Northwestern University
Kellogg Graduate School of Management

Kathleen Hagerty Spring 2003
Finance 465

Midterm Exam

You are allowed one 8 ½" by 11" page of notes (both sides). There are 80 total points. Answer the questions in the space provided. SHOW ALL YOUR WORK! **Assume all the interest rates are annualized continuously compounded rates**. You can spend up to 120 minutes on the exam. Return the exam to the Finance Department by 5:00 pm Monday, May 5.

1. (10 points) Consider the following prices for natural gas.

Natural Gas Comp. - nymex

Contract	Month	Last	Change	OpenInt
Natural Gas	Jun '03	5.310	0.074	48577
Natural Gas	Jul '03	5.385	0.079	26298
Natural Gas	Aug '03	5.420	0.069	22491
Natural Gas	Sep '03	5.400	0.067	24154
Natural Gas	Oct '03	5.415	0.067	22996
Natural Gas	Nov '03	5.520	0.052	20189
Natural Gas	Dec '03	5.635	0.047	20339
Natural Gas	Jan '04	5.710	0.035	17529
Natural Gas	Feb '04	5.580	0.035	10740

Assume that the carrying costs of natural gas increase as inventories increase (i.e., the marginal cost of storing one more unit of gas is higher when inventories are higher) and that the risk free rate will be 1.5% between now and February 2004.

Based on the futures prices given above, are inventories expected to be higher between August and September 2003 or November and December 2003? Explain your reasoning.

2. In June 2002, Dreyer's Grand Ice Cream made an offer to acquire the Nestle Ice Cream Company (brands include Haagen-Dazs) for 55 million shares of new Dreyer's stock. This transaction would increase Nestle's holdings of Dreyer's to 67% of the shares outstanding. If the deal was approved by the FTC, the current Dreyer's shareholders (excluding Nestle) would exchanged on a one for one basis for their currently outstanding shares for new shares which carried a put and call feature. In particular, in May 2006, the shareholders can, if they choose, sell the shares to the company for $83/share and the company can, if it chooses, call the shares for redemption at $88/share.

a. (10 points) Assuming the deal is approved, draw the payoff to Dreyer's shareholders on May 2006 as a function of the Dreyer's share price.

b. (5 points) Under what circumstances would Nestle's be the sole owner of Dreyer's in May 2006.

c. (5 points) Give two ways to make the new shares more valuable to the current Dreyer's shareholders.

3. (15 points) Below are the futures prices for Canadian dollars. Assume the US risk free rate is 1.3% between now and September 2004.

Canadian Dollar Comp. - cme

Contract	Month	Closing Price	Change	OpenInt
Canadian Dollar	Jun '03	0.6964s	0.0052	94659
Canadian Dollar	Sep '03	0.6926s	0.0052	3757
Canadian Dollar	Dec '03	0.6890s	0.0052	2206
Canadian Dollar	Mar '04	0.6853s	0.0052	859
Canadian Dollar	Jun '04	0.6816s	0.0052	693
Canadian Dollar	Sep '04	0.6779s	0.0052	281

Suppose a US firm wanted to lock in a price for Canadian dollars in June, September and December of 2003 using a swap. Assume the June delivery date is one month from now. What is the swap price?

4. a. (10 points) Suppose Southwest Airlines needs to hedge its exposure to jet fuel prices. There isn't a jet fuel future but there is a gasoline future. Each gasoline futures contract is for 42,000 gallons. The standard deviation of the change in the gasoline futures price is .2, the correlation of changes in gasoline prices with changes in jet fuel prices is .5 and the standard deviation of the changes in jet fuel prices is .32. If the airline will be buying 1,050,000 gallons of jet fuel over the next six months, what should its gasoline futures position be (i.e. long or short how many contracts)?

b. (5 points) Suppose the airline is able to go to the over-the-counter market a buy a jet fuel collar with a $1.00/gallon floor and a $1.50/gallon cap. Draw the payoff diagram for the **counterparty** who sold the collar to Southwest. Assume the counter party doesn't own any jet fuel.

c. (5 points) If both the floor and the cap on the collar increase, what will happen to the price of the collar?

5. (15 points) Suppose the annual continuously compounded Japanese risk free rate is 1% and the annual continuously compounded British risk free rate is 5%. The current exchange rate is 190 yen/£. You observed that the price of a pound-yen futures contract (you buy pounds with yen) with delivery in six months is 175 yen/£. Explain in detail (give positions and cash flows) how you can earn an arbitrage profit.

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Answers to the Midterm Exam

1. (10 points) Consider the following prices for natural gas.

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Assume that the carrying costs of natural gas increase as inventories increase (i.e., the marginal cost of storing one more unit of gas is higher when inventories are higher) and that the risk free rate will be 1.5% between now and February 2004.

Based on the futures prices given above, are inventories expected to be higher between August and September 2003 or November and December 2003? Explain your reasoning.

$$(k-\delta) = \frac{\ln\left(\frac{F_{t,Sept}}{F_{t,Aug}}\right)}{(1/12)} - r = \frac{\ln\left(\frac{5.40}{5.42}\right)}{(1/12)} - .015 = -0.059$$

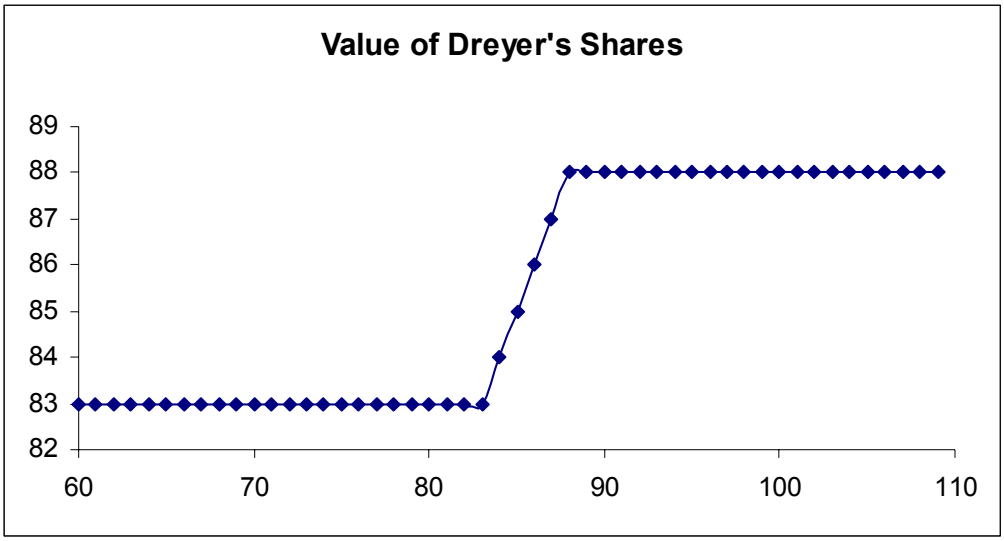
$$(k-\delta) = \frac{\ln\left(\frac{F_{t,Dec}}{F_{t,Nov}}\right)}{(1/12)} - r = \frac{\ln\left(\frac{5.635}{5.52}\right)}{(1/12)} - .015 = 0.23$$

Since (k-*) is very high is between November and December suggesting the convenience

yield is zero and the cost of carry is very high.

2. In June 2002, Dreyer's Grand Ice Cream made an offer to acquire the Nestle Ice Cream Company (brands include Haagen-Dazs) for 55 million shares of new Dreyer's stock. This transaction would increase Nestle's holdings of Dreyer's to 67% of the shares outstanding. If the deal was approved by the FTC, the current Dreyer's shareholders (excluding Nestle) would exchanged on a one for one basis for their currently outstanding shares for new shares which carried a put and call feature. In particular, in May 2006, the shareholders can, if they choose, sell the shares to the company for $83/share and the company can, if it chooses, call the shares for redemption at $88/share.

a. (10 points) Assuming the deal is approved, draw the payoff to Dreyer's shareholders on May 2006 as a function of the Dreyer's share price.



b. (5 points) Under what circumstances would Nestle's be the sole owner of Dreyer's in May 2006.

If the stock price is less than $83 or more than $88.

c. (5 points) Give two ways to make the new shares more valuable to the current Dreyer's shareholders.

They could raise the strike on the put or raise the strike on the call.

3. (15 points) Below are the futures prices for Canadian dollars. Assume the US risk free rate is

1.3% between now and September 2004.

Canadian Dollar Comp. - cme

Contract	Month	Closing Price	Change	OpenInt
Canadian Dollar	Jun '03	0.6964s	0.0052	94659
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Suppose a US firm wanted to lock in a price for Canadian dollars in June, September and December of 2003 using a swap. Assume the June delivery date is one month from now. What is the swap price?

Swap payment = C = (PV of cost of the strip of futures)/(sum of discount rates)
= 2.0690/2.9870 = .6927

Canadian Dollar

Contract	Month	Last		discount rate	PV of $ cost	Swap Payment	PV of Swap Payment
Canadian Dollar	Jun '03	0.6964s		0.9989	0.6956	**0.6927**	0.6919
Canadian Dollar	Sep '03	0.6926s		0.9957	0.6896	**0.6927**	0.6897
Canadian Dollar	Dec '03	0.6890s		0.9924	0.6838	**0.6927**	0.6874
			Total	2.9870	2.0690		2.0690

4. a. (10 points) Suppose Southwest Airlines needs to hedge its exposure to jet fuel prices. There isn't a jet fuel future but there is a gasoline future. Each gasoline futures contract is for 42,000 gallons. The standard deviation of the change in the gasoline futures price is .2, the correlation of changes in gasoline prices with changes in jet fuel prices is .5 and the standard deviation of the changes in jet fuel prices is .32. If the airline will be buying 1,050,000 gallons of jet fuel over the next six months, what should its gasoline futures position be (i.e. long or short how many contracts)?

The hedge ratio is

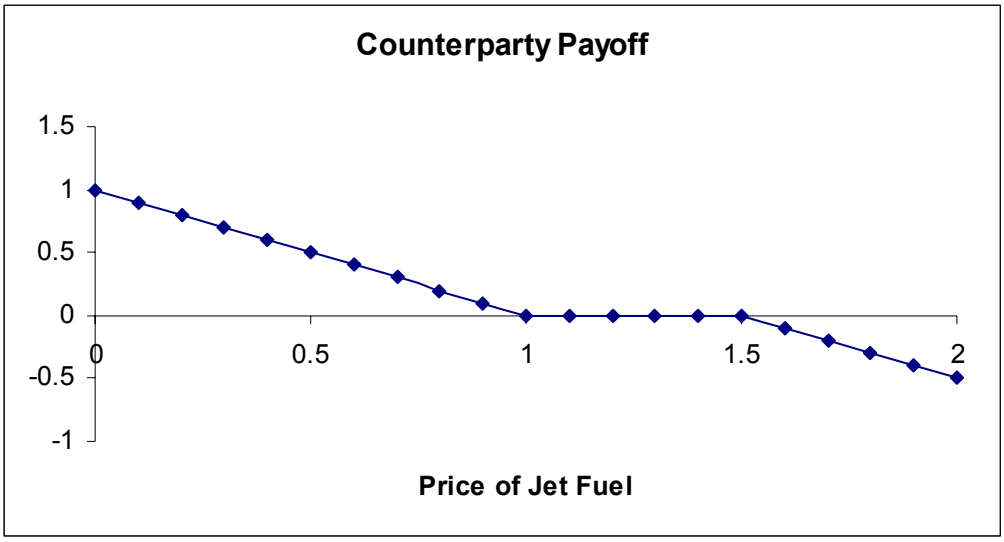
$$h = -\rho\frac{\sigma_{spot}}{\sigma_{future}} = -.5\frac{.32}{.2} = -.8$$

which means they should go <u>long</u> .8 gallons of gasoline fuel for every gallon of jet fuel (since their initial exposure is short).

The number of contracts is:

$$\frac{.8 * 1{,}050{,}000}{42{,}000} = 20 \quad \text{contracts}$$

b. (5 points) Suppose the airline is able to go to the over-the-counter market a buy a jet fuel collar with a $1.00/gallon floor and a $1.50/gallon cap. Draw the payoff diagram for the **counterparty** who sold the collar to Southwest. Assume the counter party doesn't own any jet fuel.



c. (5 points) If both the floor and the cap on the collar increase, what will happen to the price of the collar?

The price of the collar drops.

5. (15 points) Suppose the annual continuously compounded Japanese risk free rate is 1% and the annual continuously compounded British risk free rate is 5%. The current exchange rate is 190 yen/£. You observed that the price of a pound-yen futures contract (you buy pounds with yen) with delivery in six months is 175 yen/£. Explain in detail (give positions and cash flows) how you can earn an arbitrage profit.

The theoretical futures price is:

$$F_{t,T} = P_t e^{(r_{Japan} - r_{UK})(T-t)} = 190e^{(.01-.05)*.5} = 186.24$$

At the current market price the future is undervalued relative to the theoretical value. Therefore you should buy the future, short $e^{-r_{UK}(T-t)}$ units of the spot and lend. The cash flows are given below.

	Today	At Expiration
Buy the future		**-175**
Short $e^{-r_{UK}(T-t)}$ = .9753 £	**(.9753 £)*(190 yen/£) =185.31**	
Lend	**-185.31**	**$185.31e^{.01*.5}$=186.24**
Total	**0**	**11.24**