

Assignment 1  
Answer

1. Use the futures data in the Money and Investing section from a recent copy of the Wall Street Journal to answer the following questions:

(i) How far into the future can you use futures to hedge price risks for the following commodities: (Answer may vary)

- (a) Natural gas - **Aug 06'**
- (b) Crude oil - **Dec 04'**
- (c) Orange juice - **Mar 04'**
- (d) Gold - **Dec 04'**
- (e) Wheat - **Dec 01'**

(ii) For each of the five commodities in question (i) calculate the total value of the outstanding open interest for the nearest (i.e. earliest expiring) contract. (Answer may Vary)

(Open interest x contract size x settlement price)

- (a) Natural gas -  $2.258 \times 10,000 \times 59,517 = \$1,343,893,860$
- (b) Crude oil -  $\$22.05 \times 10,000 \times 58,232 = \$12,840,156,000$
- (c) Orange juice -  $\$0.7985 \times 15,000 \times 12,789 = \$153,180,247.50$
- (d) Gold -  $\$289.90 \times 100 \times 1,098 = \$31,831,020$
- (e) Wheat -  $\$2,635 \times 5000 \times 92,242 = \$1,215,288,350$

2. A newly elected congressman proposes to scrap all public unemployment insurance schemes and instead leave it to individual employees in the US to insure themselves against unemployment risk. This, he proposes, they can do through trading in a soon-to-be-launched unemployment futures contract. The contract is, according to the proposal, going to be traded on the CBOT and will take the form

$$\text{Futures payoff} = \$10,000 * (\text{US unemployment rate next quarter}) / (\text{average unemployment rate 1960-2002})$$

(i) Explain how a worker could use this futures contract to set up a hedge against unemployment risk. In particular explain whether the worker should be short or long in the futures contract.

**A worker would go long(buy) the futures using the intuition that her employment status would be linked to the economy's unemployment rate, i.e. she would be likely to be unemployed when many people were unemployed, and thus the future would pay out a large amount of money when she was likely to be unemployed.**

(ii) Give at least two reasons why the proposed scheme may fail to generate sufficient trading volume (liquidity) to be successful.

(There are three reasons that are acceptable)

**Reason 1:** News about unemployment comes out only once a month and unemployment is slowly changing and not volatile. This would discourage speculation in the futures.

**Reason 2:** The cost of the futures would be prohibitively high that the targeted audience couldn't afford to hold these assets.

**Reason 3:** The unconditional expectation of the unemployment is probably not constant, making the long base for calculating the average a poor proxy for the present average unemployment.

3. Download the Excel data set Chicagotemps.xls from the course web page and use this to answer the following questions. You are interested in establishing the price of a weather derivative (an option) with the following payoffs:

$$\text{Payoff} = \$10,000 \cdot \text{Max}(0, 25 - \bar{A}_t),$$

where  $\bar{A}_t$  is the average temperature in Chicago in the month of February in a particular year. Hence the contract pays off in years where the average temperature fell below 25 degrees Fahrenheit.

You can use the Max(.) function in excel to compute payoffs.

- (i) In how many years in the data sample would the February payoff on this contract have been zero?

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- (ii) Using the historical weather data, compute the expected payoff on the contract.  
**This is simply the average payout of the 108 months (Not the payout of The average temperature.)**

**\$25000.93**

- (iii) Assuming that the risk-free rate is 6% per annum, what is the value of the contract 6 months prior to February 2002?  
**This is the price calculated in (ii) times  $e^{(rt)}$  where  $r=.06$  and  $t=.5$**

**\$24262.04**

The weather data reflects average temperatures over a 108-year period.

- (iv) Does the variation from year to year in the daily average temperatures matter for the payoff on the contract?

**Yes. Holding the mean constant and increasing the variance will increase the average pay out, as the amounts paid when the temperature is less than 25 will increase (as we would expect more observations further away from 25) while the amount paid when it is greater than 20 (\$0) will stay the same.**

- (v) How would a trend towards higher February temperatures change your answer to question (ii)? Is it present in the data?

**Yes, increasing the mean and holding the variance constant would decrease the value of the future, as the probability of a payout would decrease. In estimating the regression  $A_t = a + Bt + e_t$ , we find a coefficient of .0307 with a t-stat of 2.26 (significant at the 5% level). Thus we have found credible evidence of a time trend in the mean temperature of February weather in Chicago (global warming maybe).**

4. On March 27, Shaina Long purchases a September S&P500 futures contract at a price of 341.20. Construct a table showing Ms. Long's weekly account based on the data given below. Assume that the initial margin is \$6,000 per contract and the maintenance margin is \$3000. Withdraw any excess profits each week. Each contract is for \$250 times the index value.

Date	Price	Updated margin	Funds withdrawn	Margin calls	Cumulative gains
3/27	341.20	6000	0	0	0
4/6	343.70	6625 ? (6000)	625	0	625
4/13	345.90	6550 ? (6000)	550	0	1175
4/20	347.05	6287.50 ? (6000)	287.50	0	1462.50
4/27	349.50	6612.50 ? (6000)	612.50	0	2075
5/4	355.90	7600 ? (6000)	1600	0	3675
5/11	353.55	5412.50	0	0	3087.50
5/18	354.15	5562.50	0	0	3237.50
5/25	351.05	4787.50	0	0	2462.50
6/4	356.35	6112.50 ? (6000)	112.50	0	3787.50
6/11	354.60	5562.50	0	0	3350
6/18	340.95	2150 ? (6000)	0	3850	-62.50
6/25	342.20	6312.50 ? (6000)	312.50	0	250