Course Description

This is an MBA level course on Risk Management for financial institutions. The quantitative level is commensurate with that and presumes a working knowledge of basic probability and statistics.

The focus of the course is on the identification, measurement and management of the major types risks within financial institutions. The emphasis will be on broad concepts and principles, with many examples given as non-graded homework problems. The lectures will be supplemented by reading material that examines topics in more depth than will be possible during class time.

We will begin by examining the nature of and the methods for measuring each major risk type. During the latter part of the course we will discuss methods, such as economic capital (EC) and stress testing, for measuring firm-wide risk, both within each risk type and across all risk types. EC is a component for assessing the capital adequacy of the firm and for evaluating the return on risk of different lines of businesses, products, and customer relationships. We will discuss the relation between risk and capital adequacy from an internal (EC) and a regulatory perspective. We will discuss the major types of regulatory capital constraints (e.g. Basel capital ratios, leverage ratios, the US CCAR process) and investigate the effect of regulatory capital constraints on a bank’s business strategy, given the need for optimizing the long-term return on capital.

The post-crisis growth in regulatory requirements for measuring risk and regulatory capital constraints have materially affected the business strategies of large banks and consequently changed the landscape of the financial service industry.

The course should be of interest and value to anyone who planning to work in the financial service industry, including: sales and trading; investment banking, commercial and retail banking, as well risk management.

Risk management is an art and a science. It requires an understanding of markets, products, processes and systems, law and regulation, as well as quantitative methods. It also requires an examination and understanding of the causes and consequences of the systemic financial crisis and large financial losses that have occurred in the past.

The course will be a mixture of theory and practice, with a focus on how large banks actually measure, limit, and manage their financial risks.

Pre-requisites and Co-requisites

None

Although the course has no pre-requisites or co-requisites, students are expected to have taken a course in statistics and a basic course in capital markets. The course assumes a basic understanding and familiarity with the common types of traded contracts (e.g. debt and equity.
securities, currency exchange, forwards, swaps, and European options), and a familiarity with discounted cash flow valuation formula for debt securities and derivative instruments. **If you have not had a basic course in capital markets, you should not take this course.**

**Lectures**
The primary content for the course will come from the lectures. The lectures will consist of original material which will be distributed as a PowerPoint file before each lecture.

**Guest Lectures**
Industry practitioners may give some guest lectures.

**Textbook**
No textbook is required. (See "other reading material" below).

**Homework**
I will assign frequent homework exercises, which will not be graded, but are an essential component of learning the course material and of self-testing your understanding of that material.

**Other reading material**
I will provide additional reading material on selected topics. Some of the material will be required background information to supplement class lectures. Other material will be optional reading, available if you want to dig deeper into some topics.

**Grades**
The grade for the course will be based on class participation (10%), the mid-term (30%) and the final exam (60%).

All homework problems will be distributed with an answer sheet. The homework will not be graded, but doing the homework assignments in a consistent and timely way will be critically important as a means of learning and of testing your understanding of the content of the course.

**Content**
The class will be two and hours long and will meet 14 times during the semester. With one exception, each meeting will be divided into approximately two 70-minutes lectures, with a ten-minute break midway. The one exception will consist of the midterm exam, and a lecture.

- **Very Brief overview**
  - Overview of the course and the major types of financial risk.
  - The components of risk management. Risk policies, risk analytics, risk measurement and reporting, risk monitoring and limits framework.
  - A very brief review of standard accounting categories (Accrual, Marked-to-market, Available for Sale/OCI) used to measure value and income and their relation to how the risks of a portfolio are measured and managed.

- **Market Trading risk**
The sub-types of market risk (trading risk, accrual interest rate risk, and equity investment risk).
A high level review of market trading risk, including:

- Discounted cash flow models and model risk.
- For each primary form of contract (cash, forward, swap or option) and each major type of market factor (interest rate, credit spread, FX, equity, commodity) we will review:
  o Discounted cash flow models and market risk factors, i.e. the fundamental prices, rates, and implied factors that determine market value.
  o The calculation of market factor sensitivities.
- The foundations for measuring, reporting, and managing market trading risk:
  o Market factor sensitivities and factor sensitivity limits.
  o Basic trading portfolio risk measures: VAR (Value at Risk), Stress VaR, ES (Expected Short-Fall), and stress tests.
- Value at Risk (VaR) in more detail
  o Historical vs. Monte Carlo statistical simulation of VAR.
  o Historic volatilities and correlations of market factors in normal and stressed conditions. Normal vs. fat tailed distributions.
  o The use and misuse of VAR; supplementing VAR with other risk measures.

- **Interest Rate Risk in the Banking Book**
  For commercial banks, or bank holding companies with large commercial bank businesses, Net Interest Revenue (NIR) is a very large, and in some cases, the largest component of firm-wide revenue. We will define and review a range of methods for measuring interest rate risk in the banking book, from simple to complex.

- **Funding Liquidity Risk**
  Definitions of funding liquidity risk for both the banking book and the trading book. The relationship between funding liquidity risk and trading liquidity risk. Funding illiquidity as one of the two fundamental causes of financial collapse. Measuring and managing short-term and long-term funding liquidity risk.

- **Credit risk**
  We will primarily focus on wholesale credit. The measurement of credit risk begins with the assessment of the probability of default (PD) of an obligor. Topics covered will include:
    - Historical default rates and economic cycles.
    - Different methods for estimating obligor risk ratings and PDs,
    - Historical rating transition matrices. Cumulative default rates and hazard rates.
    - Loss Given Default (LGD) and collateral.
    - Exposure at Default (EAD) and Credit Conversion Factors (CCFs) for contingent credit lines.
    - Relation of credit spreads, PDs, and liquidity risk.
    - Methods for simulating the probability distribution of the credit loss at a portfolio level; credit concentration risk
    - Credit risk mitigation.

Counterparty credit risk is a form of credit risk arising from (over the counter) OTC derivatives and securities financing transactions (e.g. repos). The OTC derivative market grew exponentially for almost 25 years until the financial crisis. The outstanding notional principal, at the end of June 2015, was slightly over $550 trillion. The counterparty credit risk of derivatives remain a materially important form of credit risk. In contrast to the credit risk of a loan portfolio,
counterparty credit risk is characterized by uncertain future exposures, offsetting exposures and bilateral credit risk. Topics will include:

- Methods for simulating a counterparty’s exposure profile, taking into account the effects of legally enforceable margin and netting agreements
- The definition, measurement and hedging of the Credit Value Adjustment (CVA) for counterparty credit risk.
- Economic Capital for counterparty credit risk.

Regulatory pressure will result in many derivatives between large financial institutions moving to central counterparties (CCPs). We will briefly discuss the current status of this and other regulations on derivatives.

### Brief Discussion of Other Important Risk Types

- Operational risk
- Model risk for each type of model: Pricing models, Risk models, Decision and support models; Model governance and control; Model validation
- Sovereign risk and country risk

### Economic Capital, Internal Stress Testing and Risk Appetite

The definition and measurement of economic capital (EC). EC and the measurement of solvency risk. How EC is measured for each risk type. Measuring EC for the firm as a whole across all risk types. EC and systemic stress tests.

Risk Appetite. Various measures of return on economic risk.

### Basel Regulatory Capital and US CCAR process

- Basel Committee on Banking Supervision (BCBS)
  - Composition and power of the BCBS
  - Risk Weighted Assets and. BCBS measurement of Economic Capital.
  - Capital Ratios, Liquidity Ratios, and Leverage Ratios
  - Large Exposure Limits

  - The dynamic modelling of regulatory capital ratios over time, conditional on time-dependent macroeconomic scenarios.

- The integration of risk measurement with strategic planning. Optimizing allocation of capital to maximize long-term shareholder value, given multiple regulatory constraints.

### Analysis of large financial losses in the past (If we have time)


Leverage, solvency risk, and funding liquidity risk in a financial crisis. Funding liquidity risk and trading liquidity risk in a financial crisis.

Depending on questions and class discussions, we may not have time for every topic. Judgment will be used to ensure that the most important issues are covered.

### Goals of course
The primary objective of the course is to teach you the nature of the major types of financial risk and the principles and methods underlying the quantitative measurement, management, and mitigation of these risks. There will be a particular focus on the market risk in trading portfolios, the several forms of credit risk, funding and trading liquidity risk, and the interaction of market, credit and liquidity risk.

**Planned lectures** – Each of the 14 classes will be divided into two 70-minute lectures (or mid-term exam), with a ten-minute break. Subject to revision.

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<thead>
<tr>
<th>Date</th>
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<th>Content</th>
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<td>Sep 7</td>
<td>1a</td>
<td><strong>Course Overview. Market Risk.</strong> Factors Sensitivities (FS) of spot FX, equities and commodities.</td>
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<td>- FS for debt securities – yield curve and credit spread sensitivity</td>
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<td>- FS of forwards and futures – FX, equities, commodities</td>
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<td>- FS of forwards and futures – interest rates</td>
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<td>- FS of swaps; relation of IR Swap and bond FSs</td>
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<td>4a Setting FS limits</td>
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<td>4b VAR and Expected Shortfall</td>
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<td>Oct 5</td>
<td>5a</td>
<td>Stress scenarios and stress testing of market risk</td>
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<td><strong>Interest Rate Risk in the banking book (IRRBB)</strong></td>
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<td>7b Credit Risk – Introduction to basic concepts: EAD, PD, and LGD</td>
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<td>8a - Continuation of basic concepts in credit risk.</td>
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<td>8b - Continuation of basic concepts in credit risk.</td>
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<td>Nov 2</td>
<td>9a</td>
<td><strong>Counterparty credit exposure</strong> of OTC Derivatives and SFTs</td>
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<td>9b <strong>Counterparty credit risk</strong> and CVA</td>
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<td>9</td>
<td>10a Other Risks: Operational Risk,</td>
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<td>10b <strong>Model Risk:</strong> risks to pricing models, risk models, decision support models; model control and governance, model validation.</td>
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<td>11a Economic Capital</td>
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<td>12a Firm wide stress testing; Systemic stress scenarios</td>
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<td>12b Regulatory capital; Basel Committee on Banking Supervision</td>
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