Examiner: Prof. Dr. Peter Reichling

The following aids can be used: non-programmable pocket calculator

This examination comprises 5 problems. All of them are to be solved.

EXAMINATION QUESTIONS:

Problem 1. *(20 points)*
  a) You have the following data on spot and forward rates, r and f respectively, which are compounded annually:

Time horizon	Rates
$r_{0,1}$	4.50%
$f_{1,2}$	5.00%
$f_{2,3}$	6.25%

  Construct the term structure of interest rates from the data above and determine its type.
  b) What is the forward rate $f_{1,3}$, i.e. the forward rate on a two-year loan starting in one year?
  c) Use your results from (a) to value a bond with a coupon rate of 5% paid annually, €100 face value, and three years remaining to maturity.
  d) Is there an arbitrage opportunity between the following two bonds:

	Maturity	Coupon	Price
Coupon bond 1	2 years	6.00%	102.40
Coupon bond 2	2 years	4.00%	98.61

  Which bond is priced incorrectly and what is its correct price?
  e) What is a pure yield curve? How can it be derived on the basis of coupons bonds? Explain briefly!

Problem 2. *(20 points)*
  The term structure is flat at 6% p.a.
  a) Compute the Macaulay duration of a 2-year bond with a coupon rate of 8% paid semiannually.
  b) Compute the Macaulay duration of a 3-year bond with a coupon rate of 10% paid annually.
  c) Consider a fixed-income portfolio. The current value of this portfolio is €80M, of which €25M is in the 2-year bond and €55M in the 3-year bond. Using duration approximation, compute the new value of the portfolio if interest rate falls by 50bps.

Problem 3. *(30 points)*
  Consider two stocks, which have the following characteristics:

	μ_i	σ_i
Stock A	13%	25%
Stock B	8%	15%
$\rho_{A,B}$	0.3	

  a) Which fractions of the stocks are contained within the minimum variance portfolio?
  b) Compute the expected return and the standard deviation of the tangent portfolio. (Consider the case when an investor can borrow and lend at the risk-free interest rate of 5%).

-- SEE OVERLEAF --

Problem 4. *(15 points)*

Consider the following table:

	μ	σ
Market	13%	16%
Risk-free	1%	0%
Stock A	20.2%	32%
Stock B	12.4%	18%

a) Assuming CAPM holds, calculate the betas for the risk-free security, the market portfolio, and stocks A and B. (Note: if the beta can be determined from CAPM theory, you need not show any work).

b) Define the terms systematic and nonsystematic risk. Quantify the risks for risk-free as well as for risky securities and the market.

c) Draw the Capital Market Line (CML) and the Security Market Line (SML). Be sure to place on each graph appropriate values of risk-free security, the market portfolio, and the stocks.

Problem 5. *(15 points)*

Use the data listed below to answer the following questions.

Asset	μ	σ
Market	14%	18%
Fortune Fund	19%	24%

Covariance of the Fortune Fund with the market is $\sigma_{F,M}=0.05184$. Risk-free rate is 2.0%.

a) Calculate the Sharpe, Treynor, and Jensen measures for the Fortune Fund and the market portfolio. Did the Fortune Fund outperform or underperform the market?

b) Are the ratings consistent across all measures? Explain briefly!