Econ 174 Financial Insurance Fall 2000
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Midterm exam

Please answer all questions. The weight of each question is given next to the question number.

1. (30%) Explain the reasons why you **agree** or **disagree** with the following statements. Circle the correct answer and complete the sentence.

i. If professors allowed students to insure themselves against poor performance in midterm exams at UCSD, this would lead to an overall better exam performance.

Disagree *because*

Moral Hazard (the idea that only the most vulnerable will buy the insurance) will prevent the market of exam insurance from functioning properly. If a student has insurance for an exam, she will be more likely to slack off as her worst score will be bounded. In addition, the only students who would buy the insurance are the ones who expect their grades would be less than the insured level, while better students will not buy the insurance.

ii. The graph relating the futures prices of a stock index to the time to expiration must always slope upwards.

Disagree *because*

If the dividend rate us greater than the interest rate, then the graph could slope downward (i.e. u > r in $F_0=S_0e^{(r-u)T}$.

iii. If reverse cash and carry is not possible, then the futures price of a consumption commodity, *F*, must satisfy the relation

$$F > S_0 \exp((u+r)T),$$

where S_0 is the current spot price of the commodity, *u* is the storage cost, *r* is the risk-free rate and *T* is the time to expiration.

Disagree, *because*

Reverse cash and carry involves shorting the spot asset, long the future and investing the cash from the spot short. However if we cannot do this, we cannot exploit situations where $F_0<S_0 e^{(r+u)T}$ as we would like to long the future (since it is too cheap) and short the spot (as it is too expensive). However we cannot arbitrage this, so we would have $F_0<S_0 e^{(r+u)T}$, not the opposite.

iv. A financial hedge is not guaranteed to benefit the hedger financially. Its main purpose is to offset an existing exposure to risk.

Agree, *because*

A hedge is designed to reduce the variance of the asset(s), and makes no claim as to the mean (the return). A perfect hedge would be one that would guarantee 0 variance (i.e. no risk, only a cost associated with setting up the hedge).

2. (25%) A company needs to buy 1 million gallons of heating oil in May 2001. The current futures price for this expiration date is $0.8190 per gallon, while the current spot price is $0.9602. Each futures contract is for 42,000 gallons of oil.

i. Suppose that the correlation between changes in futures and spot prices is 0.98. How many futures contracts should the company trade to set up a hedge? Should it use a long or a short hedge?

The company should use a long hedge. h^*=.98 (assuming equal variance of the spot and future). N_A= 1000000, Q_F=42000, so $N^*=h^*N_A/Q_F$ = .98 (1000000)/42000=23.333.

ii. Now suppose that, in fact, in May 2001 the spot price of heating oil is $0.7800 per gallon. How much did the company profit/lose on its futures position?

So the go long 23.333 May 2001 future contracts at $.8190. So the company gains $.7800-$.8190 = -$.0319 * 1000000 = -$31900 (or in other words, loses $31,900).

iii. If the cost of carry is 1% for oil and the current interest rate is 6% per annum, what is the convenience yield on oil between now and May 2001? What does it measure?

$F_0 e^{(yT)} = S_0 e^{((r+u)T)}$
$\ln(F_0)+ yT = \ln(S_0) + rT + uT$
$yT = \ln(S_0) + rT + uT - \ln(F_0)$
$y = (\ln(S_0) + rT + uT - \ln(F_0))/T$
$T=.5$, $r=.06$, $u=.01$, S_0=0.9602, F_0=0.8190

$y = (\ln(0.9602) - \ln(0.8190))/0.5 + 0.025 + 0.01$
$y = 0.35311$

The convenience yield measures that value of holding the good today (in other words the opportunity cost of the consumption goods). High convenience yields are consistent with short supply (or high marginal benefit from having the good for consumption).

3. (25%) On October 17, 2000 the $ per yen exchange rate in the spot and forward markets were as follows:

Spot	0.009358
Sept 01	0.009784

Each forward contract is for 12.5 million yen.

i. Which was highest on this date, the U.S. or the Japanese interest rate?

The US rate was the higher interest rate, as the Yes was appreciating (becoming more valuable, or could buy more dollars for one Yen).

ii. Assuming that the U.S. interest rate is 6% per annum for a loan expiring in September 01, what would be the Japanese interest ate for this period?

$F_0 = S_0 e^{(r-rf)T}$
$\ln(F_0) = \ln(S_0) + (r-rf)T$
F_0=.009784, S_0=.009358, r_f=.06, T=11/12

$r_f T = \ln(S_0) + (r)T - \ln(F_0)$
$r_f = (\ln(S_0) + (r)T - \ln(F_0))/T$
$r_f = (\ln(.009358) + (.06)11/12 - \ln(.009784))/(11/12)$
r_f = 1.1%

iii. Now suppose that the U.S. and Japanese interest rates are in fact identical (for loans expiring in September 01). How would you set up an investment strategy that is guaranteed to earn an arbitrage profit?

Thus, the benefit to investing in Japan is too high (or, alternatively, the price of a future is too high). Thus we want to borrow in $¥, convert to ¥, invest at the Japanese interest rate, and buy a future to pay back the $ at time T.

Suppose we borrow $1,000,000, in 11 months this will grow to $1,000,000 $e^{.06(11/12)}$ = $1056540.61. We convert to ¥ at the rate of .009358 $/¥, which yields ¥106860440. Investing this in Japan at 6% will give us ¥106860440 $e^{.06(11/12)}$ = ¥119285966. And a forward will require us to pay $1056540.61 which at the forward price will cost us ¥107986571, which yields us arbitrage profit of ¥119285966-¥107986571= ¥11299395 (or $110553.28, using the forward price to guarantee a USD denominated return).

(20%) An investor sets up a *short* position in gold futures on September 19,2000 when the price is $280 per ounce. Each contract covers 100 ounces of gold. The initial margin is $1400 and the maintenance margin is $1,050.

Fill out the margin account, funds withdrawn and margin call for the following 5 days:

Date	Gold Price	Margin account	Funds withdrawn	Margin calls	Daily Change
17-Sep	**280.00**	**1400.00**	**N/A**	**N/A**	**N/A**
20-Sep	**280.00**	**1400.00**	**N/A**	**N/A**	**N/A**
21-Sep	**279.00**	**1400.00**	**100.00**	**N/A**	**100.00**
22-Sep	**285.00**	**800.00**	**N/A**	**600.00**	**-600.00**
25-Sep	**284.00**	**1400.00**	**100.00**	**N/A**	**100.00**
26-Sep	**288.00**	**1000.00**	**N/A**	**400.00**	**-400.00**