



Strathmore
UNIVERSITY

STRATHMORE INSTITUTE OF MATHEMATICAL SCIENCES
BBS FINANCIAL ECONOMICS |BBS FINANCIAL ENGINEERING
END OF SEMESTER EXAMINATION
BSF 4126:FINANCIAL RISK MANAGEMENT

DATE: 25th JULY 2019

Time: 2 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

Question ONE

Part 1

A leading international accounting and consulting firm has fully functioning enterprise risk management, corporate governance systems, internal audit and compliance functions. It has decided to appoint a Global Ethics Officer. Describe the firm's likely motivation for the appointment. [Your answer should include reference to aspects of the role that may or may not already be found in other areas of the firm.]

[6 mks]

Part 2

BYJ commercial bank has \$100 million of retail exposures. The 1-year probability of default averages 2% and the recovery rate averages 60%. If the correlation parameter is estimated at 0.1, compute the 1-year 99.9% credit VaR

[3 mks]

Part 3

Portfolio Y has a notional value of \$1,000,000 with 30 credit positions. Each of the credits has a default probability of 3% and zero recovery rate. In addition all credit positions in the portfolio feature the same obligor. As a result, the credit portfolio has a default correlation equal to 1. Determine the credit value at risk at the 99% confidence level for this credit portfolio.

[3 mks]

Part 4

Suppose a swap curve is flat at 5%. Assume that the following principal and spread characteristics apply to each of collateral, mezzanine, and senior tranches:

Collateral: (\$100m, 350 bps)

Mezzanine: (\$10m, 500 bps)

Senior: (\$85m, 50 bps)

Discuss how the annual interest amounts would compare.

[3 mks]

Part 5

A credit risk manager needs to evaluate the value of a call option. The firm under investigation has a \$120 million of debt payable to debt holders. As a rule, equity holders receive something

only if the firm value exceeds the face value of the debt. How much would be the payoff of a call option supposing the firm has a value of \$160 million at maturity?

[3 mks]

Part 6

Rower's Inc. submitted the following data from their financial statement to be used to assess the capacity. Compute Rower's return on equity.

Total assets	\$42 million
Net income	\$6.3 million
Total liabilities	\$19 million
Cost of service provided	\$24 million

[3 mks]

Part 7

Tenacity Limited, a leveraged firm in the United States, has, in its capital structure, a five-year zero coupon bond with a face value of USD 300 million. The remaining capital is composed of equity. Currently, the market value of the firm's assets is USD 380 million, and the expected rate of change of the firm's value is 20%. Analysts have estimated annual volatility of the firm's assets at 30%. The firm's risk management unit (RMU) estimates the distance to default using the Merton model, i.e.,

$$[\ln (K/ V) - \delta \tau + 0.5 \sigma^2 \tau] \sigma \sqrt{\tau}$$

Assume that firm value takes on the lognormal distribution, with constant volatility. Estimate the default probability, given the distance to default.

[3 mks]

Part 8

XYZ Limited is an international conglomerate. Describe the advantages to a group such as XYZ of actively managing its portfolio of risks.

[3 mks]

Part 9

George Mafie, FRM, works as an analyst at a U.S. based bank. He wishes to test the bank's 1-day 99.5% VaR model over a 1-year horizon at a 99% confidence level. Assuming 252 days in a year, determine the maximum number of daily losses exceeding the 1-day 99.5% VaR that's acceptable to conclude that the model is well calibrated.

[3 mks]

[Total Marks: 30]

Question TWO

Part 1

ABC is an international conglomerate. ABC's risk management framework includes the following components:

- (a) risk capacity
- (b) risk profile
- (c) risk tolerance
- (d) risk limits
- (e) risk appetite

Discuss aspects of each of the above components that will be relatively more difficult to manage as a consequence of ABC being an international conglomerate.

[10 mks]

Part 2

An investment bank has USD 42 billion in assets. The bank's CRO computes the daily VaR at various levels of confidence as follows:

<u>Confidence Level</u>	<u>VaR (USD)</u>
90.0%	125,555,000
95.0%	180,250,500
95.5%	185,000,500
96.0%	195,500,000
96.5%	203,205,500
97.0%	211,425,000
97.5%	222,233,500
98.0%	233,562,500
98.5%	241,523,000
99%	256,300,000
99.5%	280,500,000

Determine the closest estimate of the daily ES at the 9.5% confidence level:

[3 mks]

Part 3

A renowned investment bank has a portfolio consisting of CAD 72 million invested in Canadian equities and a further CAD 58 million invested in emerging market equities. Each of these positions has a 1-day VaR of CAD 2.5 million. For optimal performance, the bank decides to rebalance the portfolio by simultaneously selling CAD 20 million of the Canadian equities and buying CAD 20 million of the emerging market equities. The bank's chief risk officer also recommends a wider VaR measure – from the current 1-day 95% VaR to a 10-day 99% VaR. The correlation between Canadian equities and emerging market equities stands at 0.47. Determine the change in portfolio VaR that will be brought about by the combined effect of portfolio rebalancing and change in risk measure. (Assume that returns are normally distributed, and that rebalancing has no effect on the volatility of the individual equity positions)

[7 mks]

[Total Marks: 20]

Question THREE

Part 1

Smart Bank (SB) recently launched a successful takeover of AC Bank. After post-acquisition analysis, senior management at SB strongly feels some of the AC's business lines do not justify their huge capital allocations. Of key concern is AC's Small and Medium Businesses Lending Division (SMBL), which has a Loan portfolio worth \$150 million. The division relies heavily on deposits to satisfy its funding needs. After extensively analyzing the division's credit risk, analysts at SB determine that the probability of default is 7% and the loss given default is 60%. What's more, the exposure at default is 100% of the loan exposure. Senior management requests a review of SMBL's capital allocation in an attempt to establish exactly how efficient the division is in its use of funds compared to other divisions. The bank applies a 1- year horizon to measure the parameters outlined in the exhibit below:

<u>Item</u>	<u>Value</u>
<u>SMBL division</u>	
Economic capital	\$120 million
Operating direct costs	\$1.25 million
Interest costs	\$6 million
Cost of debt capital	5%
Return on risk capital	2%
Return on the loan portfolio	12%
<u>Further Details</u>	
Hurdle rate	4.6%
Equity market return	6%
Risk-free rate	2%
Equity beta	1.08
Effective tax rate	30%

Assume that the effective tax rate and hurdle rate span all business lines, there are no transfers, and that correlations between the various divisions are the same. Furthermore, all divisions have a mandate to maximize shareholder wealth.

Determine the adjusted RAROC and the appropriate recommendation(s) to SB bank with regard to the SMBL division

[5 mks]

Part 2

Diamond Fitness Ltd. is a chain of three small specialist gyms which are open to women only. Diamond Fitness gyms also provide fitness classes, massage and physiotherapy services at an additional cost to members.

The company is too small to operate with sophisticated ERM.

(i) Propose ERM-related actions that the company could take which would be practical, cost effective and useful.

[3 mks]

The company is owned by Joanna Smith, who is also the Chief Executive Officer. She set it up three years ago. She invested \$1 million in the company and the company borrowed \$3 million from a bank under a ten year loan to purchase the properties and buy the initial equipment.

Membership fees are saved in a business bank account and are used to cover the loan repayments and ongoing running costs including salaries.

(ii) Describe how the bank would evaluate the credit risk within the loan at the outset, stating any assumptions that you make regarding the terms and conditions of the loan.

[7 mks]

The Board comprises Joanna as Chairperson, Claire (a former professional body-builder who teaches fitness classes at the gyms), Denise (a professional triathlete, a gym member and a school friend of Joanna) and Joanna's sister, Brenda (a hockey coach who also uses one of the gyms). There are no independent non-executive directors.

Performance appraisals of Board members are carried out by an external recruitment firm on an annual basis.

The Board meets annually to review the annual accounts, which are produced by an external accountancy firm.

Although the business is currently fully owned by Joanna, she is considering the possibility of a future share listing. She is therefore considering whether changes should be made in respect of the corporate governance of the company.

(iii) Propose, with reasons, changes that Diamond Fitness could make to improve its corporate governance.

[5 mks]

[Total Marks: 20]

Question FOUR

Part 1

A risk analyst wishes to establish the VaR of a portfolio under his management. At present, the portfolio has a value of CAD 100 million. The annual mean and volatility of the portfolio are 25% and 45%, respectively. Evaluate how the 1-year 95% VaR, calculated using the normal distribution assumption (normal VaR), compares with the 1-year 95% VaR, calculated on the basis of the lognormal distribution (lognormal VaR).

[3 mks]

Part 2

Yellow Town Society is a small mutual (i.e. not shareholder-owned) society providing a range of bank accounts, savings accounts and mortgages. It currently invests in government bonds and corporate bonds and holds a small amount of cash.

(i) Describe the main financial risks to which Yellow Town Society is exposed.

[5 mks]

(ii) Outline the likely components of Yellow Town Society's risk policies that will influence its decisions on corporate bond investment.

[7 mks]

Some of the corporate bond investments held by the Society are issued by insurance companies. The Chief Financial Officer (CFO) has suggested that the investment managers should look at Standard & Poor's enterprise risk management evaluation reports and classifications for those companies.

(iii) Discuss this suggestion.

[5 mks]

[Total Marks: 20]

Question FIVE

Part 1

The board of MicroChip is considering launching a banking subsidiary. The finance function has provided the following information on this option:

- projected balance sheet with and without the new banking subsidiary
- costs of launching and running the subsidiary
- projected surplus arising with and without the new banking subsidiary
- cost of raising debt to launch the new banking subsidiary

The board has requested the following pieces of information from the risk management function:

- current risk appetite
- current risk profile
- projected risk profile
- economic capital requirement for the banking subsidiary

(i) Explain why the board has requested this information from the risk management function.

[4 mks]

The economic capital requirement calculations include the modelling of a number of management actions.

(ii) Explain what is meant by management actions in this context.

[2 mks]

(iii) Suggest the management actions that could be modelled by Yellow Town Society.

[2 mks]

The board has decided to use Risk-Adjusted Return on Capital (“RAROC”) as a metric to help it to decide whether to launch an banking subsidiary.

(iv) Assess the suitability of RAROC for this purpose

[3 mks]

(v) Propose two other risk optimization metrics, relating to economic capital, that the board could use to enable it to assess this option.

[2 mks]

(vi) Contrast the key features of the metrics proposed in part (V) with those for RAROC

[3 mks]

Part 2

A risk management unit of a bank wishes to estimate the distance to default and expected default frequency for both existing and potential corporate borrowers. One of its clients, Smart Investments, has assets valued at a total of £15 billion, with 25% asset volatility, measured annually. The expected return on the firm’s assets stands at 6% and the risk free rate is 2% per year. Smart Investments also has short term debt of £5 billion and long-term debt of £4 billion. The following table gives the rating schedule at a 1-year horizon

Expected Default Frequency (EDF)	Rating class
0.02% - 0.04%	AAA
0.04% - 0.10%	AA/A
0.10% - 0.19%	A/BBB+
0.19% - 0.40%	BBB+/BBB-
0.40% - 0.72%	BBB-/BB
0.72% - 1.01%	BB/BB-

Determine the credit rating for Smart Investments at a 1-year horizon using the rating schedule provided:

[4 mks]

[Total Marks: 20]

Reference Table: Let Z be a standard normal random variable.

z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)
-3	0.0013	-2.50	0.0062	-2.00	0.0228	-1.50	0.0668	-1.00	0.1587	-0.50	0.3085
-2.99	0.0014	-2.49	0.0064	-1.99	0.0233	-1.49	0.0681	-0.99	0.1611	-0.49	0.3121
-2.98	0.0014	-2.48	0.0066	-1.98	0.0239	-1.48	0.0694	-0.98	0.1635	-0.48	0.3156
-2.97	0.0015	-2.47	0.0068	-1.97	0.0244	-1.47	0.0708	-0.97	0.1660	-0.47	0.3192
-2.96	0.0015	-2.46	0.0069	-1.96	0.0250	-1.46	0.0721	-0.96	0.1685	-0.46	0.3228
-2.95	0.0016	-2.45	0.0071	-1.95	0.0256	-1.45	0.0735	-0.95	0.1711	-0.45	0.3264
-2.94	0.0016	-2.44	0.0073	-1.94	0.0262	-1.44	0.0749	-0.94	0.1736	-0.44	0.3300
-2.93	0.0017	-2.43	0.0075	-1.93	0.0268	-1.43	0.0764	-0.93	0.1762	-0.43	0.3336
-2.92	0.0018	-2.42	0.0078	-1.92	0.0274	-1.42	0.0778	-0.92	0.1788	-0.42	0.3372
-2.91	0.0018	-2.41	0.0080	-1.91	0.0281	-1.41	0.0793	-0.91	0.1814	-0.41	0.3409
-2.9	0.0019	-2.40	0.0082	-1.90	0.0287	-1.40	0.0808	-0.90	0.1841	-0.40	0.3446
-2.89	0.0019	-2.39	0.0084	-1.89	0.0294	-1.39	0.0823	-0.89	0.1867	-0.39	0.3483
-2.88	0.0020	-2.38	0.0087	-1.88	0.0301	-1.38	0.0838	-0.88	0.1894	-0.38	0.3520
-2.87	0.0021	-2.37	0.0089	-1.87	0.0307	-1.37	0.0853	-0.87	0.1922	-0.37	0.3557
-2.86	0.0021	-2.36	0.0091	-1.86	0.0314	-1.36	0.0869	-0.86	0.1949	-0.36	0.3594
-2.85	0.0022	-2.35	0.0094	-1.85	0.0322	-1.35	0.0885	-0.85	0.1977	-0.35	0.3632
-2.84	0.0023	-2.34	0.0096	-1.84	0.0329	-1.34	0.0901	-0.84	0.2005	-0.34	0.3669
-2.83	0.0023	-2.33	0.0099	-1.83	0.0336	-1.33	0.0918	-0.83	0.2033	-0.33	0.3707
-2.82	0.0024	-2.32	0.0102	-1.82	0.0344	-1.32	0.0934	-0.82	0.2061	-0.32	0.3745
-2.81	0.0025	-2.31	0.0104	-1.81	0.0351	-1.31	0.0951	-0.81	0.2090	-0.31	0.3783
-2.8	0.0026	-2.30	0.0107	-1.80	0.0359	-1.30	0.0968	-0.80	0.2119	-0.30	0.3821
-2.79	0.0026	-2.29	0.0110	-1.79	0.0367	-1.29	0.0985	-0.79	0.2148	-0.29	0.3859
-2.78	0.0027	-2.28	0.0113	-1.78	0.0375	-1.28	0.1003	-0.78	0.2177	-0.28	0.3897
-2.77	0.0028	-2.27	0.0116	-1.77	0.0384	-1.27	0.1020	-0.77	0.2206	-0.27	0.3936
-2.76	0.0029	-2.26	0.0119	-1.76	0.0392	-1.26	0.1038	-0.76	0.2236	-0.26	0.3974
-2.75	0.0030	-2.25	0.0122	-1.75	0.0401	-1.25	0.1056	-0.75	0.2266	-0.25	0.4013
-2.74	0.0031	-2.24	0.0125	-1.74	0.0409	-1.24	0.1075	-0.74	0.2296	-0.24	0.4052
-2.73	0.0032	-2.23	0.0129	-1.73	0.0418	-1.23	0.1093	-0.73	0.2327	-0.23	0.4090
-2.72	0.0033	-2.22	0.0132	-1.72	0.0427	-1.22	0.1112	-0.72	0.2358	-0.22	0.4129
-2.71	0.0034	-2.21	0.0136	-1.71	0.0436	-1.21	0.1131	-0.71	0.2389	-0.21	0.4168
-2.7	0.0035	-2.20	0.0139	-1.70	0.0446	-1.20	0.1151	-0.70	0.2420	-0.20	0.4207
-2.69	0.0036	-2.19	0.0143	-1.69	0.0455	-1.19	0.1170	-0.69	0.2451	-0.19	0.4247
-2.68	0.0037	-2.18	0.0146	-1.68	0.0465	-1.18	0.1190	-0.68	0.2483	-0.18	0.4286
-2.67	0.0038	-2.17	0.0150	-1.67	0.0475	-1.17	0.1210	-0.67	0.2514	-0.17	0.4325
-2.66	0.0039	-2.16	0.0154	-1.66	0.0485	-1.16	0.1230	-0.66	0.2546	-0.16	0.4364
-2.65	0.0040	-2.15	0.0158	-1.65	0.0495	-1.15	0.1251	-0.65	0.2578	-0.15	0.4404
-2.64	0.0041	-2.14	0.0162	-1.64	0.0505	-1.14	0.1271	-0.64	0.2611	-0.14	0.4443
-2.63	0.0043	-2.13	0.0166	-1.63	0.0516	-1.13	0.1292	-0.63	0.2643	-0.13	0.4483
-2.62	0.0044	-2.12	0.0170	-1.62	0.0526	-1.12	0.1314	-0.62	0.2676	-0.12	0.4522
-2.61	0.0045	-2.11	0.0174	-1.61	0.0537	-1.11	0.1335	-0.61	0.2709	-0.11	0.4562
-2.6	0.0047	-2.10	0.0179	-1.60	0.0548	-1.10	0.1357	-0.60	0.2743	-0.10	0.4602
-2.59	0.0048	-2.09	0.0183	-1.59	0.0559	-1.09	0.1379	-0.59	0.2776	-0.09	0.4641
-2.58	0.0049	-2.08	0.0188	-1.58	0.0571	-1.08	0.1401	-0.58	0.2810	-0.08	0.4681
-2.57	0.0051	-2.07	0.0192	-1.57	0.0582	-1.07	0.1423	-0.57	0.2843	-0.07	0.4721
-2.56	0.0052	-2.06	0.0197	-1.56	0.0594	-1.06	0.1446	-0.56	0.2877	-0.06	0.4761
-2.55	0.0054	-2.05	0.0202	-1.55	0.0606	-1.05	0.1469	-0.55	0.2912	-0.05	0.4801
-2.54	0.0055	-2.04	0.0207	-1.54	0.0618	-1.04	0.1492	-0.54	0.2946	-0.04	0.4840
-2.53	0.0057	-2.03	0.0212	-1.53	0.0630	-1.03	0.1515	-0.53	0.2981	-0.03	0.4880
-2.52	0.0059	-2.02	0.0217	-1.52	0.0643	-1.02	0.1539	-0.52	0.3015	-0.02	0.4920
-2.51	0.0060	-2.01	0.0222	-1.51	0.0655	-1.01	0.1562	-0.51	0.3050	-0.01	0.4960

Reference Table: t-table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
Z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										