Case 2

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DEADLINE

You are to hand in your assignments by 23:59 on November 21, 2013 (Thursday). Late submissions will have grades reduced by 0.5 for each full 30 minutes. Please send your assignments to m.zamojski.ta@gmail.com. You will receive an automated response email if your submission was successful.

GUIDELINES

- You can work in groups of 3-4 people only, the groups should be the same as for previous case(s).
- Please note, that the questions have a varied level of difficulty.
- There is a hard limit of 5 pages (including any tables, figures, references, title pages, etc.).
- Include an executive summary of your work on the 1st page (in principle, one line per question).
- Your answers should be concise and self-sufficient.
- You may use any computing environment you wish (incl. Excel, Stata, R, Matlab, Python, C++, etc.).
- You are to send your code/spreadsheets and all additional data files you used.
- In case you use Excel, your answers are not to be hard coded, i.e., if the underlying data is changed the results should update. If you are required to use Solver or Goal Seek for a particular question, this rule does not apply.

I. Bonds and portfolio thereof

If it is not otherwise stated you may assume that coupons are annual and the face value is 100EUR.

*There are no official office hours, but you can contact me at m.zamojski@vu.nl. Please note that you are supposed to send in your answers to m.zamojski.ta@gmail.com

□ **Question 1**: The principal payment of a bond is 100 in 10 years and its yield is 4%. If it trades at par, what are its coupon rate and duration?

□ **Question 2**: A 2-year zero is trading at 8% discount. What is the current 6M interest rate if you have the following forward rates $f_{6,12} = 0.05$, $f_{12,18} = 0.045$, and $f_{18,24} = 0.04$?

□ **Question 3**: A 3-year bond with 10% coupon rate is trading at 10EUR discount. What is the YTM in the following cases:

1. Coupon is paid annually.
2. Coupon is paid semi-annually and interest is compounded semi-annually.
3. Coupon is paid semi-annually, but interest is compounded annually.

□ **Question 4**: You are offered the following investment: 5-year EUR 1000 bond with 10% annual coupon rate, but the first coupon is paid after 15 months. You checked with your broker and the same bond without the long first coupon is trading for the same price. Explain why this investment opportunity is good or bad for you.

In the following questions you can assume that there are three bonds on the market:

- 10-year, semi-annual coupon, 6% coupon rate, and 8% yield.
- 20-year, 8% coupon, and 8% yield.
- 30-year, 15% coupon, and 8% yield.

□ **Question 5**: What are the prices of these bonds?

□ **Question 6**: You have an obligation to make two payments of EUR 1m in 8 and 10 years. You are asked to fund these payments with a portfolio of bonds available on the market.

1. What is your portfolio if you match duration only?
2. What is your portfolio if you match duration and convexity?
3. Suppose after you make the first payment the yield curve shifts by 100 points upwards or downwards. For all (4) cases, are you making loses or gains?

□ **Question 7**: You raised funding by issuing 15-year bonds with 4% coupon rate at 8% yield. You are asked to fund the resulting payments with a portfolio of bonds available on the market.

1. What is your portfolio if you match duration only?
2. What is your portfolio if you match duration and convexity?
3. Suppose after three years the yield curve shifts by 100 points upwards or downwards. What is the present value of your assets and liabilities after the change in all cases?

II. Options, futures, and other derivatives

Question 8: An investment bank salesman is offering you the following structured product: □

- Amount: 1000EUR
- Term: 5 years
- Interest: 17.25% minus 6M LIBOR, semi-annually
- Minimum interest is 0%, i.e., investor will not have to pay the issuer if 6M LIBOR exceeds 17.25%

Replicate this structured product with simple instruments (vanilla options, forwards, swaps, bonds, etc.). Why is replication useful?

Question 9: A stock price is currently EUR 40. Over each of the next two three-month periods it is expected to go up by 10% or down by 10%. The risk-free interest rate is 12% per annum with continuous compounding. Using binomial trees show: □

1. What is the value of a six-month European put option with a strike price of EUR 42?
2. What is the value of a six-month American put option with a strike price of EUR 42?

Without using a tree, what is the price of an European call?

Question 10: You are told that just before the end of the first period in previous question, the underlying company will pay a dividend of EUR 1.00. How does it affect the price of the European call? □

Question 11: Would you ever exercise early an American call option on a non-dividend paying stock? □

Question 12: Consider a down-and-out call option with the strike price of 1, the barrier is set at 0.80, and the current price of the underlying is 0.90. Explain the pay-offs at maturity and why an investor might be interested in this product? □

Question 13: Consider an American lookback call option on a non-dividend paying stock. At expiry, the strike is set to the minimum price that was observed. The current price of the underlying is 35. Over each of the next 3 periods it is expected to go up or down by 10%. The risk-free rate is 5% per period. Using a three-step binomial tree, what is the price of this option? □