Finance 436 – Futures and Options
Review Notes for Midterm Exam I

Chapter 1

1. Derivative securities: concepts
2. Futures and forward contracts: definitions and comparison
   Exchange trading; contract size, delivery; default risk; marking to market
3. Options: concepts
4. Players in options and futures markets
   Hedgers: reduce price risk (uncertainty)
   Speculators: bet on price movement
   Arbitrageurs: look for risk-free profit
5. Applications
6. Examples discussed in class and assignments

Chapter 2

1. Specification of futures contracts
   Opening vs. closing a futures position
   Long vs. short a futures position
   Underlying asset
   Contract size (will be given if needed)
   Delivery month
   Daily price limit
   Position limit
   Settlement price: concepts
   Open interest: concepts and calculations
2. Convergence of futures price to spot price: concepts and proof
3. Margins: concepts and calculations
   Initial margin
   Maintenance margin
   Margin call
   Variation margin
4. Marking to market process: concepts and calculations
5. Orders and applications
   Market order
   Limit order
   Stop or stop-loss order
   Stop-limit order
   Day order
   Open order
6. Cash settlement: concepts
7. Forward contracts: profit/loss diagrams
8. Examples discussed in class and assignments

Chapter 3

1. Hedging: concepts
   Long hedging vs. short hedging
2. Basis risk: definitions and applications
3. Cross hedging
   Hedge ratio: definition, estimation, and implication
   Minimum variance hedge ratio: minimize the variance
   Optional number of contracts
4. Hedging with stock index futures
5. Examples discussed in class and assignments

Chapter 4

1. Types of interest rates
2. Measuring interest rates
3. Zero rates
4. Bond pricing
5. Forward rates
6. Forward rate agreements
7. Term structure theories
8. Examples discussed in class and assignments

Sample Problems

Chapter 1

Problem 1-11

A cattle former expects to have 120,000 pounds of live cattle to sell in three months. The live cattle futures contract on the CME is for the delivery of 40,000 pounds of cattle. How can the former use the futures contracts to hedge?

Answers: to sell 3 three-month cattle futures contracts

Problem 1-33

Theoretical futures price $F = 1{,}800 * e^{(0.05*1)} = \$1{,}892.28$

Since the actual futures price in the market is 2,000 > 1,892.288, it is overpriced

Today:

(1) Borrow $180,000 at 5% to buy 100 ounces of gold at $1,800

(2) Sell a futures contract on gold at $2,000 per ounce (one year delivery)

(3) Store the gold

In one year:

(1) Make the delivery and collect $200,000

(2) Repay the loan (principle plus interest) $\$189{,}228.80 = 180{,}000 * e^{(0.0.5*1)}$

(3) Take risk-free profit = $10,771.20

Chapter 2

Quiz 2.3

Short position: if price drops, you gain; if price goes up, you lose

Margin call: lose $1,000 for each contract in your margin account or price goes up by 20 cents per ounce (5,000 ounces per contract)

Problem 2.11

Long position: if price drops, you lose; if price goes up, you gain

Margin call: lose $1,500 per contract in your margin account or price drops by 10 cents per pound (contract size is 15,000 pounds)

If the futures price drops below 150 cent per pound, you will receive a margin call

Making $2,000 total or $1,000 per contact: if the price rises by 6.67 cents

Chapter 3

Quiz 3.6: See the textbook for the answer

Quiz 3.7: See the textbook for the answer

Sample problem

Consider the following stock portfolio that is composed of three stocks:

Stock	Shares	Price	Value	Beta
FV	12,000	34	408,000	1.25
GC	25,000	22	550,000	1.00
YH	20,000	17	340,000	1.07

If the S&P 500 index currently is standing at 400 ($500 time the index is the contract size), how many futures contracts must be bought or sold to hedge 50% of the market risk of this portfolio?

Beta of the portfolio (value weighted average) = 1.097 = 1.10

F = 500*400 = $200,000

S = 408,000 + 550,000 + 340,000 = $1,298,000

Optimal contract size N* = 7.12 contracts

A 50% hedge (or to reduce the portfolio beta to 0.55) means shorting 3-4 S&P 500 index futures contracts

Problem 3.23

Sixty futures contracts are used to hedge an exposure to the price of silver. Each futures contract is on 5,000 ounces of silver. At the time the hedge is closed out, the basis is $0.20 per ounce. What is the effect of the basis on the hedger's financial position if (a) the trader is hedging the purchase of silver and (b) the trader is hedging the sale of silver?

Answer: The excess of the spot over the futures at the time the hedge is closed out is $0.20 per ounce. If the trader is hedging the purchase of silver (long), the price paid is the futures price plus the basis. The trader therefore loses 60×5,000×$0.20=$60,000. If the trader is hedging the sales of silver (short), the price received is the futures price plus the basis. The trader therefore gains $60,000.

Chapter 4

Quiz 4.1: See the textbook for the answer

Quiz 4.4: See the textbook for the answer

T-bonds are quoted as a percentage of $100 face value (bid price is the price you receive if you sell the T-bond and offer (asked) price is the price you pay to buy the T-bond, more often T-bonds are traded in denominations of $1,000)

Problem 4.12
A three-year bond provides a coupon of 8% semiannually and has a cash price of 104. What is the bond's yield?

Cash price = quoted price + accrued interests

The bond pays $4 in 6, 12, 18, 24, and 30 months, and $104 in 36 months. The bond yield is the value of y that solves

$$4e^{-0.5y} + 4e^{-1.0y} + 4e^{-1.5y} + 4e^{-2.0y} + 4e^{-2.5y} + 104e^{-3.0y} = 104$$

Using the *Goal Seek* or *Solver* tool in Excel, we get $y = 0.06407$ or 6.407%

Or you can calculate the yield to maturity (YTM), using semiannual compounding and then convert it to continuous compounding

PMT = 4, PV = -104, FV = 100, N = 6 (semiannual), solve for i/y = 3.255%
YTM = 6.511%

Convert it to continuous compounding to get

y = m*ln(1 + 6.511% / m) = 2*ln(1 + 0.06511 / 2) = 6.407%