Examination: 2343 – Risk Management **Winter Term 2006/2007**

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You are welcome to use non-programmable pocket calculators as well as English language dictionaries without any markings. This examination comprises 3 problems (and 3 pages). All of the problems are to be solved. Derivations of the formulas from the lecture or the exercise are not (!) required. **Good luck!**

Examination Questions (Total Number of Points: 60)

Problem 1 (Variance-Covariance Approach vs. Diagonal Model – 23 Points)

A stock portfolio consists of 5,000 shares of corporation A stock (10 € per share), 1,500 shares of corporation B stock (20 € per share), and 800 shares of corporation C stock (25 € per share). All of these stocks belong to the All Share Index (ASI). Corporation A stock shows a volatility of 70 % and a beta coefficient of 1.1 (with respect to the ASI), corporation B stock shows a volatility of 40 % and a beta coefficient of 0.75, and corporation C stock shows a volatility of 120 % and a beta coefficient of 0.9. ASI volatility equals 60 %. The correlation coefficient between corporation A stock and corporation B stock rates of return equals 0.65, the one between corporation A stock and corporation C stock rates of return equals 0.8, and the one between corporation B stock and corporation C stock rates of return equals 0.1.

(a) Compute the portfolio's value at risk (in €) for an assumed holding period of 1 month and a confidence level of 90 % (see table on page 3) using

   (i) the variance-covariance approach

   (ii) the diagonal model.

(b) Explain your different results in (a) by a technical and economical discussion of the more restrictive assumption of the diagonal model in comparison to the variance-covariance approach.

(c) If the stock portfolio consisted of 1,000 different kinds of stock, how many parameters and of what kind (beta coefficients, volatilities, etc.) would you have to estimate before you can compute the portfolio's value at risk using

   (i) the variance-covariance approach

   (ii) the diagonal model.

Problem 2 (Hedging Foreign Currency Risk – 20 Points)

The treasurer of a German corporation knows that the corporation will have to pay £1 million in 6 month. Today the EUR/GBP exchange rate in the spot market equals 1.4914 (€/£). The treasurer wants to hedge against exchange rate movements and enters into an appropriate forward contract with a bank, i.e. today he agrees that the corporation buys £1 million in 6 month from the bank. Today the following quotes concerning risk-free investments can be found: 3-month Euribor: 3.878 % p.a.; 6-month Libor (GBP): 5.464 % p.a. (both discretely compounded). The standard deviation of the daily (absolute) change of the EUR/GBP exchange rate equals 0.00139 (€/£).

(a) Compute the (fair) 6-month forward EUR/GBP exchange rate (in €/£) provided by the bank today.

(b) Plot the payoff of the bank's (!) forward contract on foreign exchange (in €) against the spot exchange rate in 6 month.

(c) Compute the value at risk of the bank's forward contract on foreign exchange (in €) for an assumed holding period of 10 trading days and a confidence level of 99 % (see table on page 3) using the delta-normal method.

(d) From which (bank regulation) document do the assumptions of a holding period of 10 trading days and a confidence level of 99 % come from? (institution, year, approximate title)

(e) Collect the technical (and more or less plausible) assumptions of the value at risk computation used in (c).

Problem 3 (Ratings-Based Approach – 17 Points)

A corporation plans to issue a coupon bond with a maturity of 3 years, a volume of 10 million €, issue price and repayment at par, and annual coupon payments. The corporation has been rated by a rating agency prior to the issue and (initially) got a rating of S. The rating agency uses 3 rating classes (I – investment grade, S – speculative grade, D – default). The following numbers are the corporations' probabilities of default during a time interval of one year after being rated:

Rating class	I	S	D
Probability of default during the year after being rated	1 %	20 %	100 %

The rating agency audits the assigned ratings and re-adjusts them if necessary periodically after one year. The following table contains the probabilities that corporations with ratings I or S migrate into another rating class after auditing or stay in their rating class (these probabilities are therefore called migration probabilities):

New rating class	I	S	D
Migration probability coming from rating class I	97 %	a %	b %
Migration probability coming from rating class S	c %	72 %	d %
Migration probability coming from rating class D	e %	f %	g %

The expected recovery rate in case of default depends on the rating received directly before the year of default, applies to the sum of one coupon plus principal owed, and is:

Rating class before the year of default	I	S
Expected recovery rate	70 %	40 %

The current term structure of interest rates is:

Maturity	1 year	2 years	3 years
Yield (!) to maturity	3 % p. a.	4 % p. a.	5 % p. a.

(a) What are the correct values of a, b, c, d, e, f, and g in the second table?

(b) Write down an equation which contains only one variable which is the coupon payment that has to be chosen by the corporation to place the bond at the market if investors are assumed to be risk-neutral. (You do not (!) have to solve this equation for the coupon payment.)

(c) How would you compute the credit spread using the assumption in (b)?

(d) Is the true (realistic) credit spread larger, smaller or equal to the one in (c)? Justify your answer.

Distribution Function of the Standard Normal Distribution for Non-negative Arguments

x	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7034	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9773	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9983	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9990	0.9993	0.9995	0.9997	0.9998	0.9998	0.9999	0.9999	1.0000