Strategic Knowledge Transfer

# Corporate Group Rating Methodology

## Nov. 5, 2017

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# Mission

**We assist financial institutions and regulatory authorities with the development and refinement of compliance architecture, models, tools and processes to manage risk**

# We are organized in two practice areas

## Consulting Practice

### Financial Institutions

We assist risk and finance functions with regulatory compliance. Our projects are delivered by professional quants, formally trained as consultants

### Regulatory Authorities

We provide coverage across the key prudential topics, such as financial stability, regulator-mandated stress testing and depositor insurance

### Training

Consulting professionals and risk practitioners use a variety of tools to diagnose compliance gaps and identify potential solutions. Our training programs are designed to equip participants with 'best practice' consulting and risk modelling toolkits

## Content Practice

### Regulation Self Assessment

Our Self Assessment toolkits allow you to objectively determine gaps due to regulatory changes. We map proven management consulting approaches with regulatory requirements

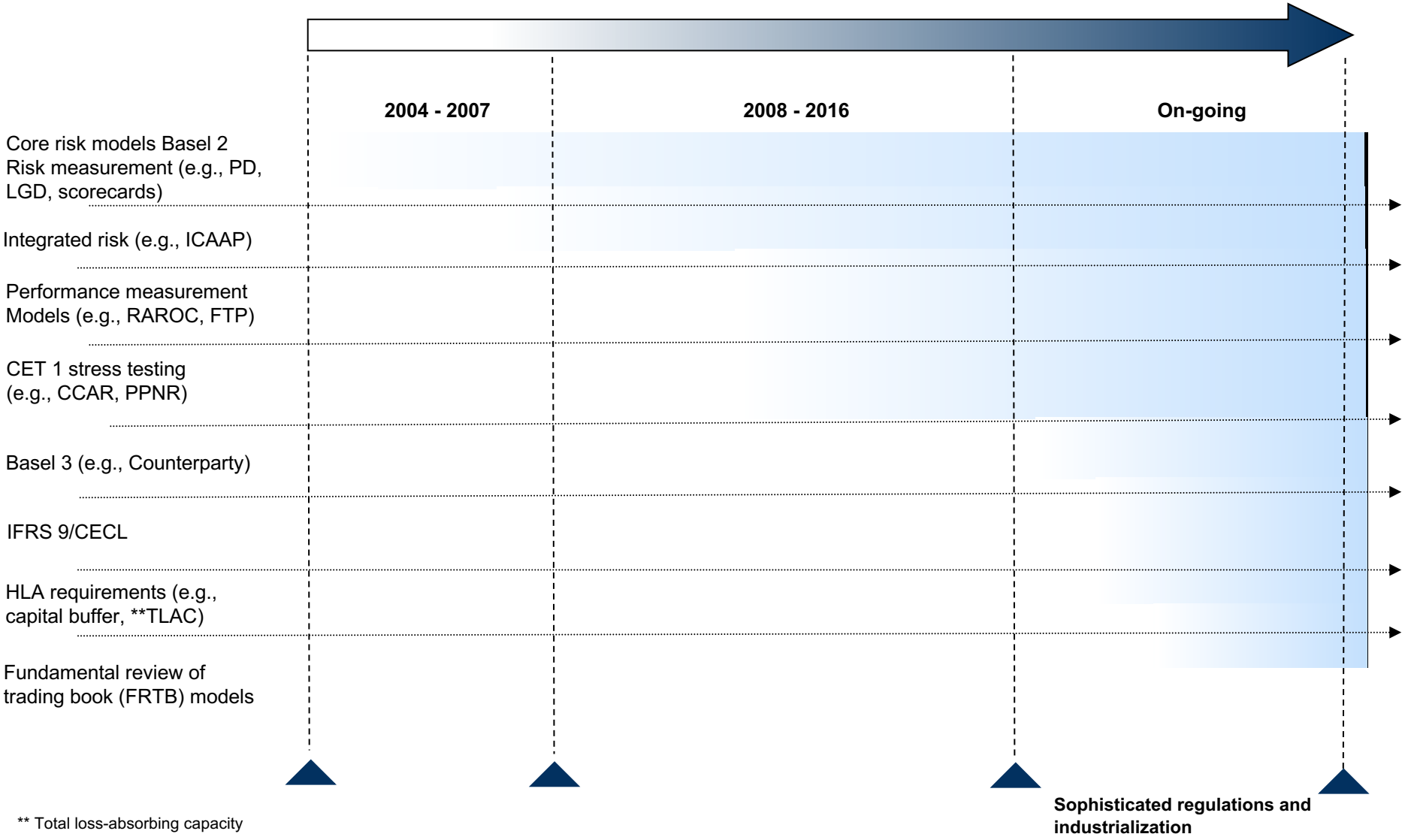
### Best Practice Benchmarking

Best Practice Benchmarking diagnostic tools would allow you to understand how the 'leading practice' financial institutions are influencing the changes across the industry, and how such changes are impacting your organization

### Strategic Knowledge Transfer

Strategic Knowledge Transfer provides you deep insights into the "practitioners' knowledge base", that would enable you to conceive complex projects internally from design to implementation

# Emerging regulatory pipeline as the driver of our business




** Total loss-absorbing capacity

# Delivery approach

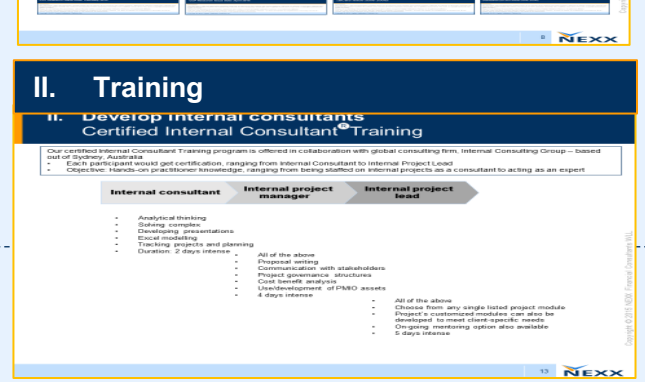
NEXX
Expertise. Independence

## I. Content

II. Content leveraging
Our content is scaled and customized to meet your needs

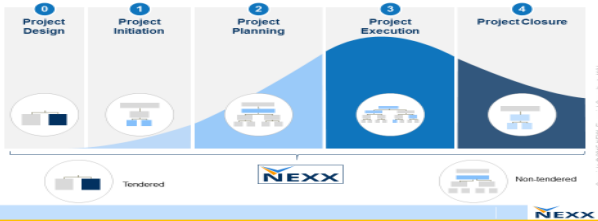

## II. Training

II. Develop internal consultants
Certified Internal Consultant Training



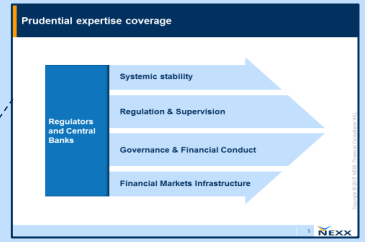

## III. Consulting

Use our specialists: Access our tendered or non-tendered projects stream




## Client

### 1st line of defence




### 2nd line of defence






NEXX

# Web based content distribution enables robust knowledge transfer

## Helps kick-start development mandate in client organizations

### Step 1

**Understand requirements**

- Download Nexx Consultants' proprietary content from the website
- Share it with key process owners, managers and stakeholders
- Understand the requirements and prepare for the Self-Assessment

### Step 2

**Undertake Self-Assessment**

- Rate Self-Assessment to benchmark your current state
- Nexx Consultants would collate the results, validate the Self-Assessment, understand your needs and develop a target state

### Step 3

**Nexx Consultants Gap Analysis**

**Other optional services include:**

- Development of implementation plan, including a delineation of external and internal resources
- Development of a vision document, roadmap or requirements document and Request for Proposals (RFP's)

**Nexx Consultants site downloads**

**Separate quote**

# We are uniquely well-qualified to help clients

- Our consultants use a wide range of **quantitative and qualitative approaches** to ensure a balance of rigor and practicality while developing the FS content
- The Nexx Consultants team has experience in **formative research, communication plans and strategies, developing and disseminating materials, and utilizing traditional and non-traditional social marketing and communication strategies**, including social media
- Our research and consulting teams undertake **mandated and proprietary research**, focusing on regulatory publications (Basel, FSB), industry, academic journals and practitioners interviews
- **Case Studies:** Nexx Consultants combines interviews, content analysis, engagement results and 'pit-falls' to design content that addresses complex needs of today's consulting, regulatory and FS client organizations. This approach is particularly well suited to clients looking for the "lessons learned" to avoid pitfalls since it pulls together multiple perspectives into one "story"
- Our production team **creates and publishes** the content on our website
- In a nut shell, our proprietary web platform enables you to **realize significant savings**

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# A menu of options are available when implementing Basel II Pillar 1

| | | | |
|---|---|---|---|
| **Credit Risk** | **Standardised**<br>▪ Risk-weights set based on external risk ratings (with 100% risk-weight for unrated)<br>▪ Intended as catch-all for smaller banks | **IRB Foundation**<br>*(Available for non-retail only)*<br>▪ Risk weights differentiated by internal credit risk ratings/scoring (PD)<br>▪ Treatment of collateral and guarantees set by supervisors | **IRB Advanced**<br>▪ Risk weights differentiated by internal credit risk ratings/scoring (PD)<br>▪ Internal parameters used to estimate LGD and EAD |
| **Trading Risk** | **Standardised**<br>▪ Basel II provides parameters for capital to be held<br>▪ Considered too simplistic for any significant trading portfolio | **Internal Model Based**<br>▪ Internal value at risk (VAR) model used to quantify exposure<br>▪ Capital charge set as 3 to 4 times 10-day holding VAR<br>▪ Models need to be consistent with Basel II standards | |
| **Operational Risk** | **Basic**<br>▪ Basel II provides parameters<br>▪ No specific requirements to be met | **Standardised**<br>▪ Basel II provides parameters<br>▪ Basic operational risk management required (designated op risk function, loss data collection, reporting) | **AMA**<br>▪ Internal parameters and models to measure operational risk<br>▪ Comprehensive requirements for op risk management (target setting, validation, documentation) |

**Bank's Sophistication**

Focus of this presentation

# The Risk Measurement Requirements of the Advanced IRB Approach Are Substantially Beyond the Current Capabilities of Most emerging market Banks

Corporates
Sovereigns
Public sector entities
SMEs
Banks
Specialized lending / Project finance
Commercial real estate
Residential mortgages
Small businesses
Revolving retail
Non-revolving retail (e.g. instalment finance)
Equities
Purchased receivables
Securitized investments

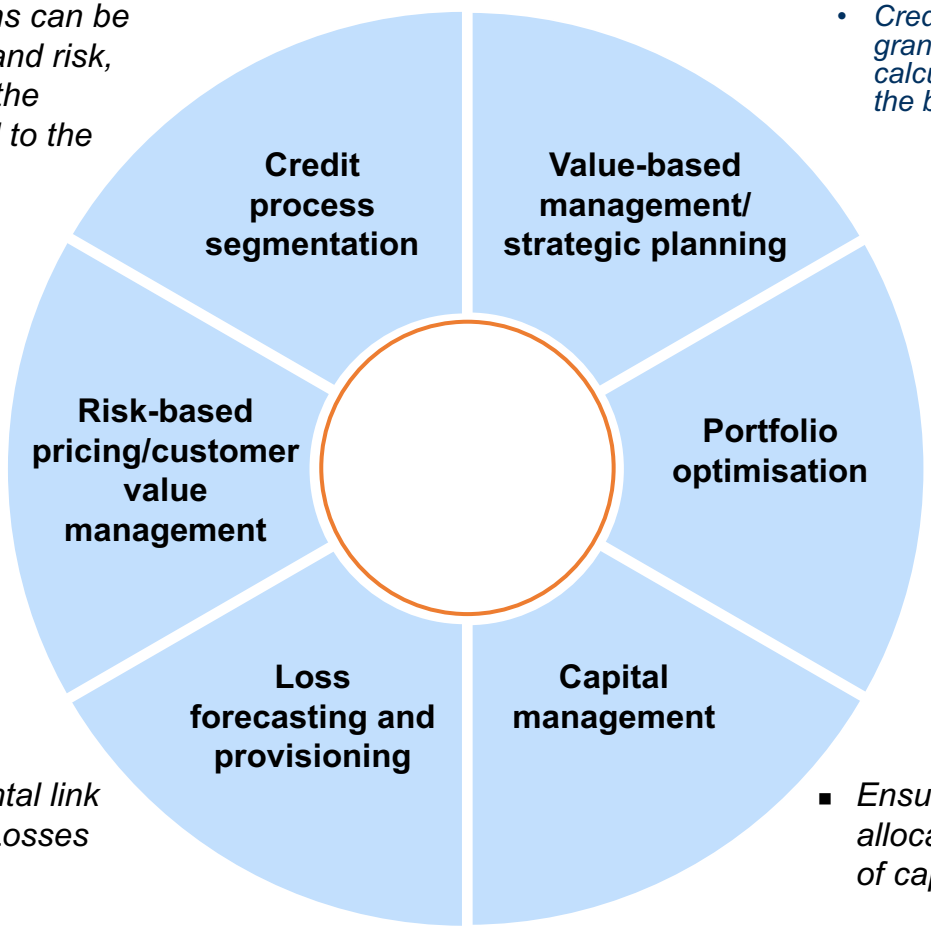
**Separate PD, LGD, EAD tools required for each customer segment**

**Rigorously tested, calibrated, validated, maintained and used**

# The suite of credit risk models offers the ability to address a number of core management objectives

- *Incoming applications can be segmented by size and risk, in order to optimise the resources dedicated to the credit process*

- *Credit risk is a key input into granular economic profitability calculations used to manage the business*




- *Actively differentiate customers by value*

- *Detailed understanding of economic profitability will enable MB to more effectively manage the portfolio*

- *There is a fundamental link between Expected Losses and provisions*

- *Ensure the optimal sourcing, allocation and management of capital*

# There Are Several Key Issues to Keep in Mind

- **Underestimation of the effort and change required**
- **Data and IT bottlenecks**
  - The data requirements for Basel 2 are very large and many banks will have to work hard to find historical data and start capturing new data
  - The very nature of the IT implementation requires Banks to adopt a more evolutionary approach, as compared to standard back-office IT work
  - Banks should adopt a Prototype -> Pilot -> Roll-out approach to ensure that the bank has sufficient time to understand their own requirements, rather than trying to theoretically design the whole system 2 years before it is actually used
- **Organisational resistance**
  - Basel 2 will ask many banks to change a lot of fundamental processes throughout the banks, which will (as all change) encounter a lot of resistance
  - The best way to overcome this resistance is to demonstrate the business benefits for every piece of expenditure: models do not equal benefits

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# It Needs to Be Decided Where the Cutoff Between Retail and Corporate Will Be Set With Respect to Rating Systems Basel 2

- Decisions that will need to be made with respect to segmentation:
  - Which exposures will be classified as retail for Basel 2 purposes?
    - Basel 2 allows retail treatment if exposure to client group is below EURO 1 MM
    - Qualifying exposures need to be treated like retail, I.e. non-intensive client management
  - How will small businesses be rated?
    - Special rating tool considering financial data
    - Adaptation of behavioral retail scoring models
  - Where will the cut-off between retail and corporate rating models be set?

**Ideally, the different segmentation cut-offs should be aligned - this means that all exposures that are classified as retail for Basel 2 purposes will be rated with retail models (and should ideally be handled by the retail division) whereas Basel 2 corporate exposures should be rated with corporate rating models**

# A Bankwide Masterscale Facilitates the Internal Communication, Aggregation and Comparison of Risks

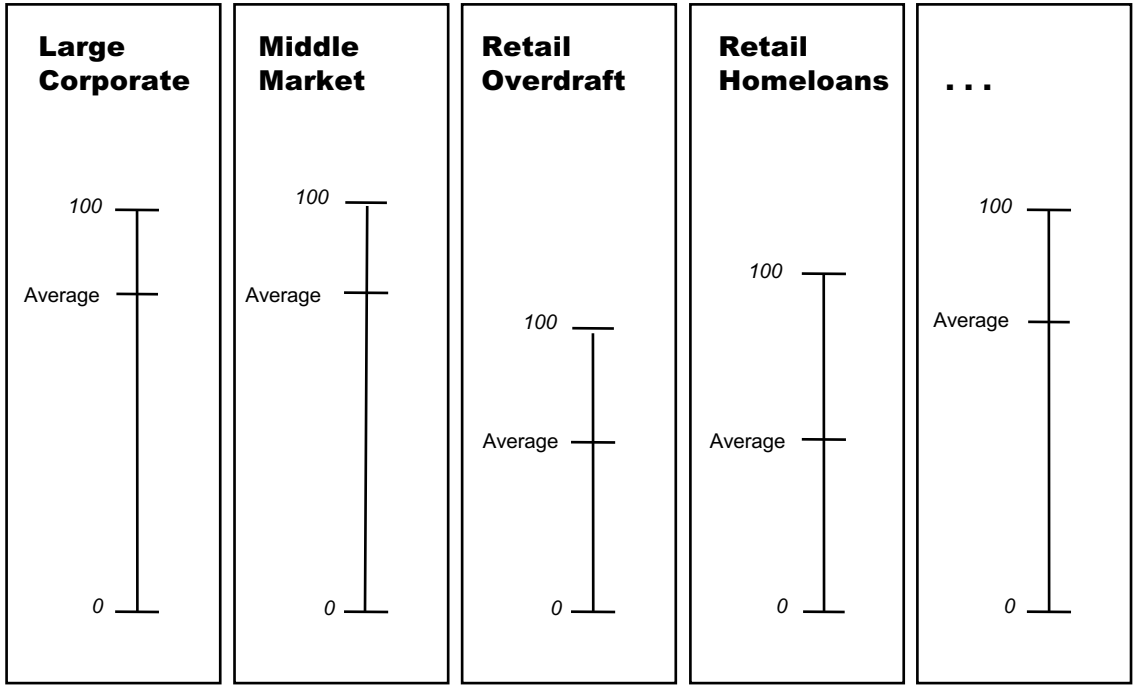
- While not explicitly required by Basel 2, implementing a bank-wide masterscale has a number of benefits
  - Represents a single, simple and clear framework for risk assessment and aggregation
  - Facilitates communication of creditworthiness within the bank and to external parties (e.g. for secondary market transactions)
  - Allows for an easy, consistent way of mapping internal grades to external ratings
- The masterscale should fulfil a number of requirements
  - Sufficient level of detail for all relevant segments. Merging rating classes for controlling purposes is always possible, breaking up insufficiently granular ones, however, is difficult
  - Meaningful population of all classes
  - Intuitive and unambiguous names for classes
  - Unambiguous assignment of PD's to classes
  - Coverage of the entire spectrum of customers within the bank (Blue Chip to Junk Bond)
- The same working group of experts can in parallel also decide on a group-wide and consistent definition of a default event (e.g. always consider 90 days in arrears as default, specific provisioning as back-up criterion)

# The Different Business Segments of the Bank Can Populate Different Spectrums of the Masterscale

– Illustration –

## Conversion of Scores (1-100) Into the Classes (1-14) of the Masterscale

| Masterscale | |
|---|---|
| **Rating Class** | **PD** |
| 1 | 0.015% |
| 2 | 0.03% |
| 3 | 0.06% |
| 4 | 0.11% |
| 5 | 0.20% |
| 6 | 0.35% |
| 7 | 0.60% |
| 8 | 1.05% |
| 9 | 1.85% |
| 10 | 3.25% |
| 11 | 5.70% |
| 12 | 10.00% |
| 13 | 17.50% |
| 14 | 30.00% |



# Default Definition/Masterscale – Worksteps

| Worksteps | Details |
|---|---|
| **Default Definition** | ▪ Review of existing default definitions<br>▪ Assessment of available counterparty information and consolidation into one definition with defined backup options |
| **Review of Existing Scales** | ▪ Review of scales used currently within the bank<br>▪ Requirements for MS resulting from existing scales, e.g. maintaining level or PD granularity for each portfolio |
| **Masterscale Development** | ▪ Development of a bankwide grading scale, meeting the following requirements<br>○ Sufficient level of detail for all relevant segments.<br>○ Meaningful population of all classes<br>○ Intuitive and unambiguous names for classes<br>○ Unambiguous assignment of PD's to classes<br>○ Coverage of the entire spectrum of customers within the bank<br>○ Minimum 7 +1 grades (Basel II)<br>▪ Mapping to external scales<br>▪ Description of risk characteristics of each grade |
| **Communication/Buy-in** | ▪ Workshop with relevant parties (Branch Managers, RMs, Credit Analysts etc.)<br>▪ "Selling" the advantages of a single, simple, clear framework for risk measurement and reporting |

# Guarantees and Parent Support Need to be Considered in a More Stringent Way – a Group-Wide Coordination of this Effort is Highly Recommended

## Current Practice

### Guarantees

- Legally enforceable 3rd party guarantees are currently considered in the loan process
- Both borrower and guarantor are assigned a rating at loan origination in Corporate Banking
- Other divisions do not consider guarantees to adjust rating

### Group Support

- Some name-lending in corporate banking, but no standardised criteria
- Business banking always uses consolidated group rating for all companies
- No strict rating ceiling/notching applied based on parent rating

## Basel 2

### Guarantees

- Clearly specified criteria must exist within the bank for the types of guarantors allowed, and the guarantee must be evidenced in writing and non-cancelable
- Borrower and guarantor must be assigned a credit rating at the outset
- Advanced banks may adjust LGD or PD estimates.

### Group Support

- The influence of the group on the subsidiary's credit quality has to be taken into account when rating the subsidiary
- Both parent and subsidiary must be separately rated on a standalone basis
- Risk mitigation reflected in LGD and/or PD
- Risk mitigating effect of “soft” support has to demonstrated

## Best Practice

### Guarantees

- Differentiation of recovery rates from 3rd party guarantees by guarantor type and rating
- ‘Soft’ guarantees from related companies are considered in a group support framework

### Group Support

- Group/parent support based on standardised process taking into account:
  - Ability to support
  - Willingness to support
  - Type of support
- Generally seen as an integral part of the rating process
- Adjusted rating based on either ‘notching’ of parent rating or blending of parent and subsidiary PDs

# In Order to Appropriately Consider Transfer Risk for Foreign Currency Lending, the bank should Develop a Group-Wide Framework

- Concept of transfer risk:
  - Besides counterparty risk, foreign currency lending contains the additional component of transfer risk
  - This arises as it would be possible for a foreign country to block all foreign currency payments that would leave the country (so-called transfer risk event)
  - In such a case, even when the counterparty that the bank is lending to does not default itself, it will not be able to service its foreign currency liabilities
- Currently, transfer risk is only being considered in a qualitative manner: when granting a foreign currency credit, the internal country rating is considered but does not have a direct impact on the rating
- In the future, transfer risk will need to have a direct impact on the counterparty's rating
  - Add transfer risk to standalone counterparty risk, potentially taking into account correlation between the two risk types

**Group Credit Risk will join together with the Economics Department and the Business Units that are doing foreign currency lending in order to develop such a framework (several units within Corporate Banking, Capital Markets)**

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# Wholesale rating models - typical status at most EM banks

## Current Practice

- Currently only very basic Rating Tools for large corporates, no statistical development, no structural approach for capturing qualitative information)

## Basel 2

- Segmentation of non-retail exposures into Corporate, Banks, Sovereigns, Specialised Lending (5 sub-segments)
- The rating models need to be calibrated to produce a 1-year probability of default (PD)
- The rating assignment should be based on empirical evidence where possible
- External ratings can be used for the assignment of internal ratings. Mappings must be based on a comparison of internal rating criteria to the criteria used by the external institution

## Best Practice

- Large Corporates: development of rating model based on default data where available, otherwise shadow-bond or expert rating model
- Middle Market (Business Banking, Asset Finance): development of rating model based on default data
- Commercial Real Estate (Property Finance): development of rating model based on default data or expert input
- Project Finance (Capital Markets): simulation-based rating model
- Focus rating efforts on borrowers without reliable external ratings and material levels of risk

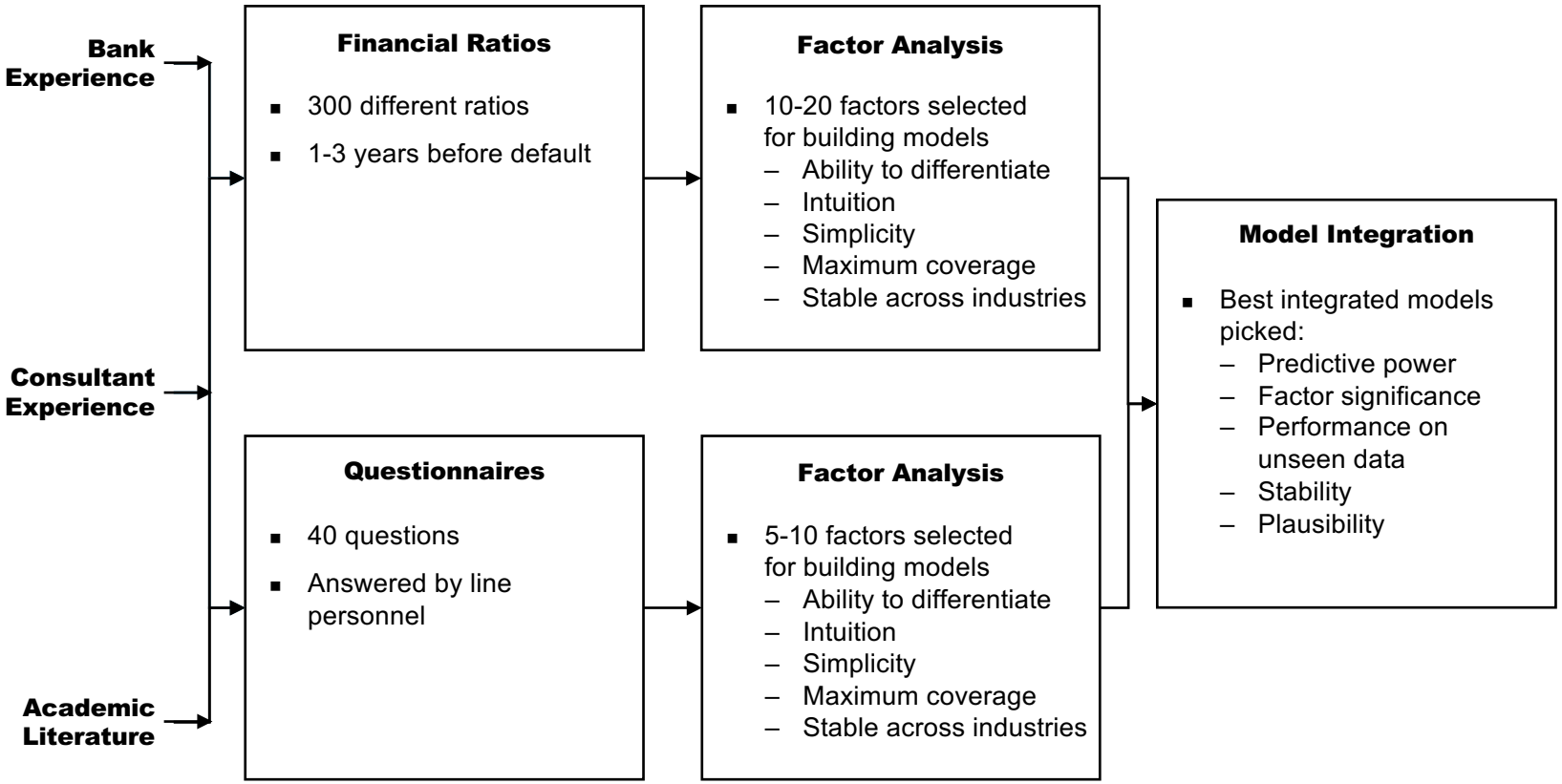
- **Develop new rating models for Large Corporates, Middle Market, Commercial Real Estate, and Project Finance**
- **Leading International banks have developed similar tools for Basel 2 compliance**

# Rating Tools for Can Either Be Scorecard-based or Simulation-based

| | Scorecard Rating Model | Simulation-based Rating Model |
|---|---|---|
| **Modelling** | ▪ Regression analysis based on good/bad data<br>▪ Resulting scorecard with quantitative and qualitative factors, warning signals and overrides produces PD | ▪ Model of Cash-flows with link to macro(economic) variables<br>▪ Simulation of Cash-flows using different scenarios produces PD, EAD and LGD |
| **Prerequisites** | ▪ Large sample of defaults and performing clients<br>▪ Sufficient quantitative and qualitative data per default/client<br>▪ Simple economic default modelling | ▪ Thorough understanding of default causes<br>▪ Identification of restricted set of cash-flow drivers |
| **Usage** | ▪ Middle Market<br>▪ Large Corporate<br>▪ Property Finance | ▪ Project Finance |

# Building Scorecard-Based Rating Tools to Forecast PD Is Part-science, Part-art

## Illustration: Developing a Middle Market Rating Scorecard



# The Financial Module of a Middle Market Scorecard Could Look as Follows . . .

*- Illustrative -*

## Example: Financial Scorecard

**A. Gearing**

**Total Assets/ Liabilities**

| Range | Score |
|---|---|
| >=6.00 | 33 |
| 2.40 to 5.99 | 28 |
| 1.10 to 2.39 | 22 |
| 0.60 to 1.09 | 17 |
| 0.30 to 0.59 | 11 |
| 0.10 to 0.29 | 5 |
| <0.10 | 0 |

Score A ☐

**B. Liquidity**

**Current Assets/ Current Liabilities**

| Range | Score |
|---|---|
| >=12.00 | 25 |
| 3.00 to 11.99 | 21 |
| 1.70 to 2.99 | 18 |
| 1.00 to 1.69 | 14 |
| 0.50 to 0.99 | 11 |
| 0.20 to 0.49 | 7 |
| 0.05 to 0.19 | 4 |
| <0.05 | 0 |

Score B ☐

**C. Size**

**Turnover ($M PA)**

| Range | Score |
|---|---|
| >=7'000 | 22 |
| 3'500 to 6'999 | 19 |
| 1'800 to 3'499 | 16 |
| 1'000 to 1'799 | 13 |
| 600 to 999 | 9 |
| 250 to 599 | 6 |
| 0 to 249 | 3 |
| <0 | 0 |

Score C ☐

**D. Profit**

**Profit/ Turnover**

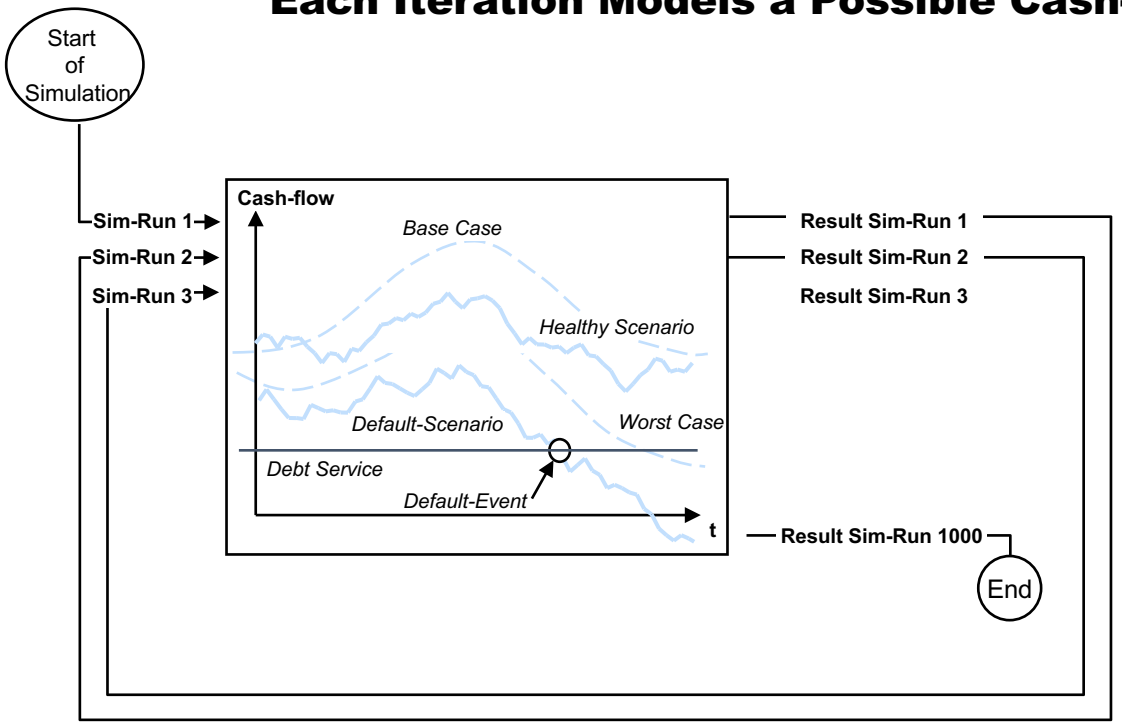
| Range | Score |
|---|---|
| >=0.25 | 20 |
| 0.10 to 0.24 | 18 |
| 0.06 to 0.09 | 15 |
| -0.03 to 0.05 | 12 |
| 0.00 to 0.02 | 10 |
| -0.03 to 0.01 | 7 |
| -0.2 to 0.04 | 10 |
| -0.45 to 0.21 | 2 |
| <-0.45 | 0 |

Score D ☐

**Total Score (Max 100) = A +B + C +D =** ☐

# The Project Finance Rating Model Can Be Based on a Cash-Flow Simulation Technique

## Simulation-Technique: Each Iteration Models a Possible Cash-flow Scenario




| Sim-Run | De-Fault | Year | Loss in the Event of Default |
|---|---|---|---|
| 1 | No | – | 0 |
| 2 | Yes | 4 | EUR 17.500.000 |
| 3 | No | – | 0 |
| 1000 | Yes | 2 | EUR 29.140.000 |

PD

LGD

**The Results From These Scenario-runs Are Collected and Finally Constitute Probability of Default and Loss Given Default**

# The Cash-Flow Simulation to Any Project Finance Rating Needs to Include Several Types of Drivers . . .

**Macroeconomic Factors**

| General | Project Specific |
|---|---|
| ▪ GDP<br>▪ Foreign exchange rates<br>▪ Money supply<br>▪ Price level<br>▪ Interest rates<br>▪ Equity level<br>▪ Unemployment<br>▪ . . . | ▪ Commodity prices<br>▪ Output prices<br>▪ Aggregate demand<br>▪ . . . |

**Qualitative Factors**

- Management quality
- Location
- Previous experience

**Exogenous Events**

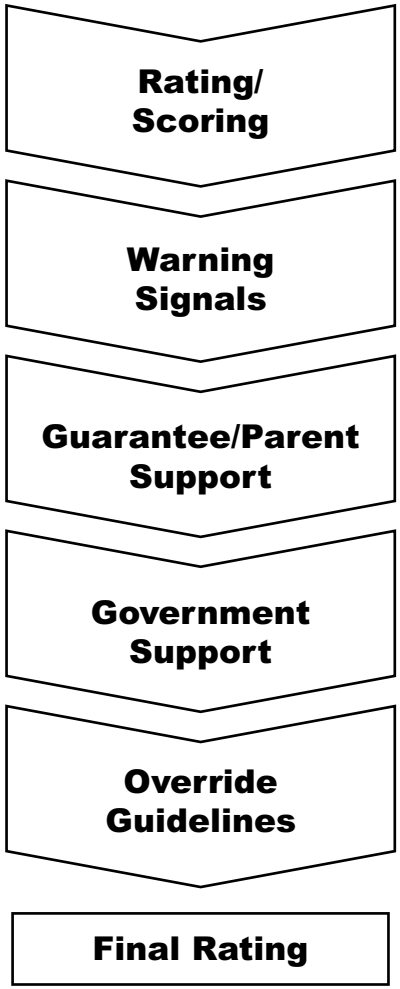
- Regulation
- Expropriation
- Weather/geology
- Major technology shifts

**Technology**

| Project Specific | Generic |
|---|---|
| ▪ Cost of production<br>▪ Reliability<br>▪ Quality of output | ▪ Aggregate cost of production |

**. . . Many Can Be Included in a Quantitative Model, Some Are Better Handled Judgementally**

# A Number of Elements Should Be Included in the Rating Process




## Rating Process Components

- Based on scorecard or rating model

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- Checklist with warning signals, based on expert experience. Automatic downgrade or placement on watchlist (triggering a periodic review of the borrower)
  - e.g. abrupt drop in market share, recent change in management

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- Structured approach towards assessing impact of guarantees and group/holding structures
  - e.g. legally enforceable guarantee, weak subsidiaries

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- Implicit or explicit government guarantees (particularly for banks/insurance companies)

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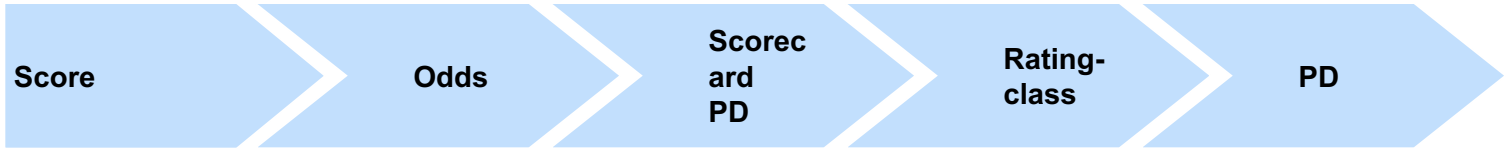
- Guidelines on rating adjustments based on other factors
  - e.g. difference from external rating

# Scorecards typically calibrated to outcome "odds", rather than probability of default per se




- Calculate the odds from the score[1]
- Calculate the scorecard PD from the odds
- Map the PD to a rating-class
- Assign the rating-class PD

$$\text{Good/Bad Odds} = \frac{Goods}{Bads} = \exp(\text{Score}) \qquad PD = \frac{Bads}{Goods + Bads} = \frac{1}{1 + \text{Good/BadOdds}}$$

**Score range design attributes**

- Anchor point (e.g.: 60 pts = 64:1 odds)
- Double odds every 10 points

**Scorecard**

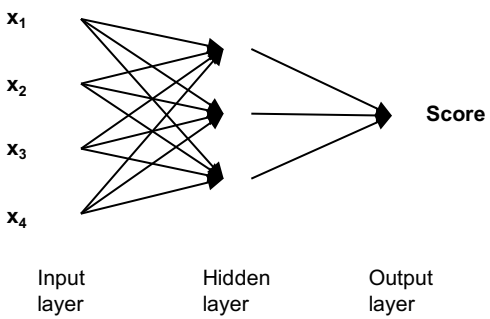
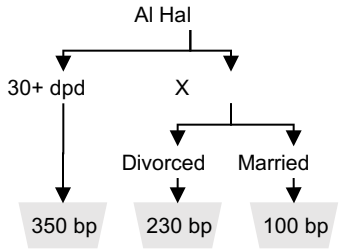
| Score | Good/Bad Odds | PD (bp) |
|---|---|---|
| 100 | 1024:1 | 10 |
| 90 | 512:1 | 19 |
| 80 | 256:1 | 39 |
| 70 | 128:1 | 78 |
| 60 | 64:1 | 154 |
| 50 | 32:1 | 303 |
| 40 | 16:1 | 588 |
| 30 | 8:1 | 1111 |

**Master scale**

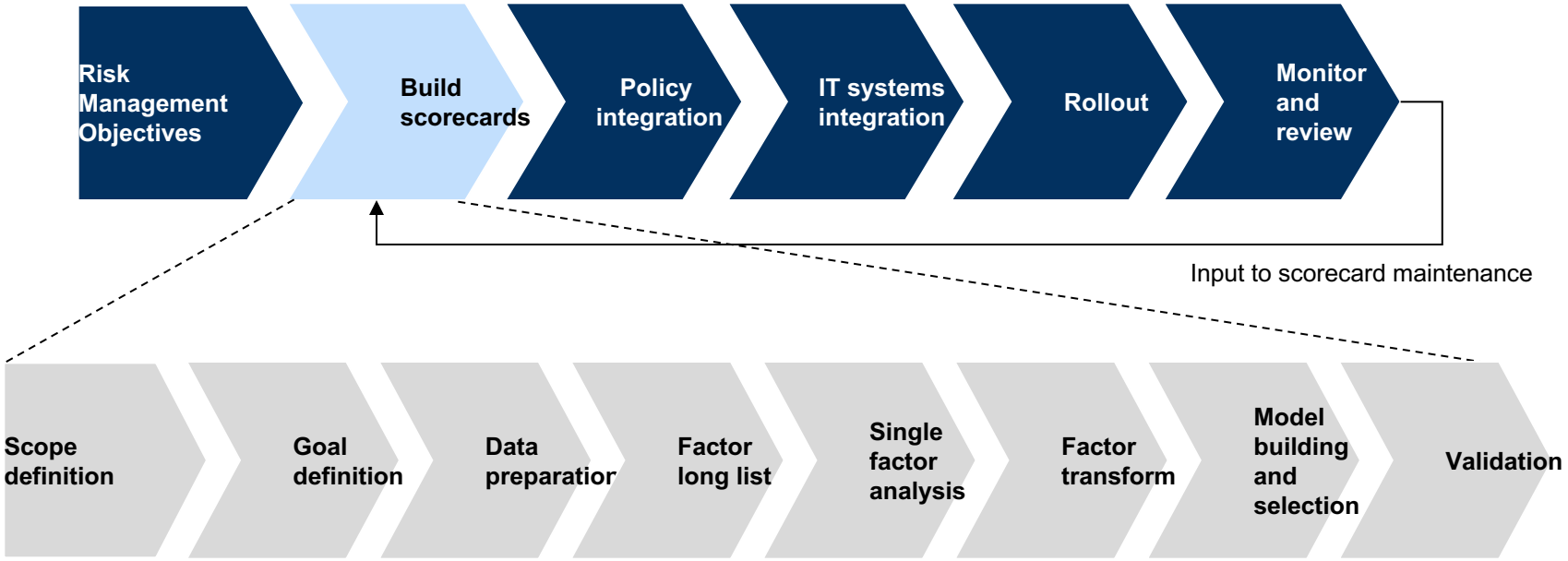
| Rating-class | PD (bp) | PD band (bp) | |
|---|---|---|---|
| | | Lower bound | Upper bound |
| ⋮ | | | |
| MRS09 | 16.0 | 13.5 | 19.0 |
| MRS10 | 22.6 | 19.0 | 26.9 |
| MRS11 | 32.0 | 26.9 | 38.1 |
| MRS12 | 45.3 | 38.1 | 53.8 |
| MRS13 | 64.0 | 53.8 | 76.1 |
| MRS14 | 90.5 | 76.1 | 107.6 |
| MRS15 | 128.0 | 107.6 | 152.2 |

1. To calculate the odds, the score must be normalised to a "calibrated score"

# Logistic regression is the industry standard scoring method

| | Regression models | Neural networks | Trees/segmentation approaches |
|---|---|---|---|
| **Desc.** | ▪ Set of predictive variables independently<br>$Score = \sum_i \beta_i x_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots$<br>▪ *Logistic* regression relates factor inputs to the **log** of the good/bad odds of a given outcome (e.g. default)<br>$Ln(\frac{1}{\text{good/bad odds}}) = \sum_i \beta_i x_i \Rightarrow \text{good/bad odds} = \frac{1}{e^{\sum \beta_i x_i}}$ | ▪ Nonlinear system of "neurons" converts set of driver variables<br>  | ▪ Decision tree leads to a risk bucket<br>  |
| **Pros** | ▪ Relationship of drivers to results transparent to developer<br>▪ Efficacy demonstrated in marketplace | ▪ More generalised relationship between inputs and result; allows for complex interactions between factors | ▪ Simple to calculate<br>▪ Permits interactions between factors |
| **Cons** | ▪ Assumes linear and independent contribution of factors | ▪ Complex "black box" solutions<br>– Non-intuitive<br>– Greater risk of overfitting<br>– Difficult to sanity-check | ▪ Statistical significance limited by bucket sample size<br>▪ Factors may have divergent impact in different branches of tree<br>▪ Difficult to sanity check<br>▪ Requires categorical splits |

# Today we focus specifically on the scorecard build process




**Continuous statistical analysis and expert review to validate consistency in each step**

# Single factor analysis

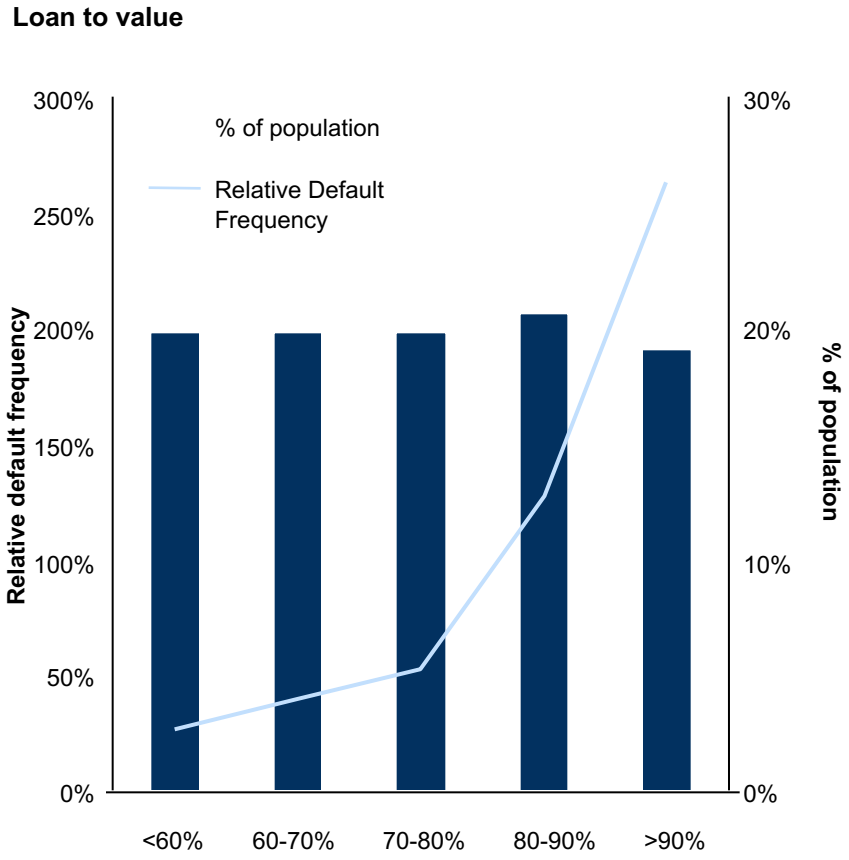
- The primary consideration when deciding which factors should be taken forward to multi-factor analysis is the predictive performance of those factors
- However, predictive performance is not the only criteria which we apply, we also take into account a number of other considerations
  - **Intuitiveness of the relation to default of the factor** – generally we want intuitive factors
  - **Availability** of the factor – in general the more regularly available a factor the better
  - **Cost of data collection** – we are generally looking for factors which are easy and cheap to collect
  - **Ease of calculation** – in general we are interested in relatively easy to calculate factors
  - **The extent to which it adds information** – in general we are interested in factors which add information not contained in other factors
- A prognosis analysis should be done on each factor so as to ensure that buckets ordering  make sense
  - A proposed definition is “The higher the bucket “score”, the better the anticipated odds”

# Single factor analysis – RDF charts

## During SFA we test the performance of factors and model the relation to default

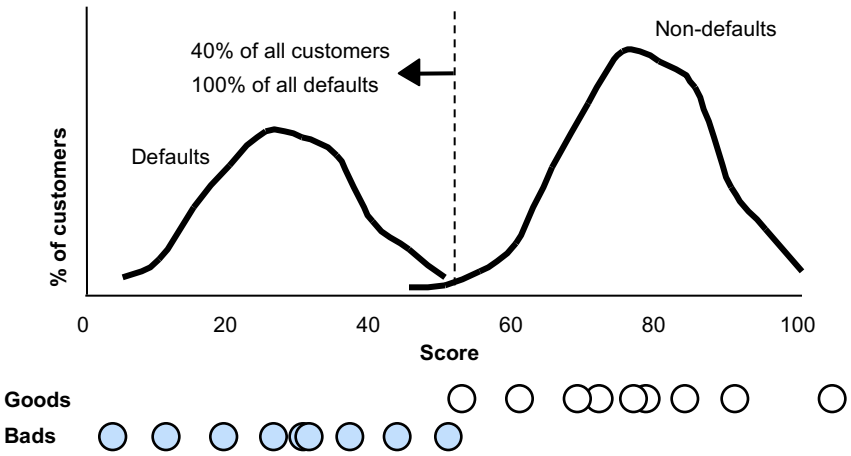
- Define factor list together with hypothesis of relation to default
- Review factor performance on number of dimensions with a view to reducing the list
  - Intuitiveness using relative default frequency
  - Availability of data
    - Historically
    - Going forward
  - Ease of calculation
  - Rank-ordering performance
  - Correlation with other factors
- Relation to default
  - Categorical vs. continuous
  - "Bucket" vs. Smoothed function
  - Capture non-monotonic relationships
  - Treat "missing" values and outliers

## Example of relative default frequency

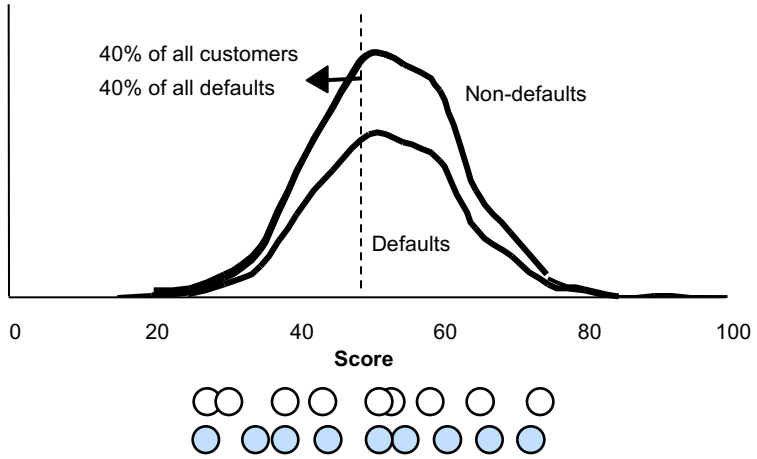


# Factors are evaluated based upon their ability to distinguish good from bad accounts

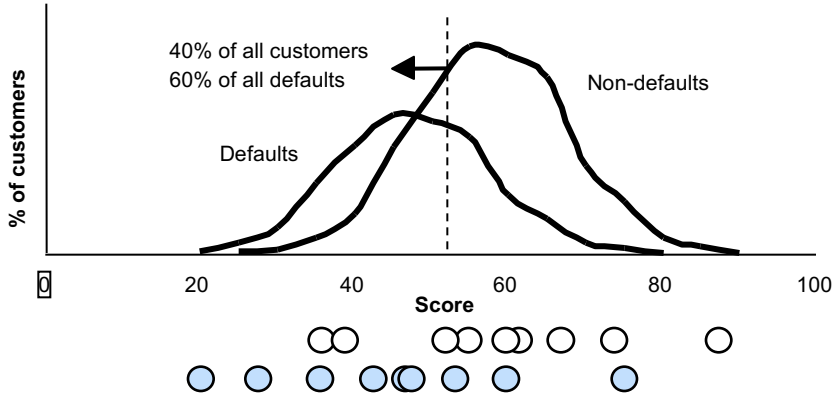
## Full discrimination (ideal system)



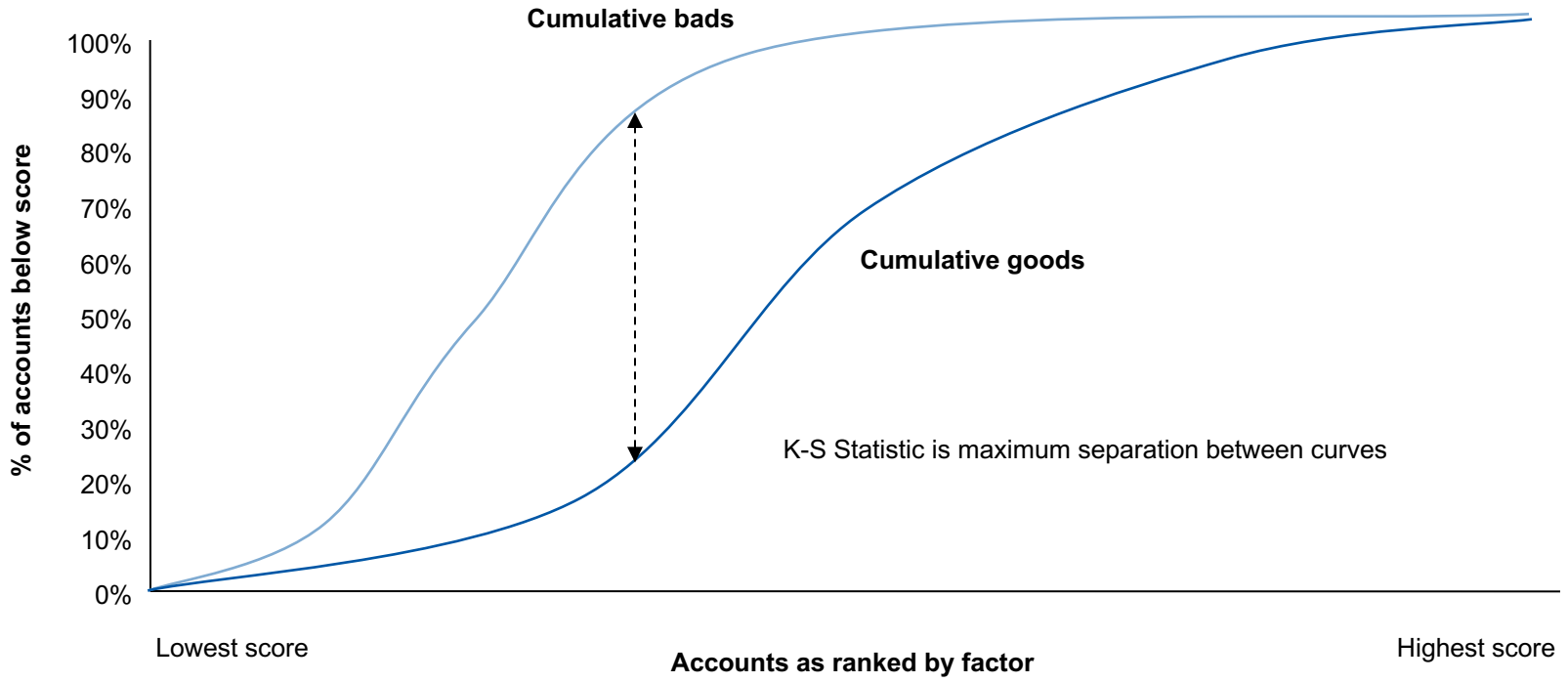

## No discrimination

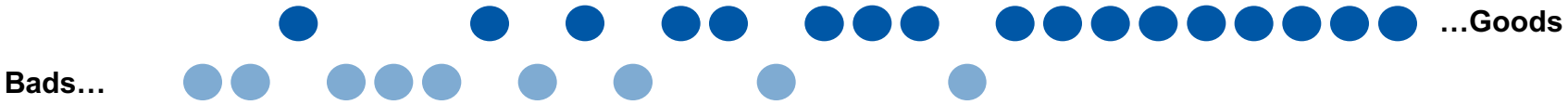



## Some discrimination (real system)

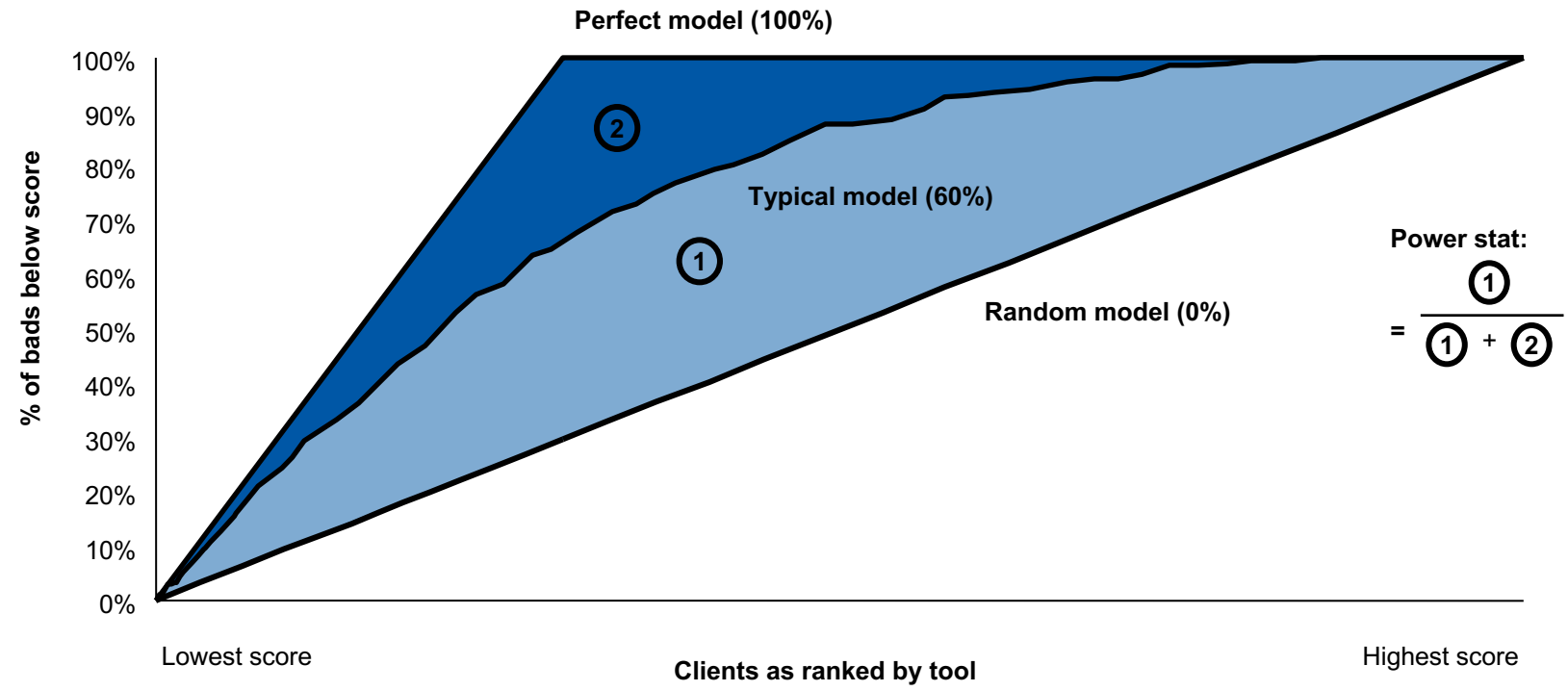


# K-S Statistic is commonly used to characterise the discriminatory power of a risk factor



# A more refined measure is the Power Statistic




# Single factor analysis – predictive performance

## The Power statistic provides a measure of the ability of a factor or model to separate defaults from non-defaults

### Key considerations for power statistics

- Better factors have values closer to 100%
- Power statistics cannot “handle” non-monotonic relations to default
- Less recent data is generally less powerful and behavioural information is generally more powerful than application information
- Powerful factors may be disguised by interactions
- In addition to the statistic, it is useful to consider the shape of the power curve to fully understand the factor’s impact

### Other useful statistics

- $\chi^2$ (chi-squared) – significance test
- Information value – degree of differentiation
- Spearman correlation – rank order correlation

# Factor transformation – missing value imputation

## There are two different approaches to deal with Missing Value Information

### Complete case analysis

- The Complete Case Analysis use only the information that have complete records in the analysis
- If the “missingness” is related to other inputs (e.g. lender only asks for the data when salary is less than X) , then ignoring missing values can bias the results
- In practice, a smattering of missing values in a high dimensional data set can cause a disastrous reduction in data

### Imputation

- The Imputation consists of filling the missing values with some reasonable value
- The simplest types of imputation methods fill in the missing values with the mean (mode for categorical variables)
  - This method can be refined by using the mean with homogeneous groups of data

# Factor transformation conditions factors to be used as scorecard inputs

- Most factors cannot be used directly within the model, rather they must be “transformed” – conditioned for inclusion in the model
- Categorical variables should be examined to see if grouping is necessary
- Continuous variables can be treated in one of two ways
  - Binned into intervals that are deemed to be relevant and proportional to credit quality
  - Mapped using “s-curve” transformation to a bounded range
- Certain factors may not be suitable for regression because the information they provide overwhelms that of all other factors considered – these must be handled outside of the scorecard
  - E.g. severe delinquency – 60+ DPD

# Assembling the scorecard from the transformed short listed factors involves systematic exploration to find the optimum combination

- Correlation analysis: Factors highly correlated and/or logically related with each other are grouped together
- Forward and backward regression is used to get a feel for which factor combinations result in the most predictive models
- Many models are computed based on the results of above analyses
  - Factors are grouped according to correlation analysis
  - Models are computed containing a preset number of factors (typically 0-2) from each group, starting with those selected in the regression steps
- The most predictive models generated in that way are compared and refined by
  - Again testing models resulting from exchanging factors
  - Manually adjusting weights of some factors

**This procedure typically results in a short list of reasonable models out of which the "best" model is to be selected**

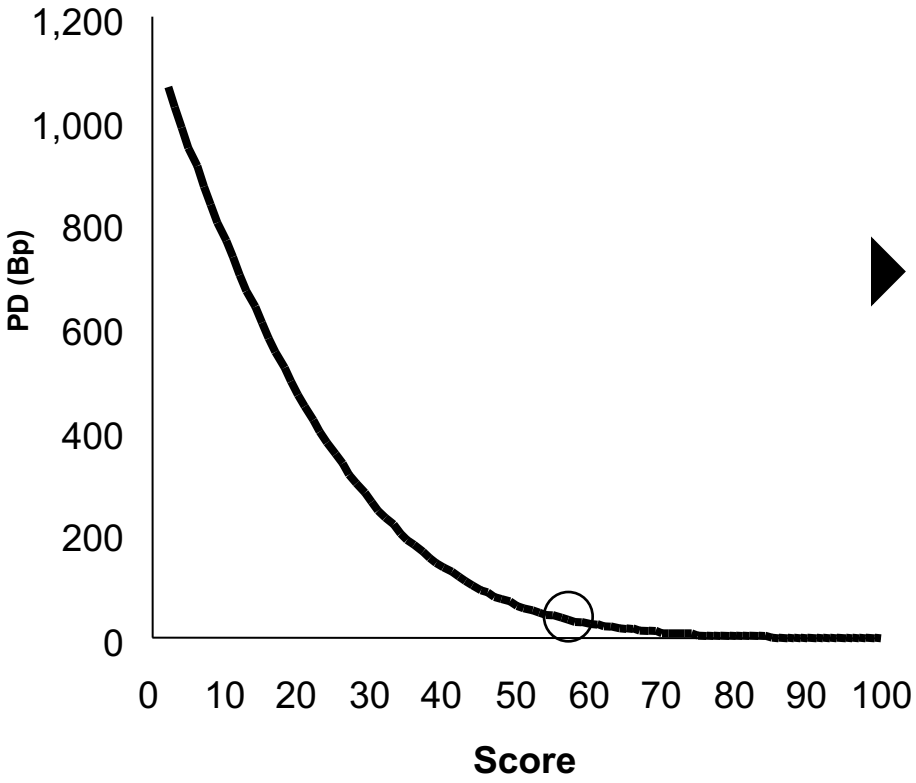
# From the candidate models, we select according to statistical and intuitive criteria

- Predictive power (high Powerstat)
- Intuitive combination of factors
- Small number of factors
- As many “areas of information” as possible should be covered
- No single factor should have too much or too little weight
- No factor should have negative weight

# Scorecard results, which have been developed based on “odds” must be then mapped to a calibrated PD

**Final rating**

**58**



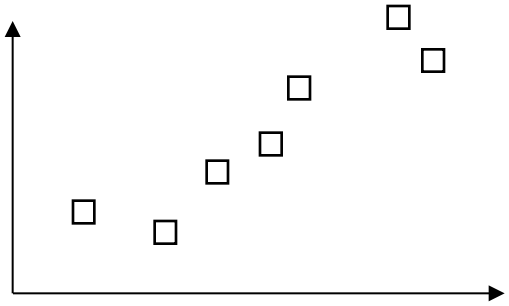

**Standalone PD**

**50 bp**
**MRS 12**

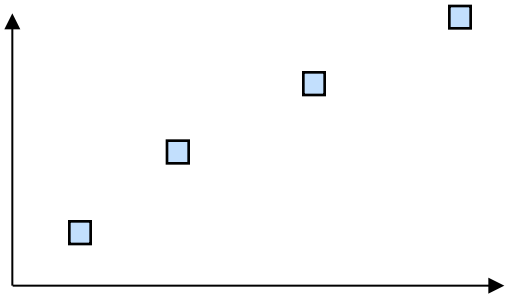
# Out-of-sample testing investigates whether a model has been "overfit" to available data

**Analogy: Two dimensional curve-fitting**

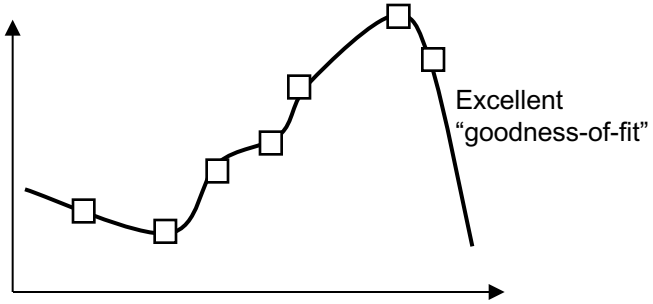
## Development sample



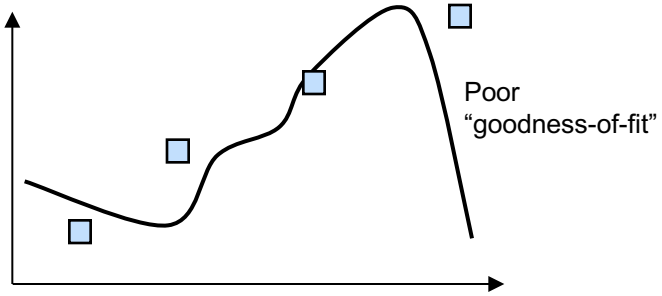
## Holdout sample



## "Best fit" model




## Holdout sample




- In scorecards, the effects of overfitting will be less apparent than in this simplified example
- Out-of-sample (and out-of-time) testing is necessary to rule out over-fitting in real scorecards
- Ultimately, confidence in the scorecard is confirmed through use – ongoing monitoring is essential

# Rating Tool Development – Worksteps

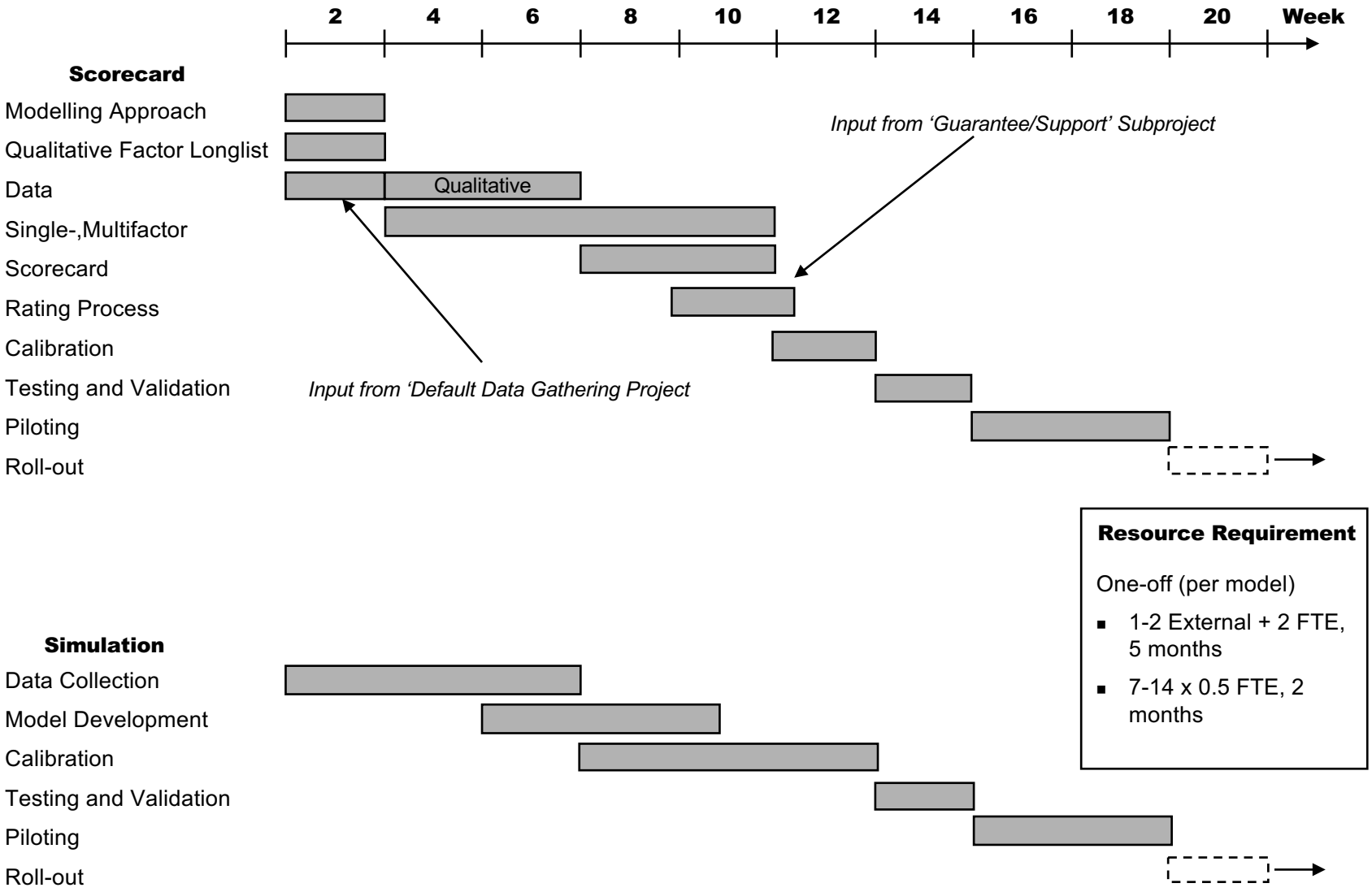
## Worksteps: Scorecard Development

| Worksteps | Details |
|---|---|
| Modelling Approach | ■ Select appropriate modelling approach based on data availability (good/bad model, expert model, hybrid) |
| Factor Longlist | ■ Define factor long-list based on analyst input and rating experience<br>■ Potentially build questionnaire for collection of non-financial factor data |
| Data collection and cleaning | ■ Define universe of rated companies that can be used for the analysis<br>■ Source financial data from external or internal data source<br>■ Potentially collect non-financial information from analysts |
| Single &Multi-factor Analysis | ■ Perform statistical analysis to select most predictive factors and determine relative factor weights |
| Scorecard Development | ■ Combine financial and non-financial factors |
| Rating Process | ■ Include, and if necessary adjust, standardised rating process elements |
| Calibration | ■ Calibrate combined rating score to PD based on external ratings and internal default history |
| Testing and Validation | ■ Build rating prototype (e.g. Excel-based) and select test sample<br>■ Outlier analysis<br>■ Compare scorecards-based rankings with analyst intuition and external ratings<br>■ Perform necessary adjustments |
| Piloting | ■ Life application of rating model with credit managers<br>■ Perform necessary adjustments |
| Roll-out | ■ Document the development/validation process as well as user guidelines<br>■ Roll-out the rating template to the relevant departments |

## Worksteps: Simulation Model Development

| Worksteps | Details |
|---|---|
| Data Collection | ■ Define data points to be collected and test sample<br>■ Gather data on test cases<br>■ Gather (macro)economic data for simulation |
| Model Development | ■ Construct project cash-flows with connection to (macro)economic variables |
| Calibration | ■ Perform simulation for test sample<br>■ Adjust PD to reflect historiacl default experience |
| Testing and Validation | Compare scorecards-based rankings with analyst intuition and external ratings<br>■ Outlier analysis<br>■ Perform necessary adjustments and test again |
| Piloting | ■ Life application of rating model with credit managers<br>■ Perform necessary adjustments |
| Roll-out | ■ Document the development/validation process as well as user guidelines<br>■ Roll-out the rating template to the relevant analysts |

# Rating Tool Development – Illustrative Timeline

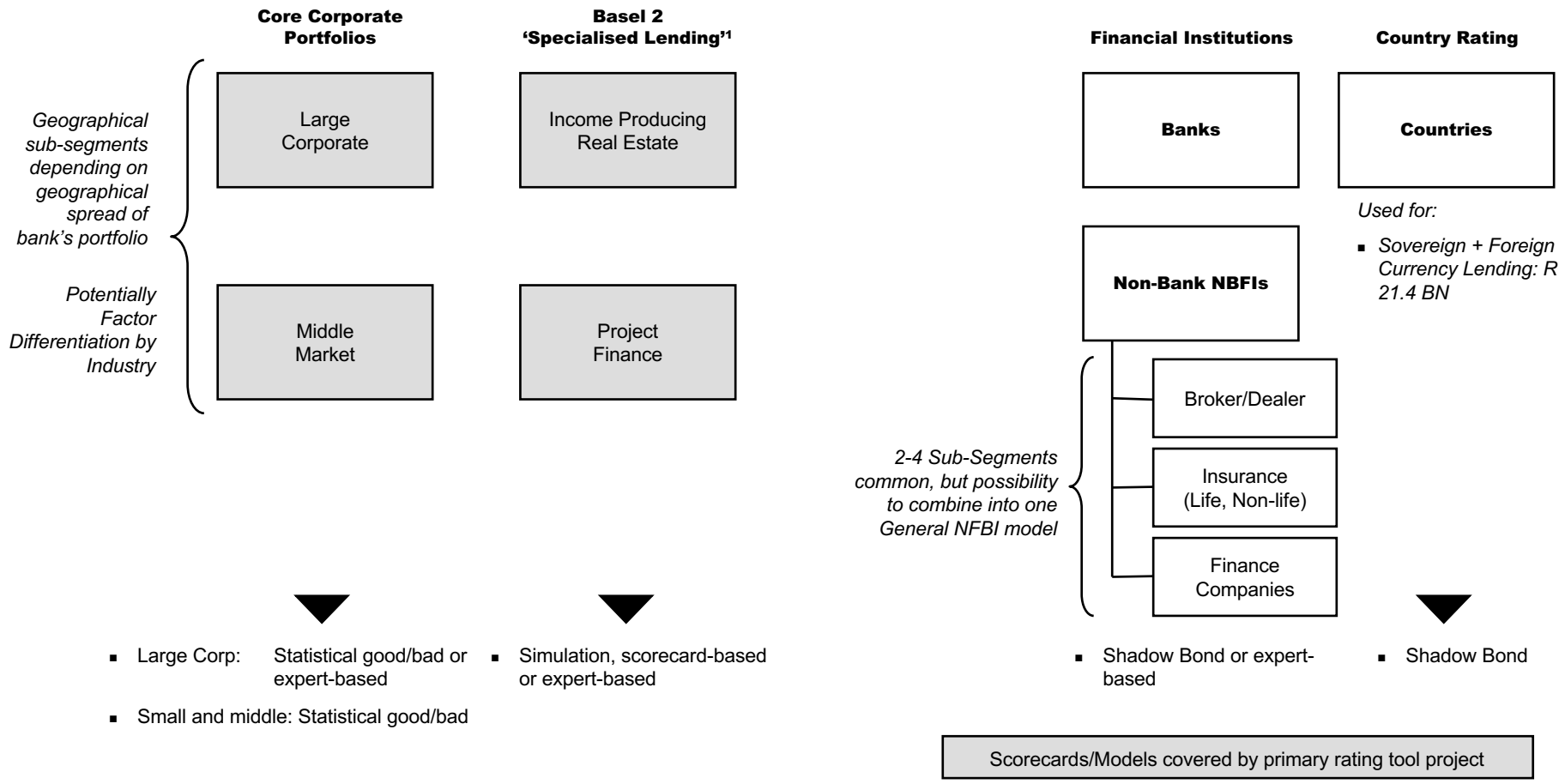



**Resource Requirement**

One-off (per model)

- 1-2 External + 2 FTE, 5 months
- 7-14 x 0.5 FTE, 2 months

# A Typical Best Practice Segmentation Includes Separate Rating Tools/Scorecards for Banks, NBFIs and Countries

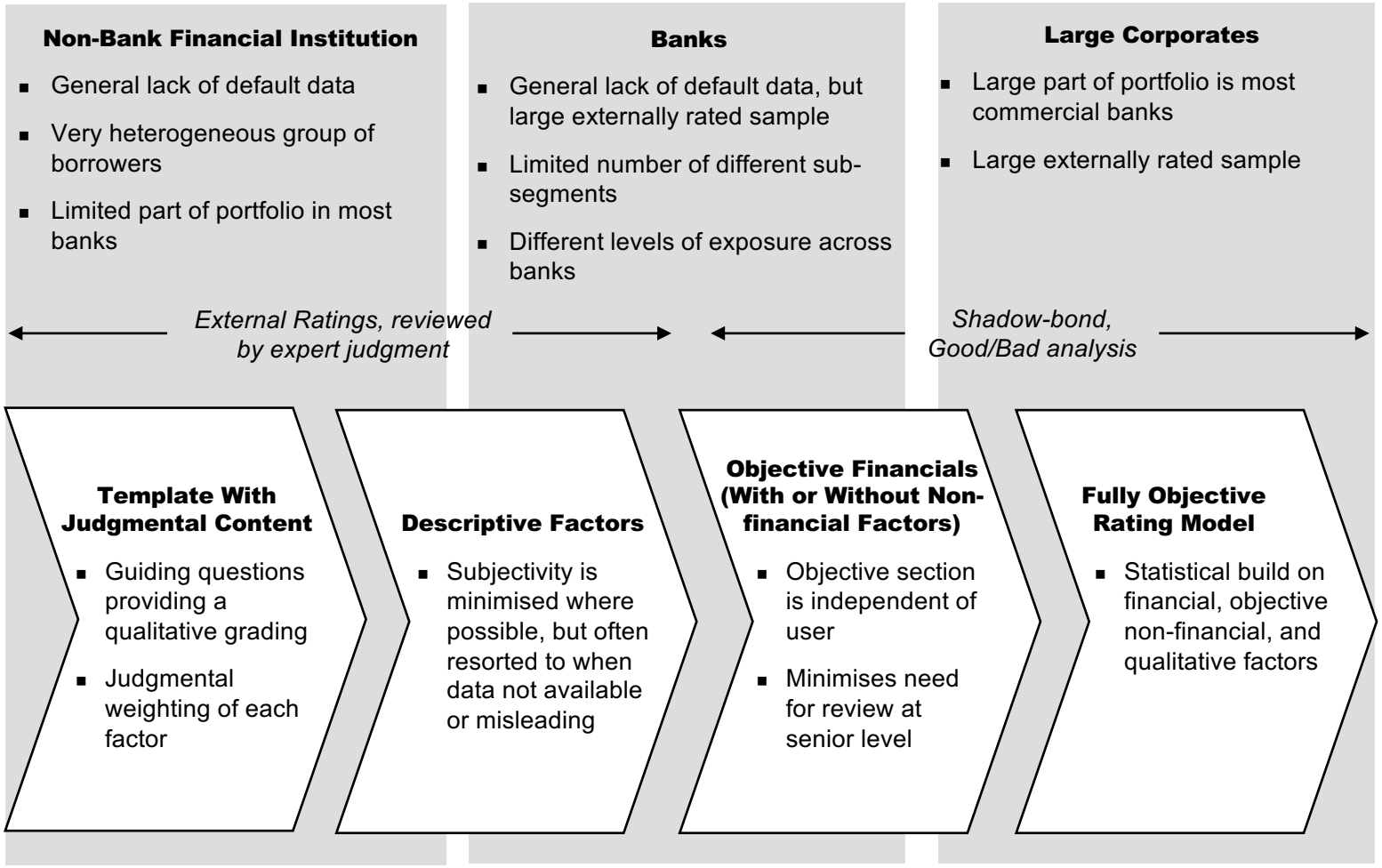



1 Lending that is financed primarily by the incoming producing capabilities of specific assets and/or projects, for example Income Producing Real Estate, Project Finance, Object Finance, Commodity Finance

# Provided a Certain Level of Standardisation, Basel 2 Does Allow Using External Ratings for Internal Ratings Assignments . . .

- The BIS II Internal Ratings Based Approach allows for the use of external ratings, but these must be assessed by the bank: *"External ratings may be used for the assignment of internal rates. However, mappings must be based on a comparison of internal rating criteria to the criteria used by the external institution"*
- Focus rating efforts on borrowers without reliable external ratings and material levels of risk
- It needs to be determined whether the banking supervisor is willing to allow expert judgment with reference to external ratings. In addition, a solution needs to be found for unrated banks.
- Only few of the non-banking financial institutions are rated. However, these only account for a very small part of the portfolio so that a pragmatic solution will have to be found

# . . . However Best Practice Normally Takes the Level of Sophistication One Step Further



# Retail rating models - typical status at most EM banks

| Current Practice | Basel 2 | Best Practice |
|---|---|---|
| ▪ Exposures and customers are assigned risk grades using a single statistical scoring tool and are not segmented into granular pools<br>▪ Current grading scale contains too few grades and does not adequately differentiate customer risk<br>▪ Risk factors tested in developing the model have been limited by systems and are weighted heavily towards behavioral factors | ▪ Customers must be segmented into granular, homogenous pools for grading purposes<br>▪ Rating scale must include at least 7 performing and 1 non-performing grade, and must not have excessive concentrations in individual grades<br>▪ Output of rating models must be sufficiently granular to provide a meaningful differentiation of risk<br>▪ All relevant information is taken into account in building ratings models | ▪ Segmentation in addition to Basel 2 requirements based on distribution techniques, LTV or loan amount<br>▪ Banks typically have 3-6 application scorecards, but as many as 30+ unique segments for the purpose of calibration<br>▪ Rating scale has sufficient granularity to maximise Basel 2 capital relief on high credit quality exposures |

- **Develop pooling methodology for segmenting customers**
- **Incorporate greater granularity into rating scale**
- **Include additional relevant risk factors in rating model**

# Rating Tool Development – Worksteps

## Worksteps: Customer Segmentation (Pooling)

| Worksteps | Details |
|---|---|
| Data Collection and Portfolio Assessment | ■ Identify and communicate data requirements (including IT architecture)<br>■ Gather available data needed for detailed segmentation (e.g. exposure sizes and risk parameters per product and collateral type)<br>■ Initiate additional data capture for later fine-tuning of segmentation (e.g. by distribution channel) |
| High-level Segmentation | ■ Use portfolio analysis to derive product and collateral type segmentation (e.g. into unsecured loans, credit cards, mortgages backed by new houses etc.)<br>■ Segmentation must cover SMEs in retail as well as personal customers<br>■ Identify high-level segments requiring further segmentation<br>■ Recommendations for modifications to rating tool |
| More Granular Segmentation | ■ Test which further separation criteria are meaningful and apply split accordingly for the different products<br>■ Give final recommendation on where to build scorecards and where to differentiate by calibration |
| Check Elected pools for Basel Compliance | ■ What is the exposure distribution within these pools?<br>■ Is any pool substantially bigger than the others?<br>■ Make adjustments if necessary |
| Monitoring the Application | ■ Ensure that data/ IT architecture capabilities are in place<br>■ Track and monitor risk characteristics at a central level |

## Worksteps: Rating Model Refinements

| Worksteps | Details |
|---|---|
| Collect Data on Additional Risk Factors (e.g. LTV) | ■ Identify additional risk factors which have not been tested in the model design, including demographic and financial position<br>■ Determine data sources and collect sufficient data for model building and back-testing |
| Perform Statistical Testing on Addl. Risk Factors | ■ Determine predictiveness of additional risk factors through statistical analysis |
| Revise Rating Model Based on Testing of Addl. Risk Factors | ■ Incorporate additional factors to create new multi-factor scorecards<br>■ Calibrate scorecards<br>■ Validate performance of revised scorecards through backtesting<br>■ Roll-out revised model |
| Align Model with Bank-wide Definition of PD and Masterscale | ■ Revised model must predict for bank-wide definition of default<br>■ Calibration of credit grades to the bank-wide masterscale |
| Break up Rating Scale Into More Granular Grades | ■ Divide grading scale to provide substantial differentiation of customer risk and reduce concentration within grades<br>■ Ensure balance between granularity of risk differentiation and added complexity |

# Once a modelling approach has been selected, the work is carried out in the following worksteps

## Construction of Rating Models

### Historical Data and Factor List

- Factor long list agreed in Phase I when defining the data request

### Single Factor Analysis

- Determine ability to predict default for all candidate factors
- Short list best factors and define score-transformation

### Regression Analysis

- Determine best combined models via regression analysis

### Model Structure

- Define structure of rating model including overlay sections

### Calibration to PD

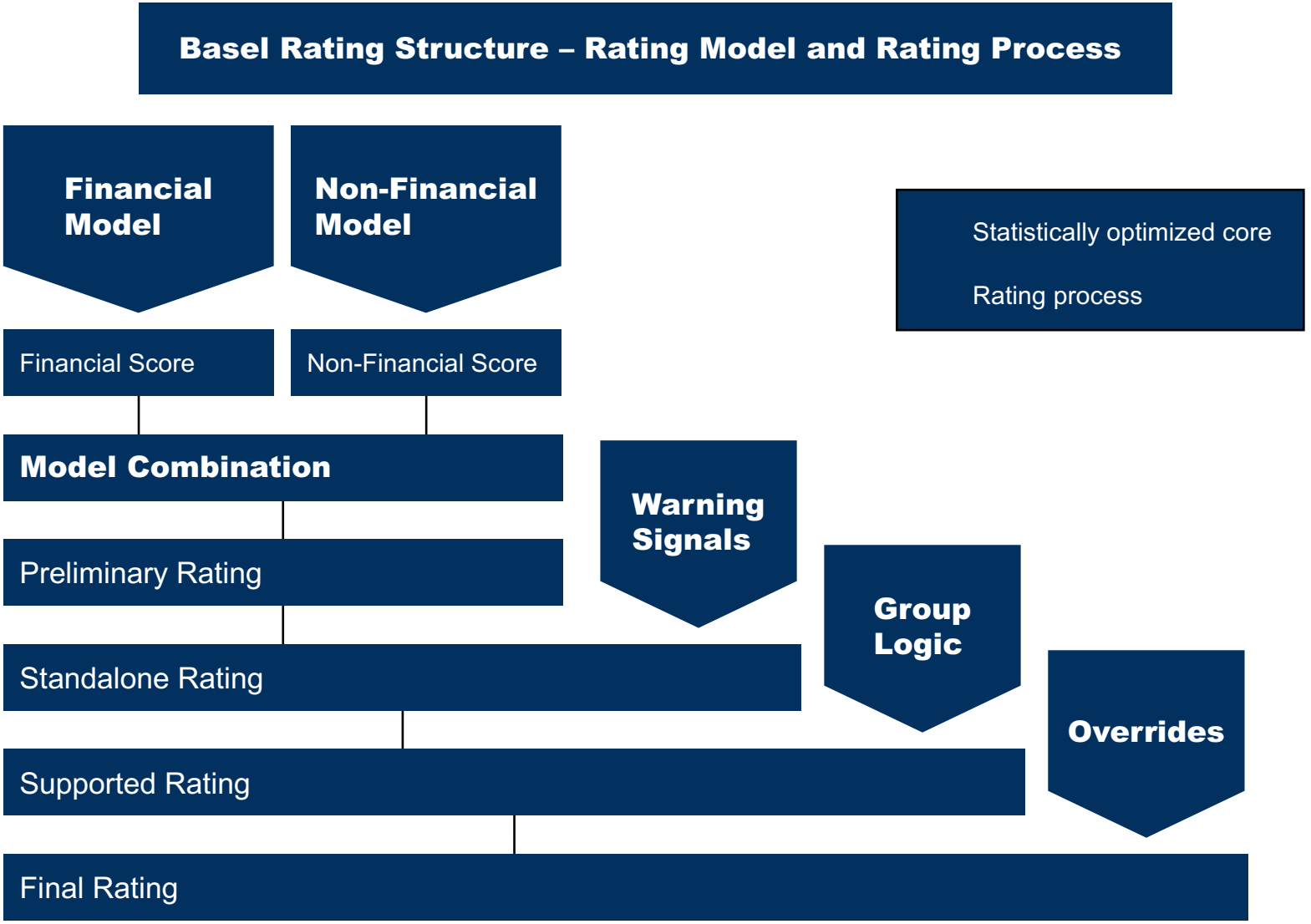
- Calibrate rating output to PD
- Define Masterscale

### Pilot and Refinements

**Judgment required to finalise results at each step**

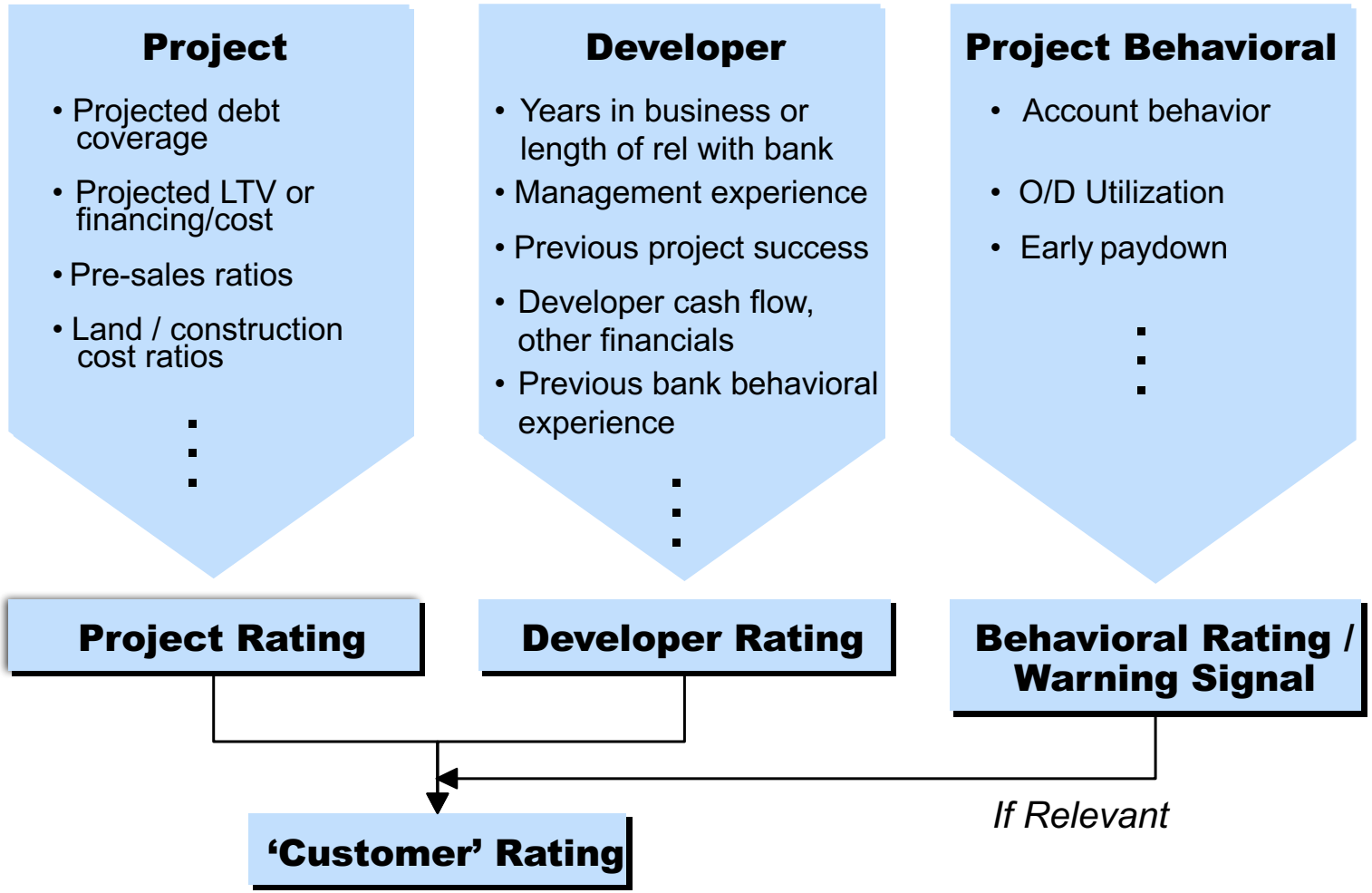
- Adjust for (e.g. hindsight) biases or gaps in data
- Statistical analysis will leave options to be decided based on underwriting practice and best practice experience

# In addition to the core model, warning signals, group logic and overrides are needed to enhance the rating process



# The rating approaches for Commercial Real Estate and Project Finance are similar, but with modifications

**Rating approach for Commercial Real Estate taking into account project rating**



# For project finance ratings we believe an evolutionary approach is best

## Project Finance Rating Approaches

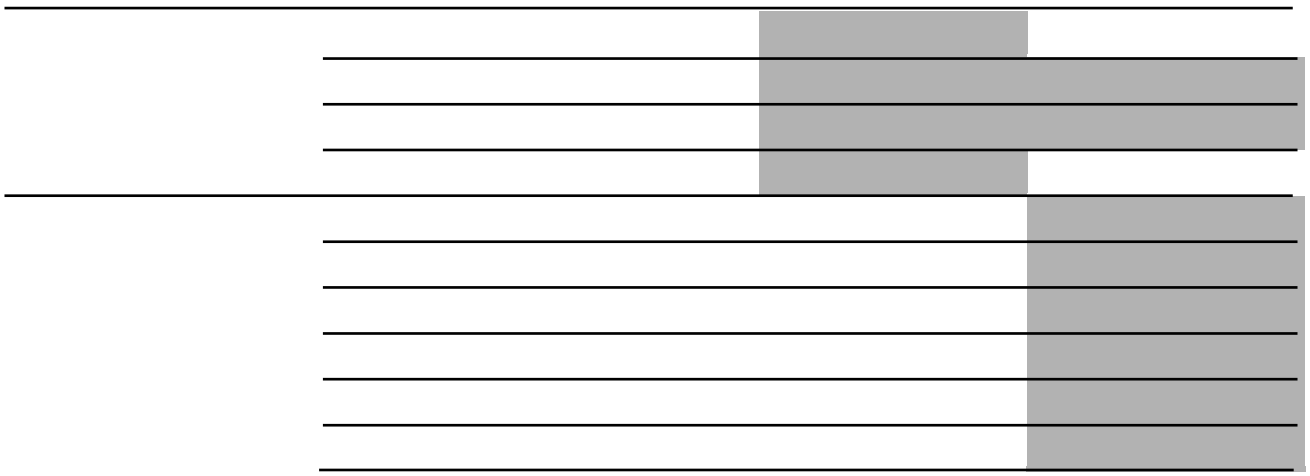
- Project finance is fundamentally different from ordinary corporate finance, but often Chinese banks have not yet educated credit managers on specialised finance techniques
- Real estate developers are an easy starting point to develop the skill set later to be applied throughout more complex project finance
  - Organisationally supported by assigning specialist credit officers to real estate and project finance
- Stage 1: real estate rating only
- Stage 2: modify real estate rating to fit to more general project finance situation
- Stage 3: Systematically integrate cashflow projections into the project finance rating approach
  - A) as overlay component
  - B) as rigid component
  - C) via simulation tools that support credit structuring

## Recommended Approach

- We recommend not to cover project finance ratings in the first wave of ratings (option 2 and 3 of the proposal)
  - Qualified internal resources are sparse and stretched during the projects
  - Typical for most Emerging markets banks
- At most attempt to develop either stage 2 or stage 3A during the project (option 1)
- Develop leading approach over time (2-3 year horizon), as project finance portfolio is large enough to eventually warrant the investment
  - We would be pleased to help you in the longer run to upgrade your capabilities

# Financial institutions models have to be tailored to the local market, as issues at Chinese banks are very different from the US/EU and even most Emerging Markets

**Client Example – Local bank template Taiwan**



**+ Consideration of Group Support and Government Support**

Important in CN

- Taiwanese market partially similar to China as many SO and smaller banks until recently still either under-capitalized or under-provisioned
- Objective tiering by capital adequacy ratio (8% threshold), NPL ratio and provisioning coverage for NPLs
- Adjustments to the objective information, given incomplete disclosure of NPLs
- Important China specific judgemental factors, e.g. fraud and ability to control the branch network

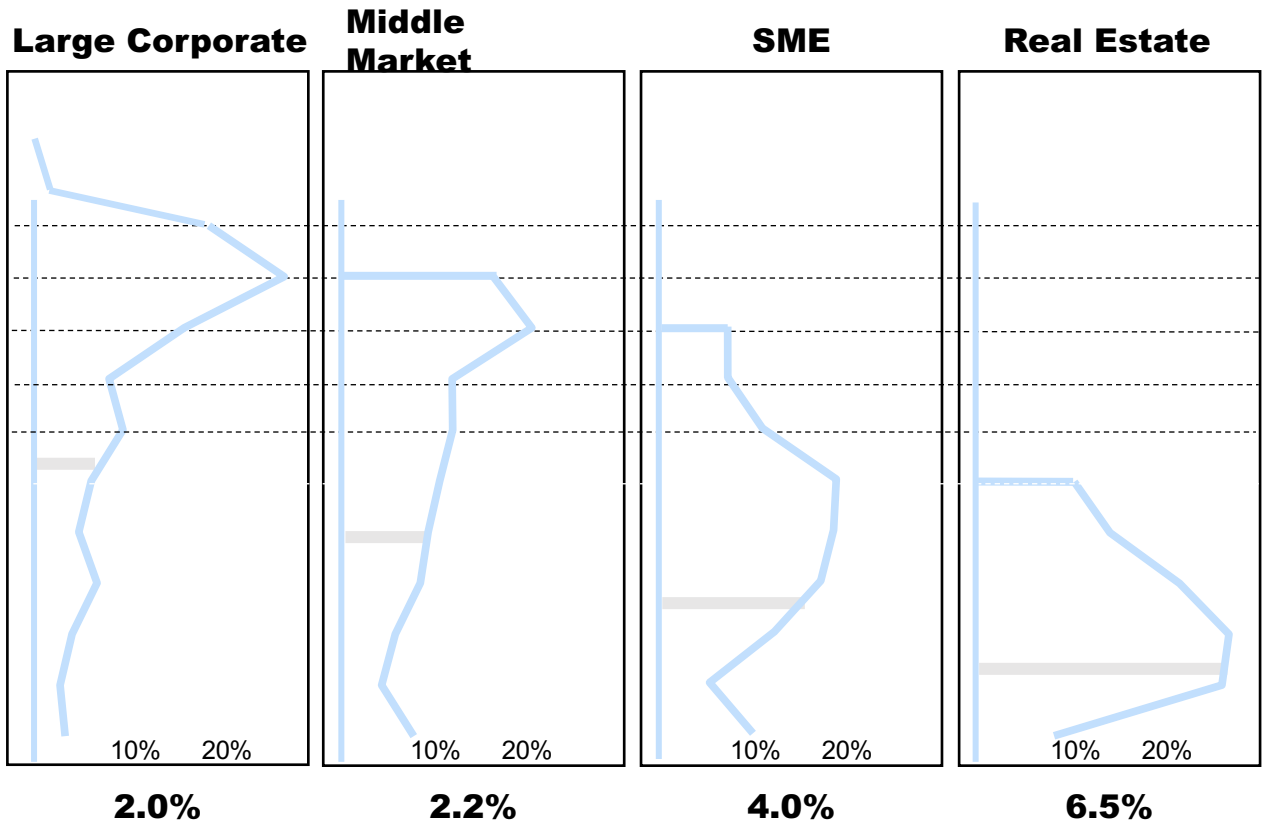
# Credit ratings are also mapped to a PD masterscale, making them comparable across customer segments

**Masterscale**

| Rating | PD |
|---|---|
| 1 | 0.10% |
| 2 | 0.20% |
| 3 | 0.35% |
| 4 | 0.60% |
| 5 | 0.80% |
| 6 | 1.1% |
| 7 | 1.7% |
| 8 | 2.7% |
| 9 | 3.5% |
| 10 | 4.5% |
| 11 | 5.5% |
| 12 | 7.0% |
| 13 | 10% |

Modified to protect client confidentiality

**Distribution of Corporate Customers Over Obligor Risk Ratings**



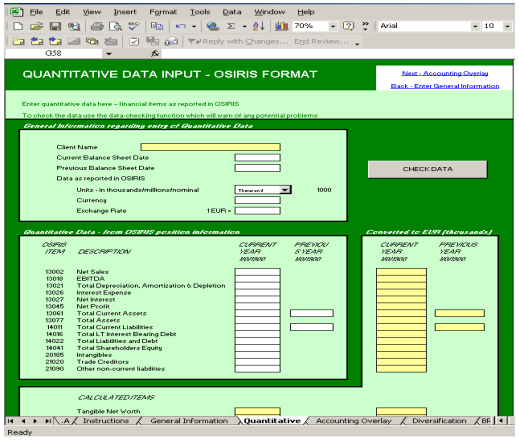

| Average PD | 2.0% | 2.2% | 4.0% | 6.5% |
|---|---|---|---|---|

Modified to protect client confidentiality

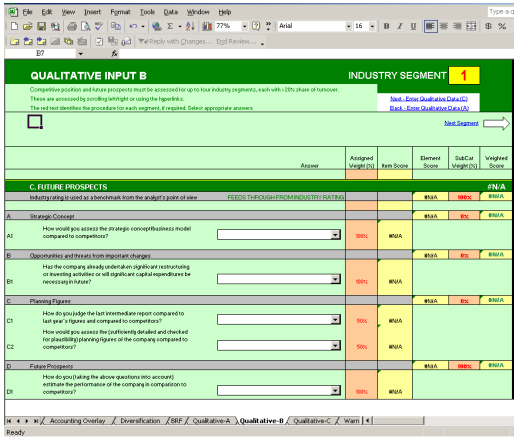
# The pilot test of the rating tools will be aided by the provision of the MS-Excel based tools built in Phase 3

## Client examples of MS Excel-based pilot testing tools

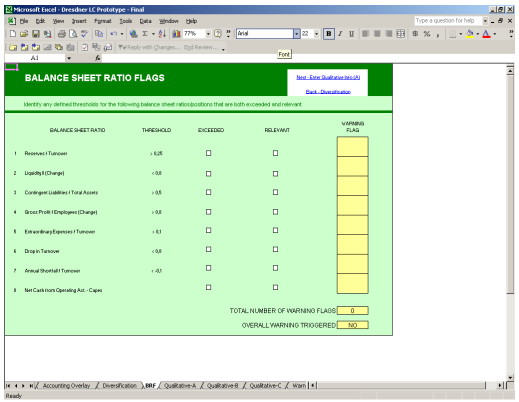
### Financial Model Inputs



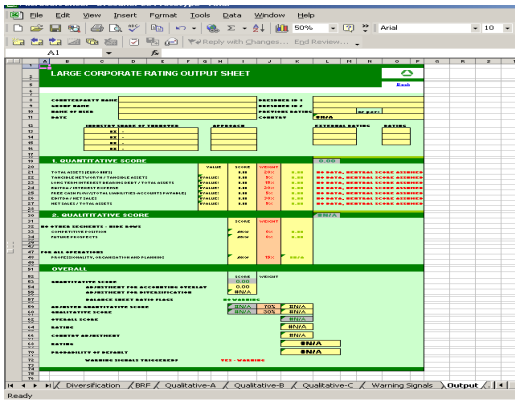

### Non-Financial Model Inputs




### Warning Signals




### Rating Model Output



# And these loan facility ratings can be mapped onto a uniform facility risk rating scale

## Illustrative approaches to the development of a Facility Risk Rating Scale

### PD Based ORR and EL based FRR under Foundation IRB

| ORR | PD |
|---|---|
| 1 | 0.03% |
| 2 | 0.10% |
| 3 | 0.16% |
| 4 | 0.26% |
| 5 | 0.42% |
| 6 | 0.61% |
| 7 | 0.90% |
| 8 | 1.35% |
| 9 | 2.04% |
| 10 | 3.15% |
| 11 | 4.93% |
| 12 | 7.82% |
| 13 | 12.61% |

x LGD

45%/75%

| FRR | EL |
|---|---|
| 1 | 0.015% |
| 2 | 0.050% |
| 3 | 0.080% |
| 4 | 0.130% |
| 5 | 0.210% |
| 6 | 0.305% |
| 7 | 0.450% |
| 8 | 0.675% |
| 9 | 1.020% |
| 10 | 1.575% |
| 11 | 2.465% |
| 12 | 3.910% |
| 13 | 6.305% |

### PD-Based ORR and LGD-based FRR under Advanced IRB

| ORR | PD |
|---|---|
| 1 | 0.03% |
| 2 | 0.10% |
| 3 | 0.16% |
| 4 | 0.26% |
| 5 | 0.42% |
| 6 | 0.61% |
| 7 | 0.90% |
| 8 | 1.35% |
| 9 | 2.04% |
| 10 | 3.15% |
| 11 | 4.93% |
| 12 | 7.82% |
| 13 | 12.61% |

| FRR | LGD |
|---|---|
| 1 | 10% |
| 2 | 20% |
| 3 | 30% |
| 4 | 40% |
| 5 | 50% |
| 6 | 60% |
| 7 | 70% |
| 8 | 80% |
| 9 | 90% |
| 10 | 100% |

| RR | EL |
|---|---|
| 1 | 0.015% |
| 2 | 0.050% |
| 3 | 0.080% |
| 4 | 0.130% |
| 5 | 0.210% |
| 6 | 0.305% |
| 7 | 0.450% |
| 8 | 0.675% |
| 9 | 1.020% |
| 10 | 1.575% |
| 11 | 2.465% |
| 12 | 3.910% |
| 13 | 6.305% |

# We will review your credit risk and rating governance and specify required changes

### Review of General Credit Risk Governance

- Benchmarking to Basel II requirements and best practice
- Overall organisation of credit risk management
  - Independence of credit approval / rating assignment
  - Control responsibilities (audit, risk asset review, . . .)
  - Responsibility for policies etc to implement credit culture
  - Role of the board in setting risk appetite and supervising the credit process

**Options and priorities for change**

### Define Roles for Rating Maintenance Function

- Roles to be defined in charter/ policy document
  - Monitoring and testing of quality of ratings via statistical methods
- "Well articulated standards for situations where deviations from expectation become significant enough to call the validity of estimates into question" (Basel II)
  - Data requirements for validation
  - Types of analyses, statistical measures, acceptance thresholds
  - Mock-up rating performance reporting template

### Clarify Oversight of Rating Maintenance

- Breadth of senior management oversight (by topic)
- Role of control units (e.g. process audit of maintenance vs independent content review: Basel II vs US-Fed)

### Specify Process Flow and Oversight of Rating Assignment

- Rules for assignment and sign-off of rating (incl overrides)
  - Independence of sign-off
- Audit routines for quality control of data entry and rating process

# Our review of your credit organisation and rating governance will leverage our experience in setting up risk departments

## Asian Client Example – Units reporting to Chief Credit Officer

### Special Asset Management (SAM)

- Management of impaired assets
- Develop remedial strategies & debt restructuring
- Reporting on problem credits to senior mgmt

### Loan Recovery Department

- Lead liquidation and collection activities
- Expert repository of recoveries knowledge

### Risk Asset Review (RAR)

- Independent, ex-post evaluation of credit management process, portfolio quality, adequacy of provisions and compliance with policies & underwriting standards and quality of debt underwriting
- As part of assessing underwriting, risk assessment and rating assignment is reviewed
- Review covers all units that directly or indirectly underwrite credit risk

### Portfolio Management (PMU)

- Development and maintenance of credit risk management tools & methodologies
- Review of credit card scoring model
- Build credit data warehouse
- **Regular and ad-hoc** port-folio reporting to senior mgmt
- Recommendation for portfolio restructuring, provisioning & limit setting
- Maintenance of related management standards

### Credit Policy Unit (CPU)

- Maintenance of credit policy architecture
- Co-ordination of adaptation & development of policy, standards & procedures
- Dissemination of approved policy documents and help desk for policy questions
- Monitoring & autopsy of policy exceptions as well as collection of feedback for maintenance of policies

### Credit Acceptance Unit (CAU)

- Independent credit approval authority
- Enforcement of compliance with underwriting standards and policy
- Final approval of rating
- Coaching of line personnel for improvement of credit skills
- General credit training for senior staff (RM and DH)
- Input and review of credit training curriculum

## Related Departments

### Compliance Unit

- Expert repository of external regulation
- Audit compliance with external regulations

### Audit & Control Division

- Audit compliance with internal rules, such as rating process and main-tenance processes

### Financial Information Services Division

- Provides Management Information Services

### Credit Administration (Shared Operations)

- Responsible for all back office support to credit depts. incl. disbur-sement, payments, documentation, covenant compliance, calling default and extinguishment of credit risk

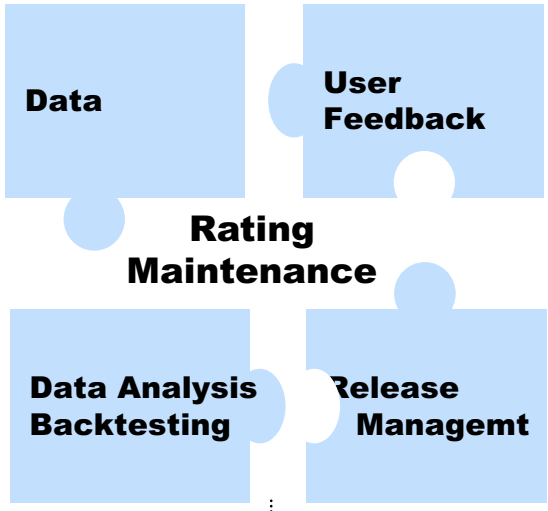
### Training Department

- Co-ordination of training efforts, including training on credit skills
- Management of training facilities

# We will also focus on the roles and responsibilities of the rating maintenance unit to ensure effective implementation

- Collection of data for backtesting
- Data cleaning
- Data adaptation (in case of new releases old data should be converted to a comparable standard so that long histories are maintained)

- Collect feedback from users
  - User friendly
  - Realistic in practice
- Collect feedback on quality of use in applications (pricing, portfolio management)




- Distribution of grades
- Migration of distribution (cyclicality) and migration of grades (volatility)
- Stability of predictive power
  - In time and across segments
- Stability of PD predictions
- Ad-hoc analysis for applications
- Re-optimisation of the model
- (Basel II compliance)

- New developments (segments, updates)
- Parameter release
- Model release and installation
- User retraining

# Following the implementation of the rating tools, should develop applications of these credit risk measures (included under Option 1)

| | | | | |
|---|---|---|---|---|
| | **Expected Loss** | = | **EL (CNY)** | **Business Applications**<br>▪ Approval ▪ Process Opt.<br>▪ Pricing ▪ Profitability<br>▪ RAROC ▪ Provisioning |
| | | | = | |
| **1. What is the probability that a client is going to default?** | **Probability of Default** | = | **PD (%)** | **Borrower Rating** |
| | | | X | |
| **2. How high should we expect the amount outstanding to be in such a case?** | **Exposure at Default** | = | **EaD (CNY)** | **Current Exposure** |
| | | | X | |
| **3. How much of the outstanding amount must we expect to lose?** | **Loss Given Default** | = | **LGD (%)** | **Facility Rating** |

# Credit risk reporting (included under Option 1) should be developed along three dimensions of report effectiveness


### Value 1: Communicate Effectively

- The new credit risk framework creates a wealth of new information at account, customer and portfolio level
- A good report uses these and other numbers to provide a comprehensive yet concise, forward looking view of the bank's credit risks

### Value 2: Prompt Action

- Report should prioritise issues and suggest actions on the most important risk management issues
- Threats to the bank can be detected and mitigated earlier

### Value 3: Support Other Decisions

- An enhanced understanding of the risk-return profile of the portfolio and segments supports lending and portfolio management decisions

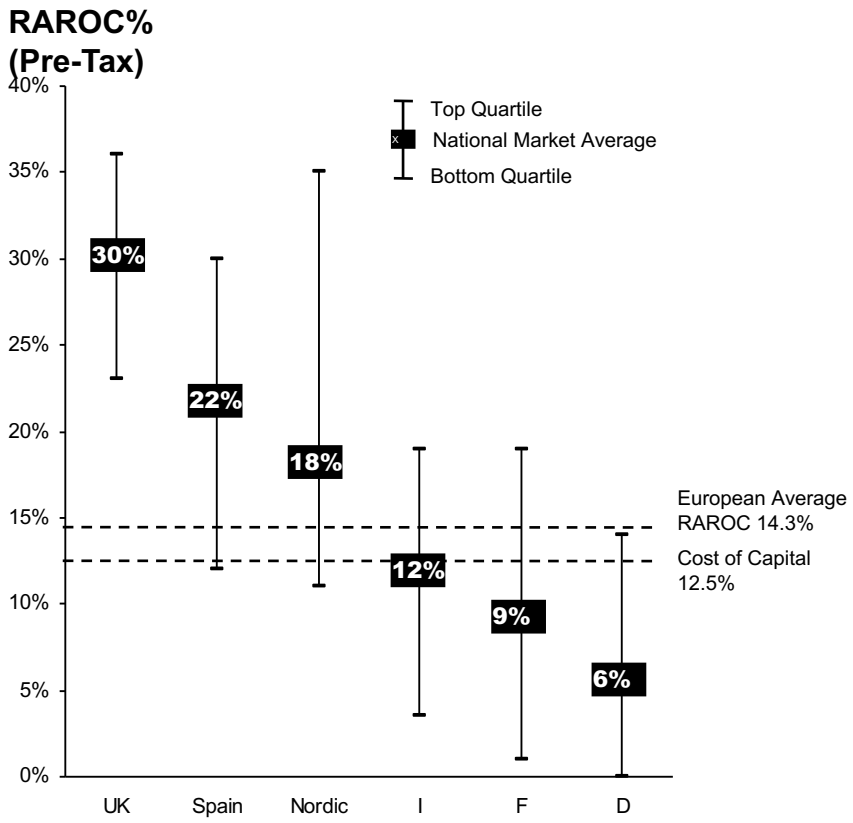
# Apart from reporting, also develop other applications of the new credit ratings framework

## Illustrative credit risk applications in compliance with the Basel II 'Use Test'

| Use category | Usage | Standard Practice |
|---|---|---|
| **Credit approval** | ▪ Credit underwriting | ▪ Underwriters are aware of the risk rating of obligor |
| | ▪ Credit pricing | ▪ Credit pricing loosely differentiated by risk ratings |
| | ▪ Obligor limits setting | ▪ Differentiation of obligor limits by risk ratings |
| | ▪ Portfolio limits setting | ▪ Portfolio limits based on risk ratings and rules of thumb |
| **Risk Management** | ▪ Risk reporting | ▪ Reporting by risk grades, expected loss and obligor and sector concentrations |
| | ▪ Loan loss provisioning | ▪ Provisioning differentiated somewhat by risk grades |
| **Internal Capital Allocation** | ▪ Internal economic capital allocation | ▪ Internal capital allocation based on regulatory capital models/guidelines |
| **Corporate Governance** | ▪ Risk appetite | ▪ Risk appetite articulated in terms of exclusions and nominal limits |
| | ▪ Strategy and acquisitions | ▪ Risk is discussed informally in strategy process |
| | ▪ Profitability measurement | ▪ Profitability measured in terms of ROE post EL |
| | ▪ Performance measurement | ▪ Performance measured in terms of ROE or ROA post EL |
| | ▪ Compensation | ▪ Compensation linked to performance through income or ROE post EL |

# In wholesale banking, pricing is the biggest organic profit driver you have

## Variation in Business Banking Profitability (European example)



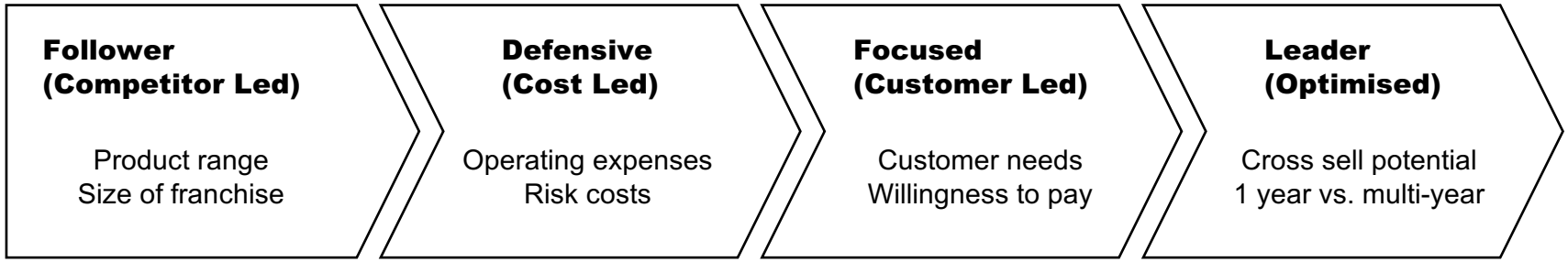

Source: Mercer Oliver Wyman analysis

## Pricing as a Key Profit Driver

- Commercial banks have historically been poor pricers, and few fully appreciate the pricing leverage they have
- Poor pricing decisions are often made because of lack of clear ownership and accountability
  - Pricing strategy is unclear and mis-aligned to overall business objectives
  - Separate product and relationship management fails to meet customer demand
  - Local price realisation is hampered by multiple, poorly co-ordinated incentives
- Better pricing is a lead indicator of the health of the business
  - Provides evidence of customer understanding and management
  - Provides evidence of internal, cross functional value focus

# Pricing strategy must be aligned with overall business objectives, not just the need to cover costs

## Evolving a Pricing Strategy




- Price vs. competitors
- Price vs. volume

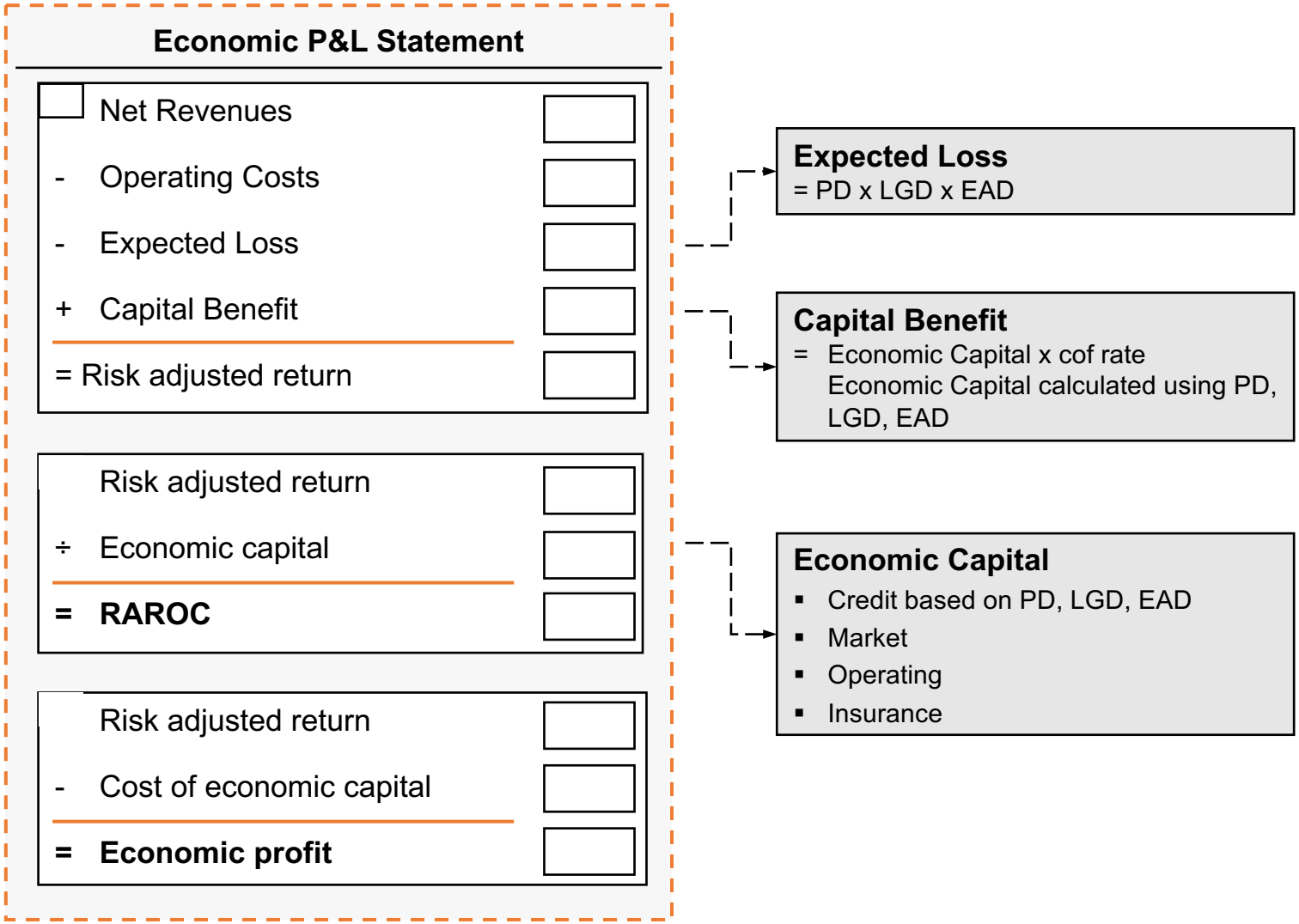
- Price vs. true cost of supply
- Price vs. attrition

- Price vs. value to customer
- Price vs. internal benchmarks
- Price vs. product substitutes

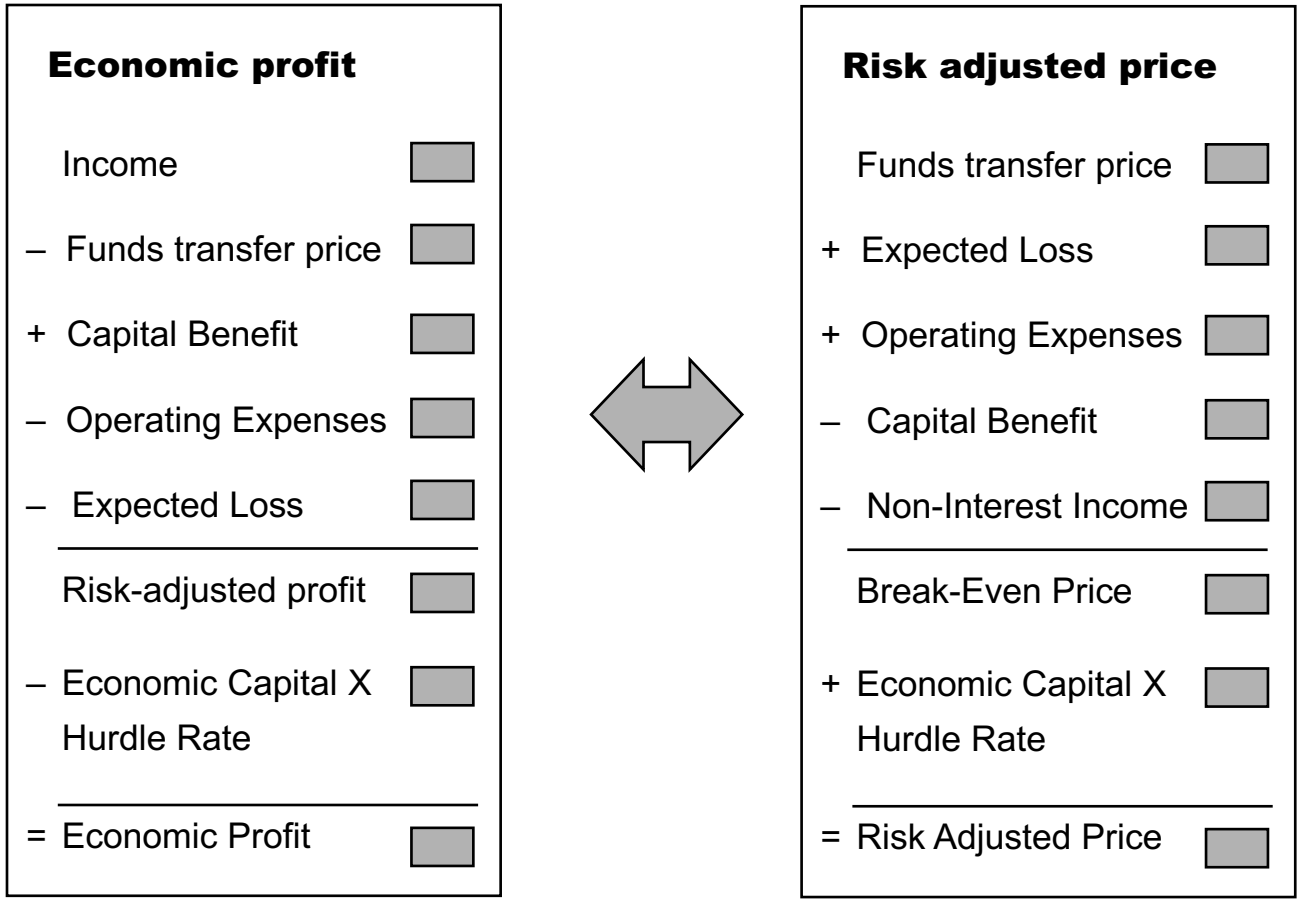
- Price vs. relationship value
- Price vs. desired behaviour
- Price vs. secondary market

# Investment in the Middle Office is critical to provide senior management with effective pricing 'intelligence'

# Pricing should cover all costs to be economically profitable



# Through the pricing model, the economic profit principles of the group are reinforced



# …but a ‘naïve’ approach to pricing can cause more harm than good

**Typical problems**

- Incorrect costing:
  - Parameter risk, e.g. incorrect quantification of risk costs
  - Model risk, e.g. one period view of customer
- Silo view of customer:
  - Failing to account for product features, e.g. prepayment options
  - Failing to recognise cross-product subsidies, e.g. cross sell
- Conceptual flaws:
  - Confusing costing and pricing
  - Confusing profit and value added

**Result**

- Accepting unprofitable deals
- Rejecting profitable customers
- High customer attrition
- Leaving money on the table

# Example: model risk

**Evaluation of a Five-Year Transaction Based on Alternative Views**

(Assume Bank Hurdle Rate = 15%)

| | Year | | | | | NPV | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Total | Annual |
| Exposure | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | | |
| Probability of Default | 3.5% | 4.0% | 3.5% | 3.0% | 3.0% | | |
| Loss Given Default | 50% | 50% | 50% | 50% | 50% | | |
| Expected Loss | 175 | 200 | 175 | 150 | 150 | 666 | 173 |
| Net interest margin | 330 | 330 | 330 | 330 | 330 | 1,272 | 330 |
| Operating Expenses | 150 | 70 | 70 | 70 | 70 | | |
| Expected Loss | 180 | 200 | 175 | 150 | 150 | | |
| Capital benefit | 70 | 70 | 70 | 70 | 70 | | |
| Risk adjusted return | 75 | 130 | 155 | 180 | 180 | 527 | 137 |
| Cost of capital | 13 | 13 | 13 | 13 | 13 | | |
| Economic Profit (Year n) | -55 | 0 | 25 | 50 | 50 | 25 | 6 |
| Economic equity | 717 | 764 | 717 | 665 | 665 | 2,741 | 711 |
| RAROC (Year n) | 10% | 17% | 22% | 27% | 27% | 19% | 19% |

Decision Based on One Period View: Reject

Decision Based on full life of transaction: Accept

# Therefore, a comprehensive view of product / customer is required

## Client Data

### Individual Counterparty Info

- Risk grade
- Risk segment, etc.

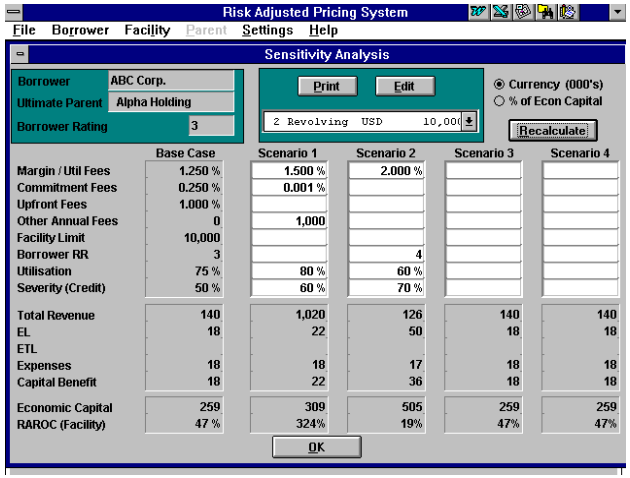
### Products

- Term loans
- Revolvers
- Standby LCs
- Trade LCs
- etc.

### Facility Structure

- Pricing (fee vs. margin)
- Exposure and limits
- Collateral and covenants
- Maturity
- Amortisation structure
- Prepayment options

## Pricing Engine (Illustrative)




## Outputs

- RAROC and Economic Profit for proposed facility
- Minimum interest margin to achieve RAROC and Economic Profit targets
- Ability to run 'what-ifs' on deal structure
- Abilitiy to integrate all facilities to the customer to see overall relationship profitability at proposed margin

## Financial Lab

### Revene Potential

- Cross sell rates
- Etc.

### Operating Costs

- Product unit cost
- Customer unit cost

### Risk Profile

- PD, LGD, EAD
- Risk Migration Profile

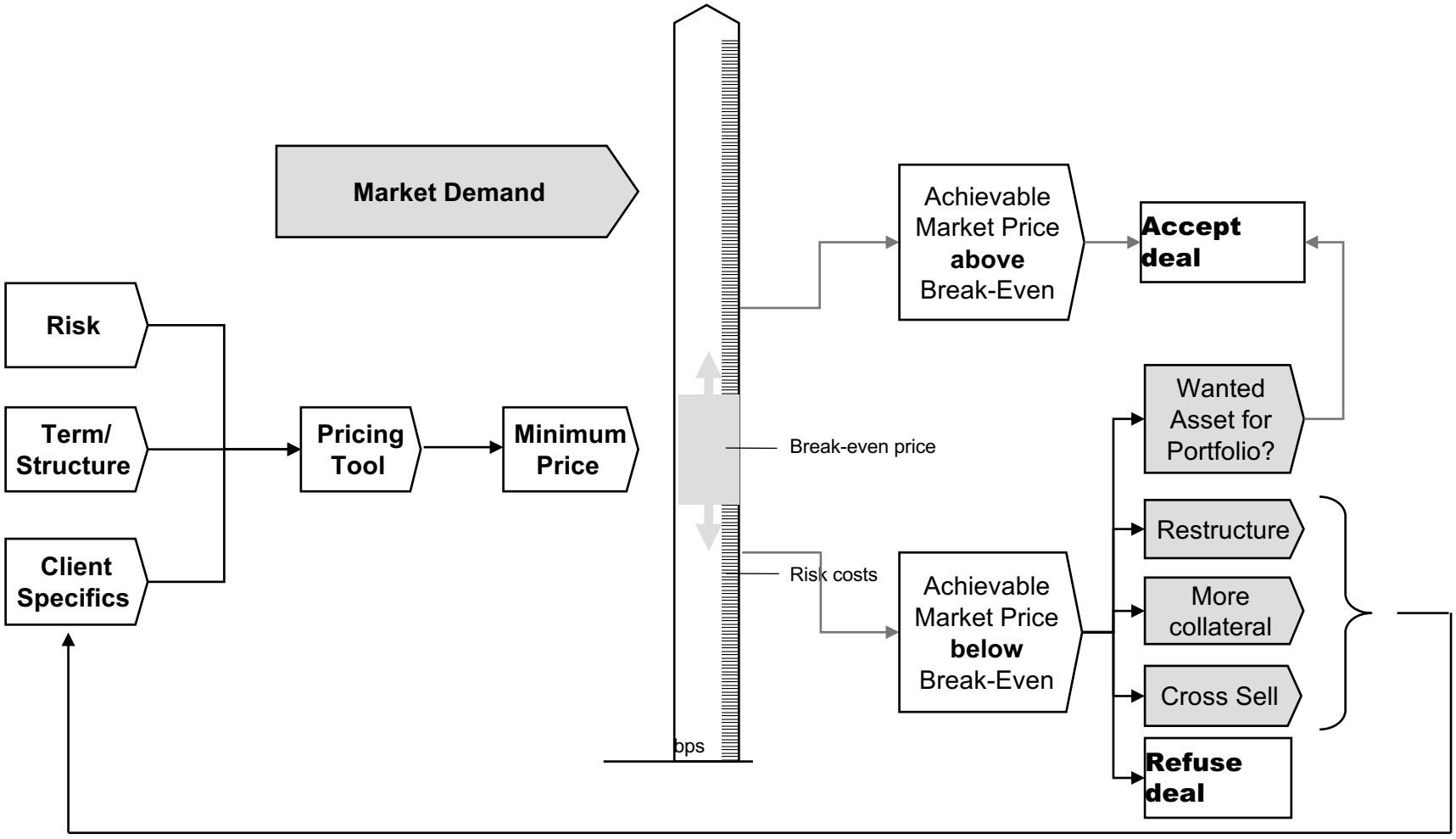
### Capital Costs

- Capital allocation
- Applicable hurdle rate

### Life Cycle View

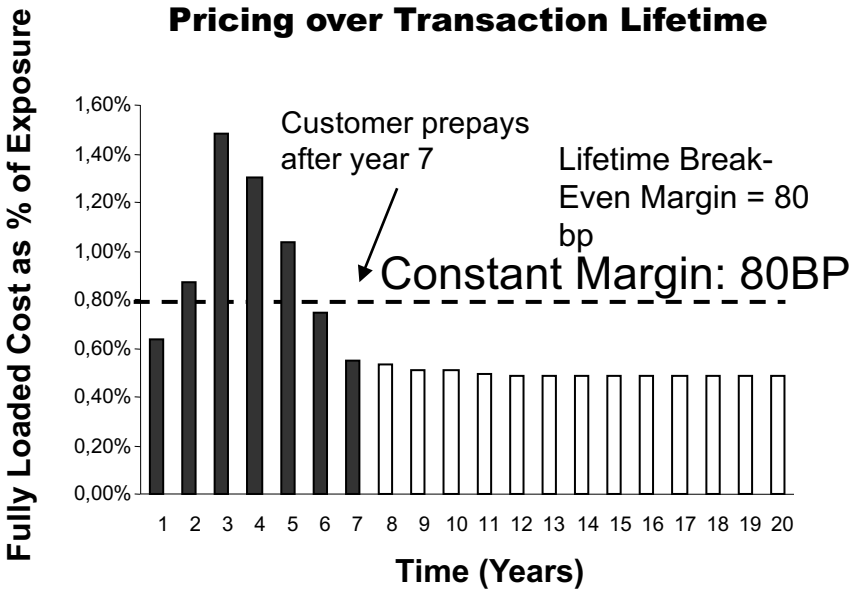
- Prepayment Options and Propensities
- Survivorship rates
- Effective maturity
- Applicable discount rate

# A well structured pricing tool can also be used in structuring and decisioning deals

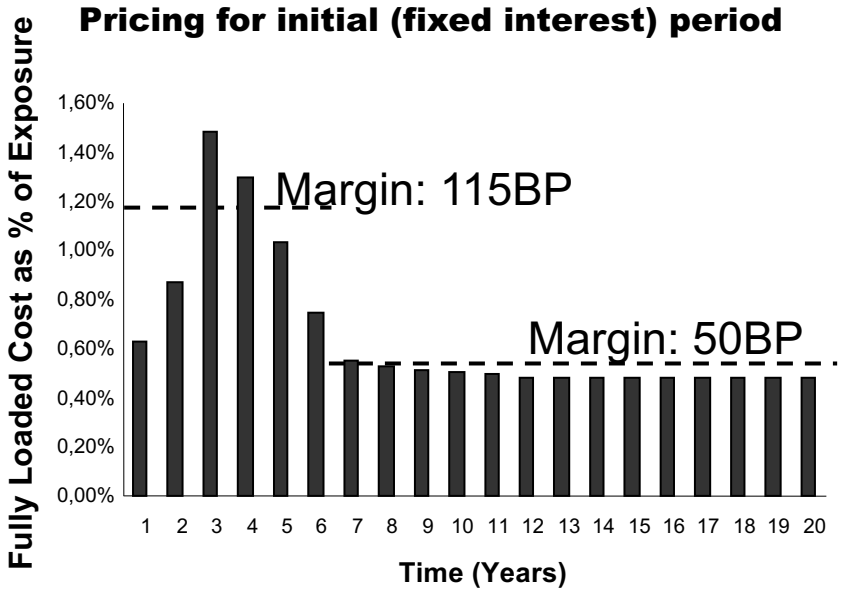


# …and to help improve product design

– Illustration –



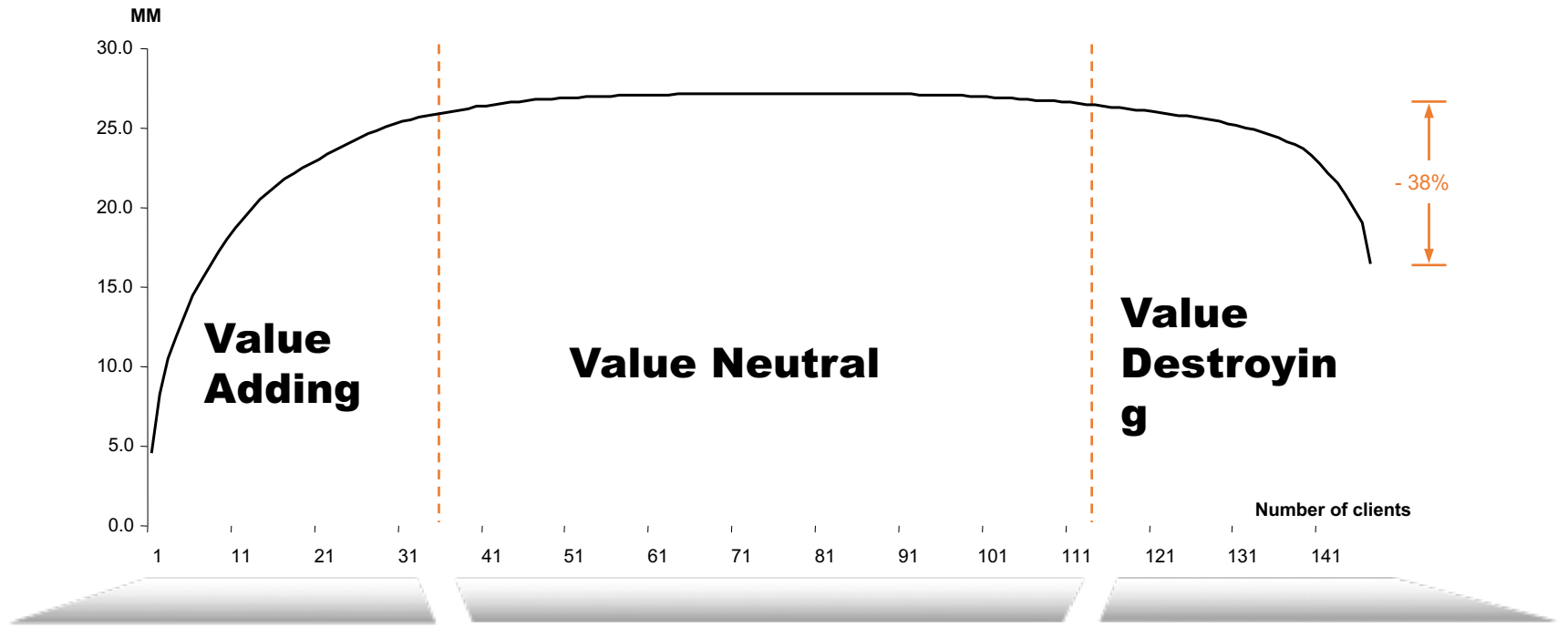

- 80 bp margin is unprofitable up to year 6
- Customer prepays at year 7 and gets a better deals elsewhere
- Consequence: project unprofitable over lifetime
- Charging for the prepayment option makes the transaction unattractive to customer




- Correct pricing strategy: start at margin of 115 bp and lower after 6 years
- Difficult to obtain in market
- Possible solution: pricing tool provides target range between 80 bp and 115 bp
- Actual minimum margin depends on contractual design of deal: covenants, breakage fees, etc.

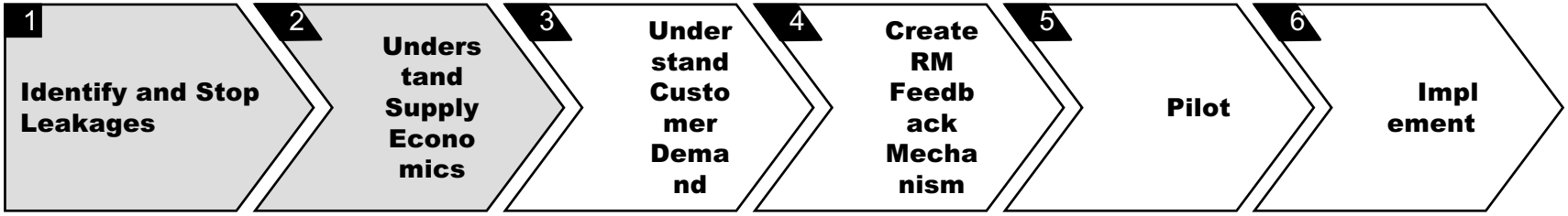
# Understanding customer economics also helps identify and exploit the profitability skews in the bank's portfolio

**Recent client example: Corporate Banking sub-portfolio (emerging markets)**




| Value Adding | Value Neutral | Value Destroying |
|---|---|---|
| **Volume** 3.91 BN | **Volume** 1.04 BN | **Volume** 1.82 BN |
| **Risk adjusted profit** 25.9 MM | **Risk adjusted profit** 0.64 MM | **Risk adjusted profit** -10.1 MM |
| ▪ Prioritise / Cross Sell<br>▪ Defend against poaching | ▪ Increase Cross Sell / Reprice / Restructure<br>▪ Classify and expand effort on 'potentials'; reduce effort on others | ▪ Reprice / Restructure (e.g. collateral)<br>▪ Subsidise where MT/LT potential<br>▪ Selectively exit relationships |

# Roadmap: ‘Quick wins’ that build foundations for the long-term




- Below hurdle credit
- Discretionary price discounting
- Fee waivers

- Identify current sources of value creation/ destruction
- Enforce ‘floor prices’ via underwriting process

- Internal best practice
- Customer willingness to pay
- Competitor pricing

- Set and communicate ‘target prices’
- Regular publication of performance against benchmarks

- Manage attrition risk in a controlled environment
- Build momentum for change internally

- Middle office support to maintain information flow
- Distribution mechanism for pricing guidelines
- Embed pricing in key decision processes

# In the medium term, the introduction of portfolio management will equip with a range of basic capabilities

## Typical Credit Portfolio Management activities

**Portfolio strategy**

- (Support in) setting portfolio strategy and risk appetite
- (Support in) defining concentration risk limits

**Front-end/monitoring support**

- Education and awareness on value
- (Market) Pricing information
- Credit portfolio 'budget'
- 'Desirable assets' guidance (investor view)
- Monitoring of names/sectors/regions
- Risk transfer proposals
- Risk/volatility/mismatch insurance
- . . .

**Back-end management**

- Mitigate risk through hedging and secondary markets
  - Acting upon trigger signals
  - Proactively driving portfolio shape
- Release economic capital
  - Disinvestment transactions to reduce concentrations and earnings volatility
  - Re-investment into diversifying assets to improve risk/return profile
- Generation of additional profit through arbitrage transactions

**Portfolio analytics**

# Central Portfolio Management will also enable to monitor and meet its Capital Management objectives

**Objectives**

- Capital adequacy
- Cost-efficient capital structure
- Efficient use of capital

| Dimensions | Recommendations |
|---|---|
| 1 Measurement and Planning | ▪ Measure and forecast adequacy (incl. stress tests)<br>▪ Develop strategic capital plan |
| 2 Allocation | ▪ Advise on capital allocation<br>▪ Monitor limit utilisation<br>▪ Determine Cost of Equity, target debt rating, and methodology |
| 3 Balance Sheet Optimisation | ▪ Propose / support asset/liability side transactions<br>▪ Optimise capital structure<br>▪ Manage capital buffer |
| 4 Communication | ▪ Provide information internally proactively<br>▪ Address shareholders and analysts with value-added information |

# Appendix 1: Model coverage details

## Retail model coverage

| Segment | Sub-segments | Obligors | Size (AED) | Status |
|---|---|---|---|---|
| Microfinance | Company auto | 6576 | 272 MM | MF template to be built |
| | Commercial vehicle | 401 | 50 MM | MF template to be built |
| | Rent-a-car | 353 | 35 MM | MF template to be built |
| | Taxi finance | 259 | 3 MM | MF template to be built |
| | Car dealer finance | 35 | 1 MM | MF template to be built |
| Secured overdrafts | Overdrafts secured | 1181 | 134 MM | 100% cash collateralized |
| | Margin financing | 135 | 122 MM | 100% cash collateralized |
| | Overdrafts Qatar | N/A | 6 MM | Immaterial size |
| Mortgages | N/A | 297 | 176 MM | Immaterial at present |
| Auto Individuals | Mashreq Bank | 11002 | 391 MM | Auto model to be built |
| | Osool | 4592 | 117 MM | Auto model to be built |
| | Osool-Islamic | 3108 | 147 MM | Auto model to be built |
| CC Model | Credit Cards Unsecured | 54465 | 329 MM | Credit Card model in place |
| | Credit Cards Secured | 41133 | 259 MM | Credit Card model in place |
| | Overdrafts Unsecured | 12870 | 57 MM | Will use Credit Card model |
| Mashreq Personal | Mashreq Personal | 14799 | 1053 MM | MP model in place |
| | MP œQatar | 8601 | 98 MM | Will use MP model |
| | Personal Loan Finance | 1111 | 175 MM | Will use adapted MP model |
| Al Hal | Al Hal | 7724 | 2027 MM | Al Hal Model in place |
| | Al Hal - Qatar | 615 | 158 MM | Will use Al Hal Model |

## Wholesale model coverage

| Segment | Sub-segments | Obligors | Size (AED) | Status |
|---|---|---|---|---|
| Non-borrowings | N/A | 327 | 8 MM | Non-traded outstandings (e.g. guarantees) |
| Wealth management | N/A | 237 | 2 132 MM | 100% cash collateralized |
| Real estate | N/A | 11 | 155 MM | Expert-based template to be produced |
| Project Finance | N/A | 21 | 1 478 MM | Expert-based template |
| Name lending | N/A | 55 | 2 391 MM | Expert-based template |
| Secondary markets exposures | N/A | 6 | 193 MM | External ratings used |
| SME | SME | 213 | 315 MM | SME model in place |
| Financial Institutions | Financial Institutions divisions | 343 | 6 273 MM | FI model in place |
| | Financial institutions | 2 | 73 MM | FI model in place |
| General Corporate | N/A | 450 | 10 512 MM | GC model in place |
| Contract Finance | N/A | 122 | 10 947 MM | CF model in place |

# THANK YOU