

Sustainable Credit Risk Rating of SMEs

Dr. Olaf Weber

GOE – Gesellschaft für Organisation und
Entscheidung m.b.H.



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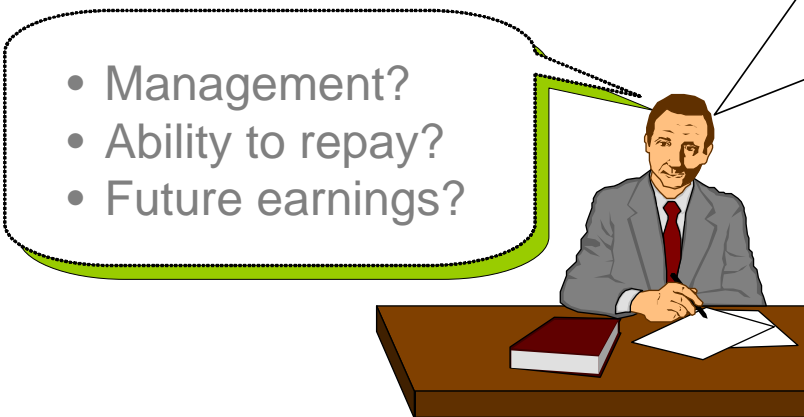
Credit risks and sustainability credit risks

- Credit risk is the uncertainty about the future outcome of loans
 - Compliance with the credit agreement
 - Default (non-compliance with the credit agreement)
- Sustainability credit risk
 - Uncertainty about the future outcome of loans emerging from environmental, economic and social sustainability risks
- Basel II Definition of Credit Default
 - The creditor considers that a debtor is unlikely to repay in full its credit obligations to the banking group, without recourse by the bank to actions such as realising security
 - The creditor is past due for more than 90 days on any material credit obligation to the debtor

Credit risk rating

■ Counterparty credit risks

- Management / creditworthiness
- Ability to repay
- Future earnings
- Capital and capital to debt ratio
- Collateral value

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- Management?
 - Ability to repay?
 - Future earnings?



Construction of Credit Risk Rating Systems

- Using real cases
 - Defaults
 - Non-Defaults
- Rating of the cases using criteria and balance-sheet ratios
- Weighting criteria and ratios using multivariate statistical algorithms
- Using weighted criteria to calculate
 - Probability of Default
 - Loss Given Default
 - Expected Loss
- Continuous Validation of the instrument

Criteria and financial ratios used in the system

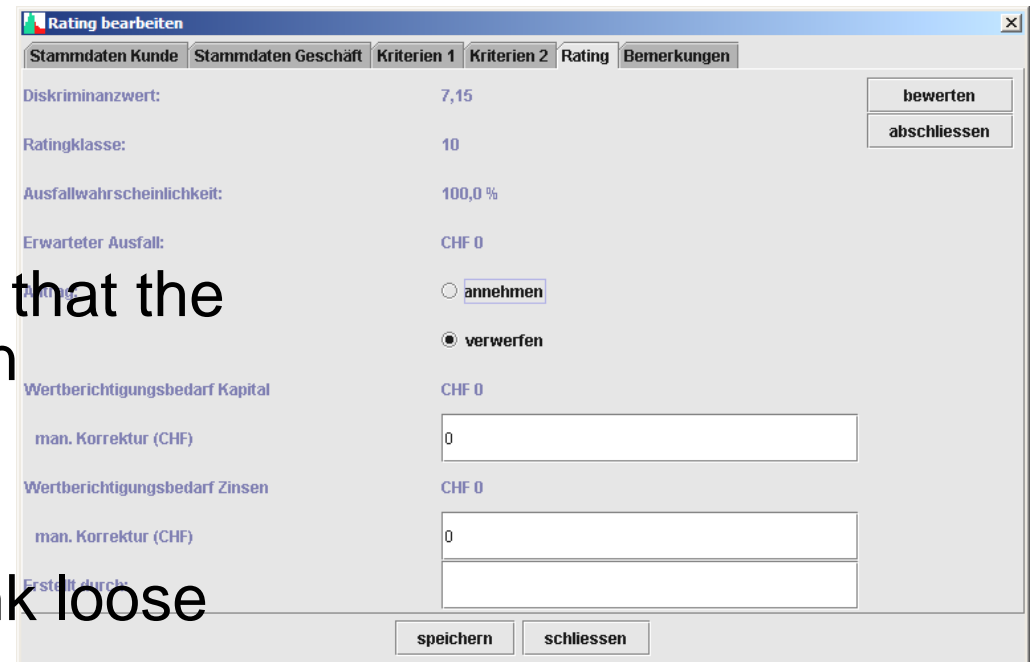
- Management
 - Attainment of budget
 - Audit report
 - Management information system
 - Management ability
 - Auditor
- Future development
 - Potential for development
 - Product
 - Volume of orders
 - Development of returns
- Business situation
 - Sector
 - Competitors
 - Region
- Financial information
 - Account turnover
 - Outstanding interests
 - Risks of interest change
 - Private drawing and dividends
- Financial ratios
 - Cash Flow Ratio
 - Liquidity ratio
 - Return on equity
 - Debt ratio
 - Self-financing ratio
 - Debt capacity

The rating function

- Default / non-Default (1/0) = β_1 * Attainment of budget + β_2 * Audit report + β_3 * Management information system + β_4 * Management ability + β_5 * Auditor + β_6 * Potential for development + β_7 * Product + β_8 * Volume of orders + β_9 * Development of returns + β_{10} * Account turnover + β_{11} * Outstanding interests + β_{12} * Risks of interest change + β_{13} * Private drawing and dividends + β_{14} * Sector + β_{15} * Competitors + β_{16} * Economic region + β_{17} * Cash Flow Ratio + β_{18} * Liquidity ratio + β_{19} * Return on equity + β_{20} * Debt ratio + β_{21} * Self-financing ratio + β_{22} * Debt capacity

Results

- Credit Risk Rating
 - 10 steps
- Probability of Default
 - What is the probability that the rated debtor defaults in the following year?
- Loss Given Default
 - How much will the bank lose in case of default?
- Expected Loss
 - $\text{Probability of Default} * \text{Loss Given Default}$

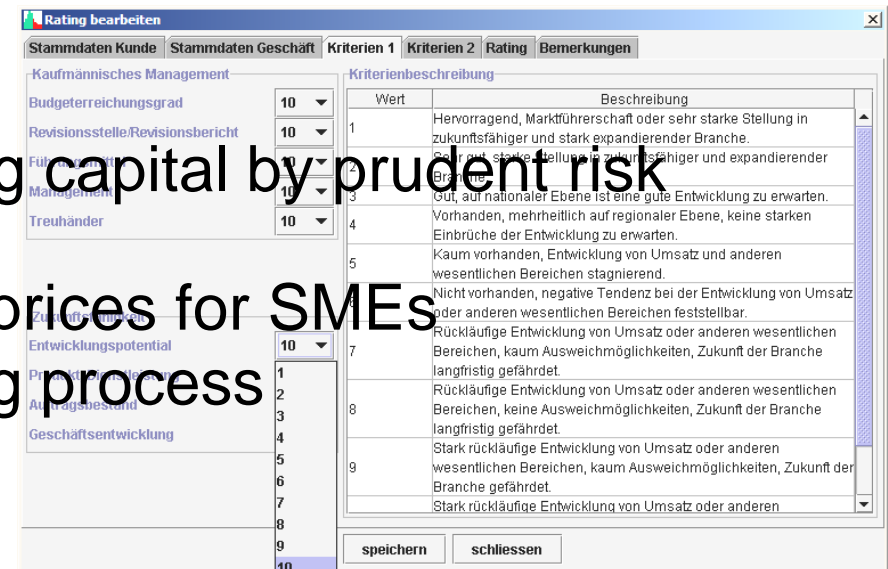


Application of the credit risk rating system RasyEA

- Used since 2001 in 60 Swiss Banks
 - More than 50 000 cases rated
- Quality of prediction of default one year before default
 - Gini = .83
 - Correct hit rate = 96.5%

■ Benefits

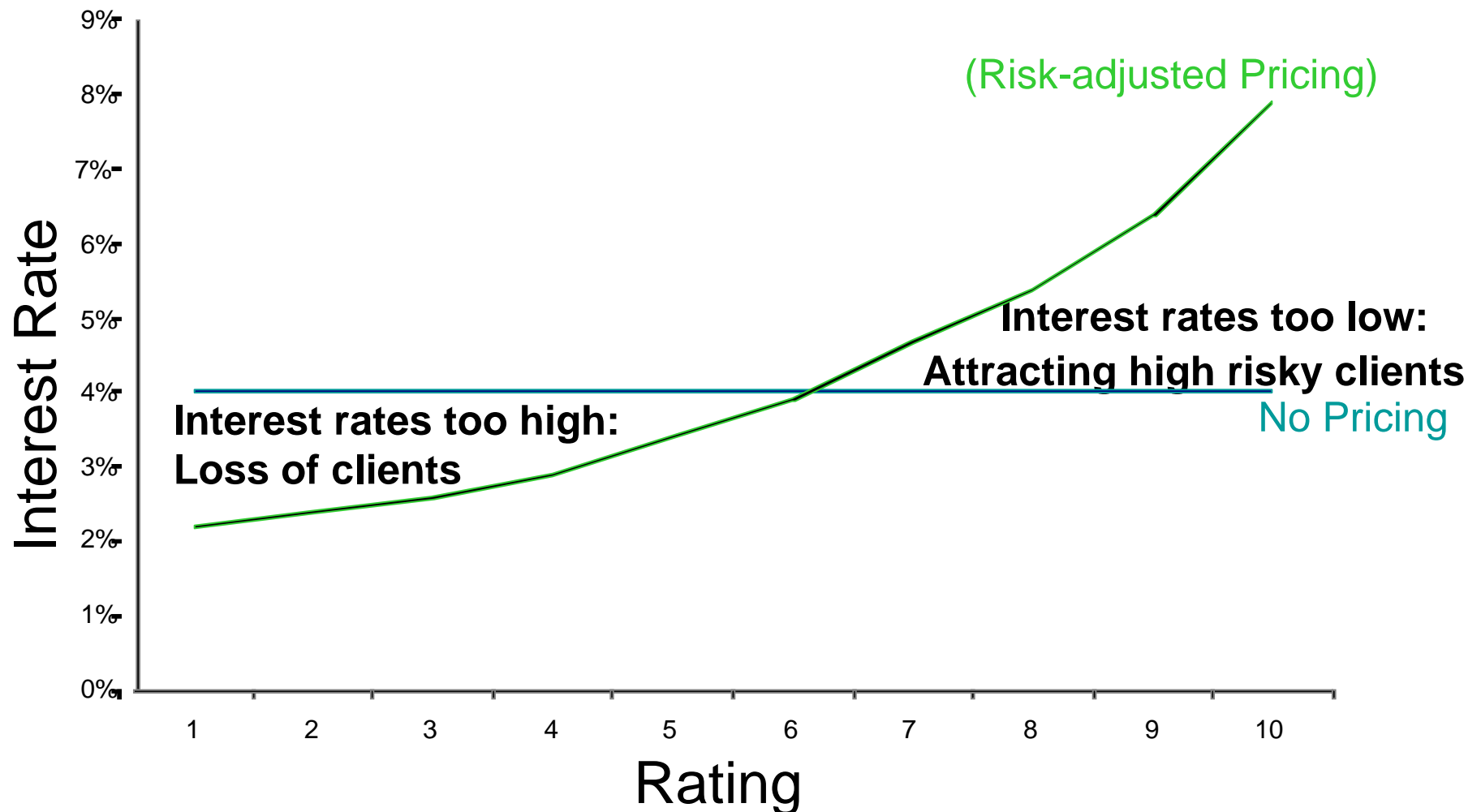
- Preventing losses and saving capital by prudent risk prediction
- Fair ratings, loan and credit prices for SMEs
- Easy and standardized rating process
- Basel II accordance



The screenshot shows the 'Rating bearbeiten' (Edit Rating) window. It has tabs for 'Stammdaten Kunde', 'Stammdaten Geschäft', 'Kriterien 1', 'Kriterien 2', 'Rating', and 'Bemerkungen'. The 'Kriterien 2' tab is active, displaying a table of criteria and their descriptions. The criteria are listed on the left, and the descriptions are on the right. The 'Rating' tab shows a dropdown menu for the rating value, currently set to 10.

Wert	Beschreibung
1	Hervorragend, Marktführerschaft oder sehr starke Stellung in zukunftsfähiger und stark expandierender Branche.
2	Sehr gut, starke Stellung in zukunftsfähiger und expandierender Branche.
3	Gut, auf nationaler Ebene ist eine gute Entwicklung zu erwarten.
4	Vorhanden, mehrheitlich auf regionaler Ebene, keine starken Einbrüche der Entwicklung zu erwarten.
5	Kaum vorhanden, Entwicklung von Umsatz und anderen wesentlichen Bereichen stagnierend.
6	Nicht vorhanden, negative Tendenz bei der Entwicklung von Umsatz oder anderen wesentlichen Bereichen feststellbar.
7	Rückläufige Entwicklung von Umsatz oder anderen wesentlichen Bereichen, kaum Ausweichmöglichkeiten, Zukunft der Branche langfristig gefährdet.
8	Rückläufige Entwicklung von Umsatz oder anderen wesentlichen Bereichen, keine Ausweichmöglichkeiten, Zukunft der Branche langfristig gefährdet.
9	Stark rückläufige Entwicklung von Umsatz oder anderen wesentlichen Bereichen, kaum Ausweichmöglichkeiten, Zukunft der Branche gefährdet.
10	Stark rückläufige Entwicklung von Umsatz oder anderen

Benefits of credit risk rating



Adding sustainability criteria

- Does a commercial debtor's economic, environmental and social performance affect its credit risk rating?
- Does adding criteria aimed at assessing a debtor's environmental, social or sustainability practices provide added value to traditional financial rating criteria?
- Does the integration of sustainability criteria improve the validity of the credit risk prediction?

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- Ability to repay?
 - Collateral value?
 - Reputation risk?



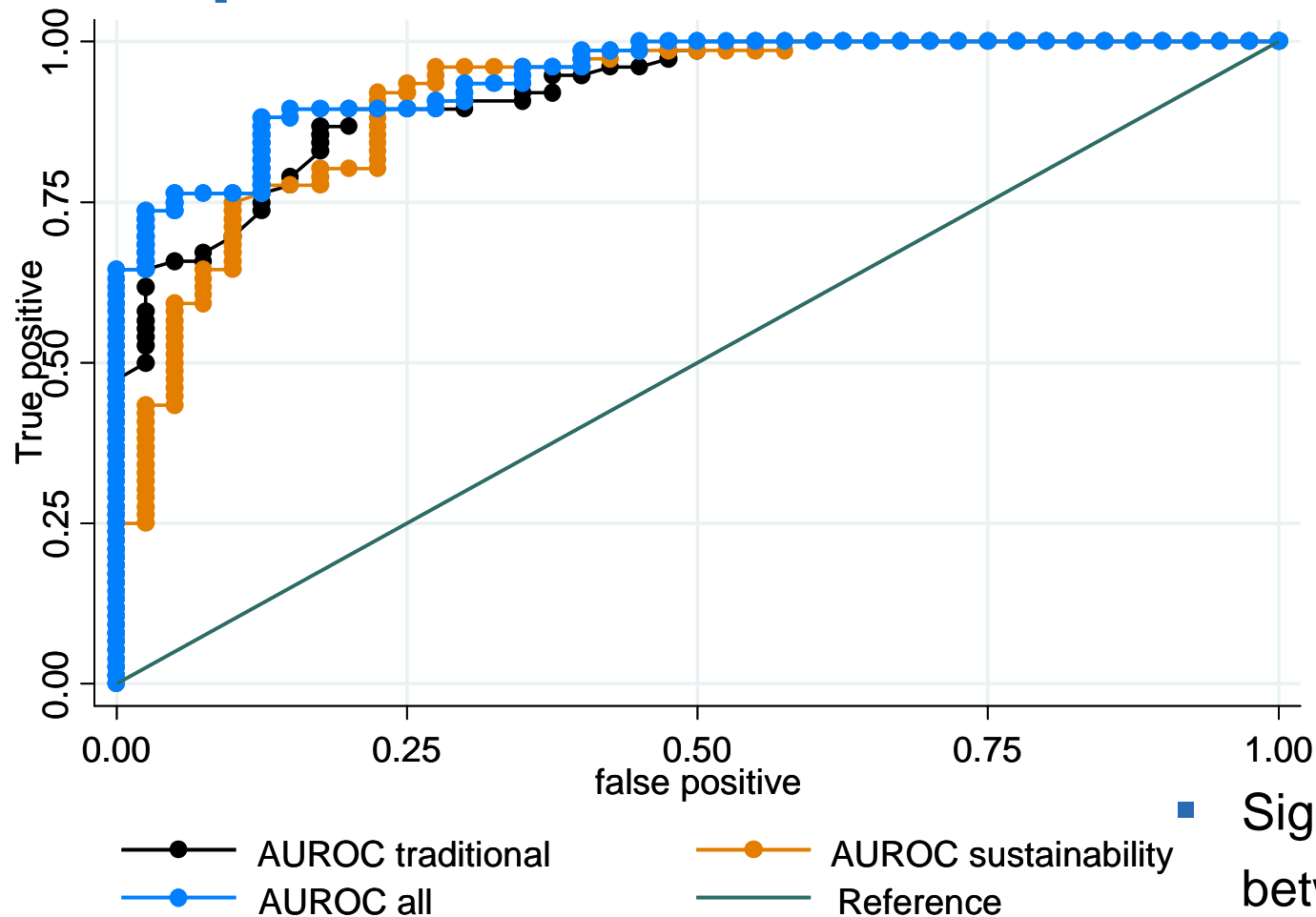
Rating Criteria

Traditional criteria (Cronbach's alpha =.91)	Economical Sustainability Criteria (Cronbach's alpha =.83)	Environmental Sustainability Criteria (Cronbach's alpha =.76)	Social Sustainability Criteria (Cronbach's alpha =.75)
Reputation	Net debt service	Costs of environmental measures	Wage policy
Legal capacity to borrow	Sustained growth	Emissions	Health policy
Competency of management	Quality of growth	Environmental friendly construction	Social security of the employees
Follow-up regulation	Sector development	Consideration of nature and landscape	Workers' participation
Relations to the lender	Integration of environmental aspect in economic decision making	Soil erosion	Conservation of workplaces
Potential for development	Robustness against crises	Sealing of soil	Flexible working conditions and working hours
Attainment of budget	Personal resources	Sewage emission	
Dividend policy	Community relations	Sewage quality	
Sector	Risk of accidents	Air emission	
Region	Job creation	Noise emission	
Product and market	Adequate firm size	Resource protection	
Competition	Eco efficiency	Material use	
Clients	Information and communication	Ratio of renewable resources	
Suppliers	Material productivity	Use of non-renewable energy sources	
Volume of orders	Spatial relation	Use of renewable energy	
Future margin	Commuter mobility	Use of water (amount)	
Agency report	Car fleet		
Credit limit	Energy efficiency		
Account turnover	Technical update of power plants and machines		
Outstanding interest and amortization	Amount of waste		
Auditing company	Waste management		
Management systems	Toxic waste		
Trustee	Contaminated sites		
Personal securities	Technology management		
Physical securities	Material substitution		
Liquidity ratio	Longevity		
Return on equity	Recycling capacity		
Cash flow ratio	Redemption of used products		
Debt ratio	Miniaturization of products		
Free Cash Flow	Ecological product design		
Equity-to-fixed-assets ratio	Contracting		
Self-financing ratio			
Risk of change in interest rates			

Predicting credit risk by traditional rating and sustainability rating

- Traditional rating (logistic regression)
 - $Credit\ Risk = 5.15 * trad. - 16.63$
 - $p < .00001$
 - Correct predictions = 81.1%
 - AUROC = .91
- Traditional and sustainability rating (logistic regression)
 - $Credit\ Risk = 5.10 * trad. + 2.14 * econ.\ sust. + 1.10 * soc.\ sust. - 1.44 * env.\ sust. - 21.87$
 - $p < .00001$
 - Correct predictions = 85.7%
 - AUROC = .94

Comparison of AUROCs



■ Significant difference between the ROC areas: $p < .0001$

State of the art credit risk rating systems

- Prevent losses caused by debtors
- Guarantee fair interest rates
- Guarantee money flows to successful SMEs
- Support standardized and comprehensible risk rating processes
- Prevent losses for the lender

• Management ?
• Ability to repay ?
• Future earnings?

Wert	Beschreibung
1	Hervorragend in fachlichen, kaufmännischen und administrativen Bereich.
2	Sehr gut in fachlichen, kaufmännischen und administrativen Bereich. Gut bis sehr gut, mindestens zwei der drei Bereiche überdurchschnittlich.
3	Gut in allen drei Bereichen gute Leistungen.
4	Ausreichend, in mindestens zwei Bereichen durchschnittlich.
5	Unterdurchschnittlich, Erfolg stark von Schicksal abhängig.
6	Schwach, Massnahmen zur Verbesserung sollten eingeplant werden.
7	Sehr schwach, Massnahmen zur Verbesserung sollten dringend eingeplant werden.
8	Unfängliches Management in allen drei Bereichen, Rettungschancen kaum vorhanden.
9	Unfängliches Management in allen drei Bereichen, keine Rettungschancen vorhanden.
10	Keine Angabe