

PAK Study Manual for AFE Spring 2012



PRODUCT FEATURES

Purposes	Features	PAK Study Manual	PAK Exam Aid	PAK Memorization Aid	PAK Test Aid	PAK Study Manual Package
Study	Summaries	X				X
Study	Practice Questions	X				X
Study	Relevant Past Questions (List)	X				X
Study	Online Tutorial	X				X
Study	Suggested Schedule (Detailed)	X				X
Study	Email Support	X				X
Practice	Mock Questions		X			X
Practice	Past Questions (Sorted PDFs)		X			X
Practice	Case Study Analysis		X			X
Review	Condensed Summary			X		X
Review	Electronic Flash Cards			X		X
Review	Memorization Maps/ Combined Topics			X		X
Evaluation	Mock Exam				X	X
Bonus	Bonus materials					X



PAK STUDY MANUAL

1. Summary

- ◇ Summarize each reading in an organized format
- ◇ Explain logics and calculations in details
- ◇ Provide examples to master the materials

2. Key Points

- ◇ Highlight the key points important for the exam
- ◇ Help you focus on what you need to know to pass this exam

3. Relevant Past AFE/8E/8F SOA Exam Questions (List)

- ◇ Save your time to search what materials are relevant

4. Practice Questions (200+ in total)

- ◇ Available in each reading to refresh the materials learnt

5. Mock Exam Questions

- ◇ Include 5 mock exam questions and solutions

6. Suggested Study Schedule (Detailed)

- ◇ Keep track on your study schedule

7. Online Tutorial

- ◇ Weekly tutorial to clarify confusing concepts and discuss important topics

8. Email Support

- ◇ Get questions? Send me an email

NOTES

1. The study manual will be released by 2 stages: The 1st release containing 50% of the materials will be released on 11/15/11. The 2nd release containing the other 50% of the materials will be released on 12/30/11.
2. It is **different** from the Fall 2011 version.

“I passed my AFE exam on my first attempt with 10. I give my credit to Eddy. Thank you Eddy.” By Su (Charlie) Yang—NJ

Read the whole story

DO YOU KNOW?

The PAK Study Manual and related aids are updated EVERY exam sitting.

You will see the most updated materials, examples, and explanations to help you master the concepts and pass this exam in the first attempt.

PAK EXAM AID

1. 30 Mock Exam Questions and Solutions

- ◇ Test your knowledge and review how the topics can be tested
- ◇ Understand how to apply what you learnt in a case
- ◇ Complement with the past exam questions

2. Case Study Analysis

- ◇ Connect the case study materials to the study materials
- ◇ Read what was tested
- ◇ Brainstorm what can be tested
- ◇ Understand the tactics to answer the case study questions

3. Past SOA Exam Questions (from All FSA Tracks) Relevant to This Exam

- ◇ Provide a list of relevant past questions
- ◇ Sort the past questions into PDFs
- ◇ Save your time to search what materials are relevant

NOTES

1. The availability date of the 1st and 2nd items above may be different. It depends on when the SOA releases the new case study.
2. The 1st release will contain item #3 and will be released on 2/15/12. The 2nd release will contain item #1 and #2 and will be released on 3/15/12.
3. If the SOA do not release the case study, an additional 5 mock questions will be used to replace the case study analysis.

PAK MEMORIZATION AID

1. Electronic Flash Cards

- ◇ Summarize the key points (with mnemonics) (PDF version is also available)
- ◇ Contain around 250 flash cards (front and back)
- ◇ Work best for any big-screen cellular phone or mp3 player (e.g. iPhone, HTC, Android, Blackberry)

2. Condensed Summary

- ◇ Summarize the key points in outline format
- ◇ Quickly refresh all the important topics in the readings

3. Memorization Maps

- ◇ Map out the key points across the readings
- ◇ Make the memorization much easier
- ◇ 10 maps are available (in spreadsheet format)

PAK TEST AID

1. Mock Exam

- ◇ This set of mock exam is different from those mock questions available in the PAK Exam Aid. You can write down your answers and send them to me. I will give you detailed feedbacks on how to improve your exam score

DO YOU KNOW?

You can find the most updated information about the PAK Study Manual and related aids under the “Announcement” section on the front page of the PAK website.

“I can unequivocally say that it is the best study guide that I have used as I've made my way through the SOA exam system ” By David

Read the whole story

RELEASE SCHEDULE

Features	PAK Study Manual	PAK Exam Aid	PAK Memorization Aid	PAK Test Aid	PAK Study Manual Package
Summaries	11/15 and 12/30				11/15 and 12/30
Practice Questions	11/15 and 12/30				11/15 and 12/30
Relevant Past Questions (List)	11/15 and 12/30				11/15 and 12/30
Online Tutorial	To Be Announced				To Be Announced
Suggested Study Schedule (Detailed)	11/15				11/15
Email Support	Any time				Any time
Mock Questions*		3/15			3/15
Past Exam Questions (Sorted PDFs)		2/15			2/15
Case Study Analysis*		3/15			3/15
Condensed Summary			2/15		2/15
Electronic Flash Cards			2/15		2/15
Memorization Maps/Combined Topics			2/15		2/15
Mock Exam*				3/15	3/15
Bonus materials					To Be Announced

*The release date may be changed if the updated case study is released later than 3/10.



PAK STUDY MANUAL PACKAGE

1. PAK Study Manual (Release on 11/15/11 and 12/30/11)
2. PAK Exam Aid (Release on 2/15/12 and 3/15/12)
3. PAK Memorization Aid (Release on 2/15/12)
4. PAK Test Aid (Release on 3/15/12)
5. Bonus materials

SAMPLES?

You can find more samples on the [PAK](#) website.

IMPORTANT NOTES

1. Please note that all products are in electronic (PDF) format. **No** hard copy is provided.
2. Once you make a purchase (please use your work email address), I will send you a confirmation email within 1 business days. Once the files are available, I will send them to you through email. Please make sure that you put the correct email address when you purchase the PAK products. **If you do not receive the confirmation email, please send me an email.**
3. Please check your “junk” mailbox. Sometimes, my email is blocked.

MORE INFORMATION

Want more information? Please contact me at eddy.chan@pakstudymanual.com or visit www.pakstudymanual.com

COMMENTS FROM THE PAST CANDIDATES

You can find more comments from the past candidates here: [PAK Testimonials](#).

WHERE TO PURCHASE PAK PRODUCTS

The PAK products are available at [Actex](#), [Actuarial Bookstore](#), and [SlideRule Books](#).

PAK Study Manual

Advanced Finance / ERM (AFE) Exam
Spring 2012 Edition



PAK Study Manual Overview

Main Goal

The main goal of the PAK Study Manual is to help you pass this exam in the first attempt. Below briefly describe the features of the PAK Study Manual:

Detailed Summary (Different from Fall 2011 Edition)

- Summarize the key points *(grasp the concepts quickly)*
- Explain the calculations in details
- Clarify the confusing concepts

Practice Questions and Solutions

- Available in each summary
- Test your knowledge
- Refresh your memory about what you just learnt

Past SOA AFE/8E/8F Exam Questions

- Know which past exam questions correspond to which summary
- Practice them and understand how the topics were tested
- Go back to the readings if you find anything unclear

Mock Exam Questions and Solutions

- Include 5 mock questions and solutions in the PAK Study Manual
- Understand how the materials can be tested

Suggested Study Schedule

- Budget your time efficiently *(what you should do everyday)*
- Know your study progress *(beyond or behind study schedule)*

Additional 200+ Practice Questions and Solutions

- 200+ “end-of-chapter” practice questions and solutions are available to strength your knowledge

Online Tutorial

- Weekly tutorial to clarify confusing concepts and discuss important topics

Bonus Materials

- Study Group
- Study Skills
- Exam-Taking Skills
- Many more =)

Users’ Feedbacks on the PAK Study Manual

Not convinced? Read others’ comments [here](#)

Frequent Answer Questions

Do You Need to Read the Source Readings?

Unlike the preliminary exams, reading the source readings (textbooks, SOA study notes, and online readings) is a must in the FSA exams. PAK Study Manual can help you understand the materials faster and memorize them quickly so that in the time-limited environment, you can be well-prepared for the exam.

How Much Time is Needed to Study for This Exam?

This varies by person. Usually it will take one 350-400 hours to study for this exam. You can read the “Study Schedule” section on next page to better understand how much time is needed.

How to Prepare for This Exam?

Please read the “Study Schedule” section on next page.

Which Readings Should You Start First?

The syllabus contains textbook readings, SOA study notes, and online readings. Which one should you start first? I highly suggest you following the reading order in the syllabus (objective by objective). The SOA usually group the same/similar topics in the same objective. You can understand the materials better by doing this way.

What is the PAK Study Manual Format?

The PAK Study Manual is in electronic format (PDF format).

PAK Study Manual Products Available

1. PAK Study Manual *(Release on 11/15/11 and 12/30/11) (subject to the SOA's syllabus release date)*
2. PAK Exam Aid *(Release on 2/15/11 and 3/15/12)*
3. PAK Memorization Aid *(Release on 2/15/12)*
4. PAK Test Aid *(Release on 3/15/12)*
5. PAK Study Manual Package *(Combine item #1-4)*

You can find more information of each product here: <http://www.pakstudymanual.com>

Where to Purchase the PAK Study Manual and Other Study Aids

Please go to [Actex](#), [Actuarial Bookstore](#), or [SlideRule Books](#)

How Long Will You Receive the Materials?

Once you make a purchase, you will receive the materials next business day. Please check your junk mailbox in case your email server blocks my email.

More Samples?

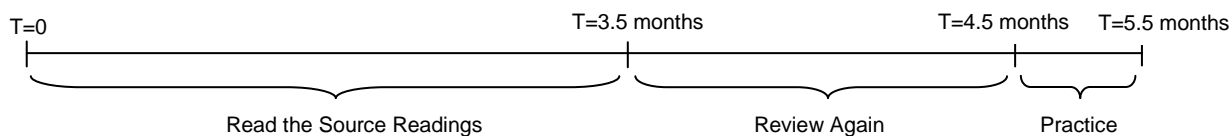
Please go to <http://www.pakstudymanual.com> for samples. If you want more, please feel free to contact me.

Any Questions?

I know you probably have a lot of questions in your mind regarding the exam or choosing study aids. Please feel free to contact me at eddy.chan@pakstudymanual.com

Study Schedule

From the date the SOA release the new syllabus to the exam date, there are around 5.5 months to study. How to plan your study schedule?



Read the Source Readings

The syllabus is huge!!! Usually it will take 3 to 3.5 months to study the whole syllabus. To study efficiently and make the read-through faster, I highly suggest you following the steps below:

Step 1: Define Your Own Study Schedule

- Use the suggested study schedule as a reference
- Prepare your own study schedule (*Target 20-30 pages @weekday and 50-60 pages @weekend*)
- Expect to read the whole syllabus and the past exams 2 or 3 times before the exam

Step 2: Read the Source Readings Together with the PAK Study Manual

- Write down your notes in the study manual
- Highlight all the key points there (*Will be used for memorization later*)
- Label any calculations that you will go over again later
- Go over the related past exam questions once you finish that reading

Step 3: Read the SOA Past Papers

- Read them once you finish your first-round of readings (*use the PAK Exam Aid*)
- Understand how the topics were tested and how the questions were answered

Review Again

After completing the three steps above, you probably have a general idea about how the exam looks like. Now you should review the source readings again (spend around a month) but this time focus more on the key topics, clarify the confusing concepts/calculations, think of what can be tested and read them carefully (use my mock exam questions)

Practice

The last month is the most critical month. You will spend most of your time on practicing the questions and memorizing the materials. Here are the steps:

- Practice the past exams and my mock questions to identify what you still do not know
- Go back to the readings and find your answers (*or send me an email if you need help*)
- Start memorizing the key points (*use the PAK Memorization Aid*)
- Use the PAK Test Aid to test your knowledge (*Send me your answers and I will give you detailed feedbacks on how to improve your score in the exams*)

More Information

I will explain how to prepare for this exam in much more details in the PAK Study Manual.

Online Reading: Summary of "Variance of the CTE Estimator" (by John Manistre and Geoffrey Hancock)**Key Points**

1. Understand how to calculate the VaR/CTE and their variances

IntroductionValue-at-Risk (VaR)

- Also called percentile or quantile value
- Is often used as a risk measure

Conditional Tail Expectation (CTE)

- Also called Expected Shortfall or Tail-VaR
- Become prevalent due to its desirable properties and ease of interpretation

Sample Average

$$\hat{\mu} = \frac{1}{n} \sum_i x_i$$

Three Points from Statistical Theory

1. The sample average is an unbiased estimator ($E[\hat{\mu}] = \mu = \text{the true mean}$)
2. The variance of the sample average = $VAR[\hat{\mu}] = \sigma^2 / n$ where $\sigma^2 = \text{the true variance}$
3. The estimator $\hat{\mu}$ has an approximate normal distribution if
 - o The sample size is large enough and
 - o A few other technical conditions are satisfied

The Distribution's Variance

- Can be estimated from $\hat{\sigma}^2 = \frac{1}{n-1} \sum_i (x_i - \hat{\mu})^2$
- The confidence interval = $\hat{\mu} \pm \frac{\hat{\sigma}}{\sqrt{n}}$ (This gives the user a sense of how large the sampling error might be)
- Users can then judge whether the precision of the estimate is high enough for the intended application

The Distribution of a CTE Estimator

- Depend on many variables
 - o Sample size
 - o The actual distribution
 - o The method of estimation
- There is no general set of formulas that are guaranteed to work in all circumstances

Three Points about the CTE Estimator

1. If the sample size is large enough, then there are approximate formulas to quantify the estimated CTE
2. One can execute the "variance verification" to test (and confirm) the validity of the approximate formulas
3. Variance reduction tools can be used to improve the precision of a CTE estimator
Variance reduction tools: importance sampling, control variate

Formulas for CTE and VaR

- $CTE(\alpha) = E[X | X > q_\alpha]$
- $VaR(\alpha) = \Pr\{X > q_\alpha\} = 1 - \alpha$
 - o Where a random variable X , with cumulative distribution $\Pr\{X \leq x\} = F(x)$ at the level α

Standard Approach to Calculate CTE and VaR

- Start with a random sample (x_1, x_2, \dots, x_n) of size n from the model
- Sort the sample in descending order to obtain the order statistics $(x_{(1)} \geq x_{(2)} \geq \dots \geq x_{(n)})$
- Calculate the plug-in estimators: $\widehat{CTE}_n(\alpha) = \frac{1}{k} \sum_{i=1}^k x_{(i)}$ and $\widehat{VaR}_n(\alpha) = x_{(k)}$ where $\alpha = 1 - \frac{k}{n}$

Example

Given 100 numbers in the sample ($n = 100$), find CTE(95%) and VaR(95%)

Scenario	100	99	98	97	96	95	94
Value	30	22	15	12	11	9	8

$$\alpha = 1 - \frac{k}{n} \Rightarrow k = (1 - 95\%) \times 100 = 5$$

$$CTE(95\%) = (30 + 22 + 15 + 12 + 11) / 5 = 18$$

$$VaR(95\%) = 9$$

Three Points from Statistical Theory

1. The pair $(\widehat{CTE}_n, \widehat{VaR}_n)$ has an approximate multivariate normal distribution if
 - o The sample size is large enough and
 - o A few other very technical conditions hold
2. The estimator pair is asymptotically unbiased
 - o For any finite sample size, the CTE plug-in estimator is negatively biased $E[\widehat{CTE}] < CTE$, but the bias goes to 0 as $n \rightarrow \infty$
 - o The bias is usually smaller than the sampling error
3. The formulas below are also asymptotically valid

$$o \quad VAR(\widehat{CTE}_n) \approx \frac{VAR(X | X \geq VaR) + \alpha(CTE - VaR)^2}{n(1 - \alpha)}$$

$$o \quad VAR(\widehat{VaR}_n) \approx \frac{\alpha(1 - \alpha)}{n[f_x(VaR)]^2}$$

$$o \quad CoV(\widehat{CTE}_n, \widehat{VaR}_n) \approx \frac{\alpha(CTE - VaR)}{n f_x(VaR)}$$

Comments on the Formulas

- CTE is clearly easier to work with than VaR
 - o It is difficult to estimate the $f_x(VaR)$, especially in the tails of the distribution
- The VaR and CTE estimators are positively correlated
- The variance of the CTE estimator has two terms
 - o 1st term: The extension of what was happening in the first ($\alpha=0$) case
 - o 2nd term: $VAR[\widehat{CTE}_n] = E\{VAR[\widehat{CTE}_n | \widehat{VaR}_n]\} + VAR\{E[\widehat{CTE}_n | \widehat{VaR}_n]\}$
 - When the CTE is estimated, both the CTE and the VaR are estimated and
 - Uncertainty in the VaR estimate increases the uncertainty of the CTE estimate

Simple Example - The European Put

European Put

- "In-the-money" European Put option at the $\alpha = 0.95$ confidence level

- The PV payoff function = $P = e^{-\delta T} \cdot \max \left[0, X - S \cdot e^{\left[\mu T + \sigma \sqrt{T} Z \right]} \right]$

o T=10 years, X=110, S=100, $\mu=8\%$, $\sigma=15\%$, $\delta=6\%$, Z = a standard Normal variate with mean=0 and variance=1, sample size (n)=1000

Example

Step 1: Use a random number generator to generate a random number (standard Normal variate). Let's say $Z_1 = -1.52$.

Step 2: Then $P_1 = e^{-0.06 \times 10} \cdot \max \left[0, 110 - 100 \cdot e^{\left[0.08 \times 10 + 0.15 \times \sqrt{10} \times -1.52 \right]} \right] = 0.9766$

Step 3: Repeat the first 2 steps 1000 times

Step 4: Rank them in descending order

Step 5: You can calculate the CTE(α), and the VaR(α) from the distribution

Estimator of Probability Density f(VaR)

$$\hat{f}(VaR) = \frac{\xi}{\hat{F}_n^{-1}(\alpha) - \hat{F}_n^{-1}(\alpha - \xi)} \quad \text{where } \xi = 1/100$$

Formula Standard Error (FSE)

$$FSE(CTE) = \sqrt{\frac{VAR(X_{(1)}, \dots, X_{(k)}) + \alpha(CTE - X_{(k)})^2}{n(1 - \alpha)}}$$

$$FSE(VaR) = \frac{1}{\hat{f}(VaR)} \sqrt{\frac{\alpha(1 - \alpha)}{n}}$$

$$Cov(CTE, VaR) = \frac{\alpha(CTE - X_{(k)})}{n \hat{f}(VaR)}$$

Calculation Example (Table 1)

$$VaR(95\%) = e^{-\delta T} \cdot \max \left[0, X - S \cdot e^{\left[\mu T + \sigma \sqrt{T} Z \right]} \right] = e^{-0.06 \times 10} \cdot \max \left[0, 110 - 100 \cdot e^{\left[0.08 \times 10 + 0.15 \times \sqrt{10} \times -1.645 \right]} \right] = 4.39$$

$$FSE(VaR) = \frac{1}{\hat{f}(VaR)} \sqrt{\frac{\alpha(1 - \alpha)}{n}} = \frac{1}{0.49\%} \sqrt{\frac{0.95(1 - 0.95)}{1000}} = 1.40$$

$$Cov(CTE, VaR) = \frac{\alpha(CTE - X_{(k)})}{n \hat{f}(VaR)} = \frac{0.95 \times (13.67 - 5.09)}{1000 \times 0.0049} = 1.65$$

$$d_1 = \min \left[z_\alpha, \frac{\ln \left(\frac{X}{S} \right) - \mu \cdot T}{\sigma \sqrt{T}} \right] = \min \left[-1.645, \frac{\ln \left(\frac{110}{100} \right) - 0.08 \cdot 10}{0.15 \cdot \sqrt{10}} \right] = -1.645$$

$$CTE(\alpha) = \frac{e^{-\delta T}}{1 - \alpha} \left[X \cdot \Phi(d_1) - S \cdot \Phi(d_1 - \sigma \sqrt{T}) \cdot e^{\left(\mu + \frac{1}{2} \sigma^2 \right) T} \right]$$

$$= \frac{e^{-0.06 \cdot 10}}{1 - 0.95} \left[110 \cdot \Phi(-1.645) - 100 \cdot \Phi(-1.645 - 0.15 \cdot \sqrt{10}) \cdot e^{\left(0.08 + \frac{1}{2} \cdot 0.15^2 \right) \cdot 10} \right] = 13.80$$

Not in the syllabus
For reference only

Not enough information to calculate FSE(CTE)

Key Points in Table 1

- There is considerable variability, especially for VaR
- The CTE plug-in estimator is (negatively) biased below the true closed form value
 - o $E[\hat{CTE}] < CTE$
 - o But the bias is much smaller than the sampling error
- The asymptotic variance formula for the CTE estimator performs quite well on average
 - o Average FSE(CTE) = empirical standard deviation of CTE
- The VaR plug-in estimator is (positively) biased
 - o But the bias is much smaller than the sampling error
- The sample covariance is close to the mean of all covariance estimators

A More Practical Example - Variance VerificationVariance Verification

- Used to test the validity of the asymptotic variance formulas

Steps to Perform the Variance Verification

1. Generate a larger sample of scenarios ($N = 5000$) and calculate the CTE_N and FSE_N
2. From the large sample size N , draw $m=100$ random sub-samples of size $n=1,000$ without replacement
3. For each of the m sub-samples, calculate a CTE estimate and an FSE estimate
 - o Check whether the CTE_N lies in the approximate 95% confidence interval $CTE \pm 2 \times FSE$
 - o If it does, set the CI (Confidence Interval) count to 1 and 0 otherwise
4. Use the standard deviation of the CTE estimates from Step 3 to check the validity of the asymptotic formula.
 - o A simple adjustment is needed (*shown below*)

Adjust the Biased Estimate of Sampling Error

- If the $FSE_{N=5000}$ is correct, then the $FSE_{n=1000}$ should be $159\sqrt{5} \approx 355$, not 316
- One possible explanation for this discrepancy is sampling error
- The other explanation: Std deviation of the $m=100$ sub-samples is a biased estimate of the sampling error
 - o Since the sub-samples (each of size $n=1000$) were all drawn from the same universe of $N=5000$ so they are not independent
 - o In the large sample limit, the correlation of two sub-sample estimates is $\rho = n / N$
 - o A better estimate for the sampling error when using a sample size of 1,000 is not 316, but

$$\text{Adjusted standard deviation} = \frac{\text{Std Dev}'n}{\sqrt{1 - \frac{n}{N}}} = \frac{316}{\sqrt{1 - \frac{1000}{5000}}} \approx 354$$

The Variance Verification Test

- Compare the empirical error estimate 354 with the mean formula estimate 346
- Conclusion: The asymptotic variance of the CTE Estimator agrees with "experiment," after adjusting for the non-independence of the sub-samples

The CI Count Result

- Is also consistent with the idea that the formula standard errors are working
- The actual count of 94 is very close to expected value of 95 (a 95% confidence interval)

Sample Bias

- If samples are **independent**, the following estimate can be used
 - o The mean of the 100 sub-sample estimates = 2111
 - o The upper bound of CI = $2111 + 316 / 100^{0.5} = 2143$
 - o It is much smaller than the mean of the N=5000 sample = 2214 → material bias
 - o But this analysis is misleading due to the non-independence of the sub-samples
- If samples are **positively correlated**, the variance of the sample mean is larger $VAR(\bar{x}) = \sigma^2 [\rho + (1-\rho)/m]$
 - o Better estimate: $STD(\bar{x}) = \sigma\sqrt{\rho + (1-\rho)/m} = 346\sqrt{\frac{1000}{5000} + (1 - \frac{1000}{5000})/100} \approx 158$
 - o The "2111+158" is not materially different from the sampling error in the 2,214 value
 - o The bias is lost in the sampling error

ConclusionsThe Asymptotic Formulas

- Practitioners can use the asymptotic formulas to understand the sampling error in a given CTE estimate
 - o The variance verification exercise can be used to prove that the asymptotic formulas are working
- Increasing the run size can reduce the sampling error
 - o E.g. The sampling error (in this example) = $355/2004 = 18\%$
 - o If the number of scenarios is increased by a factor of K , then the sampling error scales by a factor of $1/\sqrt{k}$

Practice QuestionsQuestion #1

You are given the following data:

- $n = 10,000$
- $\alpha = 90\%$
- $VaR(90\%) = 8$
- $CTE(90\%) = 30$
- $VAR(X | X \geq VaR) = 12$
- $\hat{f}(VaR) = 0.005$

Calculate the formula standard errors for CTE, VaR, and Cov

Answer

$$FSE(CTE) = \sqrt{\frac{VAR(X_{(1)}, \dots, X_{(k)}) + \alpha(CTE - X_{(k)})^2}{n(1-\alpha)}} = \sqrt{\frac{12 + 0.9 \cdot (30-8)^2}{10000 \cdot (1-0.9)}} = 0.67$$

$$FSE(VaR) = \frac{1}{\hat{f}(VaR)} \sqrt{\frac{\alpha(1-\alpha)}{n}} = \frac{1}{0.005} \sqrt{\frac{0.9 \cdot (1-0.9)}{10000}} = 0.6$$

$$Cov(CTE, VaR) = \frac{\alpha(CTE - X_{(k)})}{n\hat{f}(VaR)} = \frac{0.9 \cdot (30-8)}{10000 \cdot 0.005} = 0.396$$

Question #2

You are given the following data:

- T = 5 years
- X = \$90
- S = \$100
- $\mu = 9\%$
- $\sigma = 15\%$
- $\delta = 6\%$
- Z = A standard Normal variate with mean=0 and variance=1
- Sample size (n) = 1,000
- $\hat{f}(VaR) = 0.1$
- $Call = e^{-\delta T} \cdot \max \left[0, S \cdot e^{\left[\mu T + \sigma \sqrt{T} Z \right]} - X \right]$

Calculate the VaR(95%) for the European call option and the formula standard errors for VaR.

Answer

$$VaR(95\%) = e^{-\delta T} \cdot \max \left[0, S \cdot e^{\left[\mu T + \sigma \sqrt{T} Z \right]} - X \right] = e^{-0.06 \times 5} \cdot \max \left[0, 100 \cdot e^{\left[0.09 \times 5 + 0.15 \times \sqrt{5} \times -1.645 \right]} - 90 \right] = 0.24$$

$$FSE(VaR) = \frac{1}{\hat{f}(VaR)} \sqrt{\frac{\alpha(1-\alpha)}{n}} = \frac{1}{0.1} \sqrt{\frac{0.95(1-0.95)}{1000}} = 0.0689$$

Question #3

You are given the following data:

- n = 5,000
- VaR(95%) = 10
- CTE(95%) = 32
- $VAR(X | X \geq VaR) = 12$
- The confidence interval = CTE(95%) +/- FSE(CTE)

Calculate the confidence interval.

Answer

$$FSE(CTE) = \sqrt{\frac{VAR(X_{(1)}, \dots, X_{(k)}) + \alpha(CTE - X_{(k)})^2}{n(1-\alpha)}} = \sqrt{\frac{12 + 0.95 \cdot (32 - 10)^2}{5000 \cdot (1 - 0.95)}} = 1.37$$

$$\begin{aligned} \text{The confidence interval} &= \text{CTE}(95\%) \pm FSE(CTE) \\ &= 32 \pm 1.37 \end{aligned}$$

Past AFE/8E/8F SOA Questions Related To This Reading

None

Online Reading: Measuring and Managing Reputational Risk (by Daniel Diermeier)**Key Points**

1. Understand the three core difficulties in managing corporate reputations
2. Understand the three core capabilities needed to successfully manage reputational challenges

Measuring and Managing Reputational Risk**Reputation**

- Used to be “nice to have”
- Now considered as a *core asset* that needs to be protected and managed

Reputational Damage

- Can hurt a company in many ways
 - o Customers lost *(In Wal-mart’s case, 2-8% of shoppers have taken their business elsewhere)*
 - o Diminishing future opportunities *(Wal-mart has encountered increased resistance to opening new stores)*
- Impacts
 - o Affect the company’s performance
 - o Stock price decreased *(Wal-mart’s stock price has been depressed over the last two years)*

Lesson Learnt from the Wal-mart case

- A company’s reputation is only partially shaped by direct experiences (e.g. shopping) with the company
- Third parties, especially the media, play an important role in shaping customer perception

Three Core Difficulties in Managing Corporate Reputations

1. Lack of **control**
2. Limited **credibility**
3. Overwhelming **complexity**

Control

- Companies cannot directly control the messages received by third parties
 - o *E.g. if the NY Times runs an article detailing the alleged abuse of late fees among credit card companies, the company cannot reach all the readers of this article, certainly not among potential customers*

Complexity

- Customers do not understand the complexity underlying certain business decisions
- They will rely on heuristics and rules of thumb when forming an opinion about a company
- Risk perception is subject to various biases and so-called “framing effects”
 - o *E.g. customers will overestimate the risk to themselves if they empathize with the reported victim of allegedly improper business practices*

Credibility

- When third parties play a role in shaping a company’s reputation, companies’ own credibility is much lower than that of the experts
 - o Third parties
 - Scientists
 - Doctors
 - Non-governmental organizations
 - Government actors
 - Journalists
- Which third parties have the high credibility varies from country to country
 - o Companies need to understand that what works in one market may not work in another
 - *E.g. in Northern Europe, non-governmental organizations have higher credibility scores*
 - *This is not true in Japan or the United States where some government agencies (e.g. the FDA) have more credibility with customers*

Reputational Management

- Should not be relegated to functional specialists (*e.g. the legal or PR department*)
- Should integrate reputational considerations into the day-to-day business decisions

Three Core Capabilities Needed to Successfully Manage Reputational Challenges

1. A functioning **early warning system**
2. Ongoing **measurement** of the reputation of the company, its markets and products
3. Rapid **situational assessment** by issue, product, and market

Early Warning System

- Reputational challenges have their origin in areas not frequently monitored (*e.g. privacy data issue*)
- Companies can minimize reputational crises by
 - o Changing business practices
 - o Stakeholder outreach or
 - o Detailed communication plans
- But
 - o Developing such responses takes time
 - o The warning signs could have been identified but they never reached the key decision-makers
 - o Enterprise-critical issues were not even identified as potential risks
- Value proposition for investing in early warning systems
 - o Informally monitor various media sources over proactive stakeholder outreach
 - o Develop an internal issue anticipation group
 - o Use information technology tools to identify and monitor emerging issues
- “Open source intelligence”
 - o In the context of emerging issues, the shortcoming does not rest in the lack of information but in too much information
 - o Unfortunately, much of the information is never aggregated to actionable intelligence

Measurement

- It is difficult to quantify reputational risk
 - o Two things are lacking:
 - Operational measures (*customer satisfaction scores in marketing / quality measures in manufacturing*)
 - Financial measures (*connect reputational with financial performance*)
- Media coverage heavily influences the perception of customers and other stakeholders
 - o The media opinions can be measured by using computer algorithms (*similar to a spam filter*)
 - o Then the quantitative data about a company’s reputation can be generated and further analyzed

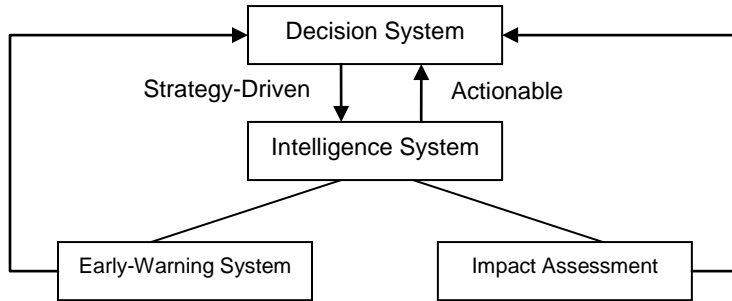
Steps to Measure Reputational Risk

- Compare the reputations of a given product in two different markets
- Measure reputational challenges over time and
- Assess whether a particular strategy has “moved the needle”
- Connect it to a company’s financial performance (*Integrate reputational risk with other risk types*)

Situational Assessment

- Once critical issues have been identified and their impact measured
 - o Managing such issues requires rapid and reliable situational assessment
 - In many cases, issues are “owned” by only a few journalists
 - Companies need to understand who is an “ally” or an “opponent”

The Key Components of an Effective Reputational Risk Management System



Practice Questions

1. What are the three difficulties in managing corporate reputations?

Three Core Difficulties in Managing Corporate Reputations

1. Lack of control
2. Limited credibility
3. Overwhelming complexity

2. What are the three capabilities needed to successfully manage reputational challenges?

Three Core Capabilities Needed to Successfully Manage Reputational Challenges

1. A functioning early warning system
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3. Rapid situational assessment by issue, product, and market

3. What are the potential impacts of reputational damage? List 6 impacts.

Potential Impacts

1. Customers lost
2. Diminishing future opportunities
3. Adverse impacts on company’s performance
4. Decrease in stock price
5. Loss in market share
6. Employees lost

(Other answers are also acceptable)

Past AFE/8E/8F SOA Questions Related To This Reading

None