Seminar 4609
Applied Credit Risk Modeling (S)

February 10, 2019

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Class: Wednesday, 16:15 - 18:00
Room: RAA-E-12

Seminar Description

The seminar will cover the most recent innovations in credit risk measurement for retail portfolios with a focus on the practical implementation of credit risk models and methodologies. The students will be encouraged to analyze the methodologies and results of credit risk related studies in light of their practical application within the financial industry. Practical and real experts from the bank will support the students and give hands on feedback. We will cover a wide range of important aspects of credit risk modeling such as the modeling of probability of default, loss given default, dependencies, expected and unexpected credit losses. We will look at credit risk modeling across a wide set of lending products. The students will be exposed to research papers on a variety of lending products like: mortgages, corporate lending, security backed lending, leasing, and credit cards among others, gaining a general understanding of their treatment for internal as well as regulatory capital requirement purposes.

Goals of the Seminar

The objectives of the seminar can be summarized as follow:

- Understand the role and importance of credit risk modeling in practice.
- Apply credit risk models and techniques to major lending products.
- Inspire critical thinking and develop a feeling to detect practical and theoretical limitations of credit risk modeling techniques.
- Practical implementation of advanced credit risk modeling approaches.

Prerequisites

- Before taking the course, students should have a good knowledge of mathematics, statistic, financial theory, and econometrics.
- Students should be willing to work on a practical implementation of one of the seminar topics with R, SAS, STATA, MATLAB, or similar software.

Deliverables and Grades

Students work on a specific credit risk related topic, where they cover different aspects. Depending on the number of seminar participants, students may work alone or in groups of two. The final grade consists of four parts:

- **Practical application:** Implementation of the approach/technique covered in the selected research paper with real or simulated data. Focus should be to highlight the pros and cons of the approach from a practical perspective.
- **Class presentation:** This includes a presentation of a general aspect of the selected research paper as well as the own findings of the practical application proposed. A critical discussion of the methodology and the results in the context of applied credit risk modeling is required.
- **Summary report:** This includes the preparation of (non-technical) one pager (no formulas) on the selected research paper and the related practical application, with a critical discussion of the model and own results in the context of applied credit risk modeling.
- **Class participation:** Part of the final evaluation will be participation in the class. Students are requested to read the papers of each seminar session in advance and be able to participate in an informed discussion about them.

The grade for this seminar will be based on the performance on all of these deliverables. Class attendance is required.

Presentation

The class presentation must not be longer than 45 minutes and should cover the following topics:

- Introduction: Quick summary of the main contribution of the paper in relation to credit risk modeling
- Theory: High-level summary of the theory / technique presented in the paper.
- Empirical Part: Description of empirical exercise, results, and difficulties encountered (or insights gained) along the way.
- Implementation: Presentation of the results of the student's own numerical exercise.
- Summary & Conclusion: Critical discussion of the method/model in the paper in the light of the own practical experiences.

Remark: If you present in groups, all group members shall present in class.

Application

Please register online on the OLAT course website no later than Sunday, 17 February, 18:00 CET. In addition, please send me an email with the following information before Sunday, 17 February, 18:00 CET:

- Name, Student ID, Email address
- Master program, field of study, background, experience with credit risk modeling in practice,
- Three topics you would like to present, labeled with: Prio 1, Prio 2, and Prio 3.

Preparation

After each session, the respective students will have the possibility to discuss the focus of the next week's presentation with myself and an additional expert from the banking industry. Please come prepared, with a good understanding of the paper and with an outline of your presentation. Send me a copy of your presentation and the summary paper no later than Sunday night before the presentation (simone.bernardi@uzh.ch).

Seminar Topics and Outline[1]

Date	Topic
20.02.2019	**Seminar organization** The goal of this first session is to get to know each other and define the final assignment of the topics. The students will also have the possibility to ask first general questions about the structure and organization of the seminar, as well as first questions on applied credit risk modeling.
27.02.2019	**Free talk - the role of models in the management of credit risk** The goal of this session of the seminar is to make students aware of why, where, and how credit risk modeling is used within the financial industry. This will be done in the form of a free talk and brainstorming session together with the class and some guests from the financial industry. From a couple of simple business cases, the students will start to see where it makes sense to model credit risk and where not, as well as where intuitive modeling assumptions might fail when confronted with the reality of the credit business.
06.03.2019	**RWA modeling - regulatory capital requirements, RWA, and implications** The goal of this assignment is to get a thorough understanding about banking regulation in the credit risk area by summarizing the current regulatory landscape, developing a rough understanding of the derivation of the RWA formula and by calculating the RWA for a sample of mortgage loans. Basel Committee on Banking Supervision (2017). *Basel III: Finalising post-crisis reforms.* ISBN 978 92-9259-022-2 (online), p. 18–24 and p. 74-77 Additional Material Baesens, B., Roesch, D. and Scheule, H. (2016). Credit Risk Analytics: Measurement Techniques, Applications, and Examples in SAS, p. 5–15. Vasicek, O. A. (1987). Probability of Loss on Loan Portfolio. San Francisco: KMV Corporation.

[1] Please note that dates and topics can be subject to change.

Date	Topic
13.03.2019	**PD modeling - the Merton model** The goal of this assignment is to present the Black-Scholes-Merton model (together with a practical application) highlighting pros and cons of its use within the financial industry. Black, F., and M. Scholes. (1973). The pricing of options and corporate liabilities. *Journal of political economy* p. 637–654. Additional Material Merton, R. C. (1974) On the pricing of corporate debt: The risk structure of interest rates. *The Journal of finance* p. 449–470. Merton, Robert C. (1973) Theory of rational option pricing. *The Bell Journal of economics and management science* p. 141–183.
20.03.2019	**PD modeling - probit regression model for corporate lending** The goal of this assignment is to build a simple empirical model to calculate one year out Point-in-Time (PIT) and Through-The-Cycle (TTC) Probabilities of Default (PD). The PIT PD should reflect current economic conditions while the TTC PD should reflect average economic conditions. Students are expected to explain these concepts, to construct empirical estimates based on a dataset that will be provided, and to explain some of the difficulties involved in estimation. Lennox, C. (1999). Identifying failing companies: a re-evaluation of the logit, probit and DA approaches, p. 347–364. Journal of Economics and Business Additional Material Altman, E. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy, p. 589–609. Journal of Finance.
27.03.2019	**PD modeling - alternative modeling approaches** The goal of this assignment is to alternative numerical methods in credit risk modeling, beyond regression models, like Monte Carlo simulations, decision trees, and random forest algorithms highlighting advantages and disadvantages with respect to traditional model choices. Addo, P., Guegan, D., and B. Hassani (2018). Credit risk analysis using machine and deep learning models, *MDPI, Risks*, p. 1-20 Additional Material Audhamathy, G. (2016). Credit risk analysis and prediction modeling of bank loans using R, *International Journal of Engineering and Technology*, p. 1954-1966.

Date	Topic
03.04.2019	**LGD modeling - reduced form loss given default modeling** The goal of this assignment is to discuss how the Loss Given Default (LGD) can be calculated and what type of data would be needed to do so, give an overview of the different approaches to calculate LGD, and to construct a reduced form model to calculate point-in-time downturn LGD on a dataset that will be provided. Altman, Resti, Sironi (2004) - Default Recovery Rates in Credit Risk Modelling: A Review of the Literature and Empirical Evidence.
10.04.2019	**LGD modeling - mortgage financing under stress** The goal of this assignment is to win insights in the LTV - LGD relationship within mortgage financings, highlighting theoretical as well as practical implications implementing the methodology proposed. Greve, C., and L. Hannenstein (2014) Stress testing the credit risk of mortgage loans: the relationship between portfolio LGD and the LTV distribution.
17.04.2019	**EAD modeling - challenges in exposure at default modeling** The goal of this assignment is to elaborate on the practical challenges in exposure at default modeling for (un)committed and contingent (banking or trading) products. Tong, E., Mues, C., Brown, I., and L. Thomas (2016) Exposure at default models with and without the credit conversion factor, *European Journal of Operational Research*, p. 910–920. Additional Material Jacobs, M., and P. Bag (2010) What do we know about exposure at default on contingent credit lines? - A survey of the literature, empirical analysis and models, *Journal of Advanced Studies in Finance*, p. 26-46.

Date	Topic
08.05.2019	**Loss modeling - limits in modeling joint portfolio losses** Explain and discuss main risk mesures like (Value-at-Risk, Expected Shortfall, etc...) and their limitations as a risk measure in the modeling of joint losses for multiple portfolios. McNeil, A. J., Frey, R., and P. Embrechts (2005) Quantitative risk management: Concepts, techniques and tools. Vol. 3. Princeton: *Princeton university press*, Chapters 2 and 6. Additional Material Embrechts, P., Puccetti, G., and L. Rüschendorf (2013) Model uncertainty and VaR aggregation. *Journal of Banking & Finance*, p. 2750–2764.
15.05.2019	**Loss modeling - lending values for Lombard lending** The goal of this assignment is to understand the credit risk inherent loans collateralized by liquid assets as e.g. stocks and to investigate the liquidity (size) effects on the riskiness of the position. Juri, A. (2014). Lending Values and Liquidty Risk, *Journal of Applied Finance & Banking* **4**(1), 173–221
22.05.2019	**Effects of Monetary Policy on Credit Risk Taking** The goal of this assignment is to present the propored paper with an emphasis on how monetary policy effects bank credit-risk taking, by means of a critical assessment of econometric methods proposed and via own replication exercise or additional analysis. Jiménez, G., Ongena, S., Peydró, J. L., and Saurina, J. (2014). *Hazardous Times for Monetary Policy: What do Twenty-Three Million Bank Loans Say About The Effects of Monetary Policy on Credit Risk-Taking?* Econometrica, **82**(2), 463–505.