ESTIMATION OF A CREDIT SCORING MODEL FOR LENDERS COMPANY

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Final Presentation Research Practise 3

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November 24 2015

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The Company

- Equity Firm
- Different Branches
- Mortgage Loans
- Midtown $\neq$ Linkvest
- Loans Money
- High interest

Brief Explanation

1. People ask for a loan.
2. Linkvest analyze the background.
3. Make decisions based on experience.
4. Lend money.
5. **Faith.**

Literature Review

- Credit Scoring [Cantón, Rubio, & Blasco, 2010] [Hand & Henley, 1997]
- Discriminant Analysis [Altman, 1968].
- Linear Probability Models [Orgler, 1970].
- Logit Models [Wiginton, 1980].
- Neural Networks [Rosenberg & Gleit, 1994].

The model

The logistic regression model [Cantón et al., 2010] can be formulated as

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \mu$$

where μ is the disturbance and p is the probability of default [Hand & Henley, 1997] and can be estimated as follows

$$p = \frac{e^z}{1 + e^z} = \frac{1}{1 + e^{-z}} \tag{1}$$

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The model

Then, using (1) our response is going to be

$$Default = \log\left(\frac{p}{1-p}\right)$$

This response is going to give us a number near to 0 or 1, 0 for no paying and 1 for paying [Orgler, 1970].

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General objective

- Estimate a credit score model to improve lending decisions on a person using historical data

Specific objectives

- Analyze the best model to improve in our case based in the data
- Identify the most influential variables for the company when lending money [Altman, 1968]
- Specify the model in mathematical terms
- Estimate the probabilities of default
- Analyze the results for decision making

$$Z = \Sigma \Psi$$

where

$$\Sigma = [\beta_0 \quad \beta_1 \quad \cdots \quad \beta_{28}] \qquad \Psi = \begin{bmatrix} 1 \\ V_1 \\ V_2 \\ \vdots \\ V_{27} \end{bmatrix}$$

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Variables

V_1 Amount

V_2 Interest

V_3 Months*

V_4 Age*

V_5 Years school*

V_6 Married*

V_7 Dependents*

V_8 Home*

V_9 Employment*

V_{10} Income*

V_{11} Expense*

V_{12} Cash

V_{13} Assets

V_{14} Questions
($V_{14}, V_{15}, \ldots, V_{25}$)

V_{26} Ethnicity*

V_{27} Gender*

Estimation

$$\widehat{\Sigma'} = \begin{bmatrix} -18.42007(0.0433) \\ 0.02773(0.0216) \\ 0.02606(0.0234) \\ 0.00793(0.0034) \\ -0.16936(0.0123) \\ -0.14049(0.0399) \\ 0.75352(0.0012) \\ -0.73294(0.0016) \\ -0.00029(0.0273) \\ 0.00012(0.0145) \\ 0.39758(0.0043) \\ -0.136413(0.0023) \end{bmatrix} \qquad \widehat{\Psi} = \begin{bmatrix} 1 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \\ V_7 \\ V_8 \\ V_9 \\ V_{10} \\ V_{11} \\ V_{26} \\ V_{27} \end{bmatrix}$$

Estimation

Only those 12 variables were statistically significant, so the other ones does not represent the model because at a significant value of 5% they are not explaining the model.

Simulation exercise

Estimated probability	Real response
0.8754	0
0.9347	0
0.2365	1
0.7912	0
0.7890	0
0.0012	1
0.0233	1
0.3134	0
0.9899	0
0.4679	1

Table : Calculated probability of default and if the individual paid or not.
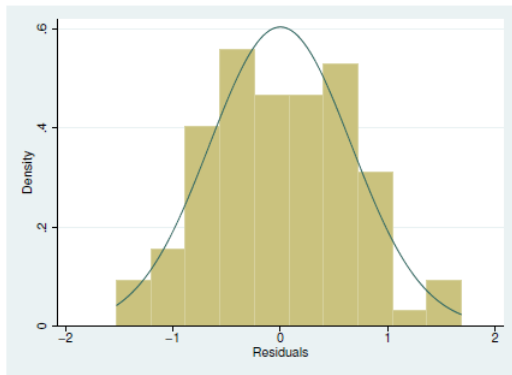
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Basic assumptions

Figure : Residuals with normal distribution

Basic assumptions
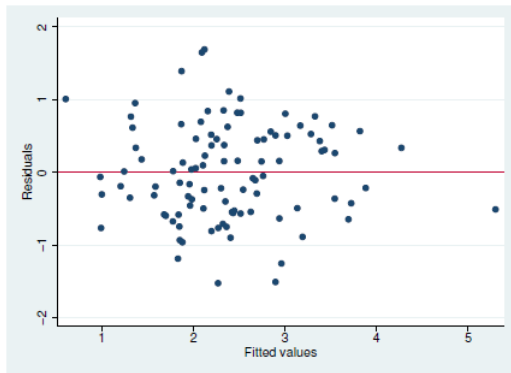
Figure : Residuals vs estimated values

Basic assumptions

Source	chi2	df	p
Heteroskedasticity	15.77	17	0.5400
Skewness	10.30	5	0.0671
Kurtosis	1.15	1	0.2827
Total	27.23	23	0.2463

Table : White Test

Basic assumptions

Ramsey RESET test using powers of the fitted values
Ho: model has no omitted variables

$$F(3, 91) = 0.69$$
$$Prob > F = 0.5617$$

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Conclusions

- Basic model working
- More information
- Neural networks
- Time series data

Resources

Altman, E. I. (1968, September). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bakruptcy. *The Journal of Finance*, *XXIII*(4), 589-609.

Cantón, S. R., Rubio, J. L., & Blasco, D. C. (2010, June). A Credit Scoring Model for Institutions of Microfinance under the Basel II Normative. *Journal of Economics, Finance and Administrative Science*, *15*(28).

Hand, D. J., & Henley, W. E. (1997). Statistical Classification Methods in Costumer Credit Scoring: A review. *Journal of the Royal Statistical Association*, *160*(Part 3), 523-541.

Orgler, Y. E. (1970, November). A Credit Scoring Model for Commercial Loans. *Journal of Money, Credit and Banking*, *2*(4), 435-445.

Rosenberg, E., & Gleit, A. (1994, August). Quantitative Methods in Credit Management: A Survey. *Journal of Operations Research*, *42*(4), 589-613.

Wiginton, J. C. (1980, September). A Note on the Comparison of Logit and Discriminant Models of Consumer Credit Behavior. *Journal of Financial and Quantitaty Analysis*, *15*(3), 757-770.

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Thanks for attending!