Exam CFEFD

AFTERNOON SESSION

Date: Wednesday, October 31, 2018
Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 5 questions numbered 8 through 12 for a total of 40 points. The points for each question are indicated at the beginning of the question. No questions pertain to the Case Study.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam CFEFD.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

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Exam CFEFD-Front Cover

8. (*7 points*)

(a)   (*1 point*) List the three parts of the yield-curve extrapolation problem that the "macroeconomic" / phased approach aims to address.

(b)   (*3 points*)

    (i)   Describe the two views regarding the basic purpose of yield-curve extrapolation.

    (ii)   Compare and contrast the two views.

You have been asked to determine the value of your company's Long-Term Care (LTC) block.

Since the majority of the liabilities extend beyond 30 years, your boss recommends using the ratio of the 30-year and 29-year Treasury rates for the ultimate forward rate.

The CFO read the "Static Control Model" (SCM) paper, and now believes that the SCM with CTE(20) is the best approach for the LTC valuation.

(c)   (*3 points*)

    (i)   Critique your boss' recommendation.

    (ii)   Critique the CFO's recommendation.

    (iii)   Recommend an appropriate approach to yield-curve extrapolation for the LTC valuation. Justify your recommendation.

9. (*9 points*) Your CRO wants to build a stochastic economic capital model that quantifies the potential change in economic surplus over a one-year period, under a set of economic scenarios and stress tests.

He is considering buying an economic scenario generator (ESG) from an outside vendor to produce scenario sets incorporating interactions between multiple risk factors. The CRO is considering 30 vendors that offer this type of ESG.

    (a)   (*2 points*)

        (i)   Describe how you would apply an optimal stopping strategy to select the ESG vendor.

        (ii)   Explain the rationale behind your strategy.

        (iii)   Explain the limitations of your strategy.

The CRO requests that the economic capital model reflect embedded optionality in the assets and liabilities. You need to improve the current liability model to meet the CRO's request.

    (b)   (*2 points*) Compare the following two approaches to model the liabilities.

        (i)   Stochastic-on-stochastic modeling

        (ii)   Building proxy models that replicate the behavior of the liabilities

The Chief Actuary feels that the current liability model cannot be adapted to a stochastic-on-stochastic model. She suggests building a proxy model.

    (c)   (*2 points*) Evaluate the following proxy model options for the liabilities.

        (i)   Replicating polynomial

        (ii)   Replicating portfolio

9. **Continued**

Your CRO now wants to superimpose his own view of risk factor evolutions on your scenario set. He believes that the most likely options for the next year are as shown in the table below.

Shock Names	Description	Measure
Flat Interest Rates	Rates remain level	Average Surplus
Interest Rate Drop	Rates drop 200 bps	Average Surplus
Equity Drop	Equities down 15%	CTE (95) Surplus

(d)   (*3 points*)

   (i)   Explain how re-weighting and the entropy statistic can be used to incorporate "own views" into a forecast.

   (ii)   Assess the suitability of this technique for the shocks listed above.

10. (*9 points*) Restaurant Dolly is a family owned restaurant with 30 locations and with two primary growth goals:

- Open 10 additional locations in the next five years
- Mass-produce its popular homemade bread

Available alternative funding strategies include:

I.   Licensing
II. Franchising
III. Joint Ventures
IV. Co-Branding

(a)   (*1 point*) Explain why an alternative funding strategy would be advantageous to Dolly.

(b)   (*2 points*) Evaluate whether each alternative funding strategy (I-IV) is appropriate for each of Dolly's growth goals.

Dolly is considering two funding options for the mass production of its bread.

Option 1: Self-funding. Dolly estimates the following:

Mass Production Project	
Project Term	4 years
Revenues	$200M annually
Initial Expenses	$320M for building $50M for equipment $45M for marketing
Ongoing Expenses	$37M annually
Building Depreciation	$40M annually
Equipment Depreciation	Straight Line over project term
Dolly Operating Metrics	
Equity Cost of Capital	9.0%
Debt Cost of Capital	5.0%
Unlevered Cost of Capital	8.2%
Tax Rate	21%

10. Continued

Dolly intends to keep their debt-to-value ratio constant. Assume the mass production project has similar risk to that of Dolly as a whole.

Option 2: Joint venture with Hill company, a large multinational bakery.

In the joint venture, purchasing the building and equipment is no longer necessary, ongoing expenses are reduced by 40%, and revenues are evenly split with Hill. Assume all else would remain the same as Option 1.

(c)   (*3 points*) Recommend, based on NPV, whether Dolly should self-fund the project or pursue the joint venture with Hill. Show your work.

Dolly's CFO says, "Let's re-do the analysis assuming the mass production project has a different risk profile than the company as a whole."

(d)   (*2 points*)

   (i)   Identify which component in the calculation in part (c) would change based on the CFO's request.

   (ii)   Explain how to modify the component identified in part (i).

(e)   (*1 point*) Describe two factors Dolly should consider in evaluating a joint venture with Hill.

11. (*8 points*) RichCoin is a new cryptocurrency whose value has risen extraordinarily since its Initial Coin Offering (ICO) 6 months ago.

Brook Fund is considering adding RichCoin to its portfolio, which currently consists of only stocks and bonds. To help it decide, Brook Fund has hired two independent consultants, Audrey and you, to answer the following forecasting question:

"Will the value of RichCoin increase by at least 100% within the next 6 months?"

Audrey wastes no time in her response. She says, "I am very skeptical about cryptocurrencies. They are highly volatile assets and many cryptocurrencies fail. Therefore, the value of RichCoin will probably decrease."

(a)   (*2 points*) Critique Audrey's forecast from the perspective of a Superforecaster.

You are an aspiring Superforecaster. From your research, you have collected the following facts:

Month	T-6	T-5	T-4	T-3	T-2	T-1	T (today)
RichCoin Price	$0.50	$2.00	$1.60	$2.30	$2.90	$2.60	$2.50

- RichCoin was created by a billionaire tech entrepreneur.
- RichCoin competes with other, more popular cryptocurrencies.
- 67% of cryptocurrencies fail within their first year.
- 15% of cryptocurrencies increased in value by 100% in the previous six months.
- Cryptocurrencies are likely to be met with stricter government regulation in the next six months.

(b)   (*3 points*)

   (i)   Develop three questions to "Fermi-ize" the Brook Fund's forecasting question.

   (ii)   Describe "outside view" and "inside view."

   (iii)   Explain which questions in (i) are from an "outside view" and which are from an "inside view."

11. Continued

    (c)   (*2 points*) Approximate the likelihood that RichCoin will increase by at least 100% within the next 6 months using Fermi-style analysis and the data above.

    (d)   (*1 point*) Identify two additional steps you can take to improve your approximation.

12. (*7 points*) An IT programmer e-mailed the following comments describing the process used to implement the new economic capital model.

- IT reviewed three options and the algorithm in the new model was the fastest.
- We relabeled the code documentation so it's clear that this is an entirely new model, and not just a new version of the old model.
- To test it, I manually chose 100 random scenarios from the 10,000 we ran last quarter, verifying that all the results came out as expected. We will repeat this process each quarter going forward.
- We confirmed that our process to automatically load data from our other systems remains intact. The failure rate is slightly lower now, too.
- I know that you actuaries haven't tried the new model yet, but you'll like it!

(a)   (*3 points*) Critique the implementation process the IT programmer described.

Below are eight scenarios used to project economic capital for three major product lines.

Scenario	Equity Returns	Mortality Shock	Interest Rate Change
1	-10%	+10%	+100bps
2	-10%	-10%	+100bps
3	-10%	+10%	-100bps
4	-10%	-10%	-100bps
5	+10%	+10%	+100bps
6	+10%	-10%	+100bps
7	+10%	+10%	-100bps
8	+10%	-10%	-100bps

12. **Continued**

You produced the graph below of economic capital amounts, in which each line represents a scenario result for one year.
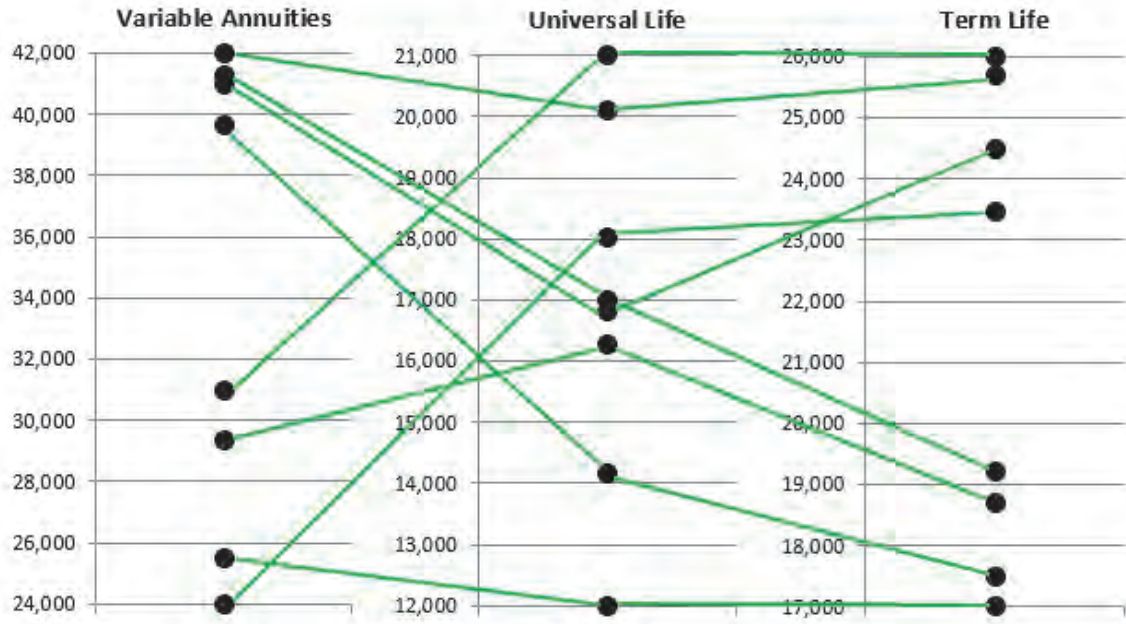
(b) (*2 points*) Interpret the graph.

Senior management believes the analysis above captures a sufficiently wide range of possible outcomes for the company's economic capital.

(c) (*2 points*) Evaluate senior management's belief.

END OF EXAMINATION
Afternoon Session

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