CFRM 522 Syllabus

Introduction to Trading Systems

Daniel Hanson, Instructor

Textbooks and Reading

Irene Aldridge: *High-Frequency Trading (2E), (Wiley 2013)* (textbook)
- Ch 1: How Modern Markets Differ from Those Past
- Ch 2: Technological Innovations, Systems, and HFT
  - Hardware
  - Messaging
  - Software
- Ch 3: Market Microstructure, Orders, and Limit Order Books
  - Types of Markets
  - Limit Order Books
  - Modern Microstructure
  - Fragmentation in Equities, Futures, Options, Forex, Swaps
- Ch 4: High Frequency Data
- Ch 5: Trading Costs
  - Transparent Execution Costs: Commissions, Exchange Fees
  - Implicit Execution Costs: Bid-Ask Spreads, Slippage, Market Impact
- Ch 6: Performance of HFT Strategies
  - Basic Performance Measures: Return, Volatility, Drawdown, Win Ratio, Average Gain/Loss, Correlation, Alpha and Beta, Skewness and Kurtosis
  - Comparative Ratios
  - Performance Attribution
- Ch 7: The Business of HFT
  - Key Processes of HFT
  - Financial Markets Suitable for HFT
  - Market Participants
- Ch 8: Statistical Arbitrage Strategies
  - Practical Applications: Equities, Forex, ETF’s, Options
  - Summary

Mebane T Faber: *A Quantitative Approach to Tactical Asset Allocation (2006)*
Mebane T Faber: *A Quantitative Approach to Tactical Asset Allocation (2013)*

These two papers provide an example of a basic trading strategy employed on a familiar topic, namely asset allocation in funds, where an asset it compared to a moving average each month. Although not “high frequency trading”, the strategy is similar to a basic HFT case, or other trading algorithm.

Jaekle and Tomasini: *Trading Systems, (Harriman House 2009)* (textbook)

- Ch 1: What is a Trading System?
- Ch 2: Design, test, optimisation and evaluation of a trading system

Part II: Trading System Development and Evaluation of a Real Case
- Ch 3: How to develop a trading system step-by-step – using the example of the British pound/US dollar pair
  - First Evaluation
  - Variation of Input Parameters
  - Inserting an Intraday Time Filter
  - Determination of Appropriate Exits – Risk Management
Ch 4: Two methods for evaluating the system’s predictive power
  • Timescale Analysis
  • Monte Carlo Analysis (including supplemental material on simulation using four-parameter distributions)

Ch 5: The factors around your system
  • The Market’s Long/Short Bias
  • Out-of-Sample Deterioration
  • The Market Data Bias
  • Optimization and Over-Fitting
  • Rule Complexity

Ch 6: Periodic re-optimisation and walk forward analysis
  • “Normal”, Static Optimisation
  • Anchored vs Rolling Walk Forward Analysis
  • Rolling WFA on the LUXOR System
  • Sample Size and Market Structure

Ch 7: Position sizing example, using the LUXOR system
  • Money Management vs Risk Management
  • Money Management Schemes
  • Monte Carlo Analysis of the Position Sized System
  • Conclusion

Additional Reading
  • Books of related interest
  • Research papers and/or other articles related to trading

Software for Modeling and Simulated Trading
R with RStudio (or Microsoft RTVS)
R packages:
  quantmod
  xts
  blotter
  quantstrat
  IBrokers
  RSQLite

Interactive Brokers:
Trader Workstation (paper accounts will be provided to students)

Course Overview
First half of the quarter
Start with a general but comprehensive view of HFT and systematic trading, as presented in chapters 1-7 (and ch 8, if time permits) in the Aldridge book. Random quizzes will cover topics in the book, and assignments will cover deeper topics and some of the mathematics in the book.

There may also be readings of related interest, on which students may be required to report or provide analysis. During this time, we will also introduce the R packages we will be using, get students set up on IB-TWS, and have them get practice placing different types of trades via IB-TWS and IBrokers, plus set up basic components of strategies such as moving averages, locate crossovers etc, using one-day bars and average of OHLC. Also, we will include collecting data for testing, storing it in an SQLite DB, and accessing it in R with RSQLite.

Second half of the quarter
For the 2nd half of the quarter, work through chapters 1-7 of Jaekle and Tomasini, which introduces and builds upon a USD/GBP LUXOR strategy.
During this portion of the course, students will have the opportunity to use the topics covered to construct their own similar strategies, and implement them in R.

Additional supplemental reading may be assigned during this part of the course as well, again requiring student reports or analysis.

**Supplemental Topics (Time Permitting)**
- Basic overview of Single Instruction, Multiple Data (SIMD) computing, and GPU’s
- Option trading strategies
- Case studies of firms that specialize in HFT/algorithmic/automated trading: strategy prototyping, backtesting, implementation, risk management, commonly used programming languages
- Overview of cryptocurrency trading

**Grading** is based on:
Assignments (coding and strategies)
Reading assignments (books and papers), and reports analysis to be submitted
Random in-class/online quizzes
Midterm
Final exam and/or final project (TBD)