REAL OPTION ANALYSIS
FINANCE 5325
Department of Finance
Albers School of Business and Economics
Seattle University

Peter Brous, Ph.D.   Phone: 206 296-6495
Professor of Finance   E-mail: pbrous@seattleu.edu

Course Description:
Real option analysis is an extension of the traditional DCF models by considering the value of flexibility associated with real investment opportunities (the ability to wait and learn before investing). Real option analysis uses the models developed to value stock options and applies these models to value real options and this course presents the motivation and the methods for applying real option analysis (ROA). Real options analysis is most useful for evaluating investments with great uncertainty and flexibility (new product development, R&D or technology driven investments, phased investments, patents, joint ventures, investments in emerging markets etc.). ROA can also be used to value new start-up firms that may not yet have a product to market but have potential future opportunities to monetize their innovation.

Course Objectives:

1. to provide you with a conceptual understanding of real option analysis such that you can enter conversations regarding its beneficial applications

2. to provide you with a conceptual understanding of real options to aid in developing strategies,

3. to create a mindset such that you are always thinking about and looking out for real options,

4. to provide you with the building blocks of real option analysis in order for you to be able to value common simple real options and the necessary tools to value complex real options, and

5. ultimately, to generate an interest in this area so that you will continue to learn more about this subject in the future after this class is over.

Requirements:
The requirements for this course are that you actively participate in the learning process, you complete the three problem set assignments, you complete the real option application project, you complete a take-home midterm, and you complete an in-class comprehensive final exam.

Course Participation:
The more we participate, the more we will learn. Therefore, you are expected to actively participate in the learning process by reading, thinking, and talking about the material related to the course and by working through the assigned problems in order to be familiar with the issues to be discussed in class. The level and quality of your participation which may occur during the weekly Zoom meetings, through e-mails, and one on one or small group spontaneous Zoom meetings and will make up 10% of your grade.

Problem Set Assignments:

There will be three assignments that will consist of a set of problems to solve to provide you the opportunity to practice applying the various models presented in class. These problem sets can be worked in groups of no more than two students and will make up 20% of your grade. Assignments are available on Canvas and should be submitted via Canvas' assignment tab. **Please only upload Word documents and Excel files (no PDFs).**

Take-Home Midterm:

There will be a take-home midterm which will consist of a problem set to be handed out on Monday, April 26th and will be due on Sunday, May 2nd. This midterm must be completed individually (no group collaboration) and will make up 20% of your grade. Midterm will be available on Canvas' Assignments tab and should be submitted via Canvas' Assignment tab. **Please only upload Word documents and Excel files (no PDFs).**

Real Option Application Project:

You are asked to identify a real option application, estimate/assume reasonable inputs, and develop a model(s) to value this option. Often it is useful to start off with a relatively simple model, solve the valuation problem and then add complexity to the model and determine the impact on the estimated value. This project can also be worked in groups of no more than **two** students. This project has three separate requirements: 1) an initial description of your real option application (completing the template) is due Sunday, May 9th, 2) you or your group is also required to set up a 30 minute Zoom meeting with me during the second two last week of classes (May 24th through May 29th) to informally present your model in order to get feedback for your final presentation, and 3) your group's final presentation of your analysis will be occur in a small group Zoom meeting (up to three other students, another finance faculty member, a finance department advisory board member and myself) during the last week of classes (June 2nd, 3rd, and 4th). Your final 20-minute presentation should clearly describe the situation that creates the option, the procedures used to estimate inputs, the model(s) used to value the real option, the results, and the implication of your analysis. This project will make up 25% of your grade. **Your grade on this assignment is solely based on the final presentation (a grading rubric/criteria will be provided).**

Final Exam:

The final exam is an open book, comprehensive exam on Friday, June 13th and will make up 25% of your grade. **There should be no collaboration on this exam.**

<u>Required Readings:</u>	Various Articles available via Canvas (click on Modules).
<u>Recommended Readings:</u>	Copeland and Antikarov, <u>Real Options: A Practioner's Guide,</u> Texere, 2001.
<u>Supplementary Readings:</u>	Ross, Westerfield, & Jaffe, <u>Corporate Finance</u>, 9th Ed., Chapters 5, 6, 7 (pages 218-225) and 22
	Brealey, Myers, & Allen, <u>Principles of Corporate Finance</u>, 9th Ed. Chapters 6, 7, 21, 22 and 23
	Trigeorgis, Real Options: Managerial Flexibility and Strategy in <u>Resource Allocation</u>, The MIT Press, 1996.

Amram and Kulatilaka, <u>Real Options: Managing Strategic Investment in an Uncertain World</u>, Harvard Business School Press, 1999

<u>Academic Resources</u>

- Library and Learning Commons (http://www.seattleu.edu/learningcommons/) (This includes: Learning Assistance Programs, Research [Library] Services, Writing Center, Math Lab)
- Academic Integrity Tutorial (found on Canvas and SU Online)

Academic Policies on Registrar website (https://www.seattleu.edu/redhawk-axis/academic-policies/)

- Academic Integrity Policy
- Academic Grading Grievance Policy
- Professional Conduct Policy (only for those professional programs to which it applies)

<u>Notice for students concerning Disabilities:</u>

If you have, or think you may have, a disability (including an 'invisible disability' such as a learning disability, a chronic health problem, or a mental health condition) that interferes with your performance as a student in this class, you are encouraged to arrange support services and/or accommodations through Disabilities Services staff located in Loyola 100, (206) 296-5740. Disability-based adjustments to course expectations can be arranged only through this process.
Notice Regarding Religious Accommodations

It is the policy of Seattle University to reasonably accommodate students who, due to the observance of religious holidays, expect to be absent or endure a significant hardship during certain days of their academic course or program. Please see, *Policy on Religious Accommodations for Students* (https://www.seattleu.edu/media/policies/Policy-on-Religious-Accommodations-for-Students---FINAL.PDF)."

<u>Office of Institutional Equity:</u>

Title IX of the Education Amendments of 1972 (Title IX) prohibits discrimination based on sex in educational programs or activities that receive Federal financial assistance. This prohibition includes sexual misconduct, which encompasses sexual harassment and sexual violence. Seattle U remains committed to providing a safe and equitable learning, living, and working environment. Seattle U offers emergency, medical, and other support resources, as well as assistance with safety and support measures, to community members who have experienced or been impacted by sexual misconduct.

Seattle U requires all faculty and staff to notify the University's Title IX Coordinator if they become aware of any incident of sexual misconduct experienced by a student.

For more information, please visit https://www.seattleu.edu/equity/. If you have any questions or concerns, you may also directly contact the Title IX Coordinator in the Office of Institutional Equity (email: oie@seattleu.edu; phone: 206.296.2824) University Resources and Policies

<u>COURSE SCHEDULE</u>

<u>Date</u>	<u>Topics, Readings, and Assignments</u>

3/29   **I. Introduction to Real Option Analysis**

      Readings: Business Week, *Exploiting Uncertainty*, June, 1999
                       Triantis and Borison, *Real Options: State of the Practice*, JACF, Summer 2001
                       Copeland and Keenan, *How Much is Flexibility Worth,* The McKinsey Quarterly, 1998
                       Eapan, *Accidental Real Options Practitioner,*JACF, Winter 2003
                       Copeland & Antikarov - Chapters 1 & 2

4/5   No Class: Easter Weekend

4/12   **II. Valuing Real Options Using the Black-Scholes Option Pricing Model**

      Readings: Arnold & Shockley, *Value Creation at Anheuser-Busch: A Real Option Example*. JACF, Summer 2001
                       Damodaran, *The Promise of Real Options*, JACF, summer 2000

      Assignment: Problem Set 1, Due Sunday 4/18

4/19   **III. Valuing Real Options Using the Binomial Option Pricing Model**

      Readings: Hervert, *Real Options Primer: A Practical Synthesis of Concepts and Valuation Approaches*, JACF, Summer 2001
                       Brealey, Myers, & Allen, *Brealey, Myers Allen on Real Options,* Journal of Applied Corporate Finance, Fall 2008
                       Copeland & Antikarov – Chapter 4 (pages 95-117)

      Assignment: Problem Set 2, Due Sunday 4/25

4/26   **IV. Additional Valuation Applications Using the Binomial Option Pricing Model**

      Readings: Royer, *Why Bad Projects are so Hard to Kill?*, Harvard Business Review, February 2003

Fink, *Reality Check*, CFO magazine, September 2001
Copeland & Antikarov – Chapter 5

Take-Home Midterm, Due Sunday 5/2

5/3   **V. Advanced Valuation Applications Using the Binomial Option Pricing Model**

    Readings: Brous, Buchanan, and Orcutt, *Valuing Raise Your Rate Certificates of Deposit*, 2014

    Real Option Application Project Description, Due Sunday 5/9

5/10   **VI. Estimating the Value and Volatility of the Underlying Asset**

    Readings: Copeland & Antikarov – Chapter 9

    Assignment: Problem set 3, Due Sunday 5/16

5/17   **VII. Valuing Compound Real Options**

    A. Valuing Simultaneous Compound Options
    B. Valuing Sequential Compound Options

    Readings: Shockley & Et.al., T*he Option Value of an Early-Staged Biotechnology Investment*, JACF, Winter 2003
         Copeland & Antikarov – Chapter 6, pages 163-171
         Copeland & Antikarov – Chapter 6, pages 171-179.

    Real Option Application Project Individual/Group Zoom Meeting: Each individual/group is required to sign up for a one-hour meeting from May 24th to May 29th to discuss your real option application project in preparation for your presentation the following week.

5/24   **VIII. Valuing Rainbow Options**

    Readings: Copeland & Antikarov – Chapter 10
         Brous, *Valuing an Early-Stage Biotechnology Investment as a Rainbow Option*, JACF, Spring 2011

    RO Application Project Presentations, Wednesday 6/2, Thursday 6/3, and Friday 6/4

5/31   Presentation Week: No Class but **two** half-hour sessions are required from June 2nd to June 4 from 6:00 to 9:00 pm. In one session your group will present your real option application and the other session your group will be the audience for another group's presentation.

6/7   No class but final exam review sessions Wednesday 6/9 and Thursday 6/10 at 6 pm.

6/13   **Final Exam**

Important Due Dates:

Sunday 4/18	Problem Set 1
Sunday 4/25	Problem Set 2
Sunday 5/2	Take-Home Midterm
Sunday 5/9	Real Option Application Project Description
Sunday 5/16	Problem Set 3
Monday 5/24 through Saturday 5/29	Real Option Application Project Required Meeting (you are required to set up the meeting time, I am not available Tuesdays/Thursdays 3:30 to 6:00 pm)
Wednesday 6/2 through Friday 6/4	Real Option Application Project Presentation (you are required to set up the meeting time, I am not available Tuesdays/Thursdays 3:30 to 6:00 pm)
Friday 6/11	Final Exam (6:00 to 7:30 pm)