**New York University**
**Courant Institute of Mathematical Sciences**

**Syllabus**

# Mathematical Finance Seminar Course: A Practical Approach to Risk Assessment of Mortgage-Backed Securities

September 8, 2010 – December 9, 2010
Wednesdays, 11:00 a.m. – 12:00 p.m.
Warren Weaver Hall, Room 1314

Instructors:
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(MD, South Street Securities and CEO, Capital Markets, Engineering & Trading LLC)

## Course Description

Mortgage-backed securities (MBS) are widely perceived as the culprit of the 2007-2008 global economic crises because the risks associated with MBS are often misunderstood and the extent of the potential loss is misjudged. With the instructors' practical experience in the bond markets and a step-by-step analysis of an MBS arbitrage trading strategy, commonly known as "dollar roll", the students will learn

- how to identify the risks inherent in the MBS market;
- how to devise the appropriate mathematical models to quantify the risks; and
- how to evaluate the results to make an informed business decision.

## Prerequisite

- Post-graduate with major concentration or equivalent proficiency in mathematics or finance.

## Reading Materials:

As suggested in the course outline below

Recommended reference material: *The Handbook of Mortgage-Back Securities*, Sixth Edition, by Frank J. Fabozzi, McGraw Hill

## Course Outline

Session 1: Bond Market (Fixed-Income Market)
Session 2: Mortgage-Backed Securities (MBS)
Session 3: Repurchase Agreement (Repo & Reverse Repo)
Session 4: The Depository Trust & Clearing Corporation (DTCC)
Session 5: To-Be-Announced (TBA) market
Session 6: Dollar-roll trading strategy

### Session 1
### Bond Market
### (Fixed-Income Market)

Reading Materials:

- 9/30/1999 NY Times: Fannie Mae Eases Credit To Aid Mortgage Lending
- 02/23/2009 Wired Magazine: The Formula That Killed Wall Street
- http://en.wikipedia.org/wiki/Bond_market
- http://en.wikipedia.org/wiki/Primary_dealer
- http://www.investinginbonds.com/marketataglance.asp?catid=31&id=78

General Discussion Topics:

- Importance of the bond market
- Relationship among centralization, standardization, liquidity and transaction costs
- The Depository Trust & Clearing Corporation (DTCC)
- Diversity of bond markets
- Bond market participants (see primary dealer below)
- Bond market volatility
- Difficulty of bond valuation: Multiple variables and OTC nature
- Simplicity sells

Additional Discussion Topic:

Primary dealer

- Approved by the New York Fed
- $100 million market cap is adequate
- Commit to buying 5% of issuance if auction fails
- There are approximately 18 primary dealers
- The Fed is interested in a dealer’s ability to distribute TSYs, not just hold them

Why use Eurodollar (ED) futures to hedge and to build yield curve?

- ED futures is extremely liquid
- T-bills are often held to maturity by investors, resulting in unreliable prices
- Fed fund futures is also used for the first three months
- Divergence between ED & FF futures during Lehman’s default in 2008

Curve construction

- ED deposit rate (Libor) up to the first ED futures settlement date
- ED futures prices up to four years
- Convexity adjustment using option pricing model
- Convexity adjustment using broker quotes
- Over 4 years, on-the-run Treasuries + swap spreads
- Boot-strapping to derive zero-coupon Treasury yields
- Risk control issues: Timing of mark-to-market parameters, price manipulation at closing, on/off-the-run, and when-issue (WI)

## Session 2
## Mortgage-Backed Securities
## (MBS)

Reading Materials:

- http://en.wikipedia.org/wiki/Mortgage-backed_security
- http://en.wikipedia.org/wiki/Government-sponsored_enterprise
- The Handbook of MBS by Frank J. Fabozzi, chapter 4

General Discussion Topics:

- MBS definition (what do MBS investors own?)
- Government-sponsored entities (GSE): GNMA vs. FNMA (Fannie Mae), FHLMC (Freddie Mac), SLM (Sallie Mae), etc.
- MBS unique feature: prepayment risk. RMBS higher than CMBS.
- Weighted-average maturity (WAM)
- Weighted-average coupon (WAC) vs. bond coupon (pass-thru rate)
- Pass-through RMBS & CMBS, CMO, SMBS, IO, and PO
- Prime, Alt-A and subprime
- Covered bonds
- Original objectives of securitization
- Root cause of 2007-2008 mortgage crisis: Upfront profit on securitization
- Overview of credit risk, interest rate risk and prepayment risk
- Factors affecting prepayment risk
- Trading, settlement and clearing procedures for agency MBS

Additional Discussion Topics:

Servicer

- For agency-backed, if borrower is delinquent, servicer makes up difference
- Servicer gets reimbursed by agency after periodically
- Servicer is giving a bridge loan

MBS Underwriting Process

- Bank usually acts as the servicer of the mortgages it originates and securitizes
- Accumulation of mortgage pipeline for securitization
- Bank pays agencies guarantee fee to reduce its interest cost on MBS
- Servicer "bridge loan" for delinquencies and defaults

Maximum Credit Exposure – Announcement Day vs. Actual Payment Day

- REITs finance MBS portfolios with repo dealer
- It can take a servicer up to 60 days from collection to factor announcement on the 4th business day of each month (many mortgagees still pay in checks)
- Another 2 weeks (~50%) to 3.5 weeks for servicer to pay bondholders
- Scheduled and unscheduled payments cause decrease in MBS value
- REITs suffer liquidity risk due to unexpected margin call (Lehman's demise)
- Lender is at risk for counterparty default
- Solution: Legal assignment of right to receive scheduled and unscheduled prepayment

Evolution from Market Risk to Credit Risk to Liquidity Risk

Addiction to securitization "profit"

- Upfront recognition of gains from securitization
- Initial objective of securitization

Pricing of MBS

- Use of CDS spreads to price MBS (i.e., ignoring fundamentals)
- Failure to recognize the importance of home equity loans

Central clearing of CDS to reduce systemic risk

- CME – publicly traded
- ICE Trust – owned by 9 dealers
- Euroclear
- My message to NY Fed: "Selective Netting" may actually increases systemic risk

MBS vs. ABS on consumer loans (credit card, auto/student/home equity loans)

Structured product market

- CMO tranches – Investors fear of structured/complexity
- Simplicity reduces costs
- Simplicity sells

## Session 3
## Repurchase Agreement
## (Repo & Reverse Repo)

Reading Materials:

- http://en.wikipedia.org/wiki/Repurchase_agreement

General Discussion Topics:

- Legal definition
- Economic substance and accounting treatment
- U.S. Code Title 11 – Bankruptcy (the Bankruptcy Code)
- Federal Deposit Insurance Act (FDIC & FDIA)
- Securities Investor Protection Act of 1970 (SIPC & SIPA)
- English law and Lehman's "Repo 105"
- Legal risk; standard MRA and GMRA by SIFMA
- Type of repo: Held in custody, Tri-party, whole loan, equity
- Sell/buy backs; its economic substance & accounting treatment
- Securities lending
- Repo matched-book

## Session 4
## The Depository Trust & Clearing Corporation
## (DTCC)

Reading Materials:

- http://www.dtcc.com/about/subs/ficc.php
- http://www.dtcc.com/products/index.php?id=ficc
- http://www.dtcc.com/products/fi/fixed_income_mbsd/netting.php
- Handout written for the FICC loss allocation procedures

General Discussion Topics:

- Fixed Income Clearing Corporation (FICC)
- Government Securities Division (GSD)
- Mortgage-Backed Securities Division (MBSD)
- Trade matching and comparison
- Daily margining and minimum capital requirements
- Legal risk with respect to netting and settlement
- FICC = Central counterparty?
- Opaque loss allocation procedures

**Session 5**
**To-Be-Announced (TBA) Market**

Reading Materials:
- http://www.sifma.org/capital_markets/docs/TBA-Pools-2008-MBS-Brief.pdf
- http://www.dtcc.com/leadership/issues/mbsccp/index.php

General Discussion Topics:
- Euro-dollar futures market
- U.S. Treasury futures market
- “Cheapest to deliver” vs. “Specials”
- TBA definition and objective
- Uncertain counterparty risk
- Liquidity comparison among ED futures, U.S. Treasury futures and TBA
- Trade-off between liquidity risk and basis risk
- The role of MBSD
- Settlement and loss allocation procedures

**Session 6**
**Dollar Roll Trading Strategy**

Reading Materials:
- PowerPoint presentation on an actual dollar roll transaction prepared by the management of a repo dealer

General Discussion Topics:
- Dollar roll definition
- Business purpose
- Cash flow analysis
- Counterparty default risk
- Interest rate risk
- Prepayment risk

**TERENCE MA** commenced his career in the U.S. capital markets and securitization in 1981. He spent his early career at Citibank's credit card treasury division and took part in the development of the credit card securitization market in the 1980's. He left Citibank and joined the derivatives trading group at Deutsche Bank, New York in the early 90's.

Mr. Ma returned to Citicorp/Citibank in the mid 90's with the structured derivatives group. In his last six years as a financial engineer at Citicorp Securities, Inc., Mr. Ma successfully developed a securitization program to assist the foreign exchange and derivatives businesses in managing their counterparty exposure and capital utilization.

Mr. Ma is a certified public accountant in the State of New York. He earned his bachelor degree in accounting, Magna Cum Laude, at Pace University, New York and received his accounting training at Coopers & Lybrand. He also holds an MBA in finance with distinction from New York University.