define the dependent variable in each regression - (a) average default rate (b) average outstanding balances.

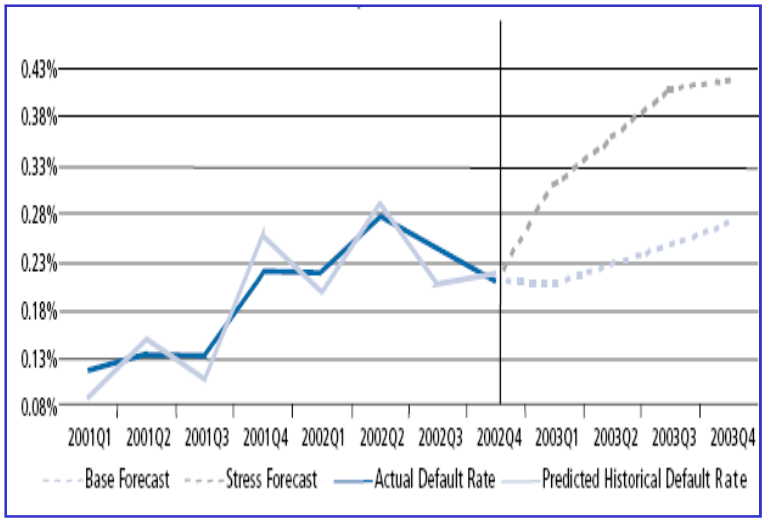
Step 3: Look at the correlations between each explanatory variable and the dependent variable. Pick the variables to include in the pooled crossed section regression.

Step 4: Next we look at the elasticities produced by the model, high elasticity implies that small changes to that variable will result in larger change to the dependent variable.

Step 5: First a base-case forecast is run, in which a business-as-usual trend of the explanatory variables is made and then applied to the regression equation.

Step 6: Next, a stress-test forecast is done, in which new values for the explanatory variables associated with the stress test are applied to the regression equation.

Illustration of Stress Test Recession – MSA 1




Source: RMA Journal

# Our analytics framework for Basel II : Operations Risk focuses on 2 key areas

**Model Development**

**Generating Aggregated Loss Distribution**

# Model development: We have a rigorous process for developing sound Frameworks and managing the associated challenges

## Model development Process

- Operational Value at Risk (VaR) is the aggregated annual operational loss that will not be exceeded with a specific level of confidence ( 99.9% as per Basel II requirement)
- Internal models for estimating capital requirements are designed to calculate operational loss distributions, based on frequency and severity data separately.
- As operation loss data is typically of shorter duration, may not adequately capture low probability and high impact events.
- Scenario analysis is employed to assess loss under these circumstances.

Scenario Analysis

- Using expert judgment method a number of plausible adverse events along with possible (1) frequency (2) severity impact are decided upon.
- In addition to the functional scenarios, technical scenarios on correlation assumptions: 1, 0.5, & 0 (for scenarios), assumption on the nature of loss distribution are considered.

## Challenges

- No data or very scarce data.
- High severity events treatment (tail fitting)
- Use external data for the estimation of operation risk parameters
- Tests for the goodness of parameters
- Dealing with correlation
- External data bias: classification, censoring, truncation
- Defining plausible but severe scenarios

# Generating Aggregated Loss Distribution

- From the historic data, fit a distribution on frequency and severity of losses separately.
- Poisson distribution most closely reflects the characteristics of frequency of losses in a given interval of time and hence is typically chosen for frequency distribution.
- Simulate loss from frequency & severity distribution.
- Simulate loss from scenario analysis.
- Add them up to generate aggregate loss in a given simulation run.
- Repeat these steps 100,000 times to simulate and generate loss distribution.
- Choose relevant confidence interval point for generating operational risk VaR.

# Marketelligent is well placed to meet your Basel II needs

## We look forward to exploring synergies with you

# Thank You

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