FRE-GY 6491
Credit Derivative and Risk Management

Instructor Information

- Frederic Siboulet, Adjunct Professor, NYU

Course Information

- FRE-GY 6491
- Credit Derivatives and Risk Management
- Credit Derivatives, Structured Products, Corporate Bonds, instrument valuation, position and portfolio risk management
- Stochastic calculus, probability methods, numerical methods,
- Mondays, 18:00-20:40, second half semester
- In person class preferred if possible (depending on COVID or such)

Course Overview and Goals

The course is focused on corporate bonds, credit derivatives and structured products, cash and derivatives instruments, for valuation, pricing in stochastic frameworks. Also looks at the application of machine learning to derivatives pricing.

Upon completion of this course, students will be able to:

- Work in team (2-3 participant) and meet well defined timely objectives
- Deliver a professional looking report, including mathematical formulas
- Program simple pricing formulas and algo using student language choice (or spreadsheet)
- Understanding of history of credit, modern definition of credit, continuity between interest rates and credit markets
- Role of issuers and buyers, protection buyers and sellers, rating agencies.
- Credit Risk modeling: expert systems, rating systems (Moddy's, S&P, Fitch), credit scoring (Altman's Z-score)
- Quantitative methods: Probability of Default (PoD) and Survival, Recovery Rate (RR), Loss Given Default (LGD).
- Understanding of structural models (Merton model, Black and Cox).
- Application to pricing IPOs and corporate recapitalization.

- Understanding of intensity models (Poisson process, Cox Process), quantification of credit (PD/EAD/LGD)
- Qualitative and quantitative review and comparison of "Structural" and "Intensity" models (Merton, Black & Cox, Jarrow & Turnbull, Duffie & Singleton).
- Instrument and their pricing, specifically corporate bonds and credit default swaps (CDS), Total Return Swaps (TRS), credit spread options (CSO), indices (iTraxx and CDX), credit linked notes (CLN) and collateral debt obligations (CDO).
- Integration and interdependence of risk types (market risk, credit risk, liquidity risk, operational risk). Hedging and diversification of risk, how do they compare, how to address them.
- Default Risk and Counterparty Credit Risk, similarities and differences.
- Credit Risk measurement and management.
- Bond pricing, Credit Default Swap bootstrapping, pricing under stochastic conditions, with or without recovery
- Flow instruments and structured finance, Credit Default Swaps, Total return Swaps, Collateral Debt Obligation
- Risk neutral valuation, risk neutral expectation of present value of expected pay off in a credit risky context, yield spread, forward rate spread, implied default probability
- The two factor Vasicek bond pricing equation
- Multivariate random variable, marginals and copulas, and their application to structured finance, specifically CDOs. Understanding of correlation vs dependence.
- Study of bivariate copulas, risk, variance and covariance.
- Understanding an exploration of Credit Value Adjustment (CVA), Debt Value Adjustment (DVA), Funding Value Adjustment (FVA), including Expected Exposures (EE) and Potential Future Exposure (PFE), Right and Wrong Way Risk (WWR),
- The subprime crisis review and explanation: how to bankrupt the economy
- Understand how to apply deep learning for derivatives pricing, and how to bridge modern finance theory with data science

Course Requirements

Class Participation

Participation required, once a week, 2:40 min
Class presentation are sent ahead of the class for student review
Some optional book reading and movies viewing recommendations

Assignments

Four team assignments (twelve days) and one individual assignment (three weeks). The individual assignment is due one week after the end of the half semester (avoiding overlap with other classes' exams).

Some simple coding (or excel work) with programming language up to each student's choice (VBA, MatLab, Mathematica, Python, Java, C++, etc.). All assignment should be typed as a report, including math formula, and (simple) bug free programs should be provided.

Tests & Quizzes

All assignments.

Assigned Readings

Some reading and website research. The class presentations are provided ahead of time, self-contained, and sufficient for the assignments. The class typically goes beyond the content of the presentation, encouraging discussion and critical thinking, and personal exploration of additional public information (ISDA, SIFMA, FINRA, FRB, OCC, SEC, CFTC, PRMIA, GARP, IAFE, RiskMag, Bloomberg, Reuters, S&P, Moody's, Fitch)

Grading of Assignments

The grade for this course will be determined according to the following formula:

Assignments/Activities	**% of Final Grade**
First team assignment	[12.5%]
Second team assignment	[12.5%]
Third team assignment	[12.5%]

Fourth team assigment	[12.5%]
Individual assigment	[50.0%]

Letter Grades

Letter grades for the entire course will be assigned as follows:

Letter Grade	Points	Percent
A	4.00	Example: 92.5% and higher
A-	3.67	Example: 90.0 – 92.49%
B+	3.33	Example: 87.5% - 89.99%
B	3.00	Example: 82.5% - 87.49%
B-	2.67	Example: 80% - 82.49%
C+	2.33	Example: 77.5% - 79.99%
C	2.00	Example: 70.0% - 77.49%
F	.00	Example: 69.99% and lower

View Grades

NYU classes for % grade on assignment and Albert for letter grade.

Course Schedule

Seven classes of the first half of each semester.

1. Structural Models
2. Credit Derivatives Instruments
3. Intensity models
4. Structured Products
5. Stochastic Credit Risk
6. Counterparty Credit Risk, CCP and SIMM
7. Credit Value Adjustment and FRTB

Topics and Assignments

Tests and Quizzes

- n/a

Course Materials

Required Textbooks & Materials

Any one of the following:

- Wilmott, Quantitative Finance
- Chaplin, Credit Derivatives
- Philipp Schonbucher, Credit Derivatives Pricing Models
- Wlimott, FAQ in Quantitative Finance

Resources

- **Access your course materials**: NYU Classes (nyu.edu/its/classes)
- **Databases, journal articles, and more**: Bern Dibner Library (library.nyu.edu)
  NYU Virtual Business Library (guides.nyu.edu/vbl)

- **Obtain 24/7 technology assistance:** Tandon IT Help Desk (soehelpdesk@nyu.edu, 646.997.3123)
  NYU IT Service Desk (AskIT@nyu.edu, 212-998-3333)

Policies

Academic Misconduct

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School's rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School's Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:
    1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person's work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.
    2. Fabrication: including but not limited to, falsifying experimental data and/or citations.
    3. Plagiarism: Intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.
    4. Unauthorized collaboration: working together on work that was meant to be done individually.

5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission have been received from the course instructor(s) or research adviser involved.
6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.

Disability Disclosure Statement

Academic accommodations are available for students with disabilities. Please contact the **Moses Center for Students with Disabilities** (212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

Inclusion Statement

The NYU Tandon School values an inclusive and equitable environment for all our students. I hope to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is my intent that all students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. If this standard is not being upheld, please feel free to speak with me.