

Modeling Probability of Default and Credit Limits

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Introduction

Default: clients not meeting their debt obligations

- Challenge: compute Probability of Default (PD)

How to limit default risk?

- Credit Limit

Outline

Data

PD model

- Computation
- Weight of evidence
- Results

Credit limits model

- Computation
- Variation of inputs

Data

Financial data (publicly available in several European countries)

Monthly trading data (private information)

- Sum of trades
- Outstanding debts
- Delayed payments
- Disputed claims

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Vrsta poročila	za leto / obdobje	Datum javne objave	Verzija	Dokument
Letno poročilo	2015	04.04.2016	-	Bilanca stanja Izkaz prihodkov in odhodkov Izkaz prihodkov in odhodkov - po vrstah dejavnosti Poslovno poročilo s pojasnili - pdf (2137 kB)
Letno poročilo	2014	07.04.2015	-	Bilanca stanja Izkaz prihodkov in odhodkov Izkaz prihodkov in odhodkov - po vrstah dejavnosti Poslovno poročilo s pojasnili - pdf (2197 kB)
Letno poročilo	2013	02.04.2014	-	Bilanca stanja Izkaz prihodkov in odhodkov Izkaz prihodkov in odhodkov - po vrstah dejavnosti Poslovno poročilo s pojasnili - pdf (1933 kB)
Letno poročilo	2012	08.04.2013	-	Bilanca stanja Izkaz prihodkov in odhodkov Izkaz prihodkov in odhodkov - po vrstah dejavnosti Poslovno poročilo s pojasnili - pdf (1202 kB)

Podatki so vam na voljo. Izberite dokument za prikaz.

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PD model

- Simple and easy to understand
- Logistic regression

$$F(x) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 \cdot woe(x_1) + \dots + \beta_n \cdot woe(x_n))}}$$

Challenge

How should default be defined?

- What if a client is late for one day?
- What if a client owes 10€?
- What if a client didn't pay one bill, but paid all bills since?

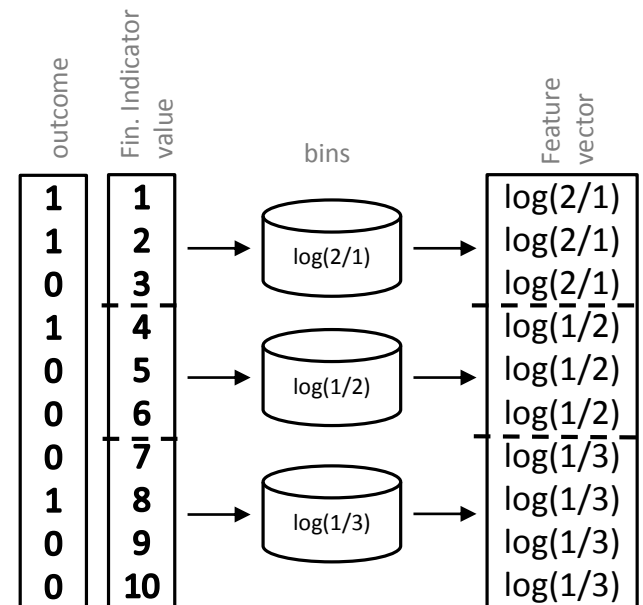
Weight of Evidence *(WOE)*

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Transformation of financial indicators
into feature vectors using WOE

Weight of Evidence (WOE)

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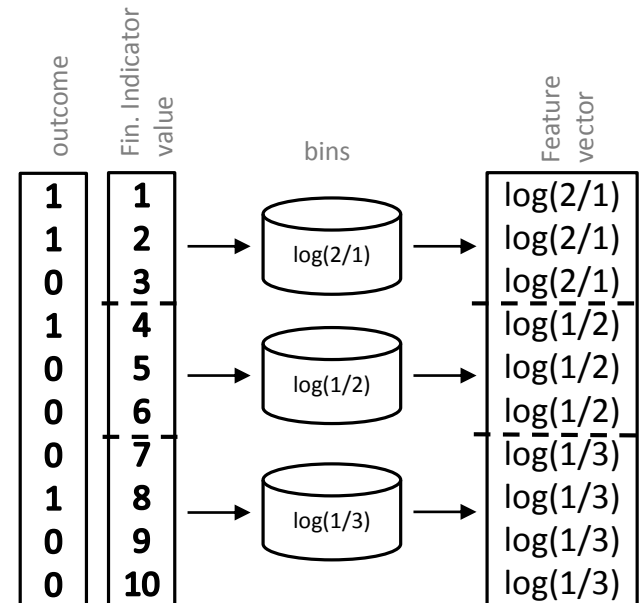


Weight of Evidence (WOE)

Transformation of financial indicators into feature of $P(\text{company}=\text{good})$
 $P(\text{company}=\text{bad})$

of $P(\text{company}=\text{good}) P(\text{company}=\text{bad})$
 $(\text{company}=\text{good}) P(\text{company}=\text{bad})$
 $P(\text{company}=\text{bad}) P(\text{company}=\text{bad})$ of
 $P(\text{company}=\text{good}) P(\text{company}=\text{bad})$ tors
 using WOE

1. Create n bins
2. Assign each company to corresponding bin
3. Count the number of bad and good companies in each bin
4. Assign WOE to companies of a corresponding bin as $\log \frac{P(\text{company} = \text{good})}{P(\text{company} = \text{bad})}$

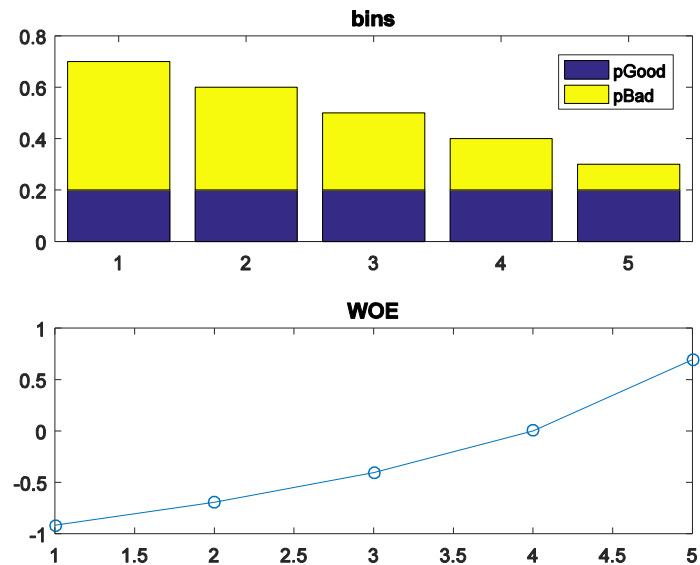


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Results

2 models:

- full
- stepwise

Comparison

- Disputed claims (true negatives)
- Amount of missed trading volume (false positives)

Cutoff?

- 1€ disputed claims vs 1€ trading volume (margin)
- In addition to profit: risk aversion

Results

2 models:

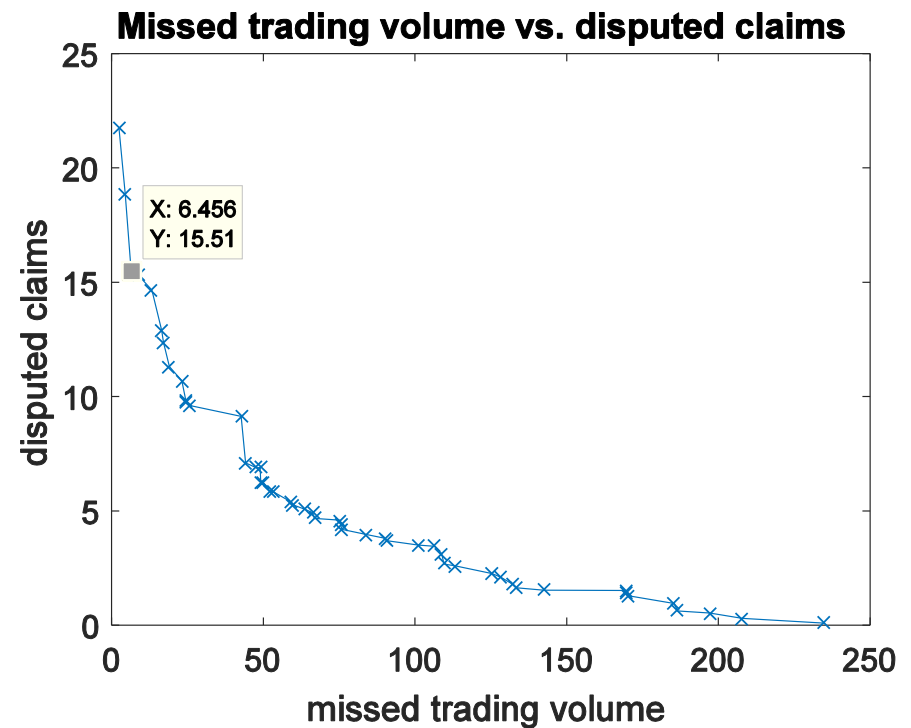
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- stepwise

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Cutoff?

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Credit limits model

How to handle identified risky clients?

➤ Credit limit

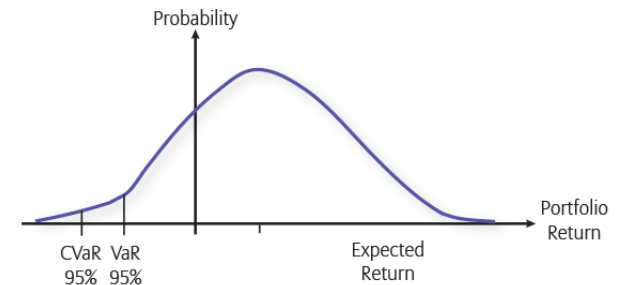
Credit limits model (2)

Optimal portfolio based on

- VaR
- Max CVaR
- Margin
- PDs
- Credit limit upper- and lower bounds

Optimization is based on tradeoff between expected profit and risk ^[1]

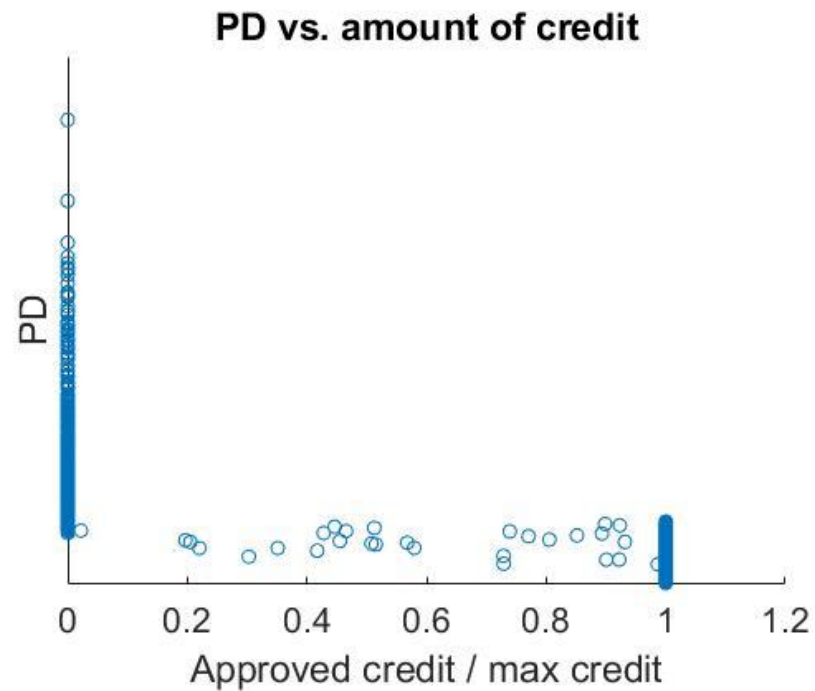
Figure 1: Illustration of CVaR and VaR with a sample confidence interval of 95%



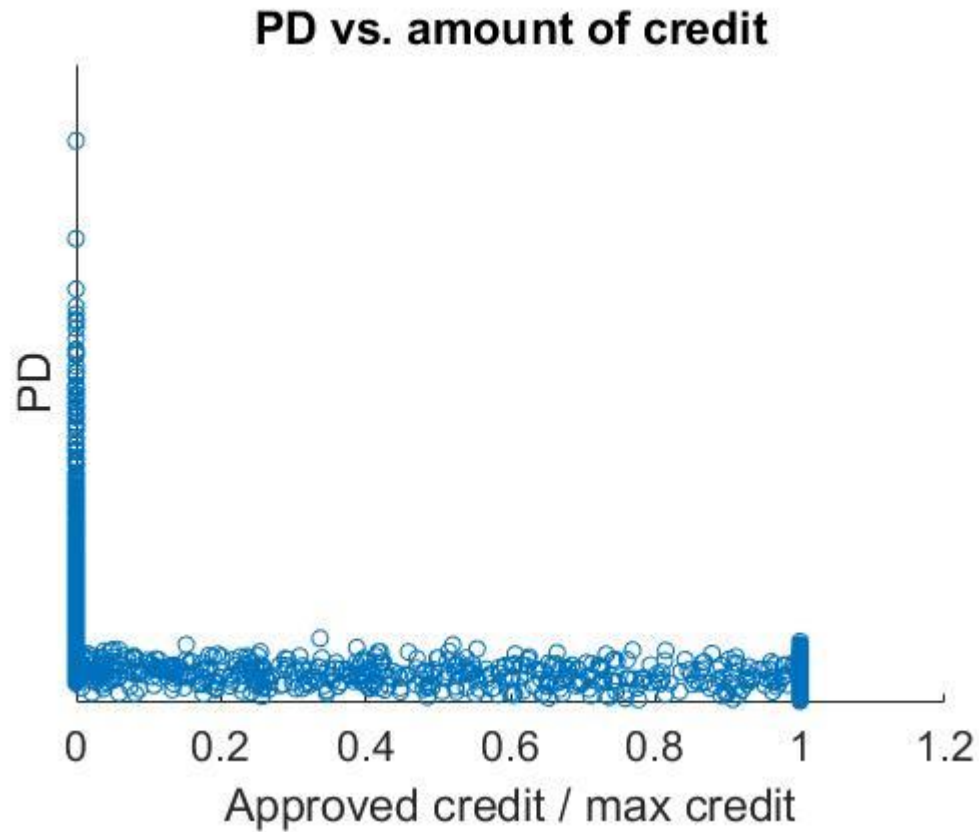
Source: risklab.

^[1] P. Krokmal, J. Palmquist, and S. Uryasev. Portfolio optimization with conditional value-at-risk objective and constraints.

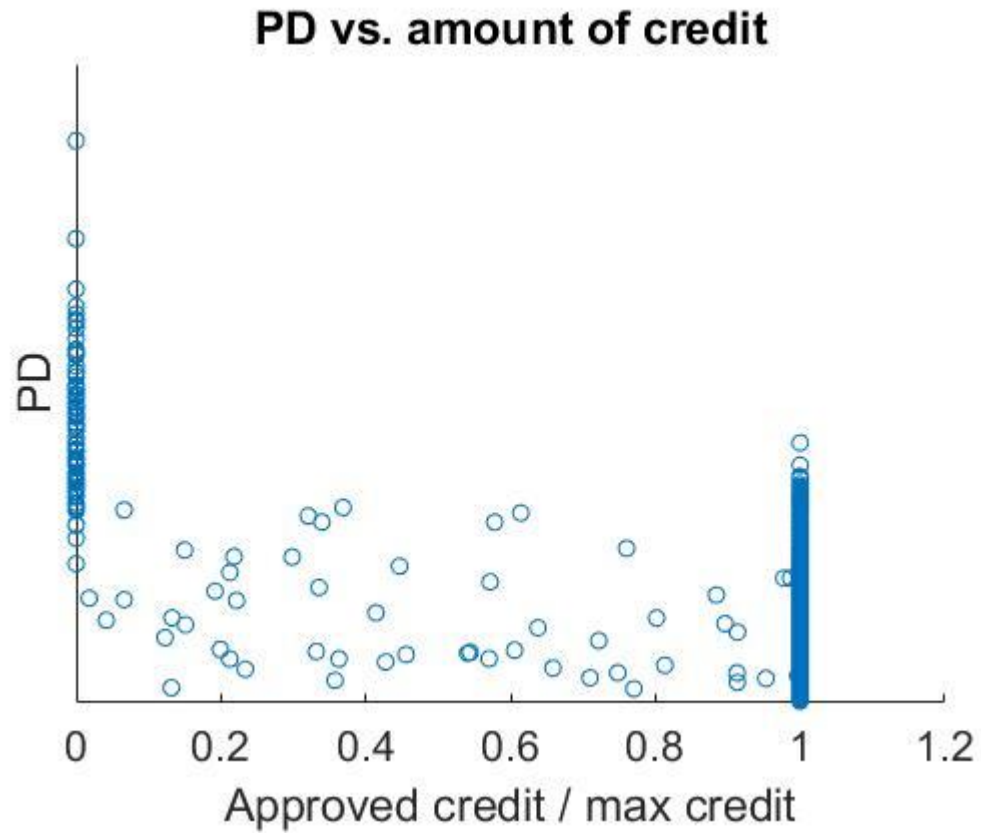
Relative amount of approved credit



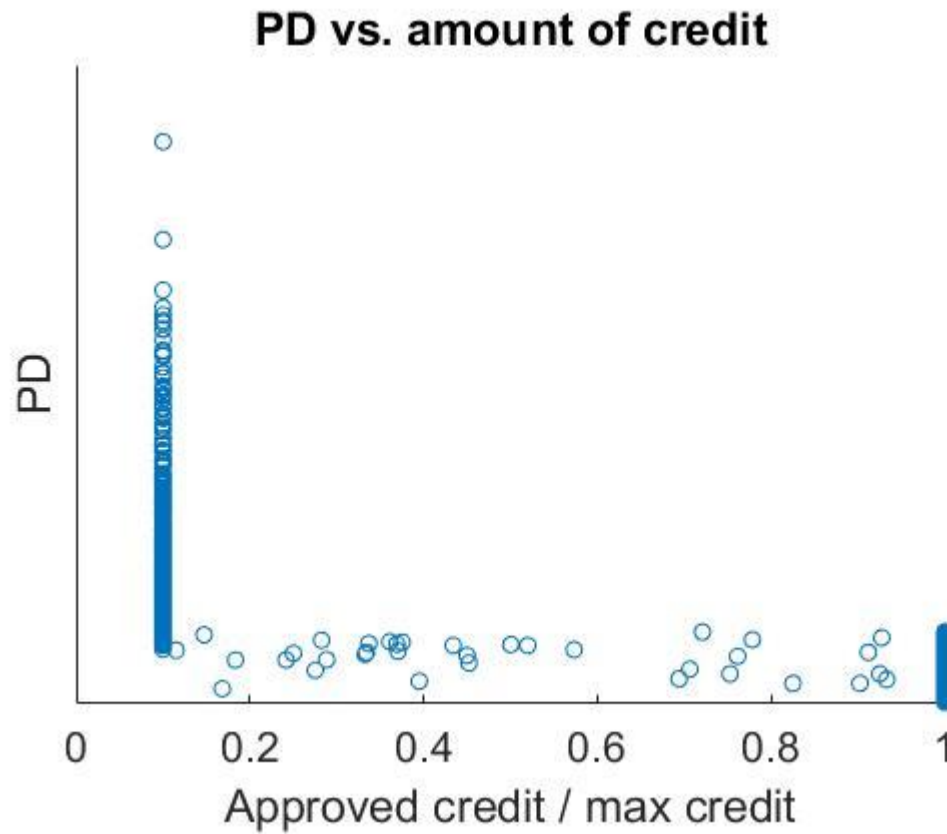
CVaR decreased by factor 10



Margin increased by factor 10



Lower bound > 0



Conclusion and future work

PD model

- More complex methods
- Use of additional features extracted from trading data

Portfolio optimization

- Additional parameters e.g. insurance compensations
- Correlation between clients

Efficient optimal portfolio calculation based on simple PD model and standard financial risk measures