EXAMINATION II:

Fixed Income Valuation and Analysis

Derivatives Valuation and Analysis

Portfolio Management

Questions

Final Examination

September 2014

Question 1: Fixed Income - Derivatives – Portfolio Management   (73 points)

You are a fund manager in charge of managing a fixed income portfolio. The mandate you have received allows you to invest only in euro denominated corporate bonds. The fund you manage has received net inflows, so you have been asked to evaluate new investments. At the time of your valuation, the par yields from the Euro interest rate swap curve are as follows:

Table 1:

Tenor	Par yield	Spot rate	Forward rate**	Discount factor
1 year	0.50%	①	0.5000%	0.995025
2 years	0.75%	②	1.0025%	0.985149
3 years	0.95%	0.9527%	④	⑥
4 years	1.25%	③	2.1811%	⑦
5 years	1.40%	1.4118%	⑤	0.932301

[Notes:
* Assumed day count-convention 30/360, with annual compounding.
** The forward interest-rates are 1-year interest rates for a forward contract starting 1 year prior to corresponding maturities.]

a) You are asked to calculate the missing values contained in Table 1, showing the formulae used and your calculations for the following rates (round your answer to the fourth decimal point):

   a1) Spot rates. [Hint: Use the Bootstrapping method for the 4 years spot rate calculation.]
   (7 points)

   a2) Forward rates. (5 points)

   a3) Discount factors. (4 points)

b) The term structure of interest rates, and consequently the shape of interest rates curves, is widely used in investment management and economic forecasts. You are asked to consider the difference between the yield to maturity curve (the par curve) and the spot rate curve. You argue that, compared to the yield to maturity curve, the spot rate curve has more explanatory power.

   b1) Describe 3 main applications of the term structure in market practice. (3 points)

   b2) Comment on the shapes of the various graphs of interest rates against time that derive from your calculations. What are the implications for future interest rates? (4 points)

c) You are now considering investing in an A rated fixed coupon-bearing corporate bond issued by CorporateX. This company is one of the leaders in its market and has a very important presence in the fixed income market as an issuer. CorporateX senior unsecured bonds are quoted on the secondary market. Table 2 gives the yield to maturity curve from 1 to 5 years (YTM curve) for CorporateX.

Table 2:

Tenor (years)	CorporateX "YTM" Curve
1	1.00%
2	1.25%
3	1.65%
4	1.85%
5	2.10%

[Notes:
* The YTM is calculated as "annual" rate. 30/360 day-count convention.
** 1 basis point = 0.01%.]

From your broker you receive offers on the following bonds issued by CorporateX, at a price calculated using the spot curve calculated under a1) for the Euro swap curve plus a credit spread for all tenors of 65 basis points:

- Bond 1: senior unsecured, expires in 3 years, annual coupon 3% (the coupon has just been paid, so there is no accrued interest);

- Bond 2: senior unsecured, expires in 4 years, annual coupon 4.5% (the coupon has just been paid, so again there is no accrued interest).

c1) Calculate the price for Bonds 1 and 2 from your broker's offer [If you have not answered question a1), use the following spot curve: 1 year 0.50%; 2 years 0.755%; 3 years 0.955%; 4 years 1.26%; 5 years 1.415%]. Show your calculations, rounding your answer to the second decimal point. (6 points)

c2) You want to investigate if the prices calculated in c1) are in line with the YTM curve quoted on the secondary market. To achieve this purpose, calculate the YTM implied by the prices calculated in c1) for the two bonds. Show the equation underlying your calculations. (5 points)

c3) You are asked to choose one of the two bonds. The parameter to use is the YTM curve quoted on the secondary market given in Table 2 versus the YTM implied by the prices calculated in c2), considering that you do not have any preference in terms of duration, and you want to optimize your choice in terms of YTM (no calculations are needed). Justify your answer. (3 points)

d) Assume that you have purchased Bond 2 at 110.00. Immediately after the purchase, because of a profit warning launched by CorporateX with likely negative implications on the debt ratio of the company, CorporateX's credit spread of the yield to maturities widens 30 basis points for all maturities.

Noting that Bond 2 has a duration of 3.76 years, and rounding your answer to the second decimal point, use the modified duration method to calculate:

d1) The percentage price change. (3 points)

d2) The price change in absolute value. (2 points)

d3) The new (approximated) price of the bond. (2 points)

e) Explain whether the modified duration method is exact or not in determining the price change of the bond due to an interest change. Give a detailed answer. (5 points)

f) Many factors may affect the yield spread (interpreted as a spread with respect to a risk-free or quasi risk-free benchmark). Provide 3 main factors, and discuss each of them. (6 points)

g) Let's assume that you invested 10 million Euro in Bond 2 buying it at 110.00 (there are no coupon accruals due as the coupon has just been paid). Due to a likely improvement in the economic recovery within the Euro area, you expect, in the next 3 months, a rate increase from the European Central Bank. You then decide to hedge the purchased bond through the Euro-Bobl Futures 6% expiry December 2014 contract (the Futures contract on the 5-year German government bond with expiry date December 2014) against the forecasted interest rates increase. The Euro-Bobl Future has the following features:

Futures Price $F_{0,T}$ = 122.50; Modified duration of the CTD = 4.5; Nominal value of 1 Futures contract = 100,000 Euro; Conversion factor (CF) = 0.9315; CTD (Cheapest to deliver) = DBR 4.25% 7/2019

Using the modified duration method, determine the number of futures contracts necessary to hedge your position, indicating the sign of the trade to put in place. (6 points)

h) In order to immunize the position on the purchased bond from a credit risk increase, what kind of action would you have to consider? Explain your answer. (4 points)

i) From the forecast that your fund will receive more inflows to invest, you also consider investing in a 5 years corporate floating rate note denominated in euros with rating BBB, senior unsecured, paying an annual coupon linked to Libor 12 months, with an annual floor on the coupon set at 2.5% and an annual cap set at 3.5%.

i1) In order to evaluate the price sensitivity of the bond to an interest rate change, you compare it to a bond with the same features but without the coupon cap & floor. Which of the two bonds has a higher duration? Justify your answer (no calculations are needed). (4 points)

i2) You also compare this bond to an otherwise identical bond of the same issuer but without the annual cap at 3.5%. At the same option adjusted spread (OAS) over Libor for both the bonds, the one with cap & floor will result in a higher, lower or equal price compared to the bond with the floor only? Justify your answer (again, no calculations are needed). [Hint: OAS in this case means the number of basis points over Libor adjusted by the value of the cap and floor options.] (4 points)

Question 2: Derivative Valuation and Analysis   **(59 points)**

Your client, the Alpha Invest Company, wants to adjust its risk exposure in a long position in Commerzbank (CBK). Alpha Invest owns 10 million stocks and does not want to trade these stocks directly. Your client expects CBK stocks to lose ground over the next few months and wants you to develop ideas as to how to offset this position temporarily using derivatives.

The actual stock price for CBK is EUR 11.72. There are no dividends payable over the next few months. The riskless interest rate is 4% p.a. (simple). You have collected the following data on CBK Mar 15 Options:

Strike Price K	Call Price C	Put Price P	Call Delta Δ_C	Put Delta Δ_P	Gamma Γ
8	3.93	0.02	0.98	-0.02	0.02
9	3	0.07	0.94	-0.06	0.053
10	2.16	0.21	0.84	-0.16	0.102
11	1.44	0.48	0.71	-0.29	0.151
12	0.9	0.94	0.54	-0.46	0.175
13	0.56	1.6	0.38	-0.62	0.162
14	0.37	2.43	0.27	-0.73	0.132
15	0.22	3.32	0.18	-0.82	0.103
16	0.13	4.28	0.12	-0.88	0.076

All prices are in EUR. Options may not trade at their theoretical values. The contract size is 100 stocks per option. The day-count convention is 30/360. The CBK Mar 15 options expire in 216 days, i.e. in 0.6 years. Assume that these options are European options. There is also a futures contract on CBK stocks (CBKF) traded at the EUREX with the same time to maturity and identical contract size.

a) Check options with strike price 10 and 14, respectively, for any violations of put-call-parity. If there are any violations, describe how to establish an arbitrage strategy and calculate the profit per option contract that you can make. If there are no violations, explain why.   (10 points)

b) Your first idea is to go short with futures. What is the theoretical futures price of the CBKF Mar 15 Futures?   (3 points)

c) You realize that the CBKF futures contract is rather illiquid. Therefore you consider using a short position in synthetic futures constructed from options. To synthesize the CBKF futures contract you chose the options with strike price K = 12 in the table above. How many options do you need to offset your client's position and how much has to be paid for that immediately? What is the main difference between the synthetic futures contract as compared to the CBKF Mar 15 Futures contract?   (6 points)

d) A colleague suggests using options with strike 10, because he asserts 'they are out-of-the-money'. Is it possible to synthesize futures using options 'not at the money'? How much has to be paid for your colleague's idea? Compare this strategy to your own solution above in c).   (7 points)

Instead of shorting synthetic futures contracts you consider using a short position in a bull cylinder to fix the maximum loss of the original position. A (long) bull cylinder is formed by buying calls and selling puts, where the call strike price exceeds the put strike price. You decide to use puts with strike 10 and calls with strike 14 to sell a bull cylinder on CBK stocks.

e) How many options do you need to fix the maximum loss of your client's position with the bull cylinder? What is the initial cost/revenue? And what is the final profit and loss of the sold bull cylinder [Note: consider interest on the option premium]? Draw a graph to illustrate the payoff of the short position in a bull cylinder at expiration.   (10 points)

f) Calculate the delta and the gamma of your client's total position including the stocks and the sold bull cylinder. How would you characterize the risk of the new position? (7 points)

g) How many options for shorting the bull cylinder do you need to end up with an overall delta-neutral position including the stocks? What is the gamma of this position? (6 points)

Eventually you realize that options on single stocks at the EUREX are American options.

h) Check the options with strike price 16 for any violations of put-call-parity given that the options are American options.   (4 points)

i) Carefully re-evaluate the option strategies discussed above, given that the options used are American options.   (6 points)

Question 3: Portfolio Management (48 points)

a) The CEO of MEGAfunds has compared the record of two different portfolio managers over the last two years, the first one only managing a growth stock portfolio, the other one only managing a value stock portfolio. The record of both managers is given below. In both cases, EUR 100 million was removed from the portfolio at the end of the first year to meet redemptions.

Growth manager:
- Year one: The initial portfolio size was EUR 200 million. The portfolio realized a performance of +6.0%.
- Year two: The portfolio realized a performance of +20%.

Value manager:
- Year one: The initial portfolio size was EUR 200 million. The portfolio realized a performance of +22.3%.
- Year two: The portfolio realized a performance of +4%.

The benchmark in year 1 realized a performance of +9%, during year two of +13%.

The CEO of the firm based his evaluation on the total internal rate of return (IRR) of the two portfolios over the whole 2-year period:
- Growth manager IRR = 10.70%
- Value manager IRR = 15.25%

As a result of his evaluation, MEGAfunds is considering advising clients to move EUR 50 million from the growth manager to the value manager, or even replacing the growth manager. The CEO of the firm is uncertain, however, that his evaluation has been properly conducted. The CEO asks you if the evaluation has been properly conducted and if his conclusions are correct.

a1) Explain why the internal rate of return is inappropriate as a measure of portfolio manager performance. (5 points)

a2) Compute an appropriate measure of the performance of both managers, and evaluate their comparative performance (assume the portfolios are of similar risk). (5 points)

a3) Explain how the difference in the two manager's IRR evaluations arose, and why your measure is better. (5 points)

b) Another fund management company, MIXfunds, investing in equity funds as well as in bond funds, was very successful in recent years by investing its funds passively. To manage its funds, MIXfunds uses several passive strategies.

b1) Describe 2 main differences between the indexing strategy applied to equity funds and the indexing strategy applied to bond funds. (4 points)

b2) Consider the following four indexing methods for equity funds:
(i) exhaustive sampling (full replication),
(ii) stratified sampling,
(iii) optimised sampling and
(iv) synthetic replication.

Describe these methods and for each of them give one advantage and one drawback.
(16 points)

b3) Mr. Big, CEO of MIXfunds, is asked by a pension fund to passively manage its bond portfolio of 1 billion USD. Which indexing method(s) should Mr. Big use? Explain for each indexing method why it can be used and respectively why it cannot be used. Additionally, for the methods that can be used, explain how Mr. Big will replicate the reference index and what practical problems he will face. (8 points)

b4) Now another pension fund requires a passive management strategy relative to the following benchmark:
- 50% SMI (Swiss Market Index / 20 stocks)
- 50% MSCI Europe ex Switzerland (multi-country Index / 430 stocks / 15 countries)

Which indexation method(s) can you reasonably propose for each sub-index? Justify your answer with the related advantages of the chosen method. (5 points)