Wealth Management System Limited

Credit Risk Models

August 24 – 26, 2010

WMSL Professional Best

AGENDA

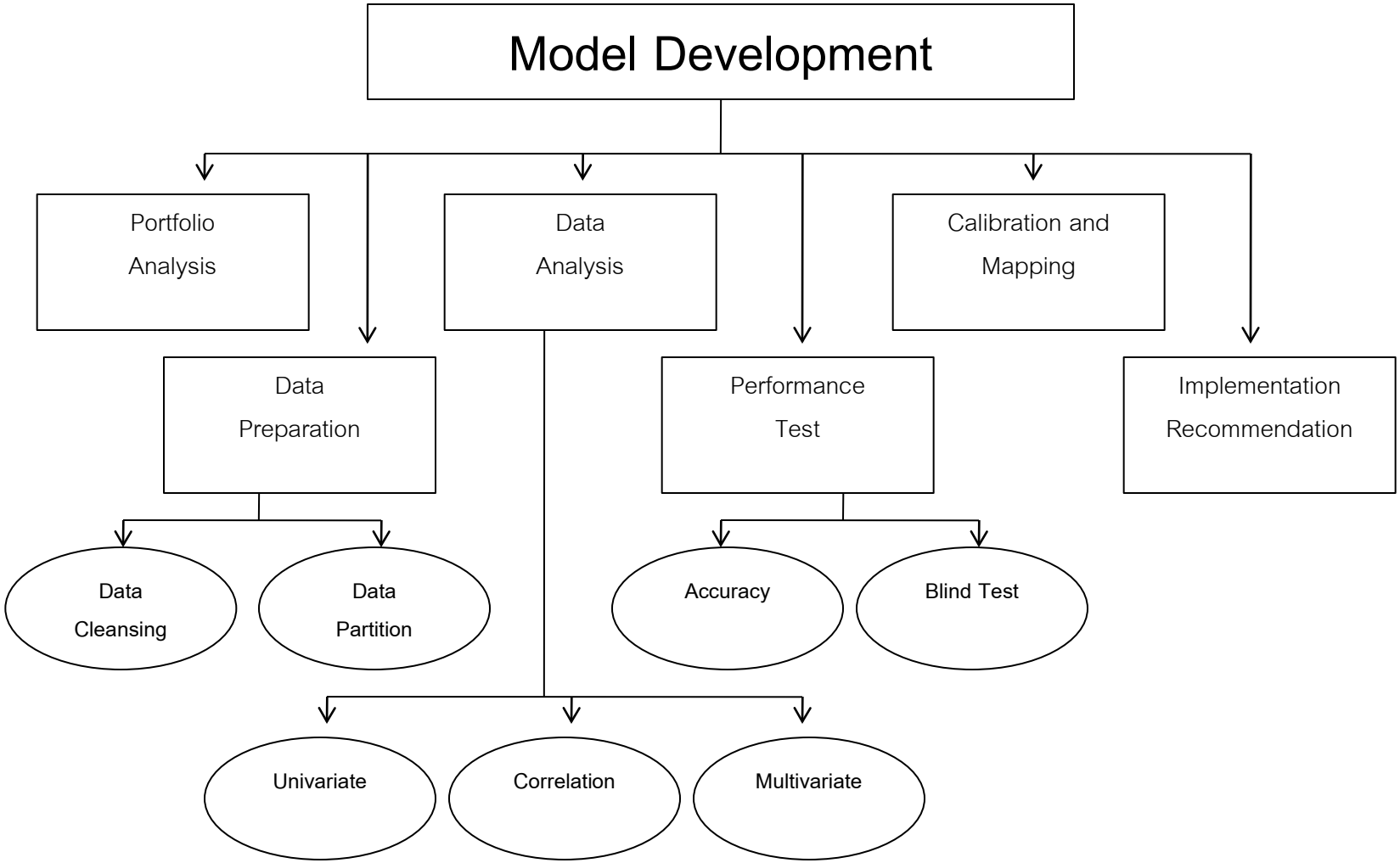
1st Case Study

Credit Rating Model

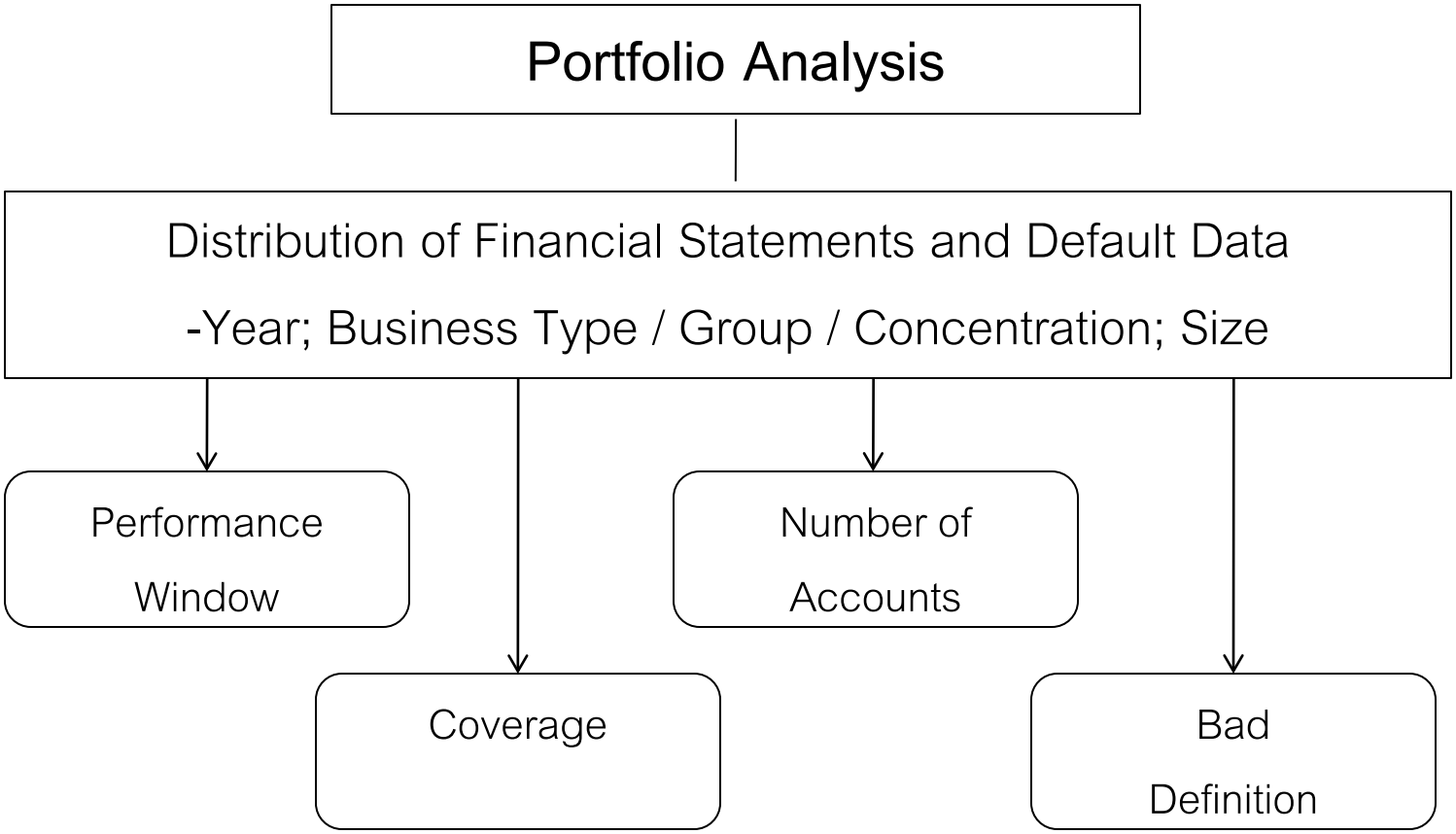
Borrowers and Factoring

(Accounts Receivable Financing)

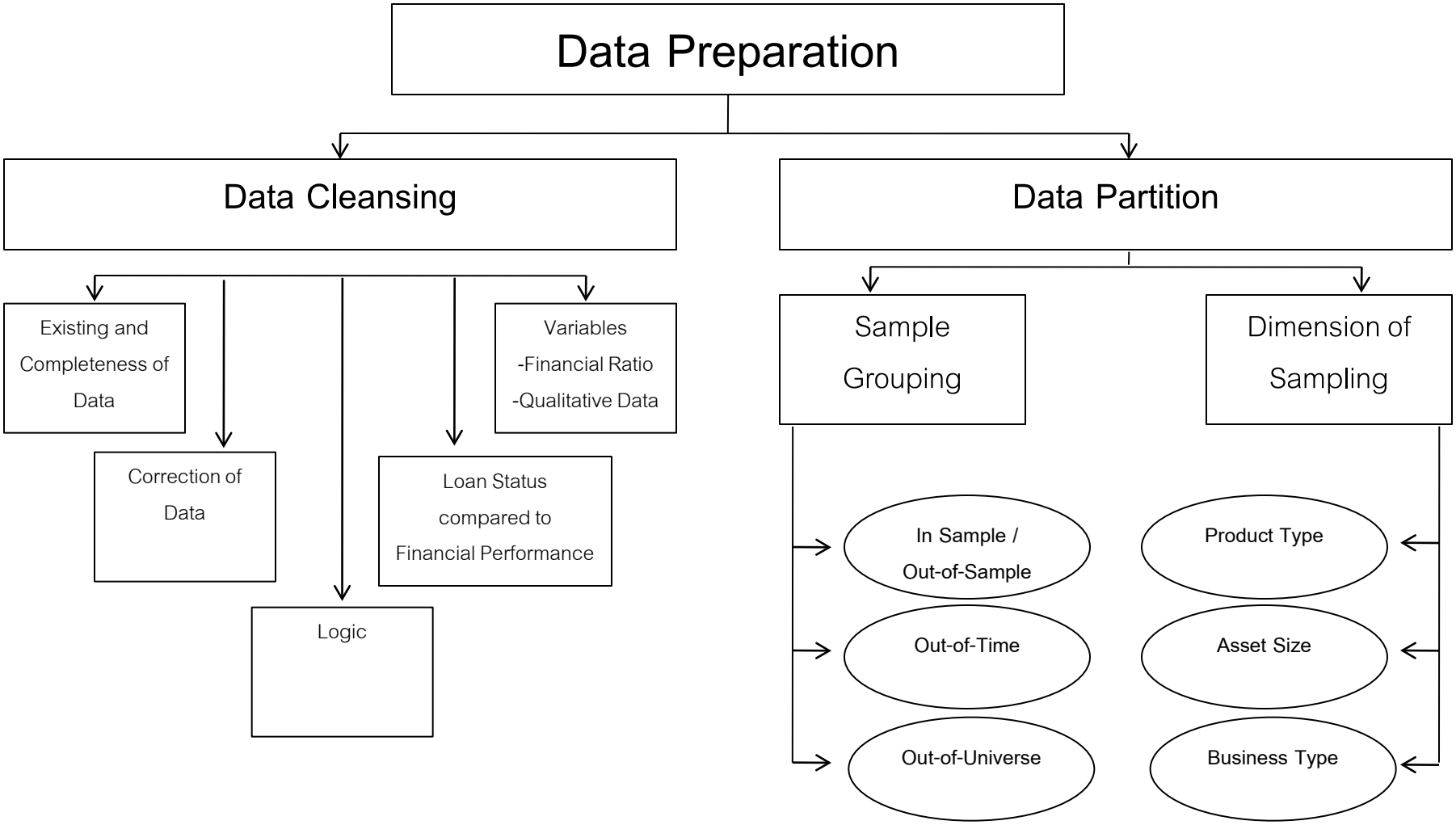
Credit Rating Model ….. (1)



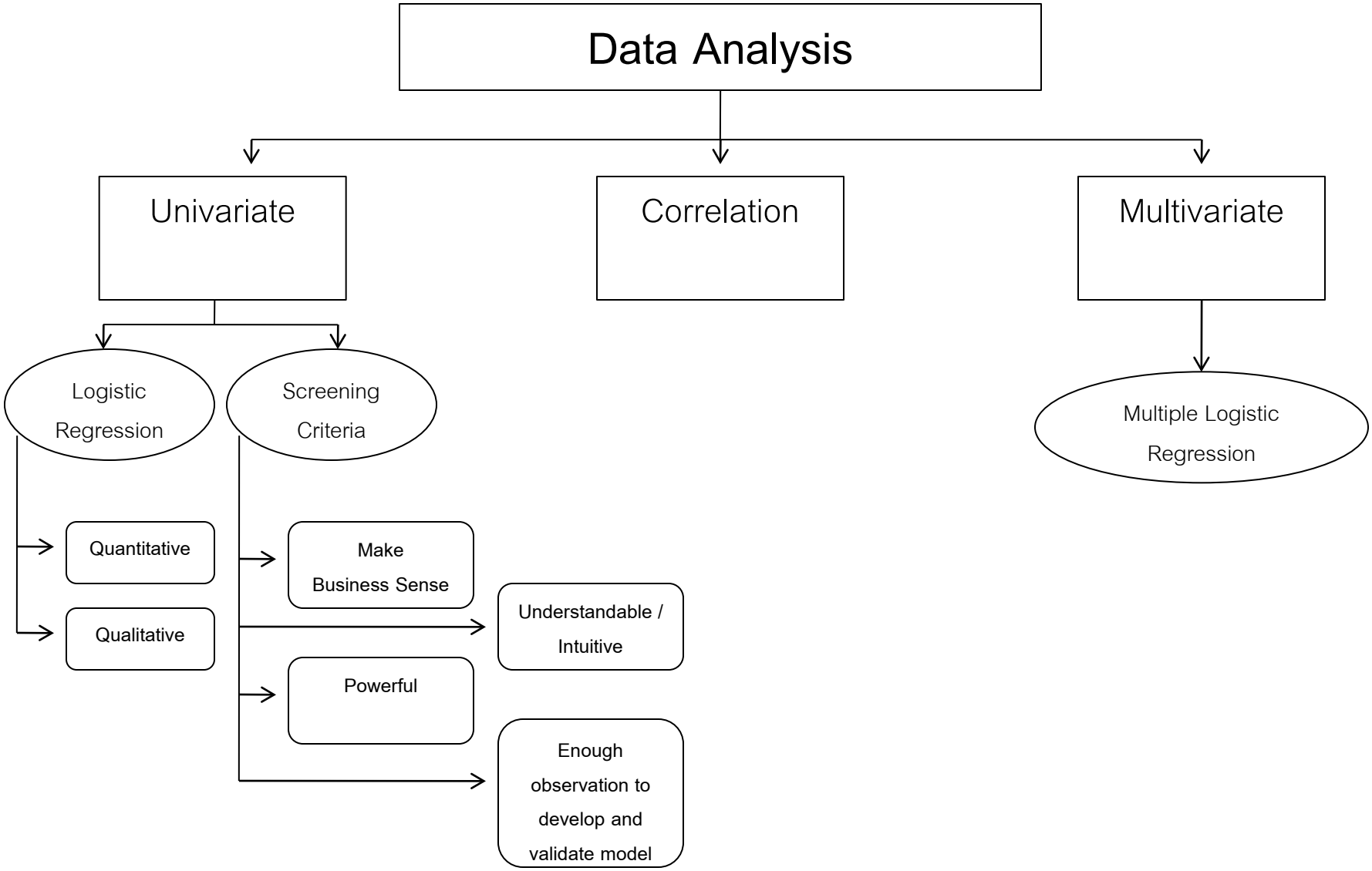
Credit Rating Model ….. (2)



Credit Rating Model ….. (3)



Credit Rating Model ….. (4)



Credit Rating Model ….. (5)

Performance Test

- Accuracy
- Blind Test

Confusion Table (Misclassification Table)

- Portfolio (884 cases)

In sample (619 cases)

Actual Status	Predicted Status		Total
	PL	NPL	
PL	479	99	578
NPL	6	35	41
Type I error		14.63%	
Type II error		17.13%	
Accuracy		84.12%	

Out-of-Sample (265 cases)

Actual Status	Predicted Status		Total
	PL	NPL	
PL	208	40	248
NPL	4	13	17
Type I error		23.53%	
Type II error		16.13%	
Accuracy		80.17%	

Out-of-time (20 cases)

Actual Status	Predicted Status		Total
	PL	NPL	
PL	9	11	20
NPL	0	0	0
Type I error		-	
Type II error		55.00%	
Accuracy		-	

Out-of-universe (165 cases: Asset size <= 10 MB)

Actual Status	Predicted Status		Total
	PL	NPL	
PL	120	40	160
NPL	3	2	5
Type I error		60.00%	
Type II error		25.00%	
Accuracy		57.50%	

Cut-off point = 4.55%

Prediction Result (Example)

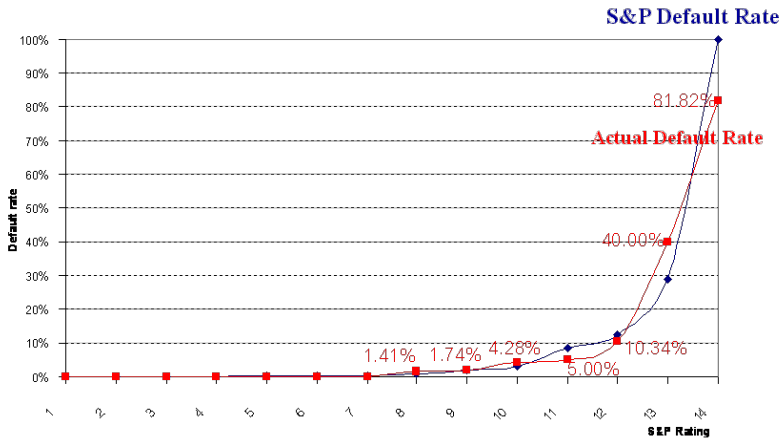
ชื่อกิจการ	ประเภท	ISIC	Loan St.	Model Score (%)	Loan St.2	Grade	Rating	P.D. (%)
	A/R	G การขายส่ง การขายปลีกฯ	PL	0.01	PL	1	AAA - AA	0.00
	A/R	I การขนส่ง สถานที่เก็บสินค้าฯ	PL	0.02	PL	2	AA-	0.02
	A/R	D การผลิต	PL	0.06	PL	4	A - A-	0.04
	A/R	G การขายส่ง การขายปลีกฯ	PL	0.06	PL	4	A - A-	0.04
	A/R	I การขนส่ง สถานที่เก็บสินค้าฯ	PL	0.09	PL	4	A - A-	0.04
	A/R	D การผลิต	PL	5.48%	NPL	10	B+	3.01
	A/R	G การขายส่ง การขายปลีกฯ	PL	5.54%	NPL	10	B+	3.01
	A/R	I การขนส่ง สถานที่เก็บสินค้าฯ	PL	5.56%	NPL	10	B+	3.01
	A/R	G การขายส่ง การขายปลีกฯ	PL	5.71%	NPL	11	B	8.34
	SME	G การขายส่ง การขายปลีกฯ	PL	5.72%	NPL	11	B	8.34
	A/R	G การขายส่ง การขายปลีกฯ	PL	5.75%	NPL	11	B	8.34
	B/R	G การขายส่ง การขายปลีกฯ	NPL	94.14	NPL	14	D	100
	B/R	G การขายส่ง การขายปลีกฯ	NPL	97.22	NPL	14	D	100
	Cor	I การขนส่ง สถานที่เก็บสินค้าฯ	NPL	97.54	NPL	14	D	100
	SME	G การขายส่ง การขายปลีกฯ	NPL	98.57	NPL	14	D	100
	SME	F การก่อสร้าง	NPL	98.96	NPL	14	D	100

Credit Rating Model ….. (6)

Calibration and Mapping

- Calibration
- Mapping

Calibration Curve



Calibration and Mapping Table

Risk Level	Loan Status	Rating	Default Rate	Proposed Rating	Avg. Def. Rate	Range Def. Rate	Grade	# Cases	% Conc.	# NPL	% Act. Def.
Low	Excellent	AAA	0.00%	AAA - AA	0.00%	0% - 0.01%	1	1	0.11%	0	0.00%
		AA+	0.00%								
		AA	0.00%								
	Very Good	AA-	0.02%	AA-	0.02%	0.0101% - 0.035%	2	1	0.11%	0	0.00%
		A+	0.05%	A+	0.05%	0.03501% - 0.045%	3	0	0.00%	0	0.00%
		A	0.04%	A - A-	0.04%	0.04501% - 0.145%	4	27	3.05%	0	0.00%
		A-	0.04%								
Acceptable	Good	BBB+	0.22%	BBB - BBB+	0.25%	0.14501% - 0.32%	5	73	8.26%	0	0.00%
		BBB	0.28%								
	Fair	BBB-	0.39%	BBB-	0.39%	0.03201% - 0.475%	6	62	7.01%	0	0.00%
	Accept	BB+	0.56%	BB+	0.56%	0.47501% - 0.755%	7	73	8.26%	0	0.00%
		BB	0.95%	BB	0.95%	0.75501% - 1.355%	8	142	16.06%	2	1.41%
		BB-	1.76%	BB-	1.76%	1.35501% - 2.385%	9	172	19.46%	3	1.74%

Credit Rating Model ….. (7)

Implementation Recommendation

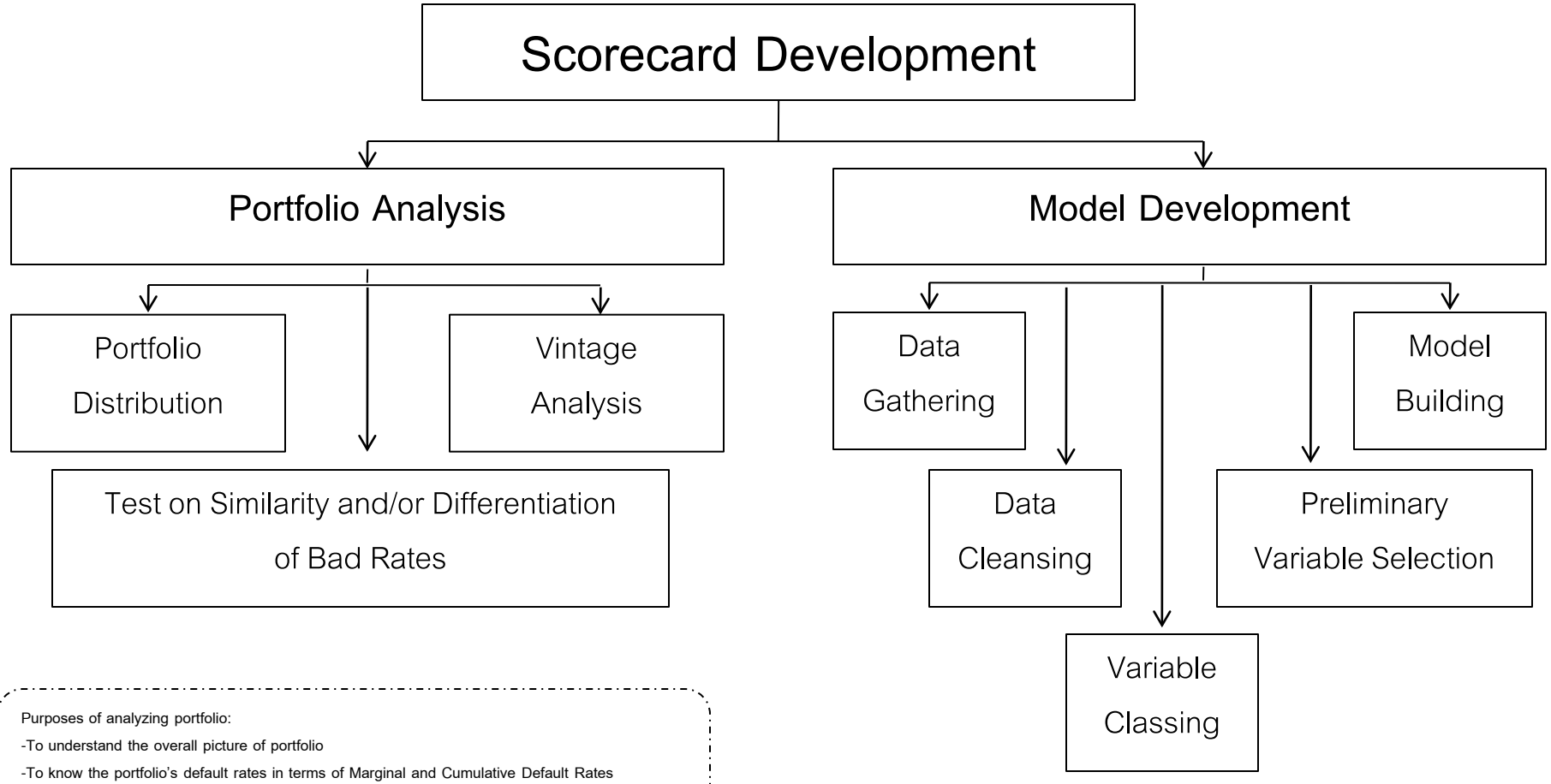
- One-year prediction model
- Require at least 2 Years financial statement (t and t-1) to calculate default probability
- Require annualized financial statement
- Require audited financial statement
- Concern the input of auditor change
- At the onset, model result should be used to supplement credit analysis in credit approval process
- For firm with an Asset size <= 10 MB, pay more attention on utilizing the model result

2nd Case Study

Credit Scoring Model

Automobile Leasing

Credit Scoring Model



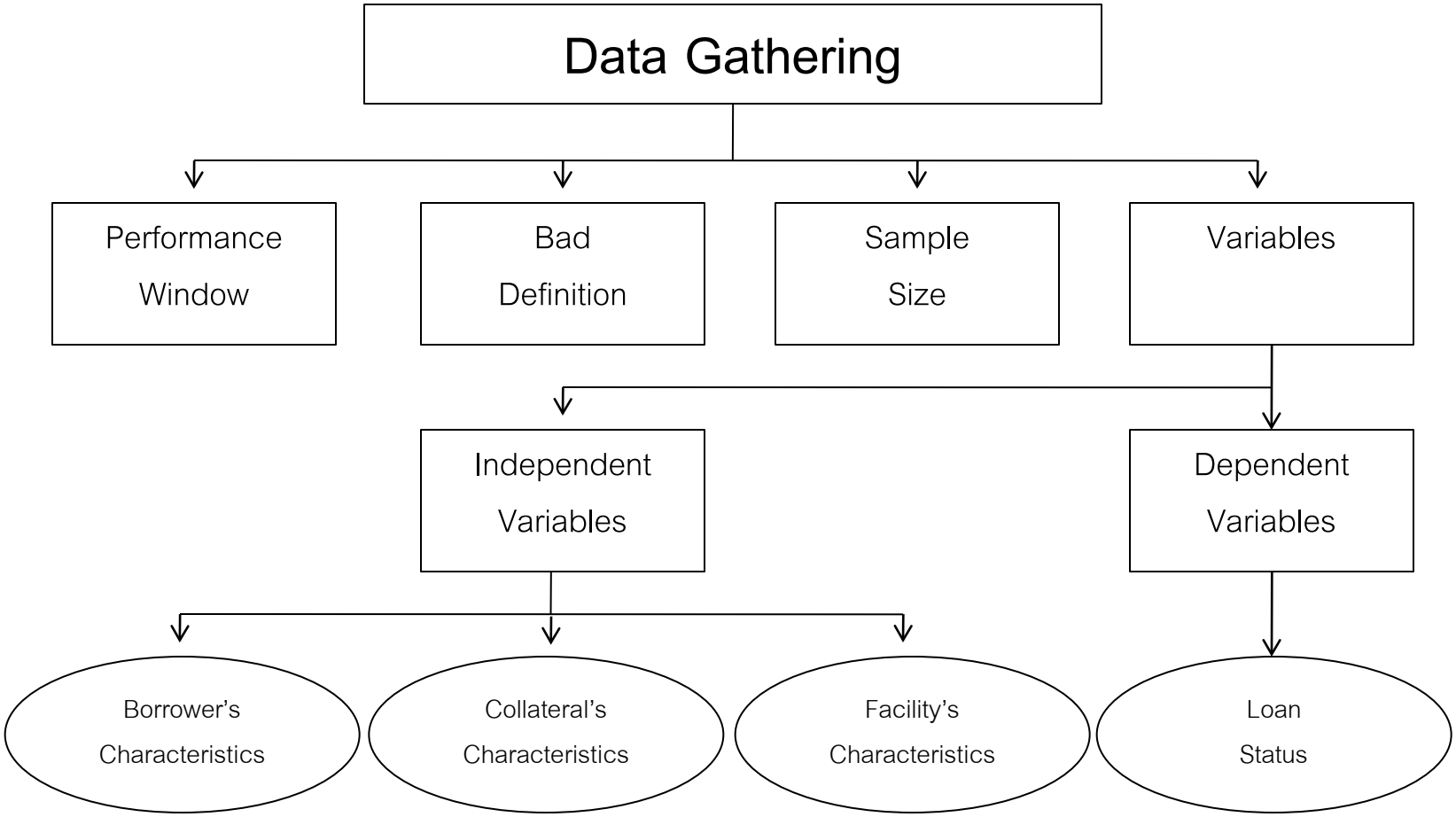
Purposes of analyzing portfolio:

-To understand the overall picture of portfolio

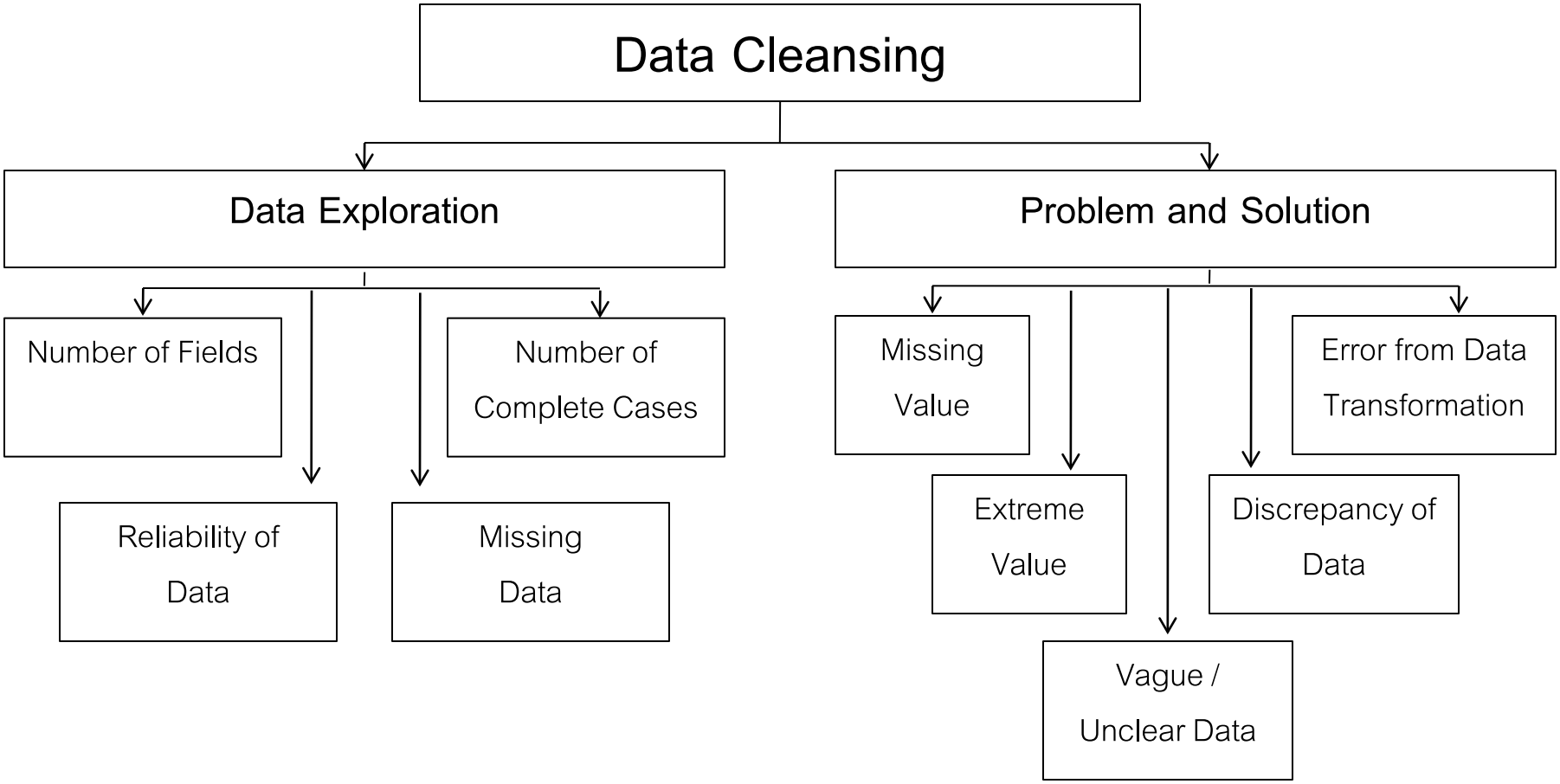
-To know the portfolio's default rates in terms of Marginal and Cumulative Default Rates

-To help set the sample group to be collected for model development

Model Development ….. (1)



Model Development ….. (2)



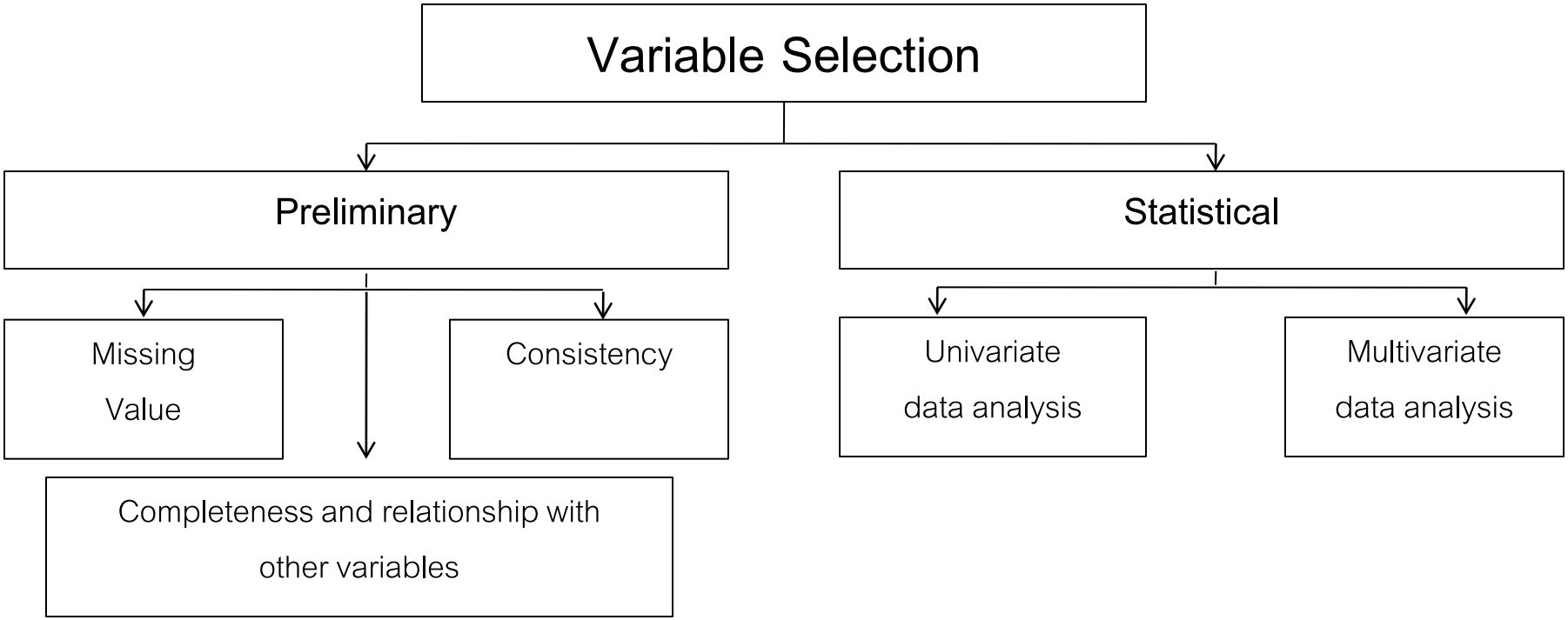
Model Development ….. (3)

Variable Classing

Classing is process of automatically and / or interactively binning and grouping interval, nominal, or ordinal input variables in order to

- Manage the number of attributes per characteristics
- Improve the predictive power of the characteristics
- Select predictive characteristics
- Make the Weight of Evidence – and thereby the number of points in the scorecard – vary smoothly or even linearly across the attributes

Model Development ….. (4)



Model Development ….. (5)

Model Building

Estimation Technique		
Categories	**Techniques**	**Algorithms**
Theory-driven (parametric)	Discriminant Analysis	Linear DA
	Regression	Logit, Probit
Data-driven (non-parametric)	Neural Networks	Multi-layer Propagation
	Decision Trees	Tree Creation

Why Logistic Regression!

-It can handle discrete variable or qualitative variable.

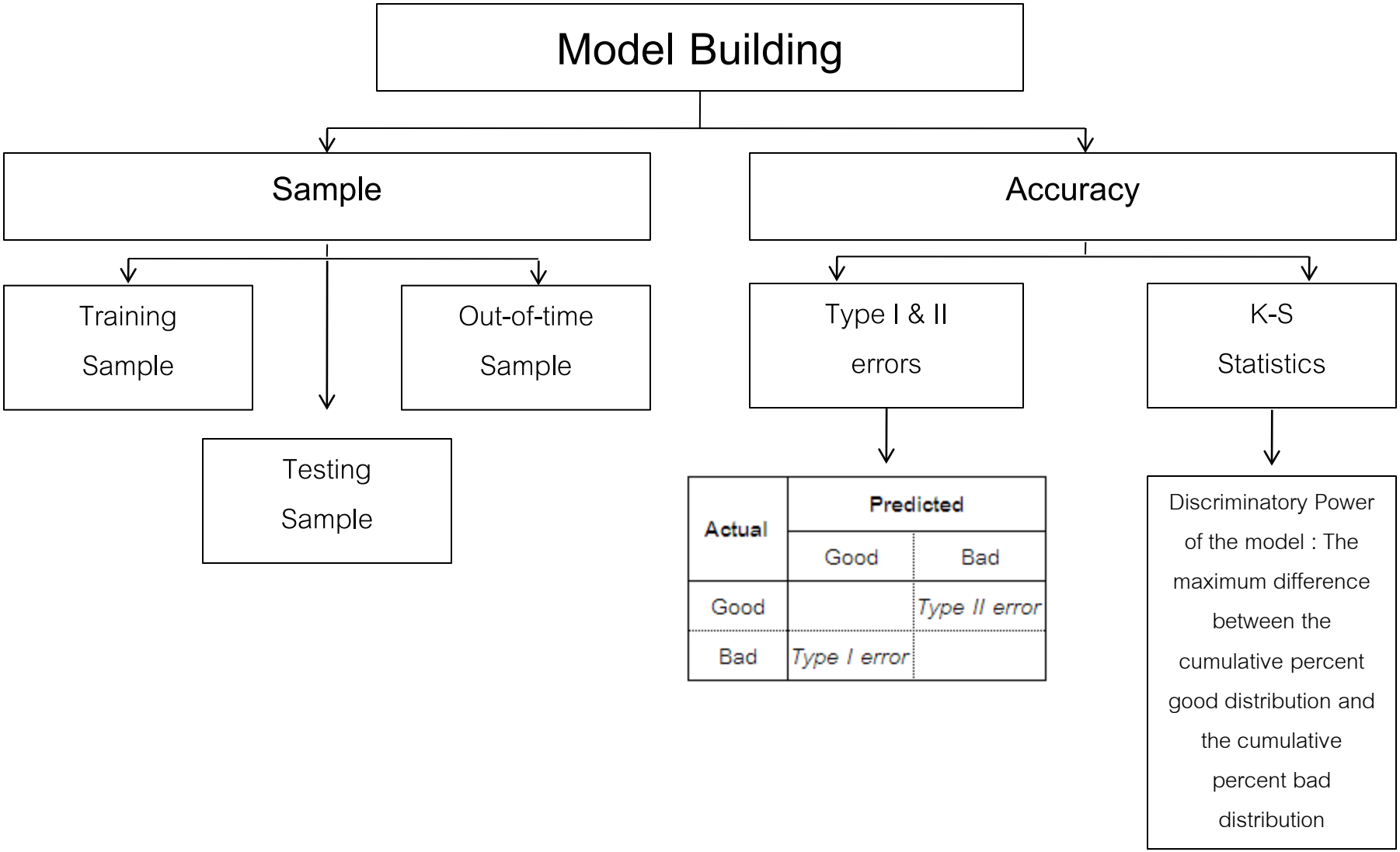
-The dependent variable need not to be normally distributed.

-The dependent variable need not to be homoscedastic for each level of the independents.

-Normally distributed error terms are not assumed.

-It does not require that the independents be interval.

Model Development ….. (6)



Model Development ….. (7)

Criteria for Model Selection

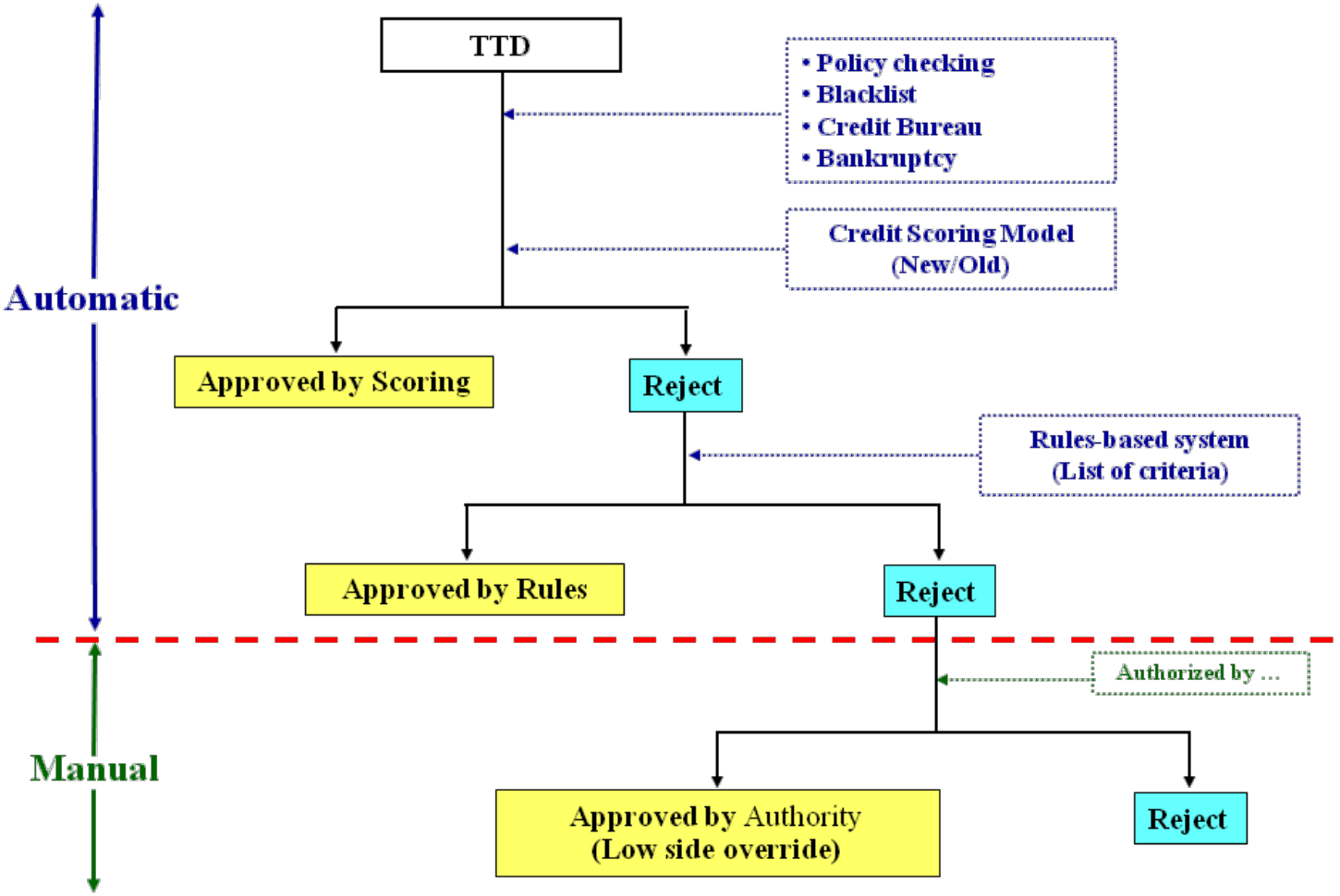
- Accuracy : Type I & II errors; K-S statistics
- Consistency of testing results among Training, Testing and Out-of-time Samples
- Number of Variables in the model
- Including or excluding Policy Indicators in the model

Example of Gain Table

Score Range	Count	Cum. Count	# G	Cum G.	# B	Cum B.	Marg. Bad Rate	Cum. Bad Rate	App. Rate	Type I	Type II	Acc	K-S
1 > 1000	38	38	38	38	0	0	0.00	0.00	0.33	0.00	99.66	50.17	0.34
2 965.01 – 1000	31	69	31	69	0	0	0.00	0.00	0.59	0.00	99.39	50.31	0.61
3 930.01 – 965	128	197	128	197	0	0	0.00	0.00	1.69	0.00	98.25	50.87	1.75
4 895.01 – 930	677	874	675	872	2	2	0.30	0.23	7.50	0.53	92.26	53.60	7.21
5 860.01 – 895	1030	1904	1027	1899	3	5	0.29	0.26	16.34	1.32	83.15	57.76	15.52
6 825.01 – 860	875	2779	872	2771	3	8	0.34	0.29	23.85	2.12	75.42	61.23	22.47
7 790.01 – 825	1564	4343	1548	4319	16	24	1.02	0.55	37.28	6.35	61.68	65.98	31.97
8 755.01 – 790	2109	6452	2078	6397	31	55	1.47	0.85	55.38	14.55	43.25	71.10	42.20
9 720.01 – 755	979	7431	958	7355	21	76	2.15	1.02	63.79	20.11	34.75	72.57	45.14
10 685.01 – 720	1680	9111	1621	8976	59	135	3.51	1.48	78.21	35.71	20.37	71.96	43.92
11 650.01 – 685	1194	10305	1124	10100	70	205	5.86	1.99	88.45	54.23	10.40	67.68	35.37
12 615.01 – 650	793	11098	711	10811	82	287	10.34	2.59	95.26	75.93	4.09	59.99	19.98
13 580.01 – 615	535	11633	448	11259	87	374	16.26	3.21	99.85	98.94	0.12	50.47	0.94
14 <= 580	17	11650	13	11272	4	378	23.53	3.24	100.00	100.00	0.00	50.00	0.00

Model Development ….. (8)

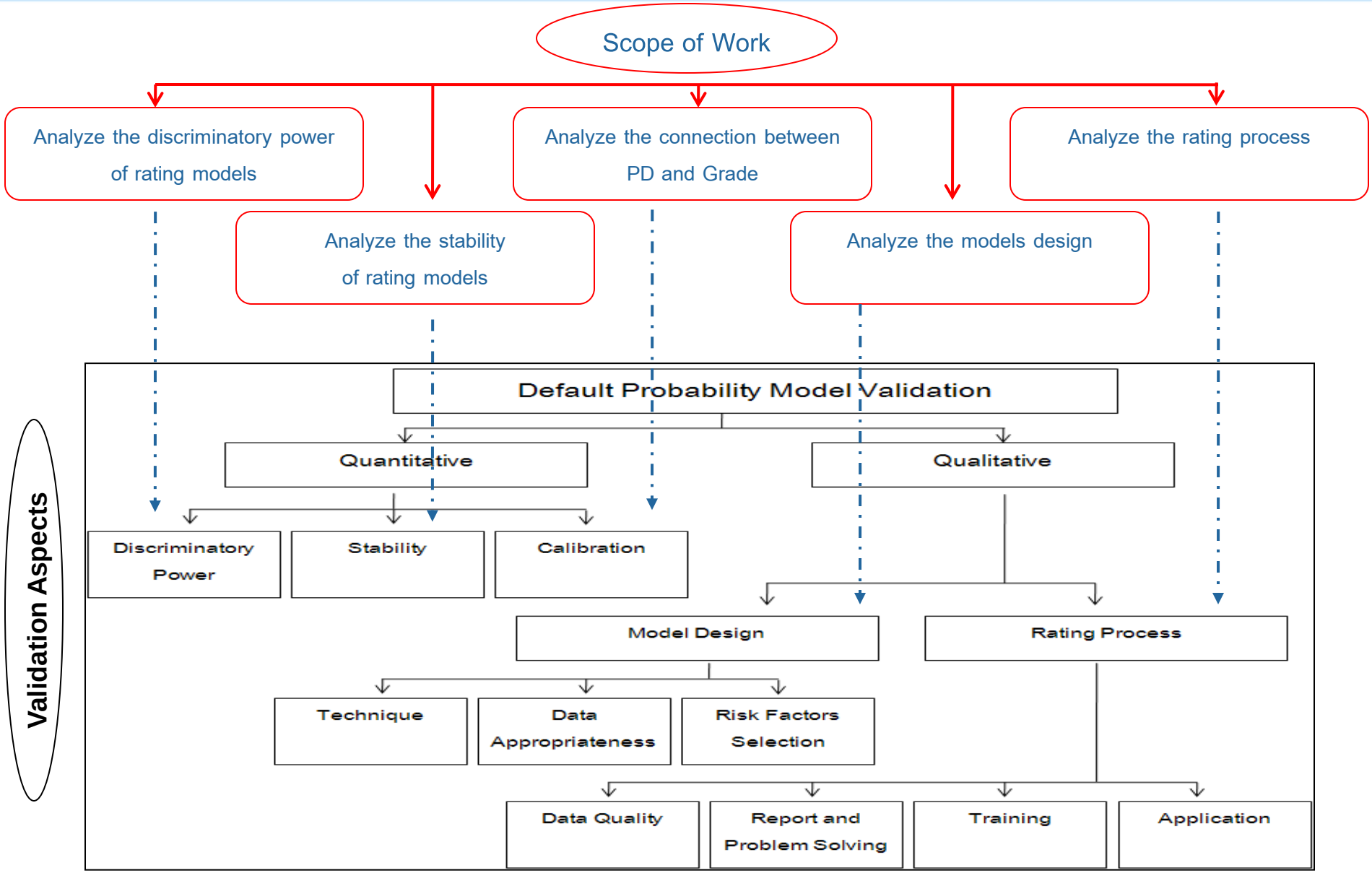
Scorecard Implementation and Application



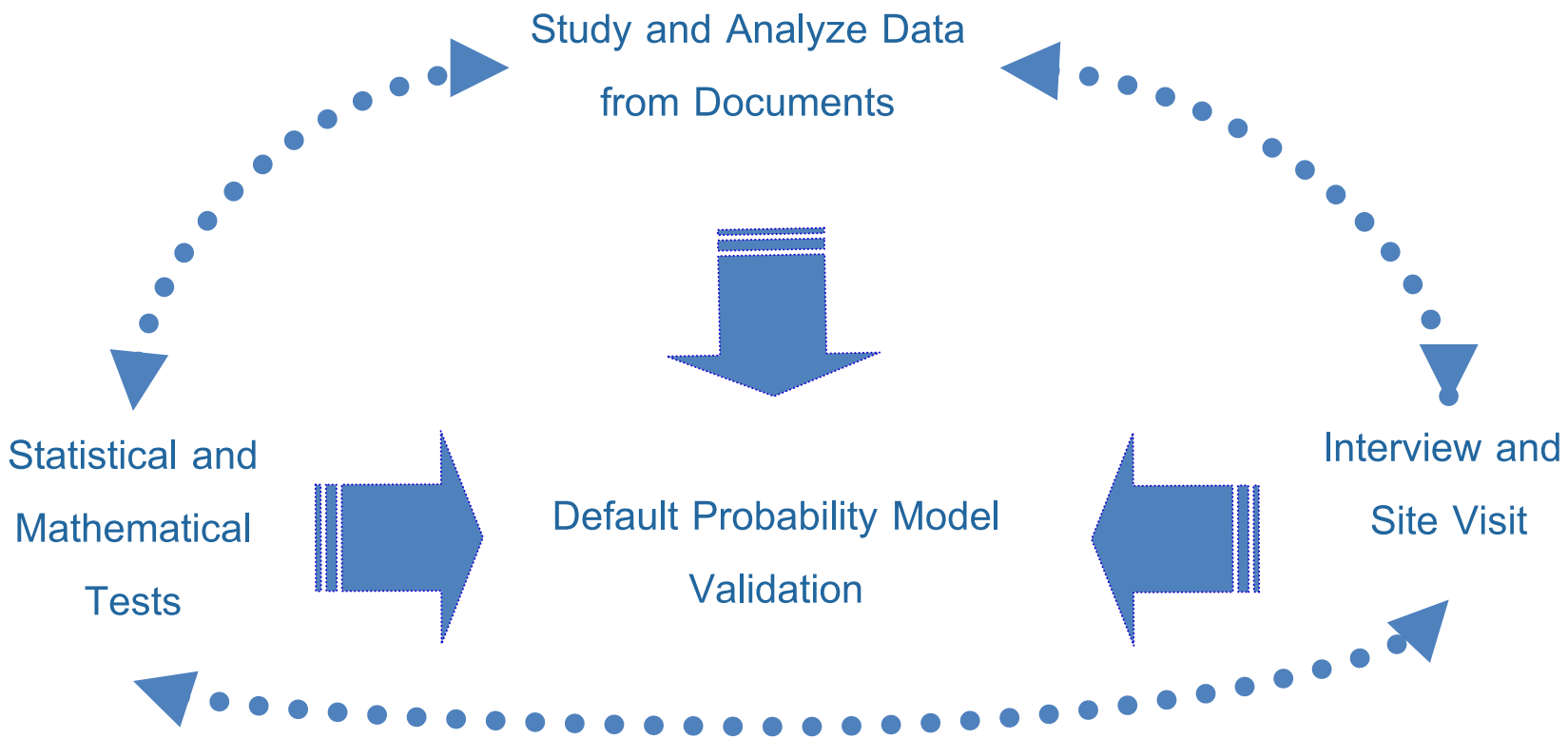
3rd Case Study

The Validation of Internal Rating Systems

Scope of Work and Validation Aspects



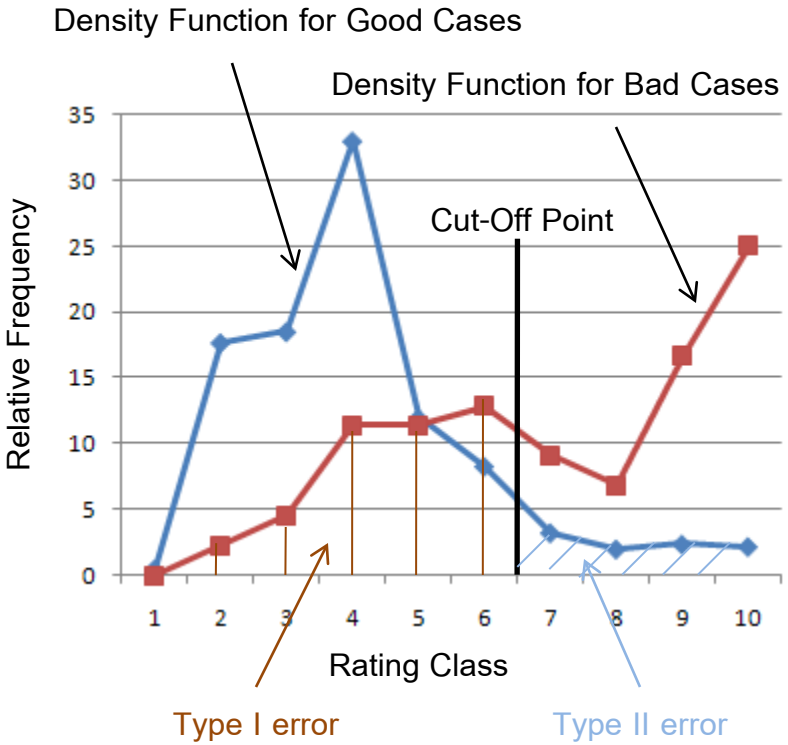
Validation Method



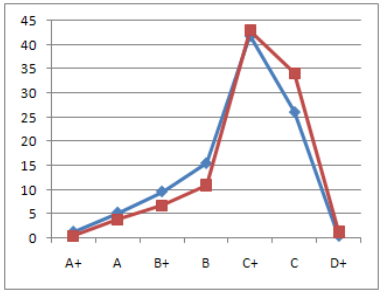
Validation Results

Quantitative : Discriminatory Power

Type I & II errors in theory

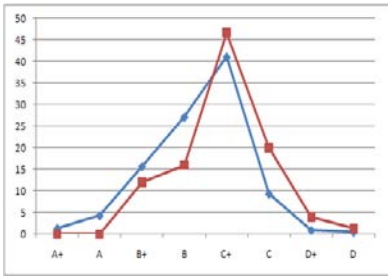


Type I error of each model

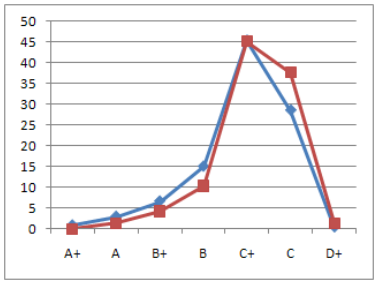


Project Financing <15M;

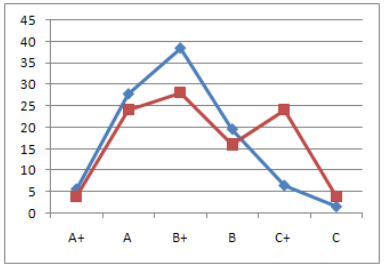
Hire Purchase; Leasing



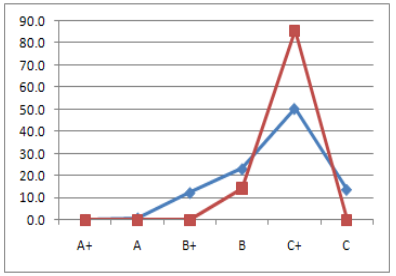
Project Financing >= 15M



Project Financing <15M



Hire Purchase and Leasing



Factoring

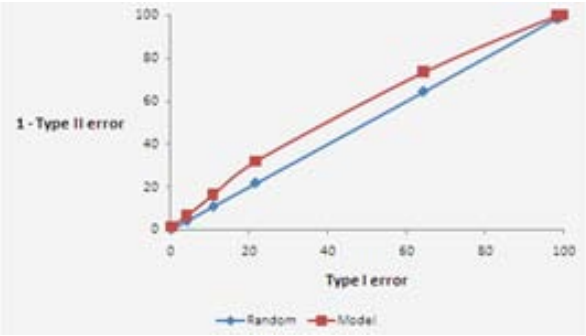
Validation Results

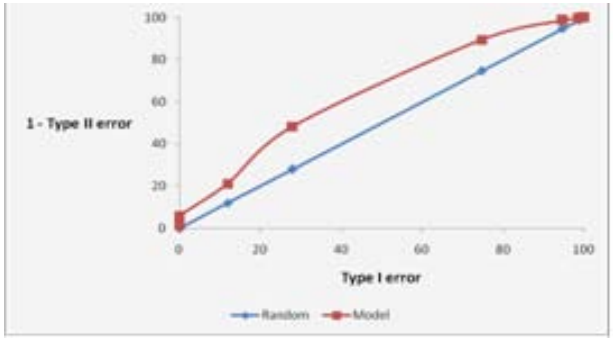
Quantitative : Discriminatory Power (ROC Curve)

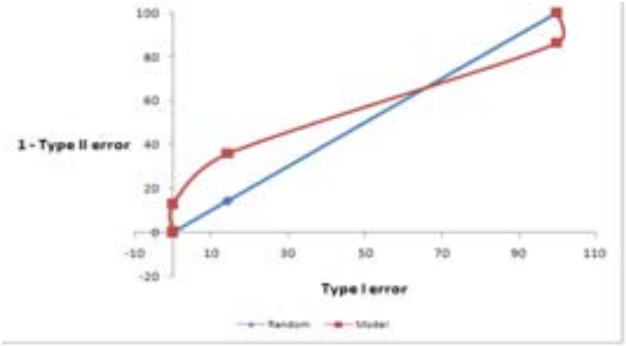
Project Financing < 15M;
Hire Purchase; Leasing

Project Financing >= 15M

Factoring







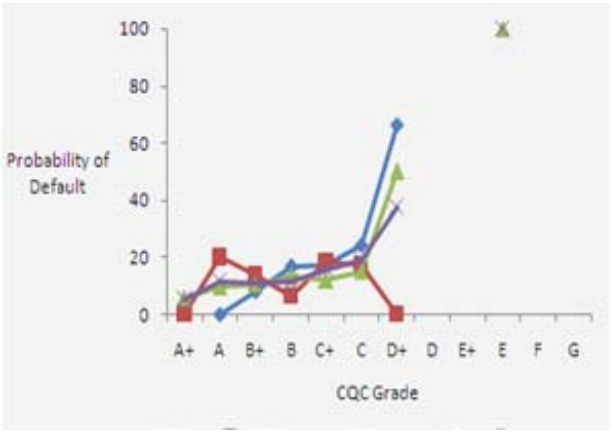
Validation Results

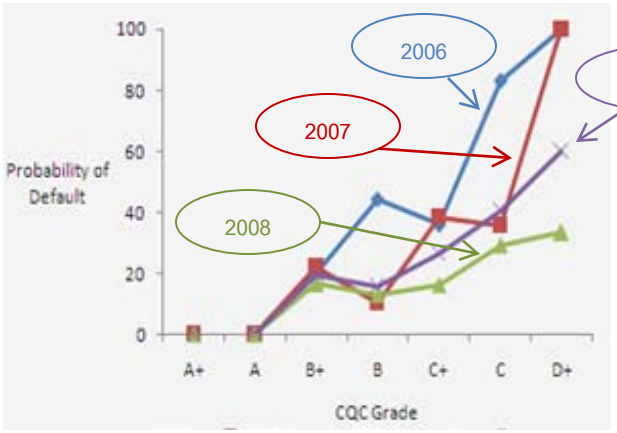
Quantitative : Stability

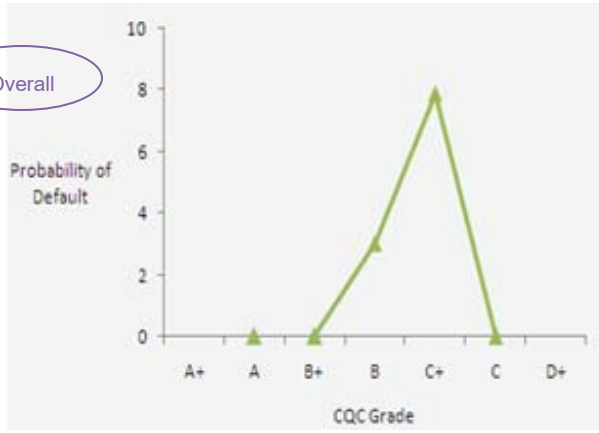
Project Financing < 15M;
Hire Purchase; Leasing

Project Financing >= 15M

Factoring



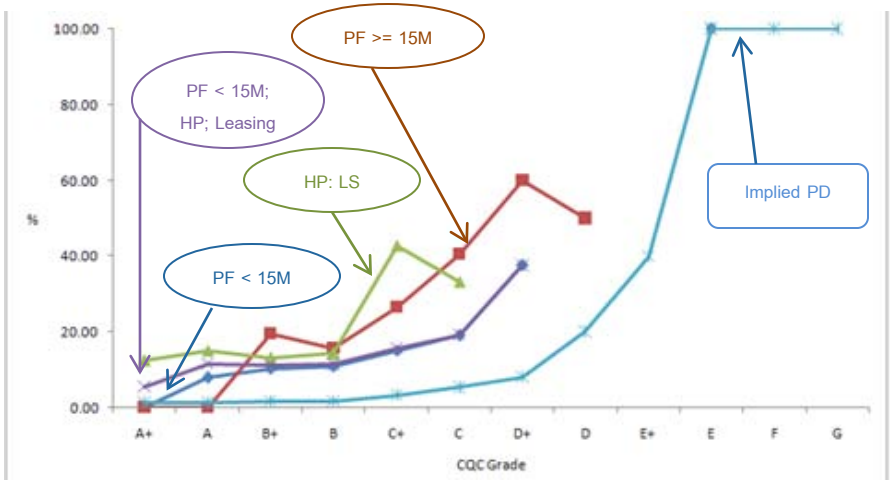


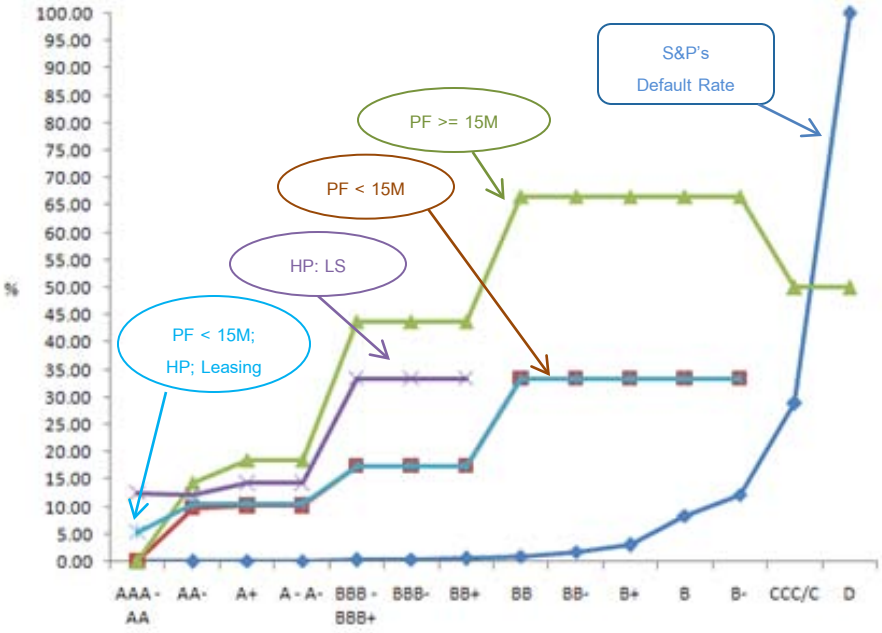


% PD from Actual Default Rate : ADR (%)

Validation Results

Quantitative : Calibration





Actual Default Rate (%) of each model compared to Implied PD (%) by CQC Grade

Actual Default Rate (%) of each model compared to S&P's Default Rate by Rating

Executive Summary

Conclusion :	
Rationale	
Quantitative	**Results**
Discriminatory Power	
Stability	
Calibration	
Qualitative	**Results**
Model Design	
Data Appropriateness	
Risk Factor Selection	
Technique	
Rating Process	
Training	
Application	
Data Quality	
Report and Problem Solving	

Remark :

Credit Risk Model ….. (1)

What is Credit Risk Model?

- A tool used to evaluate the level of risk associated with applicants or borrowers.
- It consists of a group of characteristics, statistically determined to be predictive in separating “good” and “bad” accounts.
- It provides statistically odds or probability that an applicant or borrower with any given rating or score will be “good” or “bad”.

What Properties to be expected!

- Understandable
- Powerful
- Calibrated
- Empirically validated

Credit Risk Model ….. (2)

Application

❖ *Origination Decisions*

- Given the risk and a fixed price, is the asset worth taking?
- Given the risk, what price is required to make the asset worth buying?

❖ *Portfolio Optimization*

- To reduce the portfolio's risk, concentrations of risk and how the risk can be diversified must be known.

❖ *Capital Management*

- To set capital, the loss level is needed.

❖ *Credit Process Management*

- To gain the efficiencies of application processing that comes through automation.
- To gain control and consistency in lending practices for the entire credit portfolio.
- To identify the variables which are important in the credit evaluation process
- To improve delinquency statistics while maintaining desired approval rates

Credit Risk Model ….. (3)

Credit Risk Model

only classifies and predicts risk;

It does not tell the lender

how to manage it.


Thank You
WMSL
Professional Best