ADM 4351, Fall 2020, Quiz #2 (15 question, 1 point each)

Time allowed: 80 minutes + 10 minutes for submission

Note: you must submit your quiz (as a single PDF file) by 8:30pm unless you are allowed extra time by SASS

IMPORTANT:

- All interest rates are continuously compounded (unless specified otherwise).
- The face value of all bonds is $100, the coupon payments are semiannual.
- You must keep at least 4 decimals digits while performing your calculations (unless specified otherwise).

Question 1
Find the interest rate if 5-month forward gold price is $1500 and current spot gold price is $1450.

Solution:
r=(12/5)*ln(1500/1450)=8.14%

Question 2
Find 7-month forward price of a 6%-coupon bond that matures 17 months from now. The risk-free interest rate is 7% and the bond's spot price is $99.50

*Solution: F=(99.50-3*exp(-0.07*5/12))*exp(0.07*7/12)=$100.61*

Question 3
Find the spot corn price if 9 months corn forward price is $430/ton, risk-free interest rate is 5%, continuously compounded storage cost is 7%, and convenience yield is 3%

Solution:
420*exp(-(0.05+0.07-0.03)*9/12)=$401.93

Question 4
Find your expected profit (in dollars) from buying a 9-month Forward contract on stock market index if today the index value is 8000, expected market return is 7%, risk-free interest rate is 3%, the contract size is $1 times index, and stocks do not pay dividends.

Ans: 8000*exp(0.07*9/12)-8000*exp(0.03*9/12)=$249.18

Question 5
Find the minimum possible 7-month interest rate if spot gold price is quoted at $1340-$1360 (bid-ask prices) and 7-month forward price is quoted as 1380-1390 (bid-ask prices).

Ans: r=(12/7)*ln(1380/1360)=2.5%

Question 6
Use the information in the previous question and let R_{min} be the minimum interest rate you were supposed to find in that question. However, when you looked at the interest rates you observe that you can invest a rate of R_{inv} and you can borrow at a rate of R_{borr}, where $R_{inv} < R_{borr}$. Which of the following conditions will lead to an arbitrage opportunity and which arbitrage strategy you should implement to take advantage of such opportunity (note: cash and carry strategy includes buying gold at the spot market while reversed cash-and-carry strategy includes selling gold at the spot market)

A) $R_{inv} < R_{min}$, cash-and-carry
B) $R_{inv} < R_{min}$, reversed cash-and-carry
C) $R_{inv} > R_{min}$, cash-and-carry
D) $R_{inv} > R_{min}$, reversed cash-and-carry
E) $R_{borr} < R_{min}$, cash-and-carry
F) $R_{borr} < R_{min}$, reversed cash-and-carry
G) $R_{borr} > R_{min}$,cash-and-carry
H) $R_{borr} > R_{min}$, reversed cash-and-carry

Ans: E

Question 7:
Currently you can buy £1 for $1.76 and sell £1 for $1.75. You can also enter into 1-year forward contract to buy £1 for $1.73 or to sell £1 for $1.72. You can invest dollars at r_{inv}=6% or you can borrow dollars at r_{borr}=8%. Assume you can invest and borrow £s at the same rate R. Find the minimum possible value for R.

Ans: F=S*exp((r-R)*T), hence, R_f=r-ln(F/S), with minimum value of 0.06-ln(1.73/1.75)=7.15%

Question 8
Use the information in the previous question and let R_{min} be the minimum foreign (£) interest rate you were supposed to find in that question. However, when you looked at the foreign interest rates you observe that you can invest £s at a rate of R_{inv} and you can borrow £s at a rate of R_{borr}, where $R_{inv} < R_{borr}$. Which of the following conditions will lead to an arbitrage opportunity and which arbitrage strategy you should implement to take advantage of such opportunity (note: cash and carry strategy includes buying £s at the spot market while reversed cash-and-carry strategy includes selling £s at the spot market)

A) $R_{inv} < R_{min}$, cash-and-carry
B) $R_{inv} < R_{min}$, reversed cash-and-carry
C) $R_{inv} > R_{min}$, cash-and-carry
D) $R_{inv} > R_{min}$, reversed cash-and-carry
E) $R_{borr} < R_{min}$, cash-and-carry
F) $R_{borr} < R_{min}$, reversed cash-and-carry
G) $R_{borr} > R_{min}$,cash-and-carry
H) $R_{borr} > R_{min}$, reversed cash-and-carry

Ans: F

Question 9
Find 11-monh gold forward price if 3-month gold forward price is $1500, spot gold price is $1470, and the interest rate curve is flat (i.e., zero rates are the same for all times t).

Ans: First, find interest rate r=(12/3)*ln(1500/1470)=8.08%,
Now, find Forward price F=1470*exp(0.0808*11/12)=$1583.03 (accept rounding to $1583 or any number within $0.10 from the correct answer)

Question 10
Let F_S be the 4-month forward price of a 4% coupon bond that matures in 14 months while F_L be the 4-month forward price of a 4% coupon bond that matures in 26 month. Let also P_S and P_L be the current market prices of these bonds and let $P_S = P_L$. Assume all zero rates are non-negative (but not necessary the same) and both bonds have the same face value. In this case:

A) $F_S > F_L$
B) $F_S = F_L$
C) $F_S < F_L$
D) The provided information is not sufficient to answer this question: you need additional information about zero rates to choose one of the answers above
E) None of the above

Ans: B

Question 11
If an increase in the storage costs does not affect neither the spot nor the forward price of the consumption asset and it is not accompanied by a change in the risk-free interest rates, which of the following is most likely to happen:
A) An arbitrage opportunity that did not exists before will be created
B) Convenience yield increases
C) Cost of carry decreases
D) At least two of the above answers are correct

Answer: B

Question 12
Today is May 1st. 4 month ago, on January 1st, you have entered into a 9-month forward contract to buy 1kg of gold for $37,000 on October 1st. Today the forward price for October 1st contract is $37,300. Find the value of your forward contract today if 4-month zero rate is 6.8%, 5-month zero rate is 7% and 9-month zero rate is 7.2%

Solution: $(F_0 - K)e^{-rT}$ =(37300-37000)*exp(-0.07*5/12)=$291.38

Question 13:
Find the value of a FRA that allows you to invest $1,000,000 for two years from year 3 to year 5 at 4% (simple interest rate) if currently the forward interest rate between year 3 and year 5 (simple interest rate) is equal to 3.8%, and continuously-compounded 2-year and 5-year zero rates are equal to 3.5% and 3.7% respectively

Answer: 1000000*(0.04-0.038)*(5-3)*exp(-0.037*5)=$3,324.42

Question 14:
In class, we used a simple forward rate formula $F=Se^{rT}$ to estimate the interest rate using gold futures prices and we found a reasonable estimate of 1.6%. However, when we applied the same formula to oil futures, we estimated an interest rate to be above 10%, which is clearly much higher than the actual interest rate in the market. Based solely on this estimate, we can conclude that:

A) Oil is a consumption asset
B) Oil has storage costs
C) Both (A) and (B)
D) You can make an arbitrage
E) All of the above

Ans: B
we have estimated c=r+u-y>10%. With r<2%, it implies that u>0, i.e., there is storage costs. We cannot conclude that y>0, hence, we cannot conclude that oil is a consumption asset based on this estimate alone

Question 15:
You have a long position in futures for commodity ZZZ and you observe that futures price is slightly higher than the forward price for the contract of the same maturity. Next day you have received a margin call. Which of the following most likely happened to the YTM (yield to maturity) on government bonds at that day?
A) YTM increased
B) YTM decreased
C) Nothing: YTM does not depend on ZZZ's futures prices

Ans: B

Futures prices higher than forward prices when their correlation with interest rate is positive. Hence, a decrease in futures prices is likely to be accompanied with the decrease in interest rates