Western Science

Department of Statistical and Actuarial Sciences

FM 9528A Banking Analytics

Course outline for Fall 2021-2022

1. Course Information

Course Information

This course will give students a mix of knowledge and practice in the use of business analytics tools, from using Excel for pricing a bond and calculating credit risk, to advanced deep learning models which will provide tools to tackle sophisticated problems using the latest computational tools. These models will be applied to several business problems within modern financial institutions, covering topics such as credit scoring, LGD and EAD modelling, and advanced models to extract complex non-linear patterns from large amounts of diverse data in topics such as collections, consumer fraud and other applications. The focus will be on the underlying principles, modelling methodologies, and implementation using appropriate software packages.

Monday 4:30 p.m – 6:00 p.m. WSC 240. In-person with a synchronous online option.
Wednesday 4:30 p.m. – 6:00 p.m. WSC 240. In-person with a synchronous online option.

List of Prerequisites

No courses are required.

Basic financial and statistical knowledge is required to understand the concepts and underlying mathematical processes. Previous programming experience required, but not in Python. Resources will be provided to learn the language we will use during the course. The course assumes a working knowledge of any other programming language (C, C++, R, Matlab, etc.) but no Python knowledge. The course will cover Excel and Python, with tutorials and online resources to support the analyses.

2. Instructor Information

Course Coordinator	Contact Information
Cristián Bravo	cbravoro@uwo.ca

Instructor(s) or Teaching Assistant(s)	Contact Information
TBC	TBC

Office Hours	Method	Names
Wed 11am - 12pm	In-Person or Zoom	Cristián

Students must use their Western (@uwo.ca) email addresses when contacting their instructors. We strive to answer all emails within 24 business hours.

3. Course Syllabus, Schedule, Delivery Mode

The topics covered in this module will include:

- Introduction and overview of banking analytics: CRISP-DM, Analytics problems, designing a data-driven problem-solving strategy in financial institutions.
- Fixed income credit risk: Government bonds, bills, and notes: bond auctions and after-market trading Interest rate conventions (simple, compound, continuous compound), Decomposing bonds into cash flows of coupons. Pricing bonds: day count convention, clean and dirty price. The Yield Curve. The idea of the yield curve and its empirical phenomenology. Bootstrapping the yield curve from bond price.
- Retail credit risk modelling: Credit Scoring models, LGD and EAD models, basic concepts, working with software, dealing with difficulties.
- Advanced non-linear models and deep learning: basic principles, ensembles (Random Forest, XGBoosting), data interpretability.
- Introduction to deep learning and alternative data modelling: neural networks, architecture design, advanced models (CNN, LSTM, etc) and their applications in banking analytics.

Learning Outcomes

Having successfully completed the course, you will be able to demonstrate knowledge and understanding of:

A1. The Basic principles of data science in Banking: CRISP-DM and the definition of analytics

A2. The Underlying theory of predictive modelling

A3. Solutions and technologies specifically designed for handling and extracting patterns from big data

Having successfully completed this course, you will be able to:

B1. Work with relevant software packages to develop banking analytics solutions

B2. Handle various types of data sources

B3. Work with current software packages to create models using complex data sources.

Table of Contents and Schedule

Week	Dates	Topic
1	Sept 8 – 12	Intro to Banking Regulation
2	Sept 13 – 19	Bonds and credit instruments
3	Sept 20 – 26	Provisions and capital requirements
4	Sept 27 – Oct 3	CRISP-DM and analytics in banking
5	Oct 4 – 10	Credit scoring and GLM applied in banking I
6	Oct 11 – 17	Credit scoring and GLM applied in banking II
7	Oct 18 – 24	LGD and EAD models –Ensembles I
8	Oct 25 – Oct 31	LGD and EAD models –Ensembles II
9	Nov 1 – 7	Reading Week. No lectures or activities.
10	Nov 8 – 14	Introduction to deep learning
11	Nov 15 – 21	Convolutions and architecture design I
12	Nov 22 – 28	Convolutions and architecture design II
13	Nov 29 – Dec 5	Convolutions and architecture design III
14	Dec 6 – 8	Model interpretation and transparency

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
September 8	November 1 - 7	December 8	December 9	December 10 - 21

* Nov 12, 2021: Last day to drop a first-term half course or a first-term full course without penalty

Contingency plan for an in-person class pivoting to 100% online learning
In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, synchronously (i.e., at the times indicated in the timetable). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

Please note a recording of the lecture will be made available in OWL for students who cannot attend the in-person lectures.

4. Course Materials

There is no assigned textbook for the course. The course incorporates multiple sources, publications, and books that can be used as reference:

Books:

Core
Chollet, F. (2021) Deep Learning with Python, second edition. Manning Publications (last five weeks)

Davison, M. (2017) Quantitative Finance: A Simulation-Based Introduction using Excel. CRC Press 2014 (weeks 1-3)

Siddiqi, N. (2017) Intelligent Credit Scoring: Building and Implementing Better Credit Risk Scorecards, Second Edition. Wiley. (Week 5-6)

Hastie, T., Tibshirani, R. and Friedman, J. (2013) The Elements of Statistical Learning,10th ed. NI, USA: Springer. Available freely online at https://statweb.stanford.edu/~tibs/ElemStatLearn/. Only some chapters are relevant to the course. They will be posted on OWL in each week's description. (Weeks 4 – 9)

Verbeke, W., Baesens, B. and Bravo, C. (2017) Profit Driven Business Analytics. Wiley and Sons. Chapter 5 (Week 6 and 8)

Additional Reading

Goodfellow, I., Bengio, Y. and Courville, A. (2017) Deep Learning. Freely available online at http://www.deeplearningbook.org/: MIT Press.

Thomas, L.C., Crook J.N. and Edelman. (2017) Credit Scoring and Its Applications, 2nd Edition. Philadelphia, PA, USA: SIAM Press.

Students are responsible for checking the course OWL site (http://owl.uwo.ca) regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Google Chrome or Mozilla Firefox are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click here.

Technical Requirements


Stable internet connection


Laptop or computer


Working microphone


Working webcam

We will use either Google Colab (https://colab.research.google.com) or Kaggle Kernels (https://www.kaggle.com/code) for the computational part of the course, depending on available access in your location. Instructions will also be provided for local installations, although **this is not recommended unless students have an Nvidia video card and at least 8GB of RAM**.

5. Methods of Evaluation

The course is mostly applied and will have three pieces of **individual** coursework, distributed via OWL after each topic is covered in the lectures:

- 31%: Fixed income and introduction to lending exercise. Pricing bonds, yield curves and mortgages. Deadline October 13th, 23:59. 1500 words.
- 34%: Retail credit risk models. Deadline November 17th, 23:59. 2000 words.
- 35%: Non-structured data models and deep learning. Deadline December 17th, 23:59. 2000 words.

Accommodated Evaluations

- Late assessments without illness self-reports will be subject to a late penalty discount of 10%/day (this means if your coursework gets an 80%, and you submit one day late, your final mark will be 80% - 10% = 70%). The day late starts at 00:00 of the day after the deadline posted above. There are **NO EXCEPTIONS** to this policy.
- Late assessments with illness self-reports should be submitted within 24 hours of submission of the last illness self-report. Late assessment with valid medical reports must be submitted at the date agreed upon with the counsellors.
- An assessment cannot be submitted after it has been returned to the class. An oral, open book, exam with computer support covering the topics that were missed will be given instead.
- If a make-up assessment is missed, the student will receive an INC and complete the task the next time the course is offered.
- If permission to waive the requirement that students receive an evaluation on work totalling 15% of their final grade at least three days prior to the deadline for withdrawal without academic penalty has been obtained from the Dean's Office, a statement to this effect must be made.

6. Student Absences

Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

(i) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.

(ii) Submitting appropriate documentation for non-medical absences to the Academic Counselling Office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling Office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult the University's list of recognized religious holidays (updated annually) at

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo.

Absences from Final Examinations

Please note this course is assignment-based so the below would not apply to regular assessment. This could apply however to a make-up exam if necessary.

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in a 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

6. Accommodation and Accessibility

Accommodation Policies
Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf,

7. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

For the assessments, all electronic devices are permitted and encouraged.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Professionalism & Privacy

Western students are expected to follow the Student Code of Conduct. Additionally, the following expectations and professional conduct apply to this course:

☒ Students are expected to follow online etiquette expectations provided on OWL

☒ All course materials created by the instructor(s) are copyrighted and cannot be sold/shared

☒ Recordings are not permitted (audio or video) without explicit permission

☒ Permitted recordings are not to be distributed

☒ Students will be expected to take an academic integrity pledge before some assessments

☒ All recorded sessions will remain within the course site or unlisted if streamed

Copyright Statement
Please be aware that all course materials created by the instructor(s) are copyrighted and cannot be **sold/shared**. Those include materials used in tests/quizzes, midterms, and finals. Any posting/sharing of such materials in part or whole without the owner's consent is considered a violation of the Copyright Act and will be considered a scholastic offence.

In addition, online services such as Chegg are actively monitored. Such an activity will be considered a scholastic offence and will result in an academic penalty

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic-related matters: https://www.uwo.ca/sci/counselling/.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mentalhealth) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, http://westernusc.ca/services.