



Credit Risk Analytics

2012 GARP Convention

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Key elements of effective credit risk management

■ Focus of discussion



- Topics to be covered
- 1 Expansion of dataset
 - 2 Smart analytics
 - 3 Leveraging business judgment
 - 4 Organization capability building
 - 5 Credit risk analytics outcomes

There are several drivers behind the expansion of data that can be used for Credit Risk Analytics

- **Explosion in consumer related data** – greater amount of information generated
- **Better access to existing data** – integration of data previously in silos / multiple locations within institutions
- **Limitations of traditional data sources** – current sources less effective in risk differentiation
- **Pressure to expand the credit box** – quest for identifying profitable growth in newer areas

Adding non-traditional data sources increase predictive power of models; benefits are higher for some customer segments (1/2)

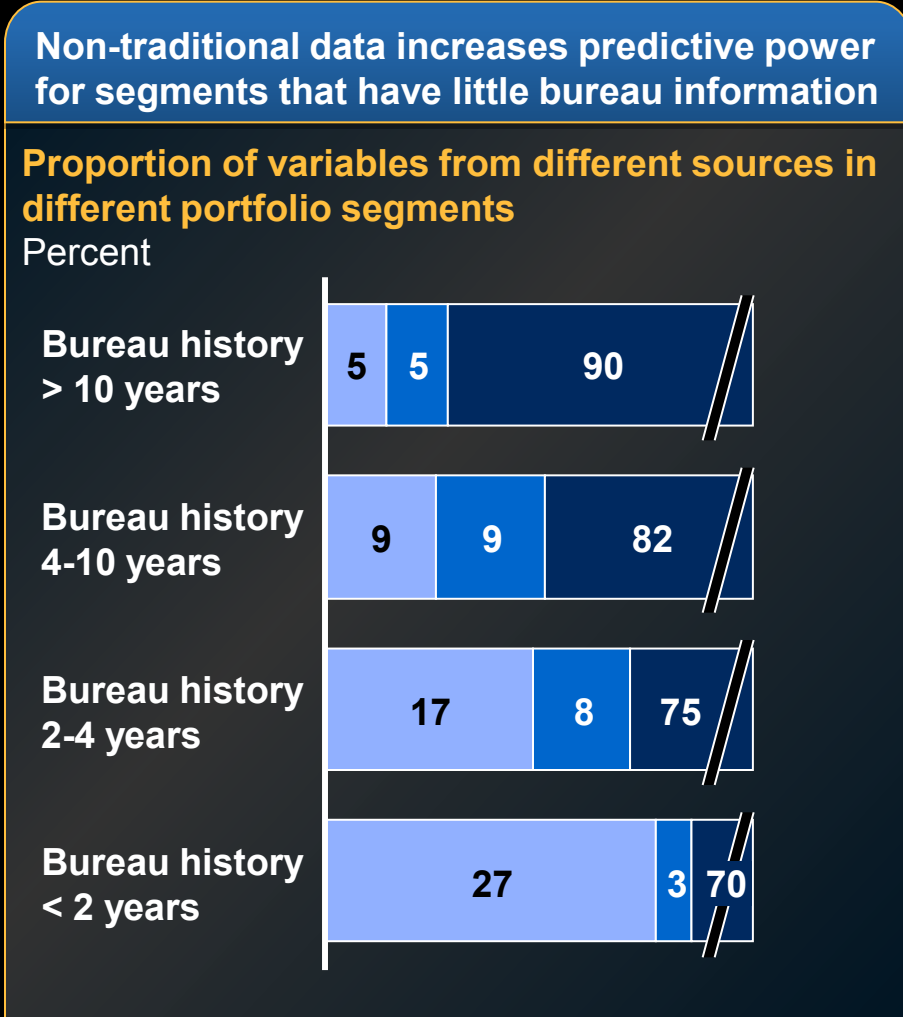
Examples of traditional data sources	
Sources	Examples
Bureau	<ul style="list-style-type: none"> • Standard bureau attributes available <ul style="list-style-type: none"> – # of inquiries – Utilization in existing accounts – Delinquencies in accounts • Generic scores (FICO) • Custom bureau attributes, coded specifically for each institution
Application	<ul style="list-style-type: none"> • Channel of application • Stated income • Whether specific product features requested in the form

Examples of non-traditional data sources	
Sources	Examples
Deposit relationship	<ul style="list-style-type: none"> • Checking account transaction history • ATM usage history • Tenure of customers
Third party information	<ul style="list-style-type: none"> • Utility bills • Rent payments • Payday lending information • Partner information
Other aggregated data	<ul style="list-style-type: none"> • Existing economic performance • Forecasts of economic indicators

Using non-traditional sources provides benefits when bureau information is scarce

Adding non-traditional data sources increases predictive power of models; benefits are higher for some customer segments (2/2)

DISGUISED CLIENT EXAMPLE



- Relationship in same bank
- Application
- Bureau



- Non-traditional data sources provide higher benefits when bureau information is scarce
- Including non-traditional information provides issuers opportunity to better differentiate line assignments
- Using only bureau information for these accounts will lead to models that have very low predictive power

Today banks could leverage information beyond financial statements and qualitative factors

■ Detail to follow

Description

Application

B2B market places

- Internet platforms where companies provide information to find trade partners
 - Financial information
 - Distribution channels and markets
 - Operational scope, e.g. factory information

- Reliable data for small enterprises
- Cross check / proof data quality

Trade references

- Information about companies willingness to pay credit lines or deliver products in a timely manner
 - Highest granted credits
 - Current owing and past due terms
 - Qualitative judgment of trade partners

- Reactions of trade partners supplement credit bureau data
- Willingness to pay information

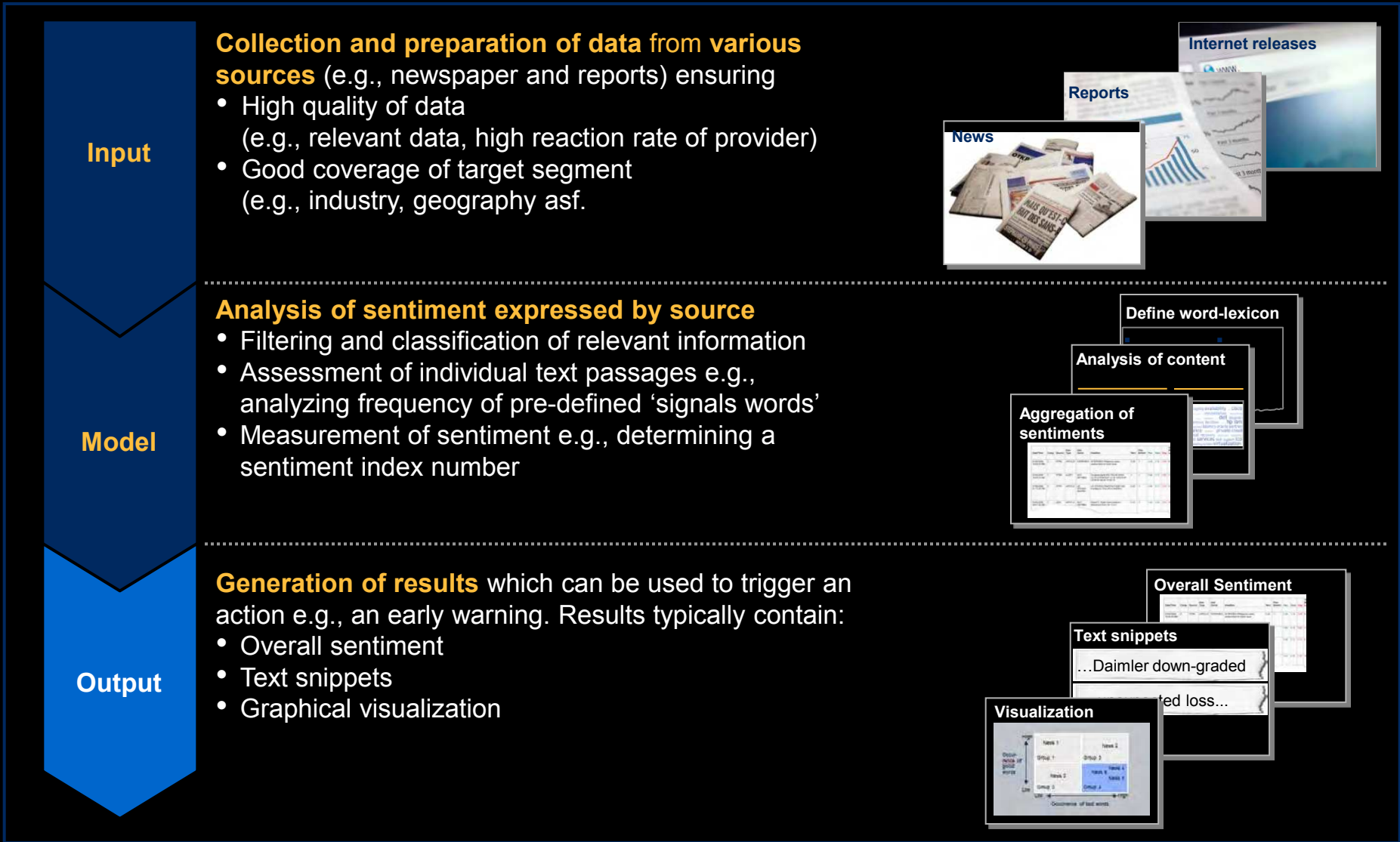
Semantic analysis

- Automated algorithms to analyze news articles, internet releases and even social media platforms
- Creation of media listening platforms

- Incorporates reputational risk elements into rating models

Semantic analysis leverages newspapers, reports and other data sources to get additional information...

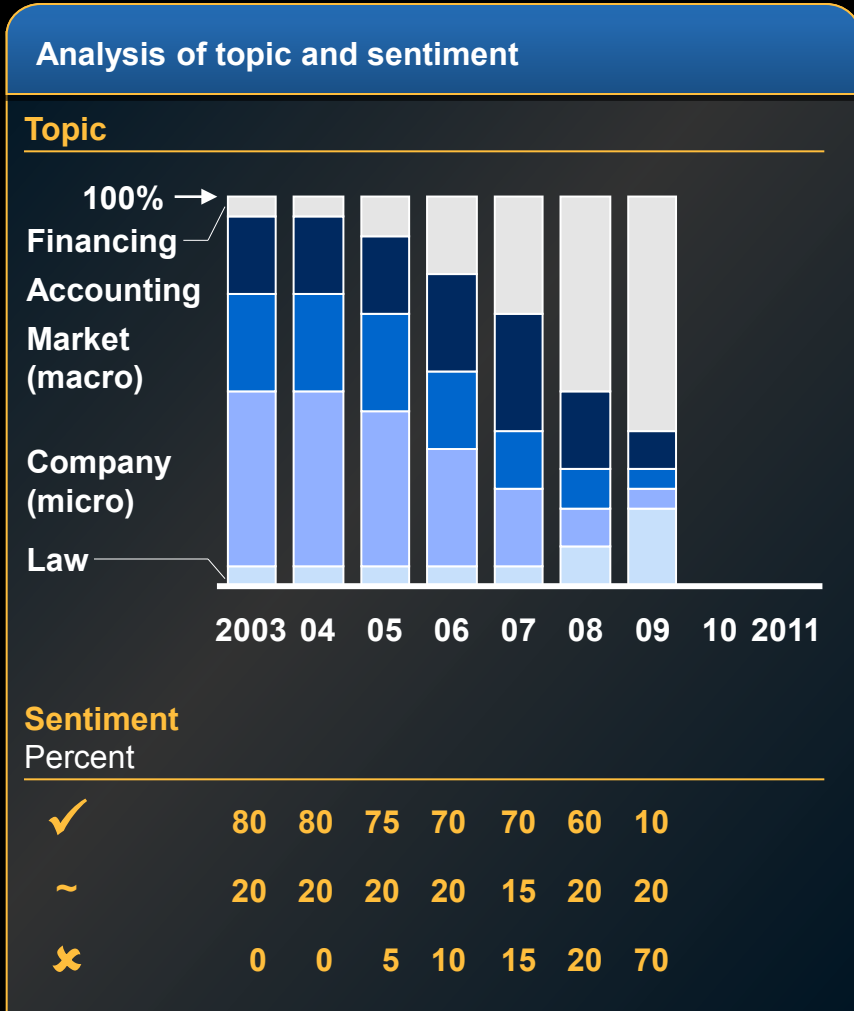
Example on next slide



1. EXPANSION OF DATASET

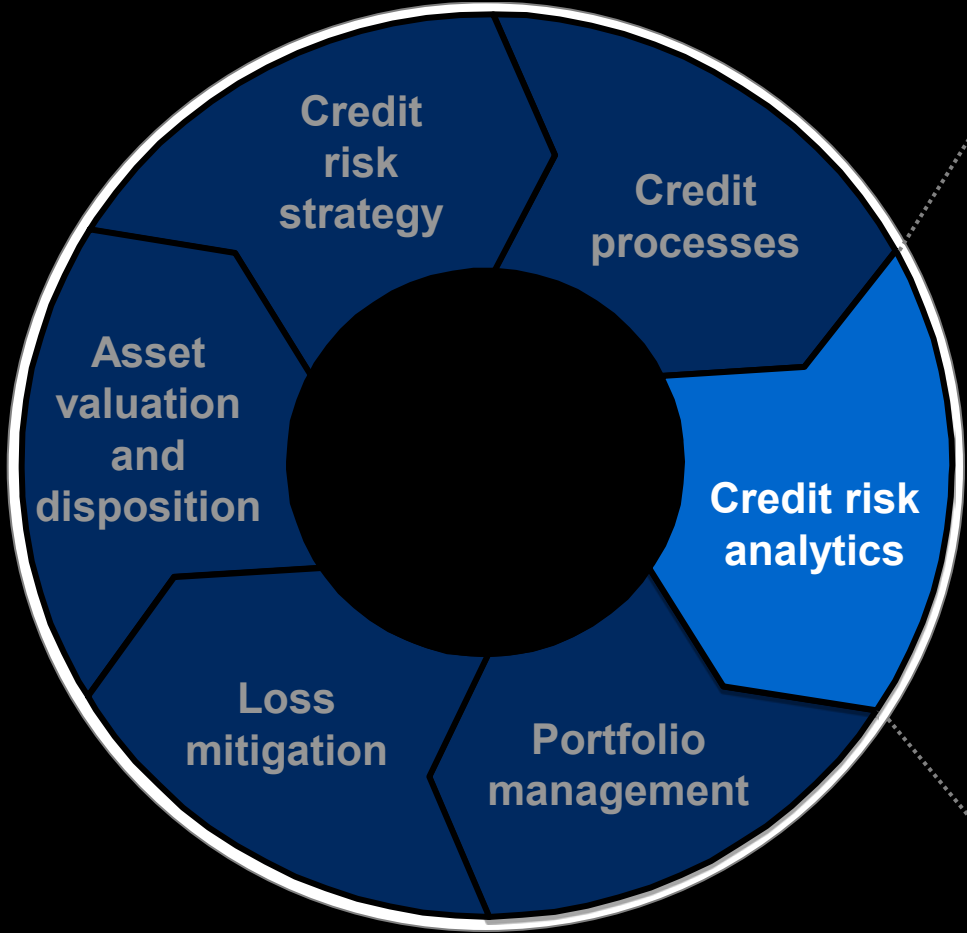
...which can be used to trigger an action e.g., an early warning

CONCEPTUAL



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How can the expanded dataset be leveraged through smart analytics?

- **More sophisticated techniques to develop customer segments** – more granular differentiation
- **Greater scope of model development** – analytics to integrate data types and sources different types
- **Improving how models are deployed** – closing gaps in how traditional model are used today

Develop and differentiate pricing based on customer segments

AUTO EXAMPLE

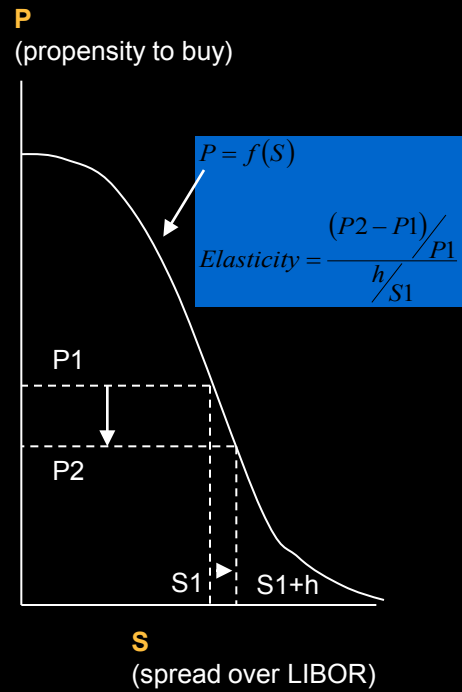


A Historical data



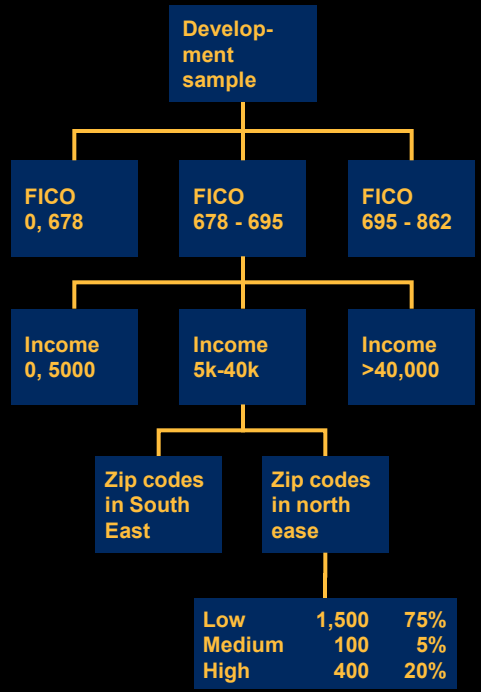
A sufficiently large & random sample of application, dealer, product, and performance data is used to build models

B Develop propensity model



Propensity curves are constructed as non-linear functions with spread as independent variable and propensity to buy as dependent variable

C Segmentation driven by elasticity characteristics



Segments with similar elasticity characteristics are created by classifying customers in development sample then using CHAID with a small number of highly explanatory variables

D Validation

- Test for statistical significance (e.g., GINI)
- In time testing to test for dev sample bias
- Out of time testing to ensure stability
- Implications on business as usual

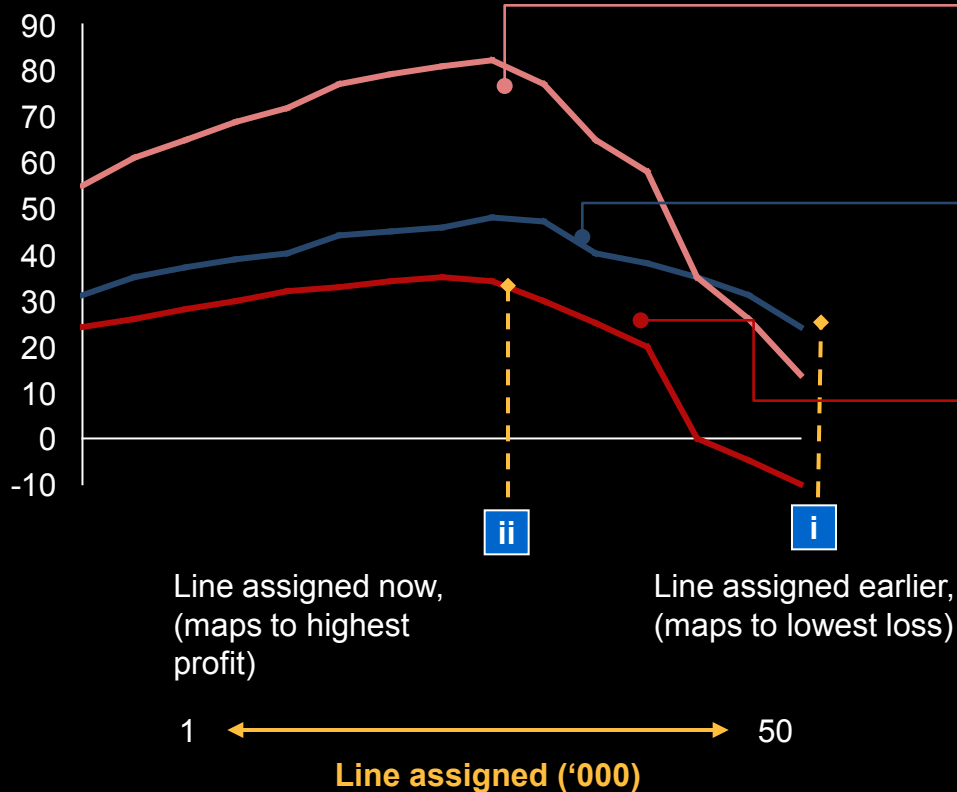
Tests are conducted to ensure model validity and stability, along with implied impact from using models

Building a set of exhaustive models for each component of profitability

CREDIT CARD

Performance of line assigned

For one peer group, \$/Account for each line



Building blocks

A

Revenue takes into account various components and regulations affecting them

- Interest income
- Fees (cash fee, late fee, etc.)

B

Credit loss considers multiple risk components

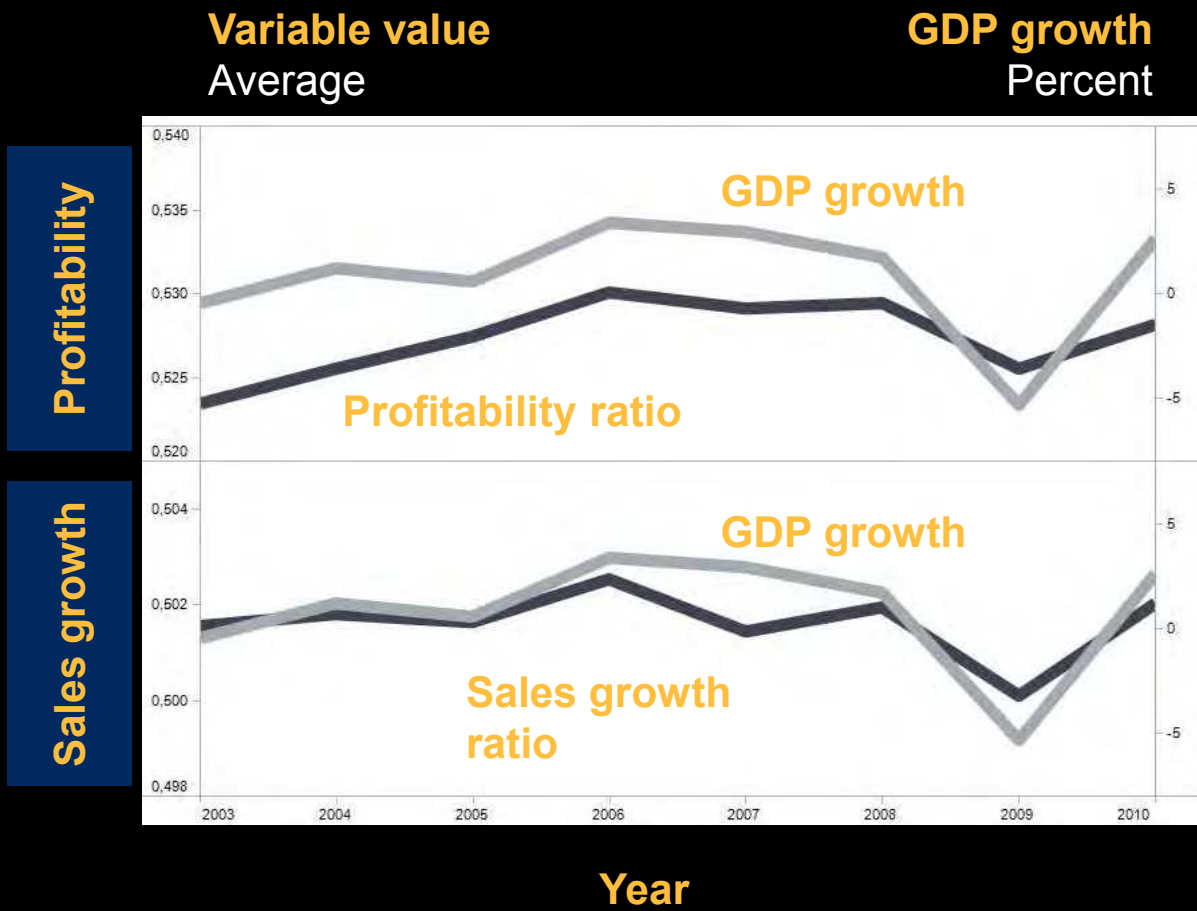
- Probability of default (PD)
- Associated loss given default (LGD)

Line assigned to maximize profit (dollar amount), which is simply Revenue - Losses

Need to consider operational constraints, which will constrain solution space. e.g.

- Maximum line assigned
- Total account exposure
- Portfolio loss constraint

Leveraging correlations between financial rating factors and macroeconomic variables



- Many indicators correlated with macro factors
- Revised models based on macroeconomic factors
- Further increase of predictive power

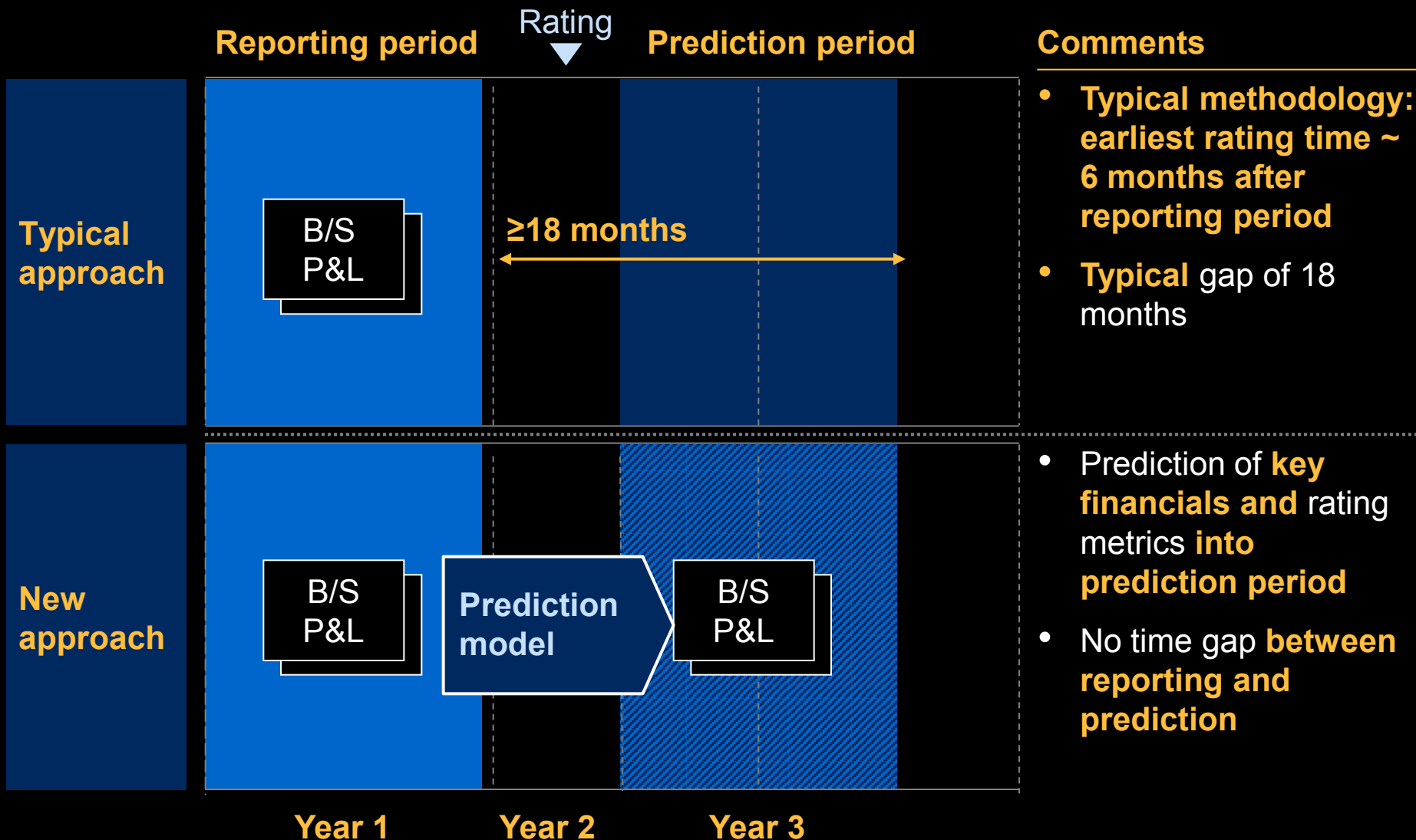
Prediction models for individual factors leverage forward looking information about macro economic development

RiskCalc ratio	# of lagged ratios	# of ME factors
1. Profitability ratio	6	2
2. Equity ratio	8	2
3. Cash flow over liabilities	6	2
4. Payables over total liabilities	5	3
5. Payables over sales	5	3
6. Personnel exp. over sales	5	2
7. Short term liabilities over assets	3	3
8. Operating profit over sales	7	2
9. Sales growth	4	2

Example model	
Variable ¹	Coefficient
Intercept	1.14
Real gross fixed investment	-0.41
Personnel exp. over sales	-0.10
Payables over sales	-0.03
Equity ratio	0.01
Profitability ratio	0.01
Producer prices	0.01

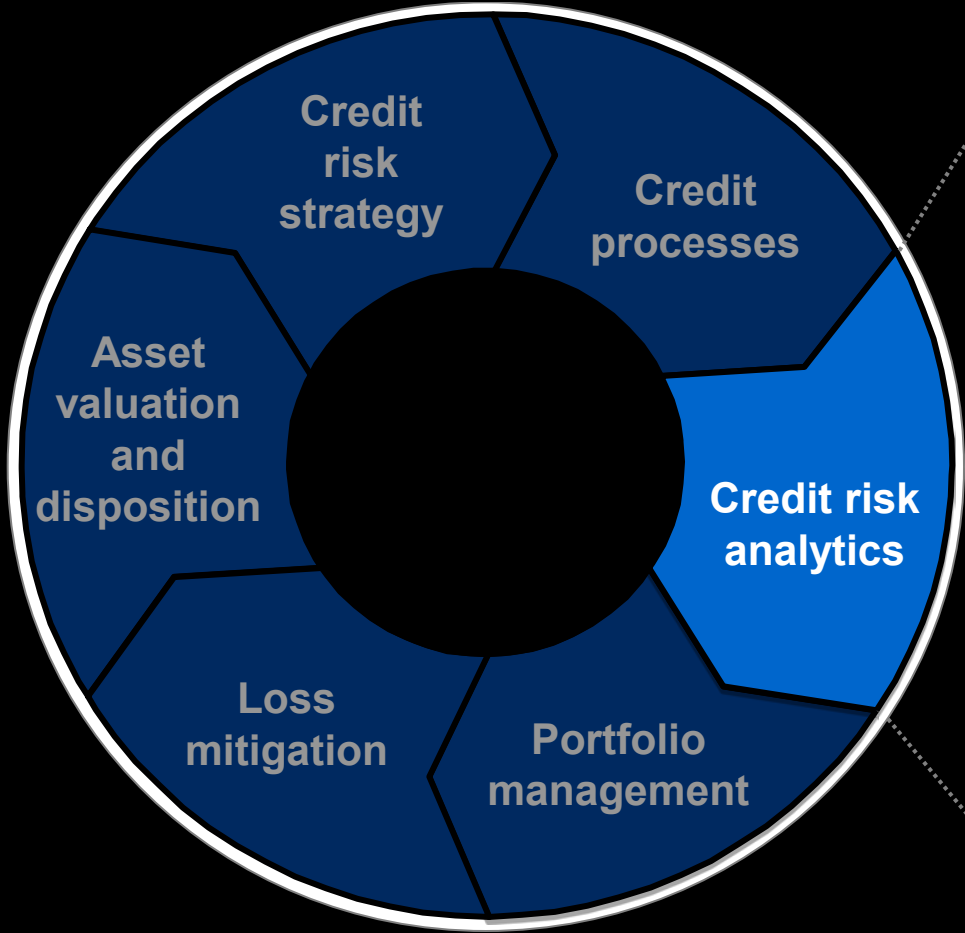
¹ Variables selected with at least 5% significance

An approach to bridge time gap between financial reporting and rating assessment



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Deploying a structured Qualitative Credit Assessment (QCA) results in much better risk segmentation

What is QCA?

- Typically 15-25 questions intended to assess a borrower's default risk
- Questions selected and answers weighed based on demonstrated discriminatory power
- Yields stand-alone probability of default

How it is used?

- Replacement for manual/judgmental review procedures
 - As a stand-alone rating methodology when dealing with scarce or irrelevant quantitative data
 - As a complement to quantitative models for a more robust decision

What are the benefits?

- Includes judgmental factors a systematic, consistent, and objective manner
- Includes “street-smart” qualitative tailored questions
- Brings experience of top performers (i.e. internal best practices) to the rest of the team and improves performance
- Increases transparency around underwriting decisions
- Sharpens eye of front line for new and potentially relevant risk factors
- Leads to significant Gini improvements (~15% to 30%, depending on starting point)

Final ratings are based on a combination of quantitative and qualitative credit assessment

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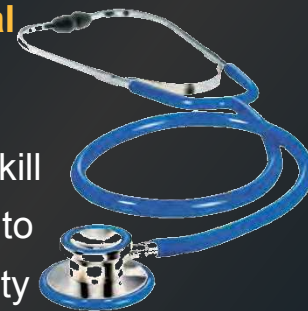
Quantitative Risk Assessment Model

- Developed mainly on **historical financial data** and “hard” qualitative information of the customers
 - P & L statement
 - Cash flow statement
 - Balance sheet
 - Number of employees
 - ...
- Divided into **sub-models by industry and customer size**
- **Back testing** conducted nationally and satisfying predictive power verified



Qualitative Credit Assessment (QCA)

- **Qualitative appraisal** of the obligor, e.g.
 - Management experience and skill
 - Borrower access to capital and liquidity
- **Credit expertise** of the bank’s credit officers **captured in an expert system – developed using a highly structured approach**
 - Approximately 20 risk factors
 - 2-4 answer options for each question
 - Precise description of evaluation criteria for each question to generate objective risk assessments



QCA supplements the quantitative model and enhances the overall PD assessment

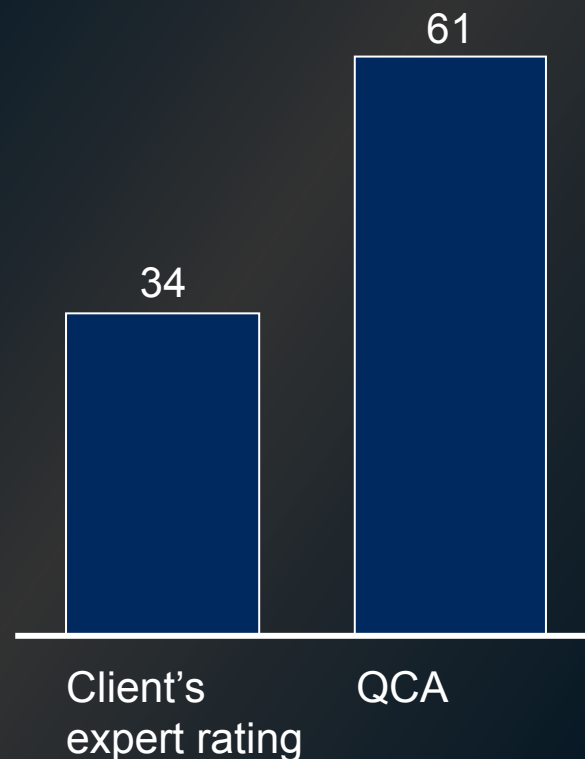
QCA is dramatically different from and superior to typical expert ratings

Key areas of improvement over individual expert ratings

- Rigorous development process yields **observable** and **objective** risk factors as opposed to conjecture
- “Textbook factors” replaced with unique insights into **local behavior**
- Layout of questionnaire safeguards against **human bias**
- Clarity of questions reduces **skill specificity requirements** and enables **flexible case assignments**
- Each question **validated statistically** using test cases (retrospective assessment of historical cases) to ensure its ability to discriminate between good and bad applicants
- **Weight** of each question determined quantitatively based on **predictive power** as opposed to ‘off the cuff’ and inconsistent weightings

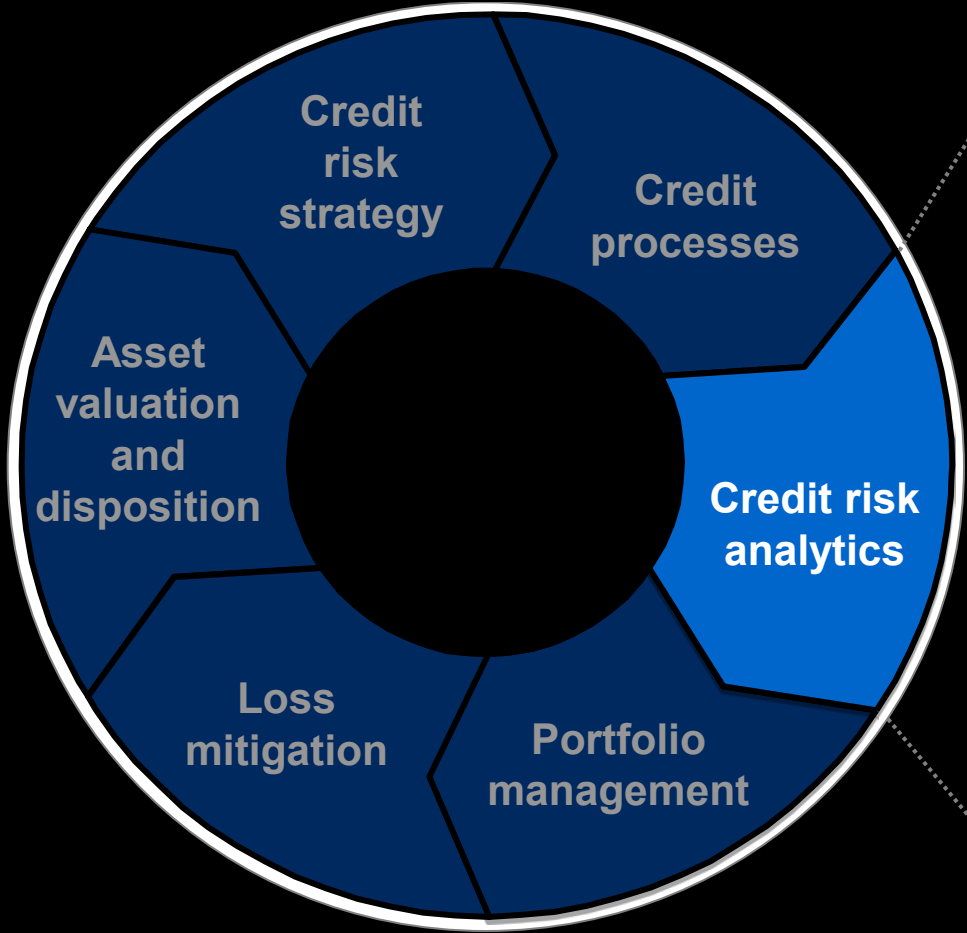
Discriminatory power

Gini coefficient



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Analytics organizations require 4 key components and analytical processes to function well

1. Org structure

Key components

- **Choice between a centralized or BU embedded analytics organization**
- **Reporting paths** well defined (solid vs. dotted)

2. Roles and responsibilities

- Detailed description of **roles within analytic organization**
- Clear definition of **interfaces** between the analytics function and businesses

3. Skills

- Description of **abilities and characteristics** requirement for each role in the analytic organization
- Comprehensive **development** and **career management** plan

4. Org health and performance

- **Feedback mechanisms** to assess how the analytic group interacts with business and peer groups
- 360-degree feedback for key roles
- **Metrics** to assess health

Key processes

- Aligning business objectives and analytical priorities
- Embedded process of leveraging analytics for business decisions
- Allocating balance sheet to test advanced analytics that creates value
- Center of excellence supporting multiple development efforts (e.g., data management, tests execution) that allows rapid development of new models
- Sharing best practices across various types of models or across product groups

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In Banking, significant advantage can be gained by leveraging advanced analytics in most types of enterprises



Improving underwriting decisions

- Incorporating non-traditional data sources
- Using advanced modeling techniques for better risk differentiation
- Target new customer segments



Generating greater customer revenues

- Efficient pricing at a more granular level
- Managing risk, propensity to buy with market level pricing
- Profit enhancement techniques for revolving exposures



Optimize product and portfolio mix

- Effective customer targeting
- Asset portfolio management and valuation
- Efficient capital allocation to different parts of the portfolio