Derivative Instruments (Produits dérivés) - Exam

Université Paris Dauphine-PSL - Master 1 I.E.F. (272)

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Answers can be formulated in English or French.

Exercise 1 (1 pt) A trader buys two October futures contracts on frozen concentrated orange juice. Each contract is for the delivery of 50,000 pounds. The current futures price is 92 cents per pound, the initial margin is \$12,000 per contract, and the maintenance margin is \$8,000 per contract.

What price change would lead to a margin call ?

Exercise 2 (1 pt) Which of the following statement is false ? Why is it false ?

(a) As the delivery period for a futures contract is approached, the futures price converges to the spot price of the underlying asset ;

(b) The daily settlement is the practice by which at the end of each trading day, the margin account is adjusted to reflect the investor's gain or loss ;

(c) The maintenance margin ensures that the balance in the margin account never falls below the initial margin ;

(d) A market-if touched order is executed at the best available price after a trade occurs at a specified price or at a price more favorable than the specified price.

Exercise 3 (3 pts) Company XYZ's stock price today ($t = 0$) is equal to 100 €/share. The risk-free yield curve is flat at 5% per annum (with annual compounding) for all maturities.

(a) What is the no-arbitrage delivery price at date $t = 0$ (today) of a forward contract F that will deliver one share of stock XYZ in exactly one year from now (at date $t = 1$) ?

(b) Consider time $t = 0.5$–year (i.e., exactly 6-months after $t = 0$). The prospects for company XYZ have changed, and the current stock price is now 92.72 €/share. What is the no-arbitrage price at date $t = 0.5$–year of a forward contract G that will deliver one share of XYZ in exactly 6-months from that date (with delivery at date $t = 1$ year) ?

(c) Suppose that at date $t = 0$ you bought (went long) on a 1-year forward contract F on one share of stock XYZ. Now it is date $t = 0.5$–year and you would like to close out (i.e., get out of) your long F position as of date $t = 0.5$–year in such a way that the total of your cash flows as of date $T = 1$ year adds up to zero. Which transactions would you need to undertake as of date $t = 0.5$–year in order to be able to do so using forward contract G and borrowing or lending at the risk-free rate ?

Exercise 4 (1 pt) Suppose that the 6-month, 12-month, 18-month, and 24-month zero rates are 5%, 5.8%, 6.4%, and 6.8%, respectively.

What is the 2-year par yield of a bond that provides semiannual coupons ?

Exercise 5 (1 pt) The six-month and one-year zero rates are both 7% per annum. For a bond that has a life of 18 months and pays a coupon of 6% per annum (with semiannual payments), the yield is 7.5% per annum.

What is the 18-month zero rate ?

(All rates are quoted with semiannual compounding and we suppose the bond has a face value of $100.)

Exercise 6 (1 pt) A trader enters in two short cotton futures contracts when the futures price is 35 cents per pound. The contract is for the delivery of 30,000 pounds.

How much does the trader gain or lose if the cotton price at the end of the contract is 35.83 cents per pound ?

Exercise 7 (4 pts) Suppose Firm ABC can issue 4-year bonds at the fixed rate of 3% in the US in dollars and at the fixed rate of 6% in France in euro. Suppose Firm XYZ can issue 4-year bonds at the fixed rate of 5% in the US and at 7% in France. Each firm wishes to borrow in the currency he has no comparative advantage.

a) Which firm has a comparative advantage in the French capital market ?

b) Design a swap that will net a bank, acting as intermediary, 40 basis points per annum. Make the swap equally attractive to the two companies and ensure that all foreign exchange risk is assumed by the bank.

c) What will the swap contract look like if the currency risk is taken over by company ABC ?

Exercise 8 (1 pt) On the global OTC derivatives market, rank the three following underlying assets by order of importance (from the most to the least in terms of notional amounts outstanding) : a) Commodity ; b) Interest rate ; and c) Foreign Exchange.

Exercise 9 (1 pt) The spot price of copper is $3.28 per pound. The storage costs are $0.04 per pound per year payable quarterly in advance.

Assuming that interest rates are 9.5% per annum for all maturities, calculate the futures price of copper for delivery in nine months.

Exercise 10 (1 pt) A call with a strike price of $53 costs $5. A put with the same strike price and expiration date costs $3.

What is the profit of the corresponding straddle if the price of the underlying asset is $56 at maturity ?

Exercise 11 (5 pts) Suppose that the LIBOR/swap rate curve (risk free rate) is flat equal to 3%.

A 2-year corporate bond provides a coupon of 4% per year payable semiannually and it has a yield of 5% (continuous compounding).

Assume that defaults can take place at the end of the year (immediately before a coupon or principal payment) and that the recovery rate is 30%.

(a) What is the market price of the bond ?

(b) What is the equivalent risk-free bond's value ?

(c) What is the bond risk premium ?

(d) What is the loss in case of default at each possible date of default ?

(e) Estimate the risk-neutral default probability $\bar{p}$ on the assumption that it is the same each year.