

Logit models

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Reduced-form models

- Numerous approaches exist to model the probability of default of a firm:
 - logit models: Westgaard & Wijst (2001)
 - probit models: Skogsvik (1990)
 - survival analysis: Luoma & Laitinen (1991)
 - machine learning: Boritz & Kennedy (1995)
 - multicriteria decision analysis (MCDA): Zopounidis & Doumpos (2002)

Logit model

- Traditional methods, especially those based on the **logit** model, are still preferred by professionals in the field.
- In the context of credit risk, a logit model provides a linear combination of independent variables x_1, x_2, \dots, x_n to estimate the likelihood p of a firm to default:

$$p = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n)}}$$

- A **cutoff** point, e.g. $p > 0.5$, is a threshold separating groups (solvent / insolvent):
 - if $p > 0.5$, the firm is assigned to the group of 'not defaulted'.

Selection of independent variables

- Companies need to be separated in two groups:
 - defaulted companies:
 - * legal situation (court proceedings - chap 7 in the USA)
 - * net negative worth (technical bankruptcy - chap 11)
 - not defaulted companies
- Explanatory variables x include financial and accounting ratios reflecting:
 - **liquidity**, .e.g. current ratio
 - **solvency**, .e.g. solvency ratio, debt to equity ratio, equity ratio, debt ratio
 - **profitability**, e.g. gross profit margin, ebitda margin, operating profit, . . .
 - **financial structure**, e.g. ROA, ROE, . . .

Selection of independent variables

- Factor analysis are carried out to reduce the number of accounting ratio and avoid multicollinearity
 - PCA (often using Kaiser criterion)
 - **Step-wise regression** (Wald forward method) to determine which subset of variables to include.

Robustness problems:

- choice of variables used in the model
- sample used:
 - Balanced samples of solvent / insolvent firms
- cutoff points:
 - Consideration of various cut-off points, .e.g. $p \in [0.2; 0.5]$