Name _____

Northwestern University
Kellogg Graduate School of Management

Kathleen Hagerty Fall 2005
Finance 465

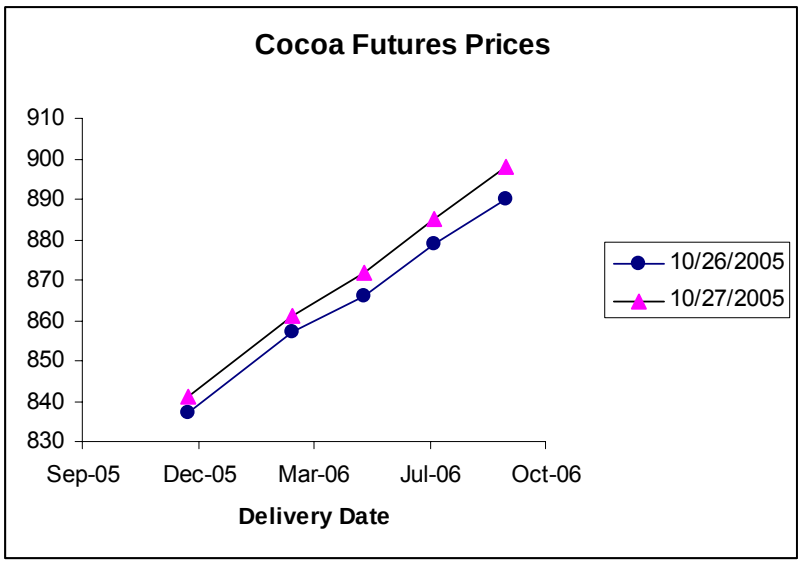
Midterm Exam

You are allowed one 8 ½" by 11" page of notes (both sides). 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 90 minutes on the exam. There are 100 total points on the exam.

The exam is **due Wednesday, November 2 by 5 pm** in my mailbox in the Finance Dept.

I. Answer the following questions true or false and explain why.

a. (5 points) Below is a graph of the futures prices for cocoa on October 26 and October 27. The change in the futures prices was due to a change in the spot price of cocoa.



b. (5 points) Suppose Southwest Airlines has a collar on the cost of jet fuel. The floor on the collar is $.95/gallon and the cap on the collar is $1.05 and the cost of the collar is $.10/gallon. If Southwest raises the floor to $1.00 the cost of the collar will drop.

II. The current continuously compounded risk free rate is 4.0%. Consider the following prices:

Gold Comp. - comex

Data retrieved at 10/27/05 10:47:56 • All quotes are in exchange local time • Data provided by FutureSource

Contract	Month	Last	Change	Open	High	Low	Volume	OpenInt
Gold	Dec '05	474.1	2.1	473.1	477.8	471.9	40262	273126
Gold	Feb '06	478.5	1.7	476.6	481.5	476.4	2088	19345
Gold	Apr '06	483.0	2.3	480.5	485.5	480.5	187	6314
Gold	Jun '06	487.5	2.9	484.4	489.0	484.4	468	10779

a. (10 points) Compute the annualize rate of change in the forward curve between Dec-05 and Feb-06 and Apr-06 and Jun-06. Assuming that the carrying costs are a percentage of the price of gold, compute the net carrying cost for gold.

b. (10 points) Suppose that the Feb-06 futures price was 481, what strategy would you use to earn an arbitrage profit. Show the exact positions you would take and the cash flows.

c. (10 points) Suppose a firm wanted to buy a gold swap where gold would be purchased in Feb-06, Apr-06 and Jun-06. What should the swap price be? Assume the February delivery date is in 3 months.

d. (10 points) Suppose an investment bank is the counterparty for the swap (i.e., they sold the swap) and they hedged their position when they sold the swap. If the firm defaulted on the swap in Mar-06, what is net gain or loss for the investment bank. Assume the interest rate is 4% and the April delivery date is in one month. The futures prices in Mar-06 are:

Contract	Month	Last
Gold	Apr '06	468.2
Gold	Jun '06	472.7

e. (10 points) Suppose the firm made a risk free $60,000 loan to a gold producing firm. The gold producer would like to repay the loan by delivering gold in February, April and June. If they made equal size deliveries, how much gold would they need to deliver at each delivery date?

III. Suppose a portfolio manager has a $100 million portfolio. Consider the following information:

Portfolio Beta	1.4
Value of the S&P 500 Index	1190
Risk free rate	4%
December S&P 500 Future	1194

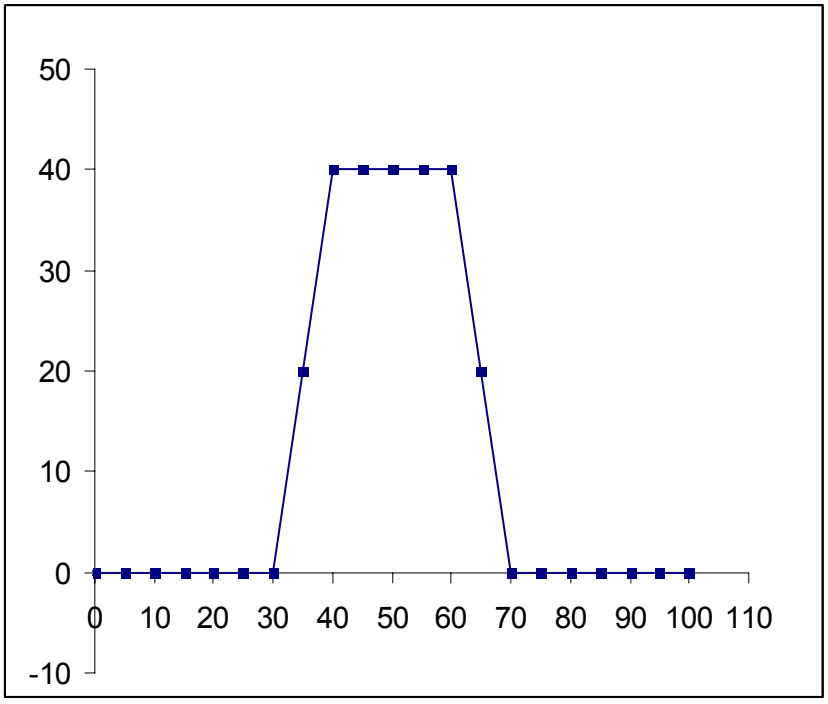
Assume the December delivery date is in 2 months.

a. (5 points) What is the dividend yield on the S&P 500?

b. (10 points) The portfolio manager would like to hedge her portfolio for six months using an April the S&P 500 mini contract. How many contracts should she buy or sell?

c. (5 points) If the beta of the manager's portfolio was equal to 1, would all the risk be hedged away? Explain your reasoning.

IV. (20 points) Explain how you can replicate the following payoff graph using only puts



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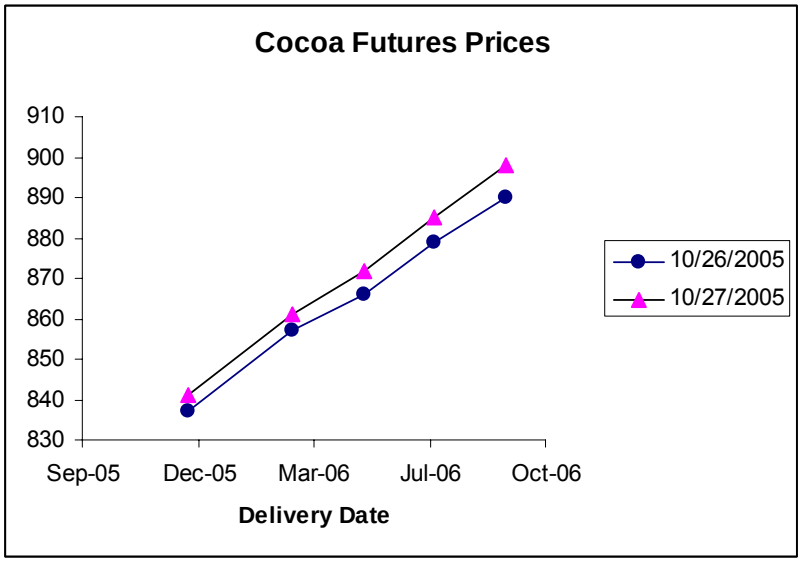
Answers to the Midterm Exam

I Answer the following questions true or false and explain why.

a. (5 points) Below is a graph of the futures prices for cocoa on October 26 and October 27. The change in the futures prices was due to a change in the spot price of cocoa.



True. The equation for the forward curve is $F_{t,T} = P_t e^{(r+k-\delta)(T-t)}$. If the forward curve has shifted up then it must be the case that the P_t has increased.

c. (5 points) Suppose Southwest Airlines has a collar on the cost of jet fuel. The floor on the collar is $.95/gallon and the cap on the collar is $1.05 and the cost of the collar is $.10/gallon. If Southwest raises the floor to $1.00 the cost of the collar will drop.

True. Since Southwest purchases jet fuel, their exposure is short. To create a collar on for a short exposure, Southwest would sell a $.95 put and buy a $1.05 call. If Southwest raised the floor, they are selling a put with a higher strike so the revenue from selling the put increases which lowers the cost of the collar.

II. The current continuously compounded risk free rate is 4.0%. Consider the following prices:

Gold Comp. - comex

Data retrieved at 10/27/05 10:47:56 • All quotes are in exchange local time • Data provided by FutureSource

Contract	Month	Last	Change	Open	High	Low	Volume	OpenInt
Gold	Dec '05	474.1	2.1	473.1	477.8	471.9	40262	273126
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Gold	Jun '06	487.5	2.9	484.4	489.0	484.4	468	10779

a. (10 points) Compute the annualize rate of change in the forward curve between Dec-05 and Feb-06 and Apr-06 and Jun-06. Assuming that the carrying costs are a percentage of the price of gold, compute the net carrying cost for gold.

$$\text{Annualized Rate of Change} = \frac{\ln(\frac{F_{t,T2}}{F_{t,T1}})}{(T2-T1)} = (r+k-\delta) = \frac{\ln\left(\frac{478.5}{474.1}\right)}{(2/12)} = 5.54\% \quad \text{Dec} -> \text{Feb}$$

$$= \frac{\ln\left(\frac{487.5}{483}\right)}{(2/12)} = 5.56\% \quad \text{Apr} -> \text{Jun}$$

Net Carrying Cost = 5.54% - 4.00% = 1.54% Dec → Feb
= 5.56% - 4.00% = 1.56% Apr → Jun

b. (10 points) Suppose that the Feb-06 futures price was 481, what strategy would you use to earn an arbitrage profit. Show the exact positions you would take and the cash flows.

The Feb future is overpriced relative to the Dec future so you should sell the Feb future and buy the Dec future. The Cash flows are:

	Today	December	February
Sell Feb Future			**481**
Buy Dec Future and pay net carrying costs		**$-474.10e^{(.0154)(2/12)}$**	
		**	
Borrow		**$474.10e^{(.0154)(2/12)}$**	**$-474.10e^{(.05+.0154)(2/12)}=478.1$**
Total	**0**	**0**	**2.90**

c. (10 points) Suppose a firm wanted to buy a gold swap where gold would be purchased in Feb-06, Apr-06 and Jun-06. What should the swap price be? Assume the February delivery date is in 3 months.

Gold Forward	Discoutnt Factor	PV of Futures Price	Swap Payment
478.500	0.990	473.739	C
483.000	0.983	475.017	C
487.500	0.977	476.257	C
Total	2.950	1425.012	
	C=	482.980	

d. (10 points) Suppose an investment bank is the counterparty for the swap (i.e., they sold the swap) and they hedged their position when they sold the swap. If the firm defaulted on the swap in Mar-06, what is net gain or loss for the investment bank. Assume the interest rate is 4% and the April delivery date is in one month. The futures prices in Mar-06 are:

Contract	Month	Last
Gold	Apr '06	468.2
Gold	Jun '06	472.7

	Feb	March
Receive Swap Payment	482.98	
Take Delivery on Feb Future	-478.5	
Net	4.48	
Invest Proceeds	-4.48	4.48*EXP(0.04*1/12)=4.495
Sell Apr future to close out futures position		468.2-483 = -14.8
Sell Jun future to close out futures position		472.7-487.5=-14.8
Total	0	-25.105

To hedge the position the investment bank initially bought Feb, April and June futures. To close out the position in March, the bank would have to sell the April and June futures.

e. (10 points) Suppose the firm made a risk free $60,000 loan to a gold producing firm. The gold producer would like to repay the loan by delivering gold in February, April and June. If they made equal size deliveries, how much gold would they need to deliver at each delivery date?

Gold Forward	Discoutnt Factor	PV of Futures Price	Ounces of Gold
478.500	0.990	473.739	D
483.000	0.983	475.017	D
487.500	0.977	476.257	D
Total		1425.012	

D*473.739+D*475.017+D*476.257 = $60,000 ➔ D = 42.105 ounces of gold

V. Suppose a portfolio manager has a $100 million portfolio. Consider the following information:

Portfolio Beta	1.4
Value of the S&P 500 Index	1190
Risk free rate	4%
December S&P 500 Future	1194

Assume the December delivery date is in 2 months.

a. (5 points) What is the dividend yield on the S&P 500?

$F_{t,T} = I_T e^{(r-\delta)(T-t)}$ ➔ $r - \frac{\ln(\frac{F_{t,T}}{I_T})}{(T-t)} = \delta = .04 - \frac{\ln(\frac{1194}{1190})}{2/12} = .01986$

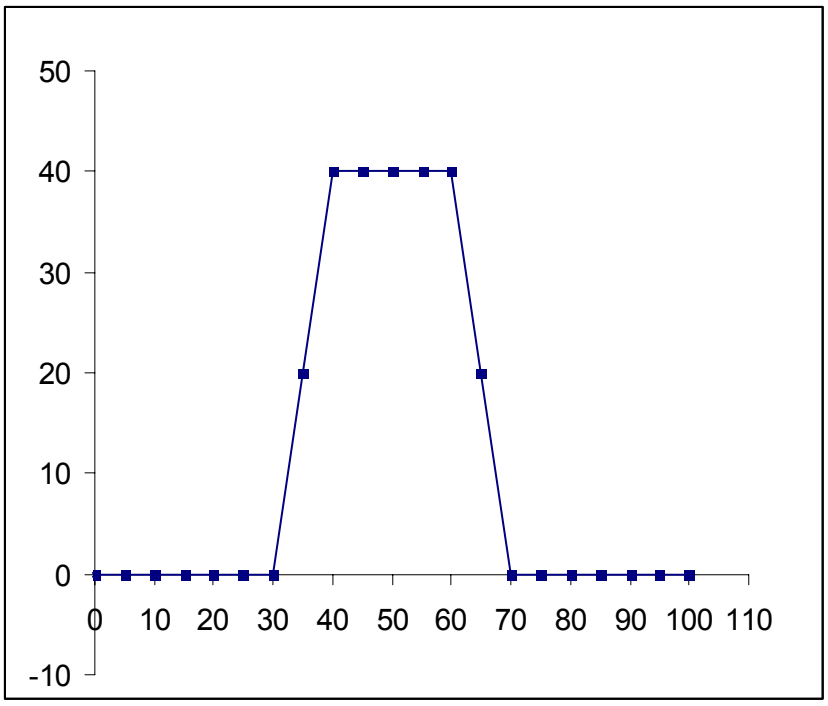
b. (10 points) The portfolio manager would like to hedge her portfolio for six months using an April the S&P 500 mini contract. How many contracts should she buy or sell?

The number of futures contracts is given by $H = \beta \frac{I_p}{N}$ **where I_p is the value of the investor's portfolio and N is the notational value of the futures contract. The notational value of the S&P mini contract is 50*1190 = 59,500. Therefore the number of contracts is -**$1.4 \frac{100M}{59,500} = -2353$ contracts. **➔ you should sell 2353 contracts.**

c. (5 points) If the beta of the manager's portfolio was equal to 1, would all the risk be hedged away? Explain your reasoning.

No, the beta only reflects market risk. Hedging with the future wouldn't eliminate any idiosyncratic risk associated with the investor's portfolio.

VI. (20 points) Explain how you can replicate the following payoff graph using only puts



Using Calls

Strike Price	No of Calls
30	4
40	-4
60	-4
70	4