Introduction to Credit Risk Modelling

Credit Scoring & Credit Control XVI
Pre-conference workshop

Dr Galina Andreeva, Galina.Andreeva@ed.ac.uk

Outline

The workshop is an introduction for complete novices, newcomers to the field of credit scoring or people with limited experience. It covers the basic principles and standard methodology of scorecard development.

1. Concepts, principles and objectives
2. What is needed
3. Stages in credit model (scorecard) development
   - Characteristics transformation
   - Modelling algorithms
     - Logistic regression
   - Measuring predictive accuracy.
4. Where to find more information.

What is credit scoring?

Decision support systems used in consumer credit

Aims at risk assessment of potential borrowers (application scoring) and existing borrowers (behavioural scoring)

Risk/ creditworthiness is usually measured by default probability

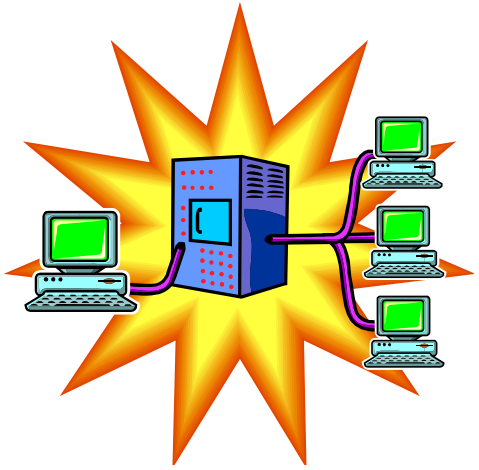
Default probability is predicted from observed borrower's characteristics on the basis of the analysis of known performance of previous customers.

Relationship v transactional lending

40-50 years ago – relationship lending

- Judgmental assessment based on 3(5) Cs (Character, Capacity, Collateral + Capital, Conditions)
- Very slow, subjective, often inconsistent

Now – transactional lending



- Automated impersonal decisions
- Quick and consistent
- Huge volumes of unsecured lending

The Basic Idea

Need the data on characteristics and performance of previous borrowers

Assign points to each category of borrowers' characteristic so that they reflect the level of risk of this category

For a new borrower, sum all the points over the relevant categories of all characteristics $\longrightarrow$ get an overall score – a summary of this borrower's creditworthiness.

UNIVERSITY OF EDINBURGH
Business School

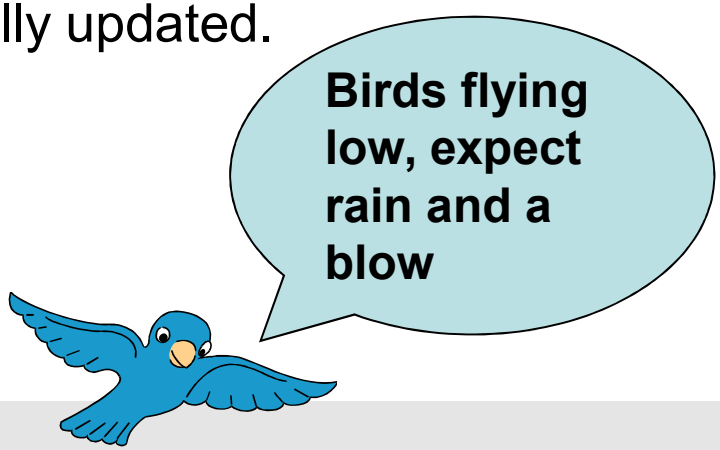
Example of a scoring table (part)

Time at current address	Less than 6 months	6m – 2 years	2 – 6 years	6 - 10 years	10 + years	Unknown	
	0	3	6	13	25	0	
Resi-dential Status	Owner	Tenant	With parents	Unknown			
	15	5	2	0			
Banking	Current account	Saving account	Current and saving	No account	Unknown		
	5	10	14	0	0		
Occupa-tion	Retired	Full-time	Part-time	Self-employed	Student	Other	Un-known
	21	16	7	6	5	10	0
Age	18-25	26-31	32-40	41-54	55+	Unknown	
	5	10	15	20	25	0	

Adapted from Lewis M. (1992) *An Introduction to Credit Scoring*, FICO: San Rafael, CA

Assumptions and general principles

- "Future is going to be like the past"
- Scoring models are based on associations / correlations, they are not causal models
  - It is predictive not explanatory.
  - Anything that helps predict can be used (but there is still a desire to understand risk drivers).
- It has to interact easily with organisations information system.
  - So variables that can be used must be easily and cheaply obtained and automatically updated.



Credit risk approaches

Lending to individuals

-Relatively small amounts of money lent to a large number of customers

- focus more on prediction, less on causality

-Management Science and Data Mining

- limited research and a few textbooks

Lending to businesses

-Large amounts of money lent to a relatively small number of businesses

- focus more on causality, less on prediction

- Finance and Accounting

- extensive research, loads of textbooks

What is scoring used for

New customers (application scoring):

- who is likely to default?
- who is likely to respond?
- who is likely to use the product?
- who is likely to switch to a competitor?

Existing customers (behavioural):

- shall we increase a credit limit?
- can we cross-sell other products?

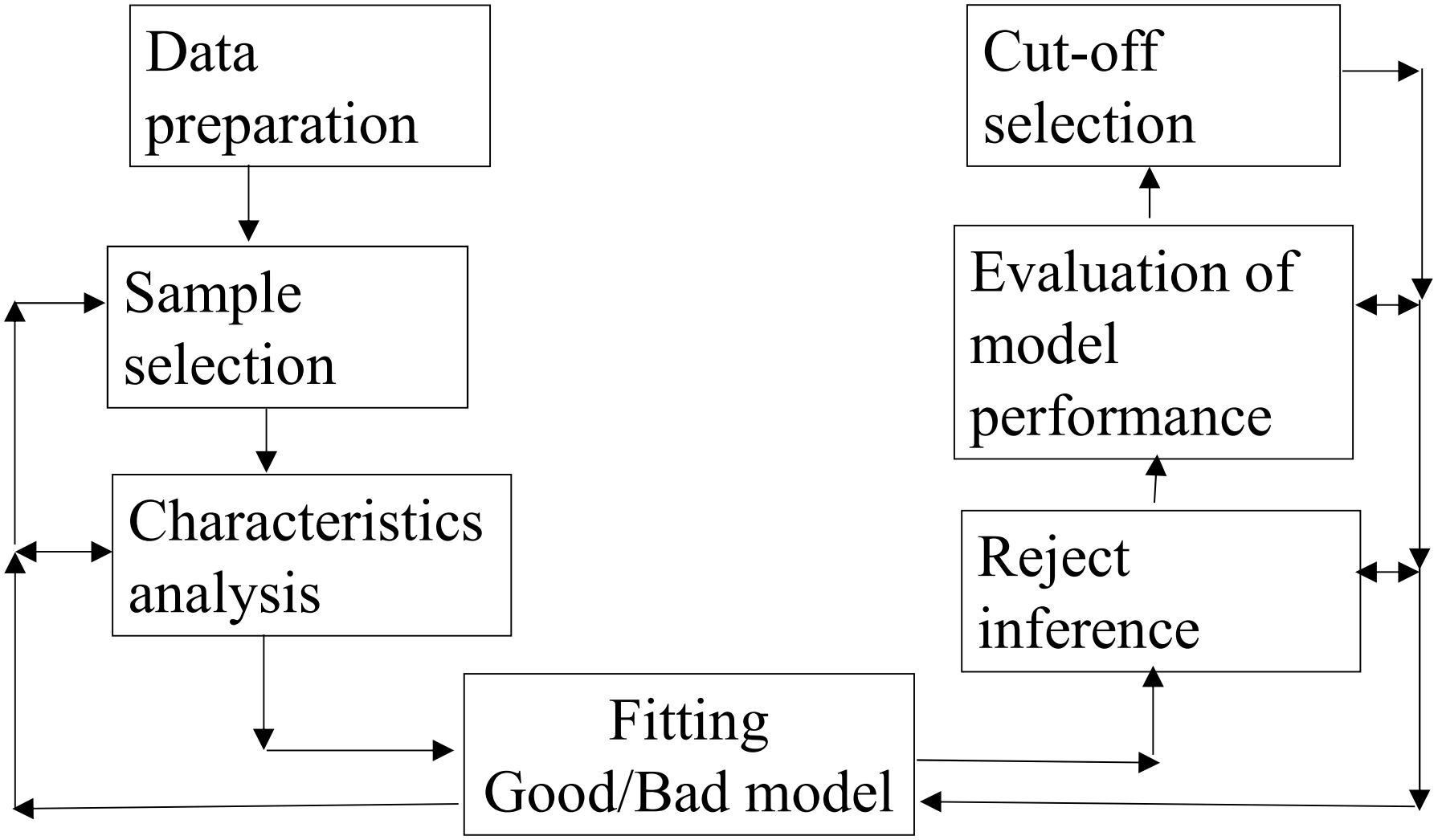
Problem customers (collections):

- shall we sell the debt off?
- if not, what method of contacting to be used?

Newer Uses:

- Risk-based pricing
- Securitisation
- Profit Scoring
- Customer Scoring
- Capital Adequacy (Basel New Accord)
- IFRS9

Process of scorecard development



Classification methods

Statistical

- Discriminant analysis (DA or LDA),
- Linear regression (LR),
- Logistic regression (LogR),
- Nearest-neighbours approach (k-NN),
- Classification trees.

Machine-Learning

- Support Vector Machines (SVM),
- Neural networks (NN),
- Genetic algorithms,
- Random Forests,

the list is not exhaustive…

Measures of predictive accuracy

- Kolmogorov-Smirnov (K-S) statistic
- Area under the ROC curve (AUROC)
  - Gini coefficient
- Error rate
- Bad rate.

Books on credit scoring

Thomas, L., Edelman, D. and Crook, J. (2017) *Credit Scoring and its Applications*, 2nd ed, SIAM: Philadelphia.

Anderson, R. (2007) *The Credit Scoring Toolkit*. Oxford University Press: Oxford.

Crook, J., Edelman, D. and Thomas, L. (2007) 'Recent Developments in Consumer Risk Assessment' *European Journal of Operational Research*. Vol. 183, No. 3, pp.1447-1465.

Mays, E. (2001) *Handbook of Credit Scoring*. Glenlake: London.

Siddiqi, N. (2006) Credit risk scorecards : developing and implementing intelligent credit scoring. Wiley: New Jersey.

Thomas, L. (2009) *Consumer Credit Models*. Oxford University Press: Oxford.

Thomas, L., Edelman, D. and Crook, J. (2004) *Readings in Credit Scoring*. Oxford University Press: Oxford.

Van Gestel, T. and Baesens, B. (2009) *Credit Risk Management*. Oxford University Press: Oxford.

Selected References

Baesens, B., Van Gestel, T., Viaene, S., Stepanova, M., Suykens, J., Vanthienen, J. (2003) Benchmarking state-of-the-art classification algorithms for credit scoring, *Journal of the Operational Research Society* 54, 627-635

Boyle, M., Crook, J.N., Hamilton, R., and Thomas, L.C. (1992) Methods for credit scoring applied to slow payers, in *Credit Scoring and Credit Control*, ed. Thomas, L. C., Crook, J. N., and Edelman, D. B., (2002) Oxford University Press, Oxford

Desai, V.S., Conway, D.G., Crook, J.N., and Overstreet, G.A.J. (1997) Credit-scoring models in the credit-union environment using neural networks and genetic algorithms, *IMA Journal of Mathematics Applied in Business & Industry*, 8, 323 – 346

Henley, W.E. (1995) *Statistical aspects of credit scoring*. PhD thesis, Open University, Milton Keynes, UK

Srinivasan, V. and Kim, Y.H. (1987) Credit granting: a comparative analysis of classification procedures, *The Journal of Finance*, 42, 665 – 683

Yobas, M.B., Crook, J.N., and Ross, P. (1997) Credit scoring using neural and evolutionary techniques, in *Readings in Credit Scoring*, ed. Thomas, L. C., Crook, J. N., and Edelman, D. B., (2004) Oxford University Press, Oxford.