



2017 FRM Part II

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信用风险测量与管理

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Credit Risk Measurement and Management

Key Point: Credit Decision and Credit Analysis

Consumers	Wealth, salary, or incoming cash per period, expenses per period, assets such as houses and cars, amount of debt, net cash available to service debt. Credit scoring models and some manual input and review for large exposures such as mortgage loans or automobile loans.
Corporations	Liquidity, cash flow combined with earnings capacity and profitability, capital position, state of the economy, strength of the industry. More complex than consumer analysis because companies are so diverse in terms of assets, cash flow, financial structure, etc.
Financial Institutions	Similar to nonfinancial firms but bank specific. Liquidity, capital position, historical performance including earnings capacity over time, asset quality, state of the economy, strength of industry. Qualitative analysis is even more important for financial firms than for nonfinancial firms.
Sovereigns	Financial factors including the country's external debt load and debt relative to the overall economy; tax receipts are important. More subjective than for financial and nonfinancial firms.

1. Golin and Delhaise divide credit analysis into four areas according to borrower type:
 - I. Consumer credit analysis is the evaluation of the creditworthiness of individual consumers;
 - II. Corporate credit analysis is the evaluation of nonfinancial companies such as manufacturers, and nonfinancial service providers;
 - III. Financial institution credit analysis is the evaluation of financial companies including banks and nonbank financial institutions, such as insurance companies and investment funds;
 - IV. Sovereign/municipal credit analysis is the evaluation of the credit risk associated with the financial obligations of nations, subnational governments, and public authorities, as well as the impact of such risks on obligations of nonstate entities operating in specific jurisdictions.

According to Golin and Delhaise, each of the following is true about key features of credit analysis with respect to borrower type, except which is not true?

- A. Individuals (consumers): Credit analysis is amenable to automation and the use of scoring models and statistical tools to correlate risk to limited number of variables

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- B. Non-financial corporations: Compared to consumers, tends to be more detailed and "hands-on" (i.e. less automated); key variables are likely to include liquidity, cash flow, near-term earnings capacity and profitability, solvency or capital position
- C. Financial Companies: In contrast to corporate (non-financial) credit analysis, qualitative analysis and asset quality are not important, but cash flow is a highly important (a "key indicator")
- D. Sovereigns: Includes analysis of country risk, which is primarily political dynamics and state of the economy; and systematic risk, which includes the regulatory regime and the financial system

Answer: C

Credit analysis of financial companies has much in common with corporate credit analysis, but the authors cite two key differences: With respect to financial companies, " The differences are: The importance of asset quality; The omission of cash flow as a key indicator."

2. ABC Company, domiciled in a country with a strong legal system, is applying for a USD 100,000 loan with an annual interest rate of 5% to be used exclusively on expanding its business and not to repay current debt. The loan will be secured by the company's factory buildings, which have an appraised value of USD 200,000. The company has an annual operating profit of USD 3,000. Which of the following statements relating to the credit risk of this company can most likely be inferred from the given data?
 - A. The company's capacity to pay is low.
 - B. The company's willingness to pay is low.
 - C. The loan exhibits a high loss given default.
 - D. The loan's exposure at default will increase.

Answer: A

Loan: \$100,000

Interest: \$5,000

Collateral: \$200,000

Profit: \$3,000

It shows that the company's capacity to pay is low.

Key Point: Credit VaR

Type of Credit Loss	Description	Formula
Expected Credit Loss	Represent the expected value of the credit loss	$EL = PD \times LGD \times EAD$
Unexpected Credit Loss	Quantile of the credit loss in excess of	$UL = \text{Credit VaR} = WCL - EL$

	the expected loss	
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3. A credit analyst at a bank has been asked to produce an exposure analysis for three of the loans in the bank's portfolio. Loan information assembled by the analyst as well as the bank's internal default.

Loan	Tenor (Years)	Notional (USD)	Loss Given Default	S&P Rating
1	2	30,000,000	0.75	BB-
2	3	100,000,000	0.90	A
3	1	100,000,000	0.70	B+

Probability of Default (PD)			
	Tenor (Years)		
Loan Quality	1	2	3
Investment Grade	0.01	0.02	0.03
Non-Investment Grade	0.05	0.10	0.20

There is no collateral provided by the borrower for these loans, so the analyst uses the notional amount provided above as the Exposure at Default. Which of the following correctly orders the expected loss for each loan from lowest to highest?

- A. Loan 1 < Loan 2 < Loan 3
- B. Loan 1 < Loan 3 < Loan 2
- C. Loan 2 < Loan 3 < Loan 1
- D. Loan 2 < Loan 1 < Loan 3

Answer: A

4. A manager of a mutual fund has taken significant credit exposure to Europe and Asia. Concerned with uncertain market conditions, the manager wants to change the assumptions in the fund's risk models by increasing the default correlation between bonds issued in Europe and bonds issued in Asia. If the default correlation is increased and all the other parameters are kept the same, which of the following is true?

- A. The expected loss of the portfolio will increase.
- B. The unexpected loss of the portfolio will decrease.
- C. The expected loss of the portfolio will decrease.
- D. The unexpected loss of the portfolio will increase.

Answer: D

Default correlation has no effect on portfolio EL, but is an increasing function with portfolio UL.

5. Suppose there is a \$1,000,000 portfolio with $n = 50$ credits that each has a default probability of $\pi = 0.02$ percent and a zero recovery rate, the default correlation is 0. In addition, each credit is equally weighted and has a terminal value of \$20,000 if there is no default. The number of defaults is binomially distributed with parameters of $n = 50$ and $\pi = 0.02$, and the 95th percentile of the number of defaults based on this distribution is 3. What is the credit VaR at the 95% confidence level based on these parameters?
- A. \$30,000
B. \$40,000
C. \$50,000
D. \$60,000

Answer: B

The expected loss is \$20,000 ($\$1,000,000 \times 0.02$). If there are three defaults, the credit loss is \$60,000 ($3 \times \$20,000$). The credit VaR at the 95% confidence level is \$40,000 (calculated by taking the credit loss of \$60,000 and subtracting the expected loss of \$20,000).

6. Becky the Risk Analyst is trying to estimate the credit value at risk (CVaR) of a three-bond portfolio, where the CVaR is defined as the maximum unexpected loss at 99.0% confidence over a one-month horizon. The bonds are independent (i.e., no default correlation) and identical with a one-month forward value of \$1.0 million each, a one-year cumulative default probability of 4.0%, and an assumed zero recovery rate. Which is nearest to the one-month 99.0% CVaR?
- A. \$989,812
B. \$1.0 million
C. \$1.7 million
D. \$2.3 million

Answer: A

The one-month PD = $1 - (100\% - 4\%)^{(1/12)} = 0.3396\%$.

Expected loss = $98.9846\% \times 0 + 1.0119\% \times \$1.0 \text{ million} + 0.0034\% \times \$2.0 \text{ million} + 0\% \times \$3.0 \text{ million} = \$10,188$

The probability of zero defaults = $(1 - 0.3396\%)^3 = 98.98464\%$.

Therefore, the 99.0% WCL is one default or \$1.0 million, and

the 99.0% CVaR = $\$1.0 \text{ million} - \$10,188 = \$989,812$.

7. At the beginning of the year, a firm bought an AA-rated corporate bond at USD 110 per USD 100 face value. Using market data, the risk manager estimates the following year-end values for the bond based on interest rate simulations informed by the economics team:

Rating	Year-End Bonds Value
AAA	112
AA	109
A	105
BBB	101
BB	92
B	83
CCC	73
Default	50

In addition, the risk manager estimates the 1-year transition probabilities on the AA-rated corporate bond:

Rating	Probability of State
AAA	3.00%
AA	85.00%
A	7.00%
BBB	4.00%
BB	0.35%
B	0.25%
CCC	0.15%
Default	0.25%

What is the 1-year 95% credit VaR per USD 100 of face value closest to?

- A. USD 9
- B. USD 18
- C. USD 30
- D. USD 36

Answer: A

The 95% credit VaR corresponds to the unexpected loss at the 95th percentile minus the expected loss, or the expected future value at the 95% loss percentile minus the current value. Using the probabilities in the given ratings transition matrix, the 95% percentile corresponds to a downgrade to BBB, at which the value of the bond would be estimated at 101. Since cash flows for the bond are not provided, we cannot derive the precise expected and unexpected losses, but the credit VaR

(the difference) is easily derived by subtracting the estimated value given a BBB rating from the current value. 95% credit VaR = 110 – 101 = 9.

8. Suppose there is a \$1,000,000 portfolio with n credits that each have a default probability, $\pi = 2\%$ and a zero recovery rate. The default correlation is 0 and $n = 1,000$. There is a probability of 28 defaults at the 95th percentile based on the binomial distribution with the parameters of $n = 1,000$ and $\pi = 0.02$. What is the credit VaR at the 95% confidence level based on these parameters?
- A. \$7,000
B. \$8,000
C. \$9,000
D. \$10,000

Answer: B

The 95th percentile of the credit loss distribution is \$28,000 ($28 \times \$1,000,000/1,000$). The expected loss is \$20,000 ($\$1,000,000 \times 0.02$). The credit VaR is then \$8,000 ($\$28,000 - \$20,000$).

9. Consider a pair of two speculative credits, rated BB and BB-, with default probabilities respectively of 2% and 3%. If their joint default probability is 0.4%, which is nearest to the implied default correlation?
- A. Zero
B. 0.083
C. 0.1424
D. 0.3750

Answer: C

Default correlation = $(0.4\% - 2\% \times 3\%) / [\sqrt{2\% \times 98\%} \times \sqrt{3\% \times 97\%}] = 0.142365$

Key Point: Probability of Default in Rating System

● Key Features of a Good Rating System

- ✧ Measurability and Verifiability
- ✧ Objectivity and Homogeneity
- ✧ Specificity

● Cumulative Default Probability

$$PD_k^{\text{cumulated}} = \frac{\sum_{i=t}^{i=t+k} \text{Def}_i}{\text{Names}_t}$$

● Marginal Default Probability

$$PD_k^{\text{marg}} = PD_{t+k}^{\text{cumulated}} - PD_t^{\text{cumulated}}$$

● **Forward Probability (Contingent to the Survival Rate)**

$$PD_{t,t+k}^{\text{Forw}} = \frac{\text{Def}_{t+k} - \text{Def}_t}{\text{Names survived}_t}$$

● **Survival Rate**

$$SR_{t,t+k}^{\text{Forw}} = (1 - PD_{t,t+k}^{\text{Forw}}) \quad (1 - PD_t^{\text{cumulated}}) = \prod_{i=1}^t SR_i^{\text{Forw}}$$

● **Annualized Default Rate**

$$(1 - PD_t^{\text{cumulated}}) = \prod_{i=1}^t SR_i^{\text{Forw}} = (1 - ADR_t)^t \quad (1 - PD_t^{\text{cumulated}}) = e^{-ADR \times t}$$

10. An analyst has noted that the default frequency in the pharmaceutical industry has been constant at 8% for an extended period of time. Based on this information, which of the following statements is most likely correct for a randomly selected firm following a Bernoulli distribution?

- I. The cumulative probability that a randomly selected firm in the pharmaceutical industry will default is constant.
- II. The probability that the firm survives for the next 6 years without default is approximately 60%.
- A. I only
- B. II only
- C. Both I and II
- D. Neither I nor II

Answer: B

Statement I is false because the cumulative probability of default increases (i.e., even the highest rated companies will eventually fail over a long enough period). Statement II is true since the probability the firm survives over the next 6 years without default is: $(1-0.08)^6 = 60.6\%$

11. A portfolio consists of 10 independent bonds. There will be one default on average in 5 years. What is the probability that only exactly one default in a year.

- A. 16.37%
- B. 26.84%
- C. 36.96%
- D. 45.28%

Answer: A

$$P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

We first need to realize that the expected number of default in one year, which is $\lambda = 1/5 = 0.2$; Using the Poisson distribution, we solve for the probability that x will be 1.

$$P(X=1) = \frac{0.2^1 e^{-0.2}}{1!} = 16.37\%$$

12. As a result of the credit crunch, a small retail bank wants to better predict and model the likelihood that its larger commercial loans might default. It is developing an internal ratings-based approach to assess its commercial customers. Given this one-year transition matrix, what is the probability that a loan currently rated at B will default over a two-year period?

Rating at Beginning of Period	Rating at End of Period			
	A	B	C	D
A	0.90	0.10	0.00	0.00
B	0.00	0.75	0.15	0.10
C	0.00	0.05	0.55	0.40

- A. 17.50%
B. 20.0%
C. 21.1%
D. 23.5%

Answer: D

13. Which of the following statements is not accurate in regard to describing a good rating system?
- A. A verifiable rating system requires backtesting default probabilities on a continuous basis.
- B. An objective rating system results in ratings that can be compared across customer types and market segments.
- C. A specific rating system accurately measures the distance from a default event.
- D. A homogeneous rating system provides judgments required comparable ratings among customer types, market segments, and portfolios.

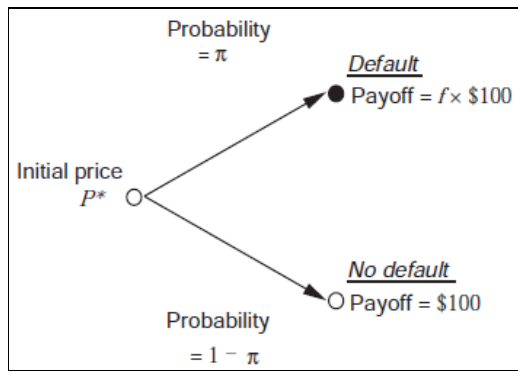
Answer: B

An objective rating system produces judgments based on considerations tied to credit risk.

Key Point: Using Spread to price Default Risk

$$P^* = \frac{\$100}{(1+YTM)} = \left[\frac{\$100}{(1+r_f)} \right] \times (1-PD) + \left[\frac{RR \times \$100}{(1+r_f)} \right] \times PD \Rightarrow PD = \frac{1}{1-RR} \left[1 - \frac{(1+r_f)}{(1+YTM)} \right]$$

$$\Rightarrow YTM \approx r_f + PD(1-RR) \text{ or } PD = \frac{YTM - r_f}{(1-RR)}, \text{ or } PD = \frac{\text{Spread}}{\text{LGD}}$$



Credit spread is the difference between the yield on a risky bond (e.g., corporate bond) and the yield on a risk-free bond (e.g., T-bond) given that the two instruments have the same maturity.

14. Consider a 1-year maturity zero-coupon bond with a face value of USD 1,000,000 and a 0% recovery rate issued by Company A. The bond is currently trading at 80% of face value. Assuming the excess spread only captures credit risk and that the risk-free rate is 5% per annum, the risk-neutral 1-year probability of default on Company A is closest to which of the following?

- A. 2%
- B. 14%
- C. 16%
- D. 20%

Answer: C

This can be calculated by using the formula which equates the future value of a risky bond with yield (y) and default probability (π) to a risk free asset with yield (r):

$$1 + r = (1 - \pi) \times (1 + y) + \pi R$$

π = Probability of default; R = Recovery rate

In the situation where the recovery rate is assumed to be zero, the risk-neutral probability of default can be derived from the following equation: $1 + r = (1 - \pi) \times (1 + y) = (1 - \pi) \times (FV/MV)$

Where MV = market value and FV = face value.

Inputting the data into this equation yield $\pi = 1 - (800,000 \times 1.05)/1,000,000 = 0.16$.

15. Suppose that you want to estimate the implied default probability for a BB-rated discount corporate bond.
- The T-bond (a risk-free bond) yields 12% per year.
 - The one-year BB-rated discount bond yields 15.8% per year.
 - The two-year BB-rated discount bond yields 18% per year.

If the recovery rate on a BB-rated bond is expected to be 0%, and the marginal default probability in year one is 5%, which of the following is the best estimate of the risk-neutral

probability that the BB-rated discount bond defaults within the next two year?

- A. 6.85%
- B. 3.28%
- C. 9.91%
- D. 10.14%

Answer: C

$$(1 + 0.12)^2 = PD \times (1 + 0.18)^2 \rightarrow PD = 9.91\%$$

16. Given the following information, what is the probability of default for this zero- coupon bond that matures in one year?

Face value of bond	\$100
Market price of bond	\$86
Risk-free rate	5%

- A. 9.70%.
- B. 30.71%.
- C. 10.74%.
- D. 35.21%.

Answer: A

First back out the yield for the bond:

$$\frac{\$100}{\$86} - 1 = 16.28\%$$

The probability of default is then calculated as:

$$1 - \left(\frac{1.05}{1.1628} \right) = 9.70\%$$

Alternatively, it can be calculated as:

$$1 - \frac{\$86 \times 1.05}{\$100} = 9.70\%$$

17. Suppose XYZ Corp. has two bonds paying semiannually according to the following table. The recovery rate for each in the event of default is 50%. For simplicity, assume that each bond will default only at the end of a coupon period. The market-implied risk-neutral probability of default for XYZ Corp. is

Remaining Maturity	Coupon(30/360)	Price	T-bill rate
6 months	8%	99	5.5%
1 year	9%	100	6%

- A. Greater in the first six-month period than in the second
- B. Equal between the two coupon periods
- C. Greater in the second six-month period than in the first

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D. Cannot be determined from the information provided

Answer: A

First, we compute the current yield on the six-month bond, which is selling at a discount. We solve for y^* such that $99 = 104 / (1 + y^*/2)$ and find $y^* = 10.10\%$. Thus, the yield spread for the first bond is $10.1 - 5.5 = 4.6\%$. The second bond is at par, so the yield is $y^* = 9\%$. The spread for the second bond is $9 - 6 = 3\%$. The default rate for the first period must be greater. The recovery rate is the same for the two periods, so it does not matter for this problem.

18. The spread on a one-year BBB rated bond relative to the risk-free treasury of similar maturity is 2%. It is estimated that the contribution to this spread by all non-credit factors (e.g., liquidity risk, taxes) is 0.8%. Assuming the loss given default rate for the underlying credit is 60%, what is approximately the implied default probability for this bond?

- A. 3.33%
- B. 5.00%
- C. 3.00%
- D. 2.00%

Answer: D

The probability of default equals the credit risk spread divided by the loss given default. $PD = \text{spread}/LGD$. Here, the spread due to credit risk equals $2.0\% - 0.8\%$ or 1.2% and the loss given default is 60%. The probability of default is then 2%.

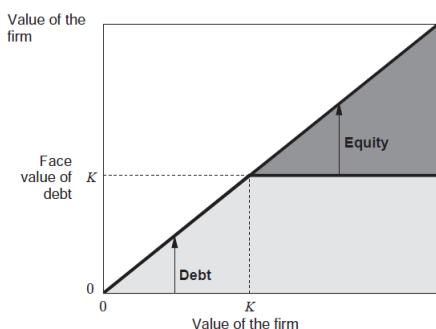
19. The risk-neutral default probability of a one-year corporate BB-rated bond is 5% with an estimated loss given default (LGD) of 65% while the risk-free rate is 2%. If we assume an annual compound frequency, which is nearest to the yield of the corporate bond?

- A. 3.57%
- B. 4.29%
- C. 5.43%
- D. 6.60%

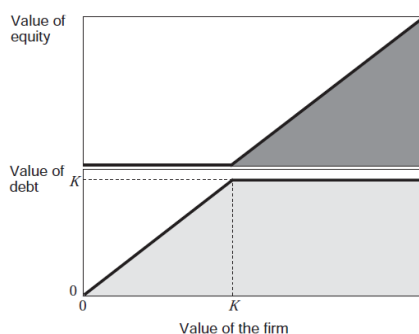
Answer: C

Implied yield $= (1 + R_f)[(1 - PD) + PD \times (1 - LGD)] - 1 = 1.02/[0.95 + 0.05 \times 0.35] - 1 = 1.02/0.9675 - 1 = 5.4264\%$

Key Point: Merton Model



Equity as an Option on the Value of the Firm



Components of the Value of the Firm

- Equity

Equity is a call option on the firm value with strike price equal to the face value of debt.

- Risky Bond

Long bond_{risk} = long bond_{risk-free} + short put

- Merton Model

$$\text{Equity} = \text{call} = VN(d_1) - Ke^{-rt}N(d_2)$$

$$\text{Bond} = Ke^{-rt}N(d_2) + V[1 - N(d_1)]$$

$$d_{1,2} = \frac{\ln(V/Ke^{-rt})}{\sigma\sqrt{\tau}} \pm \frac{\sigma\sqrt{\tau}}{2}$$

$$\text{Default probability} = 1 - N(d_2) = N(-d_2)$$

- Risk-Neutral vs. Real World

20. A firm has an asset value of \$110 million with asset volatility of 30% per annum. Its only debt is a zero-coupon bond with face value of \$80 million that matures in five years. The risk-free rate is 4%. The Black-Scholes Merton price of a put option on the firm's assets with strike price equal to the face value of the bond is \$6.95 million. Which is nears to the current value of the firm's debt.

- A. \$6.95 million
- B. \$41.30 million
- C. \$58.55 million
- D. \$65.50 million

Answer: C

$$PV(\text{risk-free debt}) - \text{put} = 80 \times \exp(-0.04 \times 5) - 6.95 = 58.55$$

21. Suppose a firm has two debt issues outstanding. One is a senior debt issue that matures in three years with a principal amount of \$100 million. The other is a subordinate debt issue that also matures in three years with a principal amount of \$50 million. The annual interest rate is 5%, and the volatility of the firm value is estimated to be 15%. If interest rates decline in the

Merton model, then which of the following is true?

- A. If the firm is experiencing financial distress (low firm value), then the value of senior debt will increase while the values of subordinate debt and equity will both decline.
- B. If the firm is not experiencing financial distress (high firm value), then the value of senior debt and subordinate debt and equity will increase.
- C. If the firm is experiencing financial distress (low firm value), then the value of senior debt and subordinate debt will increase while equity values will decline.
- D. If the firm is not experiencing financial distress (high firm value), then the value of senior debt will increase while the values of subordinate debt and equity will both decline.

Answer: A

When firms with subordinate debt are experiencing financial distress (low firm values), changes in the value of subordinate debt will react to changes in the model parameters in the same way as equity. Since equity is valued as a call option in the Merton model, a decline in interest rates will reduce the value of equity (and subordinate debt). When firms with subordinate debt are not experiencing financial distress (high firm values), changes in the value of subordinate debt will react to changes in the model parameters in the same way as senior debt. Since senior debt is valued as the difference in firm value less equity valued as a call option in the Merton model, a decline in interest rates will increase the value of senior debt and subordinate debt.

22. In the following things about Merton model, which of the statement is true?

- A. In Merton model the payment to debt holder can be seen as the payoff of a riskless bond plus a put on the value of the firm.
- B. The sudden surprise (a jump), leading to an unexpected default can be captured by the by this model.
- C. The model can take into account the default prior to the maturity of debt, when a borrower claims so.
- D. The value of the firm is difficult to pin down cause the market-to-market value of debt is often unknown. .

Answer: D

A is wrong; the payoff of a bond holder is equivalent to a riskless bond minus a put on the value on the value of a firm. B is wrong, the firm follows lognormal diffusion process, it doesn't allow for sudden change. C is wrong, because in this model default can only occur at the debt maturity.

23. Consider a firm with current asset value of \$20 billion, asset volatility of 35% per annum, short-term liabilities of \$12 billion and long-term liabilities of \$6 billion. The expected return on the firm's assets is 12% and the risk-free rate is 1%. Finally, the firm does not pay

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dividends and the credit horizon is 1 year. If the strike price default point is the sum of short-term debt plus one-half of long-term debt, what is the Merton physical probability of default in one year?

- A. 10.11%
- B. 12.11%
- C. 14.11%
- D. 16.11%

z	P(Z < z)	z	P(Z < z)	z	P(Z < z)
-1.50	0.0668	-1.00	0.1587	-0.50	0.3085
-1.49	0.0681	-0.99	0.1611	-0.49	0.3121
-1.48	0.0694	-0.98	0.1635	-0.48	0.3156
-1.47	0.0708	-0.97	0.1660	-0.47	0.3192
-1.46	0.0721	-0.96	0.1685	-0.46	0.3228
-1.45	0.0735	-0.95	0.1711	-0.45	0.3264
-1.44	0.0749	-0.94	0.1736	-0.44	0.3300
-1.43	0.0764	-0.93	0.1762	-0.43	0.3336
-1.42	0.0778	-0.92	0.1788	-0.42	0.3372

Answer: D

PD = N(-d₂) where d₂ is the distance to default.

$$d_2 = [\ln(20/15) + 12\% \times 1 - 0.5 \times 35\%^2 \times 1] / (35\% \times \text{SQRT}[1]) = 0.99$$

Such that N(-d₂) = 16.11%

Please note we use the asset drift (12%) not the risk free rate, this is not option pricing!

24. The capital structure of HighGear Corporation consists of two parts: one 5-year zero-coupon bond with a face value of USD 100 million and the rest is equity. The current market value of the firm's asset (MVA) is USD 130 million and the risk-free rate is 25%. The firm's assets have an annual volatility of 30%. Assume that firm value is log-normally distributed with constant volatility. The firm's risk management division estimates the distance to default (in terms of number of standard deviations) using the Merton Model, or

$$\frac{\ln\left(\frac{FV_B}{MV_A}\right) - \left(\delta - \frac{1}{2}\sigma_A^2\right)T}{\sigma_A T^{0.5}}$$

Given the distance to default, the estimated risk-neutral default probability is:

$$(N(1.9191) = 0.9724)$$

- A. 2.74%
- B. 12.78%

C. 12.79%

D. 30.56%

Answer: A

$$N[\ln(100/130) - (25\% - (30\%^2)/2) \times 5] / (30\% \times \sqrt{5}) = 2.74\%$$

25. A firm has a value of \$400 million with expected return of 14% per annum and volatility of 36% per annum. The firm's only debt is a short-term zero-coupon bond with face value of \$300 million due in one year. The riskless rate is 4%. Which is nearest to the firm's (normal returns-based) distance to default when deriving the physical PD?

A. 1.0

B. 2.7

C. 3.3

D. 8.5

Answer: A

$$\text{The normal returns-based distance to default (DD)} = [\ln(400/300) + (14\% - 36\%^2/2) \times 1] / [36\% \times \sqrt{1}] = 1.0080$$

26. A credit risk analyst has estimated the probability of a particular firm defaulting in the next year to be 1.25% using the Merton model. The risk analyst used his bank's definition of the default threshold, namely that default occurs when the firm's value falls below the value of its short term debt plus half the value of its long term debt. Suppose the bank switched from using the Merton model to using the KMV approach to estimate default risk with the following historical expected default frequency buckets ($N(-2.24) = 1.25\%$):

Distance-to-Default	Expected Default Frequency
< -4	0.3%
-4 to -3	0.3%
-3 to -2.5	0.6%
-2.5 to -2.0	1.6%
-2.0 to -1.6	3.8%
-1.6 to -1.2	8.3%
-1.2 to -0.9	14.9%
-0.9 to -0.6	22.7%

What would the new default probability be?

A. 0.3%

B. 1.6%

C. 2.8%

D. 3.8%

Answer: B

27. Analyst Greg is employing the Merton model to both value a firm's equity and estimate a physical default probability. He has collected the following information:

- The firm's default threshold one year forward is \$10 million; e.g., face value of short-term debt is \$10 million.
- The firm current asset value is \$12.75 million with an expected return of 8% per annum with continuous compounding
- The volatility of the firm's assets is 9.6%
- The risk-free rate is 2%

His exercise includes two components: one, valuation of the firm's equity market value by treating equity as a call option on the firm's assets; two, estimate of default probability by calculation of a forward distance to default. Greg makes two assumptions:

- I. An increase in the risk-free rate will increase an estimate of the firm's current equity market value, and
- II. An increase in the risk-free rate will decrease the estimated default probability.

Which of Greg's two assumptions is correct?

- A. Neither
- B. I only
- C. II only
- D. Both

Answer: B

Just as an increase in the risk-free rate increases the value of a call option, an increase in the risk-free rate increases the equity value under Merton. However, the risk-free rate has no impact on the Merton PD; the physical drift of 8% is used in that application.

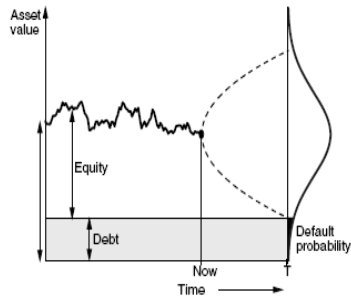
Key Point: Moody – KMV Model

- The normalized distance to default (DD)

$$z = \frac{A - K}{\sigma_A}$$

Where: K is the value of liabilities:

K = short-term liabilities + 0.5 × long-term liabilities.



28. An analyst is using Moody's KMV model to estimate the distance to default of a large public firm, Shoos Inc., a firm that designs, manufactures and sells athletic shoes. The firm's capital structure consists of USD 40 million in short-term debt, USD 20 million in long-term debt, and there are one million shares of stock currently trading at USD 10 per share. The asset volatility is 20% per year. What is the normalized distance to default for Shoos Inc.?

- A. 0.714
- B. 1.430
- C. 2.240
- D. 5.000

Answer: B

Moody's KMV model is a model for predicting private company defaults. It covers many geographic specific models, and each model reflects the unique lending, regulatory, and accounting practices of that region. Moody's KMV computes the normalized distance to default as:

$$DD = \frac{A - K}{A\sigma_A}$$

where: "K" (floor) is defined as the value of all short term liabilities (one year and under) plus one half of the book value of all long term debt: 40 million + 0.5 × 20 million = 50 million. "A" is the value of assets: Market value of equity (1 million shares × 10/share = 10 million) plus the book value of all debt (60 million) = 70 million. Thus $A\sigma_A = 20\% \times 70 \text{ million} = 14 \text{ million}$. $DD = (70 \text{ million} - 50 \text{ million}) / 14 \text{ million} = 1.429$ standard deviations

29. You are given the following information about firm A:

- Market value of asset at time 0 = 1000
- Market value of asset at time 1 = 1200
- Short-term debt = 500
- Long-term debt = 300
- Annualized asset volatility = 10%

According to KMV model, what are the default point and the distance to default at time 1?

	<u>Default Point</u>	<u>Distance to Default</u>
A.	800	3.33
B.	650	7.50
C.	650	4.58
D.	500	5.83

Answer: C

Default Point:

$$\left(500 + \frac{1}{2} \times 300\right) = 650$$

Distant to Default

$$\frac{1200 - \left(500 + \frac{1}{2} \times 300\right)}{1200 \times 10\%} = 4.58$$

30. Each of the following is true about the KMV model except which if false?

- A. Unlike Merton, which assume the default threshold is total debt, KMV's default threshold falls between short-term and total (short-term + long-term) debt.
- B. Similar to the Merton model, the KMV approach requires an estimate of asset volatility and future asset value in order to calculate distance to default as a number of standard deviations.
- C. Similar to the Merton model, the KMV approach models distance to default (DD) = (asset market value – default threshold)/(asset market value × asset volatility)
- D. Similar to the Merton model, the KMV approach assumes the future asset value is lognormal such that asset (log) returns are normal with EDF = N(DD)

Answer: D

While KMV computes the forward DD as a standard deviation, it does not assume normal returns/lognormal asset value. This is explicitly considered insufficient to model empirically heavy tails. Rather KMV first measures the distance-to-default as the number of standard deviations the asset value is away from default and then uses empirical data to determine the corresponding default probability.

Key Point: Poisson distribution and Exponential distribution

- Poisson distribution: 用来刻画违约个数的概率分布
- Exponential distribution: 用来刻画到下一次违约所用时间的概率分布
- Hazard Rates

The hazard rate (default intensity) is represented by the (constant) parameter λ and the probability of default over the next, small time interval, dt, is λdt .

● Cumulative PD

If the time of the default event is denoted t^* , the cumulative default time distribution $F(t)$ represents the probability of default over $(0, t)$:

$$P(t^* < t) = F(t) = 1 - e^{-\lambda t}$$

The survival distribution is:

$$P(t^* \geq t) = 1 - F(t) = e^{-\lambda t}$$

31. Given a hazard rate of 0.15, find the probability when a company defaults in year two given surviving the first year.

- A. 0.1393
- B. 0.2592
- C. 0.7408
- D. 0.8607

Answer: A

T	Cumulative PD	Survival Probability	PD (t, t+1)	Conditional PD Given Survival Until Time t
1	$1 - e^{-0.15} = 0.1393$	$1 - 0.1393 = 0.8607$	0.1393	
2	$1 - e^{-0.15(2)} = 0.2592$	$1 - 0.2592 = 0.7408$	$0.2592 - 0.1393 = 0.1199$	$0.1199/0.8607 = 0.1393$

32. Peter the municipal bond analyst observes that in recent years there have occurred only about 6 U.S. municipal defaults per year. If he makes the highly simplifying assumption that 6 defaults per year is the average in a Poisson process (distribution), what is the probability that the next municipal default will occur within one month?

- A. 8.42%
- B. 17%
- C. 39.35%
- D. 60.65%

Answer: C

$\Lambda = 6 \text{ defaults}/12 \text{ month} = 0.5 \text{ defaults per month.}$

$$P = 1 - \exp(-0.5) = 39.35\%$$

33. Suppose the hazard rate is constant and equal to 0.090. In this case, each of the following is true except which is false?

- A. The unconditional one-year default probability is 8.6%
- B. The unconditional two-year default probability is 16.5%

- C. The probability of joint event of survival through the first year and default in the second year is 7.9%
- D. The conditional one-year default probability, given survival through the first year, is 17.3%

Answer: D

The conditional one-year PD is equal to 8.6%, same as the unconditional one-year default probability.

34. An analyst estimates that the hazard rate for a company is 0.1 per year. The probability of survival in the first year followed by a default in the second year is closest to:
- A. 8.61%
- B. 9.00%
- C. 9.52%
- D. 19.03%

Answer: A

Using λ to represent the given hazard rate, we can calculate the cumulative probability of default in the first year using the formula $1 - \exp(-\lambda)$, which equals 0.09516.

Then, the cumulative probability that the firm defaults in the second year is equal to $1 - \exp(-2 \times \lambda)$ or 0.18127; Then, the probability of survival in the first year followed by a default in the second year is closest to: $0.18127 - 0.09516 = .08611$.

Key Point: Single-Factor Model

$$\alpha = \beta m + \sqrt{1 - \beta^2} \varepsilon$$

$$E(\alpha) = 0$$

$$\text{Var}(\alpha) = \beta^2 + 1 - \beta^2 = 1$$

Conditional cumulative default probability function:

$$p = \Phi\left(\frac{k_i - \beta_i \bar{m}}{\sqrt{1 - \beta_i^2}}\right) \quad i = 1, 2, \dots$$

35. Under single-factor model, a firm has a beta of 0.40 and an unconditional default probability of 1%. If we enter a modest economic downturn, such that the value of $m = -1.0$, what is the conditional default probability?
- A. 1.0%
- B. 1.8%
- C. 2.5%
- D. 2.8%

Answer: B

Conditional default has a mean of $0.40 \times (-1) = -0.40$ and a volatility of $\sqrt{1-0.4^2} = 0.92$. The loss threshold is -2.33. Therefore the conditional default probability is:

$$\Phi\left(\frac{-2.33+0.4}{0.92}\right) = 1.8\%$$

36. The default correlation under a single-factor credit model is 4.9%. Both credits have the same individual default probabilities of 2%. The joint default probability is characterized by a bivariate standard normal distribution. Below listed the asset correlations implied by various joint default probabilities. What is the implied asset correlation?

Asset Correlation	Joint Default Probability
-	0.040%
0.05	0.053%
0.10	0.069%
0.15	0.040%
0.20	0.110%
0.25	0.136%

- A. 0.1
- B. 0.15
- C. 0.2
- D. 0.25

Answer: D

Key Point: Other PD Models

● Linear Discriminant Analysis

◇ Produces a linear function of variables (known as “scoring function”, Z-score or Z) to separate two groups of borrowers or default events

$$Z = 1.21x_1 + 1.40x_2 + 3.30x_3 + 0.6x_4 + 0.999x_5$$

◇ The discriminant threshold (cut-off value) used to distinguish predicted defaulting from predicted performing companies is fixed at $Z = 2.675$

● Logistic Regression Model

$$g(\pi_i) = \log \frac{\pi_i}{1 - \pi_i} = \beta_0 + \sum_{j=1}^p \beta_j \cdot x_{ij}$$

$$\pi_i = \frac{1}{1 + e^{-\left(\beta_0 + \sum_{j=1}^p \beta_j x_{ij}\right)}}$$

Key Point: Concentration Risk

37. Mike Merton is the head of credit derivatives trading at an investment bank. He is monitoring a new credit default swap basket that is made up of 20 bonds, each with a 1% annual probability of default. Assuming the probability of any one bond defaulting is completely independent of what happens to other bonds in the basket, what is the probability that exactly one bond defaults in the first year?
- A. 2.06%
 - B. 3.01%
 - C. 16.5%
 - D. 30.1%

Answer: C

$$C_{20}^1 p^1 (1-p)^{19} = 20 \times 0.01 \times (1-0.01)^{19} = 0.1652$$

Key Point: Credit Exposure

- **Current Exposure (Replacement Cost)**
 - ✧ Larger of zero and the market value of a transaction or portfolio of transactions within a netting set, with a counterparty that would be lost upon the default of the counterparty, assuming no recovery on the value of those transactions in bankruptcy.
- **Expected Exposure**
 - ✧ The mean (average) of the distribution of exposures at any particular future date before the longest-maturity transaction in the netting set matures.
- **Expected Positive Exposure (EPE)**
 - ✧ The weighted average over time of expected exposures where the weights are the proportion that an individual expected exposure represents of the entire time interval.
- **Negative Exposure**
 - ✧ The exposure from a counterparty's point of view. Define measures such as negative expected exposure (NEE) and expected negative exposure (ENE), which are the precise opposite of EE and EPE.
- **Peak Exposure/Potential Future Exposure**
 - ✧ A high-percentile (typically 95% or 99%) of the distribution of exposures at any particular future date before the maturity date of the longest transaction in the netting set.
- **Maximum PFE**
 - ✧ Represents the highest PFE value over a given time interval, thus representing the worst-case exposure over the entire interval.

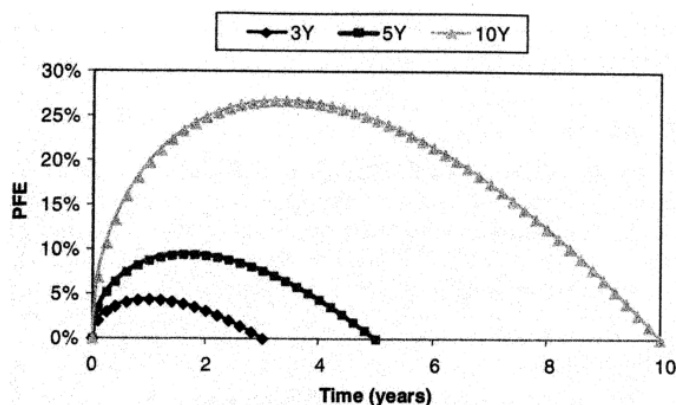


FIGURE 12-9 Illustration of the PFE of swaps of different maturities.

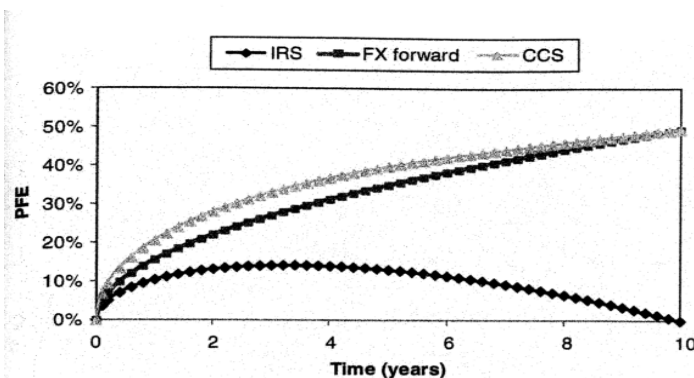


FIGURE 12-16 Illustration of a cross-currency swap (CCS) profile as a combination of an interest rate swap (IRS) and FX forward.

38. Which of the following statements regarding exposure measures is not accurate?
- A. Assuming no recovery in bankruptcy, current exposure is the greater of zero and the market value of a transaction or portfolio of transactions that the investor would be lost when a counterparty defaulted.
 - B. Potential Future Exposure measures the distribution of exposures of low percentile.
 - C. Expected exposure measures the mean distribution of exposures at a given future date prior to the maturity of the longest maturity exposure in the netting group.
 - D. The weights of expected positive exposure could represent the proportion that an individual expected exposures of the entire time interval.

Answer: B

Potential Future Exposure measures the distribution of exposures of high percentile.

39. If a counterparty defaults before maturity, which of the following situations will cause a credit loss?
- A. You are short Euros in a one-year euro/USD forward FX contract, and the euro has appreciated.

- B. You are short Euros in a one-year euro/USD forward FX contract, and the euro has depreciated.
- C. You sold a one-year OTC euro call option, and the euro has appreciated.
- D. You sold a one-year OTC euro call option, and the euro has depreciated.

Answer: B

40. Suppose a mark-to-market (MtM) is defined by a normal distribution with mean of 2% and standard deviation of 5%. Each of the following is true about the expected exposure except which is false?

- A. The EE is greater than 2%
- B. The EE is greater than the 95% confident potential future exposure (PFE)
- C. An increase in the mean assumption will increase the EE.
- D. An increase in the standard deviation assumption will increase the EE.

Answer: B

The EE will be less than the 95% PFE.

41. Each of the following is true except:

- A. At any point in time, effective EE cannot be less than EE
- B. (effective) EPE is average (effective) EE over time
- C. Effective EPE cannot be less than EPE
- D. For each point in time, there is a different maximum PFE such that maximum PFE does not represent a single value

Answer: D

Maximum PFE is a single value. Maximum PFE simply represents the highest (peak) PFE value over a given time interval.

42. Paul sells a put option on HRTB stock with a time to expiration of six months, a strike price of USD 125, and underlying asset price of USD 98, implied volatility of 20% and a risk-free rate of 4%. What is Paul's counterparty credit exposure from this transaction?

- A. USD 0.00
- B. USD 0.38
- C. USD 1.75
- D. USD 24.90

Answer: A

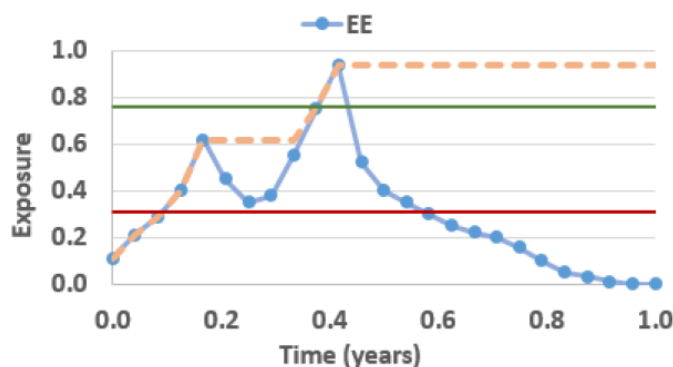
Selling a put option exposes you to zero counterparty credit risk as the premium is paid up front. The correct answer is therefore A. All the information necessary to price the option is provided but it is not necessary. The value of the put option is USD 24.90 (answer D) while the value of a call

25-58

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option with one year to expiration.

43. Refer to the chart below, which plots four lines over time.



Which of the following does the uppermost line most likely represent?

- A. Effective expected exposure.
- B. Expected positive exposure.
- C. Potential future exposure.
- D. Maximum potential future exposure.

Answer: A

Measures such as EE and EPE may underestimate exposure for short-dated transactions (since capital measurement horizons are typically 1-year) and not capture properly rollover risk (Chapter 3). For these reasons, the terms effective EE and effective EPE were introduced by the Basel Committee on Banking Supervision (2005). Effective EE is simply a non-decreasing EE. Effective EPE is the average of the effective EE.

44. Assume that swap rates are identical for all swap tenors. A swap dealer entered into a plain-vanilla swap one year ago as the receive-fixed party, when the price of the swap was 7%. Today, this swap dealer will face credit risk exposure from this swap only if the value of the swap for the dealer is
- A. Negative, which will occur if new swaps are being priced at 6%
 - B. Negative, which will occur if new swaps are being priced at 8%
 - C. Positive, which will occur if new swaps are being priced at 6%
 - D. Positive, which will occur if new swaps are being priced at 8%

Answer: C

45. Which one of the following deals would have the greatest credit exposure for a \$1,000,000 deal size (assume the counterparty in each deal is an AAA-rated bank and has no settlement risk)?

- A. Pay fixed in an Australian dollar (AUD) interest rate swap for one year.
- B. Sell USD against AUD in a one-year forward foreign exchange contract.
- C. Sell a one-year AUD cap.
- D. Purchase a one-year certificate of deposit.

Answer: D

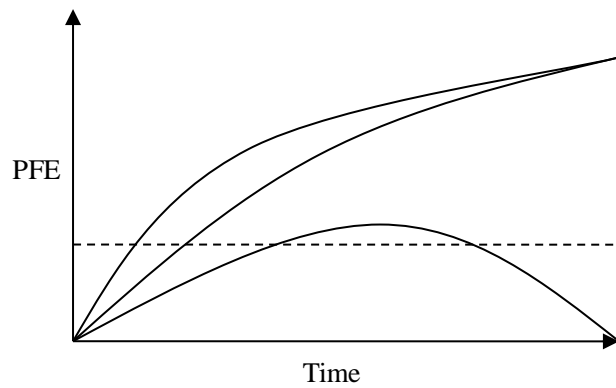
The CD has the whole notional at risk. Otherwise, the next greatest exposure is for the forward currency contract and the interest rate swap. The short cap position has no exposure if the premium has been collected. Note that the question eliminates settlement risk for the forward contract.

46. BNP Paribas has just entered into a plain-vanilla interest-rate swap as a pay-fixed counterparty. Credit Agricole is the receive-fixed counterparty in the same swap. The forward spot curve is upward-sloping. If LIBOR starts trending down and the forward spot curve flattens, the credit risk from the swap will:
- A. Increase only for BNP Paribas
 - B. Increase only for Credit Agricole
 - C. Decrease for both BNP Paribas and Credit Agricole
 - D. Increase for both BNP Paribas and Credit Agricole

Answer: B

With an upward-sloping term structure, the fixed payer has greater credit exposure. He receives less initially, but receives more later. This back-loading of payments increases credit exposure. Conversely, if the forward curve flattens, the fixed payer (i.e., BNP Paribas) has less credit exposure. Credit Agricole must have greater credit exposure. Alternatively, if LIBOR drifts down, BNP will have to pay more, and its counterparty will have greater credit exposure.

47. The chart below shows three exposure profiles, where the exposure metric is the potential future exposure (PFE): PFE of an interest rate swap (IRS), PFE of a foreign exchange (FX) forward contract, and PFE of a cross-currency swap. Also plotted is the average PFE of the interest rate swap, where "average PFE" is what Jorion calls the average worst credit exposure (AWCE). Which position's (instrument's) exposure profile is most likely the uppermost, concave plot line?

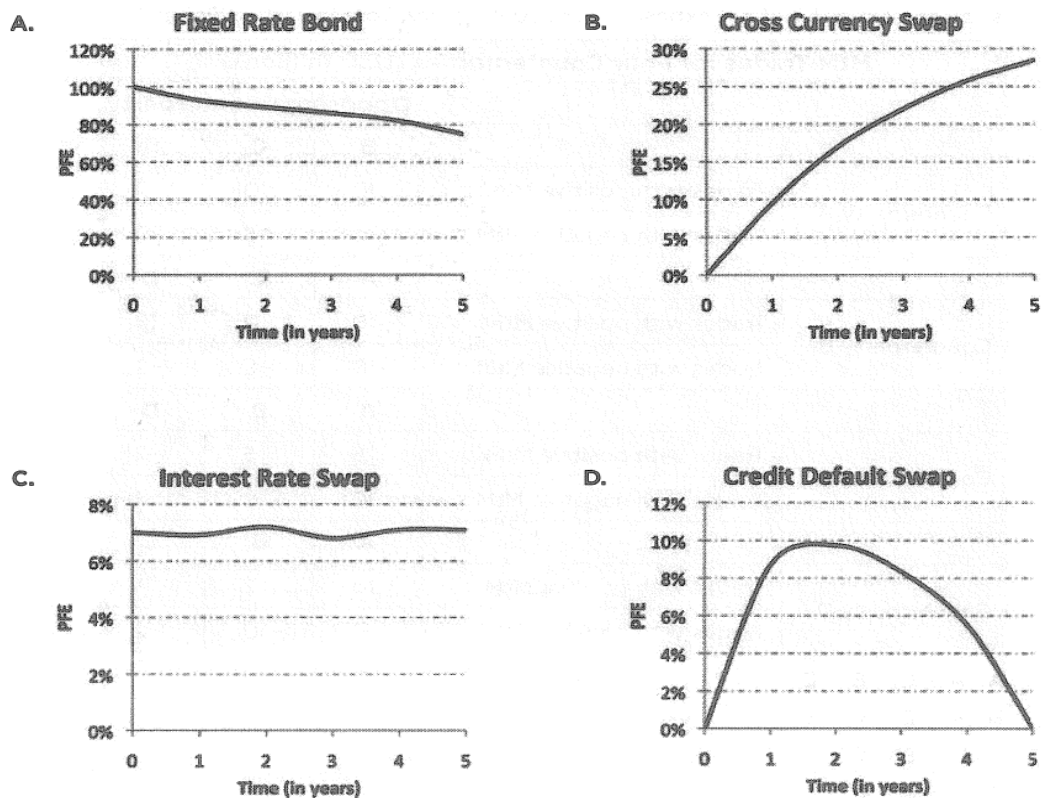


- A. PFE of interest rate swap
- B. PFE of foreign exchange (FX) contract
- C. PFE of cross-currency swap
- D. Average PFE of interest rate swap

Answer: C

PFE of cross-currency swap, which combines the exposure of an interest rate swap and the FX forward. The dotted must be the average PFE (aka, AWCE) since it is a flat line.

48. Which of the following graphs is an accurate representation of a typical potential future exposure (PFE) profile for the corresponding instrument?



Answer: B

The risk of cross-currency swaps is driven by a large final payoff, and thus the profile increases monotonically until the maturity of the trade. The FX risk of the notional exchange dominates the small contribution due to interest rate exposure.

Key Point: Credit Value Adjustment (CVA)

- CVA is the expected value or price of counterparty credit risk. A positive value represents a cost to the counterparty that bears a greater propensity to default.

$$CVA \approx LGD \times \sum EE(t) \times PD(t-1, t) \times d(t)$$

$$CVA \approx CS \times EPE$$

- Incremental and Marginal CVA

Incremental CVA calculates the cost of a new trade versus an existing one to determine the effect that the new trade has on CVA. The formula is identical to stand-alone CVA, except for the use incremental expected exposure.

Marginal CVA is used for trade level attribution. The formula is identical to stand-alone CVA, except for the use of marginal expected exposure.

- Stress Test on a Loan Portfolio

$$EL_s = \sum_{i=1}^N PD_i^s \cdot EAD_i \cdot LGD_i$$

$$EL_s - EL$$

- Stress Test on Derivative Portfolio

$$EL = \sum_{i=1}^N PD_i \cdot \alpha \cdot EPE_i \cdot LGD_i$$

$$EL_s = \sum_{i=1}^N PD_i^s \cdot \alpha \cdot EPE_i^s \cdot LGD_i$$

- Stressed CVA and Stress Loss on CVA

$$CVA^s = \sum_{n=1}^N LGD_n \cdot \sum_{i=1}^m EE_n^s(t_i) \cdot PD_n(t_{i-1}, t_i)$$

$$CVA^s - CVA$$

- DVA and Stressed DVA

$$BCVA = \sum_{n=1}^N LGD_n \cdot \sum_{i=1}^m EE_n(t_i) \cdot PD_n(t_{i-1}, t_i) \cdot S_1(t_{i-1}) - \sum_{n=1}^N LGD_I \cdot \sum_{i=1}^m NEE_n(t_i) \cdot PD_I(t_{i-1}, t_i) \cdot S_n(t_{i-1})$$

49. With respect to the CVA calculation, which of the following statement is correct when a risk manager wishes to understand which trades have the greatest impact on a counterparty's CVA?

The manager would use:

- Incremental CVA because it accounts for the change in CVA once the new trade is priced, accounting for netting.
- Marginal CVA because he could break down netted trades into trade level contributions.
- Incremental CVA because he could break down netted trades into trade level

contributions.

- D. Marginal CVA because it accounts for the change in CVA once the new trade is priced, accounting for netting.

Answer: B

Understanding which trades have the greatest impact on a counterparty's credit value adjustment requires use of the marginal CVA. Incremental CVA, by contrast, is useful for pricing a new trade with respect to an existing one.

50. A risk manager needs a quick calculation of the BCVA on a swap. Assume inputs are as follows: EPE = 5%, ENE = 3%, counterparty credit spread = 300bps, financial institution credit spread = 200 bps. Compute BCVA from the perspective of the financial institution.

- A. -1
- B. 1
- C. 9
- D. -9

Answer: C

From the perspective of the financial institution:

$EPE \times \text{counterparty credit spread} - ENE \times \text{institution credit spread}$

$= 5\% \times 300 - 3\% \times 200 = 9 \text{ bps}$

This is what the financial institution may charge the counterparty for overall counterparty risk.

51. A bank enters into a swap agreement with a counterparty. The swap has no collateral requirements, and no netting agreements are present between the bank and the counterparty.

The following data is available for the swap position:

- The counterparty expected exposure is 0.40% and approximately constant from month to month.
- The credit spread for a five year credit default swap on the counterparty is 500 bps.
- The counterparty's probability of default within five years is 10%.
- The 5-year effective duration of the swap is 4.0.

Assuming no wrong-way risk on the position, which value is the closest approximation of the credit value adjustment expressed as a running spread?

- A. 2 bps
- B. 4 bps
- C. 5 bps
- D. 8 bps

Answer: A

52. Mary assigns to John a long position in an at-the-money (ATM) call option with a one year term and strike a price of \$100.00. The current stock price is \$100.00 with volatility of 60.0%. The risk-free rate is 3.0% with continuous compounding. $N(d_1) = 0.64$ and $N(d_2) = 0.40$. The present-valued expected exposure (EE) to the counterparty, who holds the short option position, is \$23.00 with a probability of counterparty default of 5.0% and loss given default (LGD) of 75.0%. Which is nearest to John's payment for the long option position, if his cost includes a credit valuation adjustment (CVA)?
- A. \$6.15
 - B. \$19.37
 - C. \$24.32
 - D. \$26.04

Answer: C

The BSM call option price = $100 \times 0.64 - 100 \times \exp(-3\%) \times 0.40 = \25.182 , which does not include counterparty risk incurred by the long option position (the short has no counterparty risk). The CVA-adjusted value = $\$25.182 - \$23.00 \times 5\% \times 75\% = \24.32

53. Sam prices a put option on an asset with the Black-Scholes-Merton option pricing model and calculates a model premium of \$25. This \$25 also coincidentally equals the present-valued expected exposure faced by Sam with respect to the short option position. Sam estimates the probability of counterparty default by the option writer to be 10% with loss given default of 40%, such that the expected loss = $\$25 \text{ EE (writer)} \times 10\% \text{ PD} \times 40\% \text{ LGD} = \1 . He concludes that the CVA-adjusted (net of counterparty risk) option price is \$24. His colleague Jane observes that this calculation assumes no wrong-way risk. But there is a high, positive correlation between underlying asset price and the credit quality of the option writer counterparty: both the counterparty and underlying share a sector that reacts to the same common factors such that adverse economic regimes depress sector asset prices while lowering sector credit quality (and increasing credit spreads). Is Jane correct that the CVA-adjusted option value deserves further adjustment?
- A. As the correlation is positive, this is instead right-way risk; but the true CVA-adjusted value remains \$24 as there is no adjustment for right-way risk.
 - B. As the correlation is positive, this is instead right-way risk; therefore, the true CVA-adjusted value will be higher than \$24.
 - C. Jane is correct that this is wrong-way risk; therefore, true CVA-adjusted value will be lower than \$24.
 - D. Jane is correct that this is wrong-way risk but expected loss is not impacted by correlation, so Sam correctly has the CVA-adjusted value at \$24.

Answer: C

We refer to wrong-way risk as the adverse (negative) correlation between the exposure to the counterparty and its credit quality. Alternatively, it can be stated as the positive correlation between exposure and credit spread.

54. Local Company, a frequent user of swaps, often enters into transactions with Global Bank, a major provider of swaps. Recently, Global Bank was downgraded from a rating of AA+ to a rating of A, while Local Company was downgraded from a rating of A to a rating of A-. During this time, the credit spread for Global Bank increased from 20 bps to 150 bps. While the credit spread for Local Company increased from 130 bps to 170 bps. Which of the following is the most likely action that the counterparties will request on their credit value adjustment (CVA)?
- A. The credit qualities of the counterparties have changed, but not enough to justify amending existing CVA arrangements.
 - B. Global Bank requests an increase in the CVA charge it receives.
 - C. Local Company requests a reduction in the CVA charge it pays.
 - D. CVA is no longer a relevant factor, and the counterparties will use other mitigants of counterparty risk.

Answer: C

55. An investor said: "The formula for BCVA is similar to the formula for CVA, except that the BCVA formula incorporates the probability of the counterparty's survival and uses EPE." Which of the following statements is accurate?
- A. The statement is correct with regard to EPE only.
 - B. The statement is correct with regard to probability of survival only.
 - C. The statement is incorrect with regard to both EPE and probability of survival.
 - D. The statement is correct with regard to both EPE and probability of survival.

Answer: B

The BCVA formula differs from the CVA formula in that BCVA incorporates negative expected exposure (NEE), and the probability of the counterparty's survival must be included in the BCVA formula.

Key Point: Wrong-Way Risk

Wrong-Way Risk: An outcome of any association, dependence, linkage, or interrelationship between exposure and counterparty creditworthiness that generates an overall increase in counterparty risk and, therefore, an increase in the amount of the credit value adjustment (CVA).

Right-Way Risk: Any dependence, linkage, or interrelationship between the exposure and default

probability of a counterparty producing an overall decrease in counterparty risk is described as right-way risk.

56. A Mexican retailer buys its goods from global suppliers. The contracts are priced in U.S. dollars. The retailer sells its goods to Mexican consumers and receives pesos from the sales. The firm enters a currency swap in which they will pay dollars and receive Brazilian real. They use Monte Carlo simulation to model their potential future exposure (PFE) to the real. Which of the following is most consistent with the retailer's circumstances?
- A. The retailer has wrong-way exposure in the swap and should use a lognormal distribution to model the PFE to the real.
 - B. The retailer has right-way exposure in the swap and should use a distribution that allows for jumps to model the PFE to the real.
 - C. The retailer has right-way exposure in the swap and should use a lognormal distribution to model the PFE to the real.
 - D. The retailer has wrong-way exposure in the swap and should use a distribution that allows for jumps to model the PFE to the real.

Answer: D

The retailer has wrong-way exposure in the swap. They are paying dollars in their underlying business and paying dollars in the swap. If the dollar increases in value, their losses increase in both their business and the swap (i.e., the swap increases their expected losses).

The retailer should use a distribution that allows for jumps to model the PFE to the real because emerging country currencies are subject to extreme volatility.

A lognormal distribution would be used for major currencies, so choices A and C are incorrect.

57. Which of the following activities or transactions would most likely result in right-way risk with counterparty?
- A. Purchasing a put option from an A-rated company on that company's stock.
 - B. Entering Into a forward contract to buy West Texas Intermediate (WTI) crude oil from an airline company at a fixed price
 - C. Entering into a forward contract to buy WTI crude oil from a large oil producer at a fixed price.
 - D. Selling a put option to an A-rated company on that company's stock.

Answer: C

Key Point: Retail Credit Risk

Key Variables in Mortgage Credit Assessment:

FICO: Number score of the default risk associated with a borrower's credit history.

DTI: Debt-to-income ratio is used to qualify mortgage payment and other monthly debt payments versus income.

LTV: Expresses the amount of a first mortgage lien as a percentage of the total appraised value of the property – i.e., the loan-to-value ratio.

Scorecard Performance:

When measuring a scorecard's performance, the validation technique traditionally employed is the cumulative accuracy profile (CAP) and its summary statistic, the accuracy ratio (AR).

$$AR = \frac{A_R}{A_P}$$

58. In assessing the key variables associated with a potential mortgage loan, a bank will charge a higher interest rate if the borrower has a relatively:

- A. High FICO score.
- B. High loan-to-value ratio.
- C. Low debt-to-assets ratio.
- D. Low debt-to-income ratio.

Answer: B

The loan-to-value ratio represents the amount of the mortgage versus the appraised value of the property. The higher this ratio is for a property and an associated borrower, the more risk there is to the lender. In order to protect their position, a lender will charge a higher interest rate. Each of the other scenarios will result in a lower interest rate.

59. A risk manager of ABC bank is looking at the mechanics of a refinancing event. A house was originally purchased for USD 500,000 and financed with an interest-only hybrid adjustable rate mortgage (with a LTV of 80%) at an initial annual fixed rate of 2.75%. Before the interest-only period elapses, the house's appraised value drops to USD 400,000. The homeowner decides to refinance the existing mortgage with a 15-year fixed mortgage at an annual rate of 4.5% (LTV 80%) and uses cash to pay off the remainder of the original mortgage's principal balance. Assuming standard payments, what is the approximate change in monthly payments as a result of the refinancing?

- A. USD 1,500
- B. USD 1,900
- C. USD 2,400
- D. USD 3,000

Answer: A

LTV = 80%

$$\text{Loan1} = 80\% \times 500,000 = 400,000$$

$$\text{Monthly payment1} = 400,000 \times 2.75\%/12 = 917$$

$$\text{Loan2} = 80\% \times 400,000 = 320,000$$

$$I/Y = 4.5/12, N = 15 \times 12, PV = 320,000, FV = 0 \rightarrow PMT = 2,448$$

$$\text{Change in monthly payment} = 2,448 - 917 = 1,531$$

60. About the cumulative accuracy profile (CAP), each of the following statements is true except which is not?

- A. A perfect credit scoring model generates an accuracy ratio (AR) of 1.0, which is the upper bound on the AR.
- B. A purely random model that cannot differentiate between good and bad customers is likely to generate an accuracy ratio (AR) of 0.40 to 0.60; i.e., 50% +/- 10%.
- C. The CAP curve, which plots the actual rating model as a cumulative percentage of defaults, is monotonically increasing (aka, nondecreasing or weakly increasing).
- D. The CAP curve plots the fraction of defaulted customers (y axis) against the fraction of entire customer population sorted by score from highest risk (left) to lowest risk (right).

Answer: B

Key Point: Mitigation of Counterparty Risk

- Netting Arrangement
- Collateralization
 - ✧ Remargin period: the time between the call for collateral and its receipt.
 - ✧ Threshold: an exposure level below which collateral is not called. It represents an amount of uncollateralized exposure.
 - ✧ Minimum transfer amount: the minimum quantity or block in which collateral may be transferred. Quantities below this amount represent uncollateralized exposure.
 - ✧ Independently amount: an amount posted independently of any subsequent collateralization. This is also referred to as the initial margin.
- Contract Clauses
 - ✧ Close Out
 - ✧ Walkaway
 - ✧ Acceleration
 - ✧ Termination
- Central Counterparties
 - ✧ Loss waterfall: Losses are first absorbed by the defaulted member's initial margin and reserve contributions. If losses are greater, the CCP equity and survivor members'

reserves and equity are used.

- ✧ Initial Margin: beginning deposit required from all CCP members to cover future potential default losses in a worst-case scenario; Variation margin: an additional margin for daily changes in asset positions.

● Hedging

61. Sacks Bank has many open derivative positions with Lake Investments. A description and current market values are displayed in the table below:

Positions	Market Price (USD)
Long Swaptions	10 million
Long Credit Default Swaps	-25 million
Short Currency Derivatives	25 million

In the event that Lake defaults, what would be the loss to Sacks if netting is used?

- A. USD 5 million
- B. USD 10 million
- C. USD 25 million
- D. USD 35 million

Answer: B

Netting means that the payments between the two counterparties are netted out, so that only a net payment has to be made. With netting, Sacks is not required to make the payout of 25 million. Hence the loss will be reduced to: 35 million - 25 million = 10 million

62. The exhibit below presents a summary of bilateral mark-to-market (MtM) trades for four counterparties. If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from lowest to highest?

MtM Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
		B	C	D
Counterparty A	Trades with positive MtM	10	10	1
	Trades with negative MtM	-10	-5	-10
		A	C	D
Counterparty B	Trades with positive MtM	10	0	10
	Trades with negative MtM	-10	-5	-2
		A	B	D
Counterparty C	Trades with positive MtM	5	5	2
	Trades with negative MtM	-10	0	-1

		A	B	C
Counterparty D	Trades with positive MtM	10	2	1
	Trades with negative MtM	-1	-10	-2

- A. $A - C - B - D$
 B. $A - D - C - B$
 C. $D - B - C - A$
 D. $B - C - D - A$

Answer: A

The properly netted amounts are: For A: $B = \$0$, $C = \$5$, $D = \$0$, for a sum of \$5. For B: $A = \$0$, $C = \$0$, $D = \$8$, for a sum of \$8. For C: $A = \$0$, $B = \$5$, $D = \$1$, for a sum of \$6. For D: $A = \$9$, $B = \$0$, $C = \$0$, for a sum of \$9.

63. Miven Corp. has two trades outstanding with one of its counterparties. Which of the following scenarios would result in the greatest netting advantage for Miven?
- A. The two trades have strong positive correlation.
 B. The two trades have weak positive correlation.
 C. The two trades are uncorrelated with each other.
 D. The two trades have strong negative correlation.

Answer: D

The greatest netting benefit among the scenarios presented occurs when the two trades have a strong negative correlation. In this case, a large portion of the negative exposures will offset positive exposures.

64. The table below illustrates exposures for scenarios involving two trades:

	MtM	
	Trade 1	Trade 2
Scenario 1	25	15
Scenario 2	15	-10
Scenario 3	10	-5
Scenario 4	5	-5
Scenario 5	-5	-10

Which is nearest to the netting factor?

- A. 9.92%
 B. 37.50%
 C. 60.88%
 D. 71.43%

Answer: D

	MtM		Total Exposure		Netting Factor
	Trade 1	Trade 2	No netting	Netting	
Scenario 1	25	15	40	40	
Scenario 2	15	-10	15	5	
Scenario 3	10	-5	10	5	
Scenario 4	5	-5	5	0	
Scenario 5	-5	-10	0	0	
EE			14	10	71.43%

65. A diversified portfolio of OTC derivatives with a single counterparty currently has a net mark-to-market value of USD 20,000,000 and a gross absolute mark-to-market value (the sum of the value of all positive-value positions minus the value of all negative-value positions) of USD 80,000,000. Assuming there are no netting agreements in place with the counterparty, determine the current credit exposure to the counterparty.

- A. Less than or equal to USD 19,000,000
- B. Greater than USD 19,000,000 but less than or equal to USD 40,000,000
- C. Greater than USD 40,000,000 but less than USD 60,000,000
- D. Greater than USD 60,000,000

Answer: C

Define X and Y as the absolute values of the positive and negative positions. The net value is $X - Y = 20$ million. The absolute gross value is $X + Y = 80$. Solving, we get $X = 50$ million. This is the positive part of the positions, or exposure.

66. Assume three counterparties (A, B and C) are entered into bilateral derivative trades with the following net current replacement values: replacement value for A with respect to B = \$10 million (i.e., if closed out immediately, B would owe \$10 million to A); replacement value for B with respect to C = \$10 million; replacement value for C with respect to A = \$10 million. If these positions were immediately novated to central counterparty with multilateral netting, which of the following is implied?

- A. Counterparty exposures among A, B and C are each eliminated to zero; but each will have a \$10 million exposure to the central counterparty.
- B. Counterparty exposures among A, B and C are each eliminated to zero; and each will have zero exposure to the central counterparty.
- C. Counterparty exposures among A, B and C are, in total, reduced from \$30 million to \$10 million; and the central counterparty assumes \$20 million in exposure.

- D. The total exposure is not reduced from \$30 million; it is effectively transferred to the central counterparty.

Answer: B

67. What are the benefits of novation?

- A. Allows both party to walk away from the contract in case of default.
- B. A bilateral contract specifying that upon default, the non-defaulting party nets gains and losses with the defaulting counterparty to a single payment for all covered transactions
- C. Financial market contracts can be terminated upon an event of default prior to the bankruptcy process.
- D. Obligations are amalgamated with others

Answer: D

“a” is a walk-away clause.

“b” is a close-out netting.

“c” is Termination.

68. You are the credit risk manager for a bank and are looking to mitigate counterparty credit risk exposure to ABCD, an A-rated firm. Currently your bank has the following derivatives contracts with ABCD:

Contract	Contract Value (HKD)
A	20,000,000
B	30,000,000
C	14,000,000
D	1,000,000

With the information provided, what is the most appropriate credit risk mitigation technique in this case?

- A. Implement a netting scheme
- B. Use credit triggers.
- C. Sell credit default swaps on ABCD
- D. Increase collateral.

Answer: D

Increasing collateral would effectively reduce current credit exposure depending on the contract parameters, mainly minimum transfer amount and threshold.

69. An underlying exposure with an effective annual price volatility of 6% is collateralized by a 10-year U.S. Treasury note with an effective price volatility of 8%. The correlation between the exposure and the U.S. Treasury note is zero. Changes in the value of the overall position

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(the exposure plus collateral) are calculated for a 10-day horizon at a 95% confidence interval. Which of the following would one expect to observe from this analysis?

- A. The presence of collateral increases the current exposure and increases the volatility of the exposure between remargining periods.
- B. The presence of collateral decreases the current exposure, but increases the volatility of the exposure between remargining periods.
- C. The presence of collateral increase the current exposure, but decreases the volatility of the exposure between remargining periods.
- D. The presence of collateral decreases the current exposure and decreases the volatility of the exposure between remargining periods.

Answer: B

The overall annual volatility of the position (exposure + collateral) is $(0.06^2 + 0.08^2) = 0.10$ or 10%. Therefore, actual calculations of the changes in value of the position for a specified time horizon and confidence level are not necessary, since 10% is greater than that of the exposure (6%) and the collateral (8%). The correct choice is B) – the collateral mitigates the exposure today while increasing the volatility of the position in the future.

70. Rarecom is a specialist company that only trades derivatives on rare commodities. Rarecom and a handful of other firms, all of whom have large notional outstanding contracts with Rarecom, dominate the market for such derivatives. Rarecom management would like to mitigate its overall counterparty exposure, with the goal of reducing it to almost zero. Which of the following methods, if implemented, could best achieve this goal?

- A. Ensuring that sufficient collateral is posted by counterparties.
- B. Diversifying among counterparties.
- C. Cross-product netting on a single counterparty basis.
- D. Purchasing credit derivatives, such as credit default swaps.

Answer: A

Counterparty exposure, in theory, can be almost completely neutralized as long as a sufficient amount of high quality collateral, such as cash or short-term investment grade government bonds, is held against it. If the counterparty were to default, the holder of an open derivative contract with exposure to that counterparty would be allowed to receive the collateral. Cross-product netting would only reduce the exposure to one of the counterparties, and purchasing credit derivatives would replace the counterparty risk from the individual counterparties with counterparty risk from the institution who wrote the CDS.

71. There are a number of challenges for clearing over-the-counter (OTC) derivative products through a centralized counterparty (CCP). Which of the following statements best

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summarizes the key challenges for central clearing of OTC derivative products?

- A. Jurisdictional fragmentation, increased counterparty risk, less transparency, and standardization.
- B. Product complexity, illiquid products, presence of wrong-way risk, and lack of standardization.
- C. Illiquid products, jurisdictional fragmentation, presence of wrong-way risk, and legal concerns.
- D. Lack of standardization, increased counterparty risk, increased dependency risk, and less transparency.

Answer: B

Lack of standardized products, complexity, illiquid products, and presence of wrong-way risk are characteristics of OTC derivative products that make CCP clearing challenging. OTC derivative products need to be standardized before they can be cleared through a CCP. More complex and illiquid derivative products are problematic for CCPs because their unique features make them difficult to value. Products with wrong-way risk are also more complex and create additional concerns for the added risk to CCPs in the event of default.

72. Setting margin levels and loss reserves are important aspects of mitigating systemic risk through the use of a central counterparty (CCP). Which of the following statements most accurately reflects the calculation of initial margins?
- A. The value at risk (VaR) approach sets appropriate initial margins at the 99% confidence level.
 - B. The Standard Portfolio Analysis of Risk (SPAN) is considered the most advanced methodology today in calculating initial margins.
 - C. The calculation of the initial margin should be based on volatility, tail risk, and dependency.
 - D. Initial margins depend solely on the credit quality of the clearing member.

Answer: C

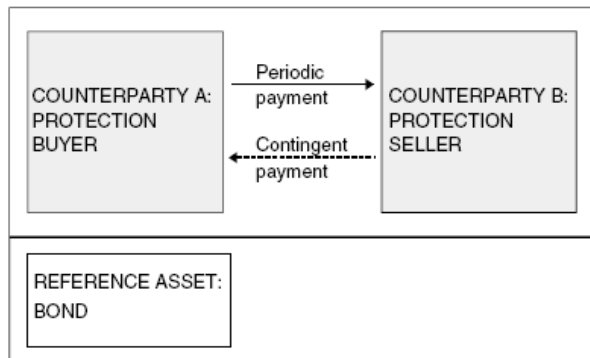
The calculation of the initial margin should be based on volatility, tail risk, and dependency. The value at risk (VaR) approach is a more advanced method than the SPAN approach for calculating initial margins. Studies suggest that the VaR approach does a good job of setting initial margins at the 95% confidence level, but at the 99% confidence level initial margins are not sufficient. The initial margin depends primarily on market risk and not the credit quality of the clearing member.

Key Point: Credit Derivatives 1 – CDS

- In a Credit Default Swaps contract, a protection buyer (say A) pays a premium to the

protection seller (say B), in exchange for payment if a credit event occurs.

- A default swap acts like a put option on the reference obligation for the buyer of the swap. If there is a default, the buyer receives a payment, which limits the buyer's downside risk.
- A long position in a corporate bond is equivalent to a long position in a risk-free bond plus a short position in a credit default swap.



- Settlement:
 - ✧ Cash-Settled (Include: Digital)
 - ✧ Physically Settled

- Nth to default CDS

An nth to default CDS pays off when the nth default occurs in the reference asset portfolio.

For this kind of swap, whenever the nth default occurs in the reference basket, the buyer stops paying the premium and receives the difference of the principal amount of the latest (nth) defaulted entity and the recovered value.

- Correlation in Nth to default CDS

If the reference assets are perfectly positive correlated, the value of the first-to-default CDS will be the same as the Nth-to-default ($n > 1$) CDS because the number of defaults will likely be either 0 or all assets.

If the default correlation is low, small number of defaults is more likely. Therefore, first-to-default is more preferable.

When default correlation increase, there is an increased probability of more defaults, and the value of the Nth-to-default ($n > 1$) goes up accordingly.

73. You are currently long \$10,000,000 par value, 8% XYZ bonds. To hedge your position, you must decide between credit protection via a 5-year CDS with 60bp annual premiums or digital swap with 50% payout with 50bp annual premiums. After one year, XYZ has defaulted on its debt obligations and currently trades at 60% of par. Which of the following statements is true?

- A. The contingent payment from the protection buyer to the protection seller is greater

- under the single-name CDS than the digital swap.
- B. The contingent payment from the protection buyer to the protection seller is less under the single-name CDS than the digital swap.
 - C. The contingent payment from the protection seller to the protection buyer is greater under the single-name CDS than the digital swap.
 - D. The contingent payment from the protection seller to the protection buyer is less under the single-name CDS than the digital swap.

Answer: D

Choices A and B can be eliminated because payments in default are made from protection seller to protection buyer. The payoff from the digital swap will be 50% of par value while the payoff from the single name will be 40% (i.e., $1 - 0.6$) of par value.

74. When an institution has sold exposure to another institution (i.e., purchased protection) in a CDS, it has exchanged the risk of default on the underlying asset for which of the following?
- A. Default risk of the counterparty
 - B. Default risk of a credit exposure identified by the counterparty
 - C. Joint risk of default by the counterparty and of the credit exposure identified by the counterparty
 - D. Joint risk of default by the counterparty and the underlying asset

Answer: D

The protection buyer is exposed to the joint risk of default by the counterparty and underlying credit. If only one defaults, there is no credit risk.

75. A risk manager is advising the trading desk about entering into a digital credit default swap as a way to obtain credit protection. Which cash flow and delivery requirement will the desk most likely experience in the event of a default of the underlying reference asset?
- A. Receive the pre-agreed cash payment; delivering nothing.
 - B. Receive $[(\text{Par Value}) - (\text{Market Value of Reference Asset})]$; deliver the reference asset.
 - C. Receive $[(\text{Par Value}) - (\text{Market Value of Reference Asset})]$; deliver nothing.
 - D. Receive the pre-agreed cash payment; deliver the reference asset.

Answer: A

A digital CDS will pay off a pre-determined fixed amount in the event of a default. Digital CDS are often used against highly illiquid reference assets that would be difficult to price.

76. A six-year CDS on a AA-rated issuer is offered at 150bp with semiannual payments while the yield on a six-year annual coupon bond of this issuer is 8%. There is no counterparty risk on the CDS. The annualized LIBOR rate paid every six months is 4.6% for all maturities. Which

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strategy would exploit the arbitrage opportunity? How much would your return exceed LIBOR?

- A. Buy the bond and the CDS with a risk-free gain of 1.9%.
- B. Buy the bond and the CDS with a risk-free gain of 0.32%.
- C. Short the bond and sell CDS protection with a risk-free gain of 4.97%.
- D. There is no arbitrage opportunity as any apparent risk-free profit is necessarily compensation for being exposed to the credit risk of the issuer.

Answer: A

Because LIBOR is flat, the fixed-coupon yield is also 4.6%, creating a spread of $800 - 460 = 340\text{bp}$ on the bond. Going long the bond and short credit via buying the CDS yields an annual profit of $340 - 150 = 190\text{bp}$.

77. Which of the following statements concerning credit default swap is correct?

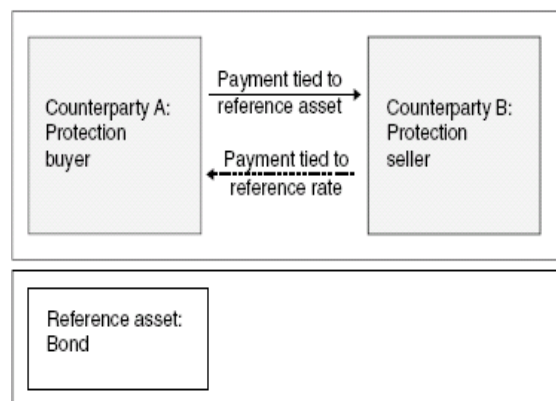
- A. The effective maturity of a CDS is reduced by including a liquidity put in the master agreement.
- B. To purchase a single-name CDS contract, the buyer must also own the reference asset.
- C. Typically, there is only one reference asset that can be delivered to satisfy a CDS contract.
- D. CDS contracts can only be satisfied through cash settlement.

Answer: A

A break clause – a.k.a., “liquidity put” or early termination option (ETO) – is an agreement to terminate (break) a transaction at pre-specified dates in the future.

Key Point: Credit Derivatives 2 – TRS

Total Rate of Return Swaps are contracts where one party, called the protection buyer (also called TROR payer and risk seller), makes a series of payments linked to the total return on a reference asset.



78. Risk Averse Bank (RAB) has made a loan of USD 100 million at 8% per annum. RAB wants to enter into a total return swap under which it will pay the interest on the loan plus the change in the mark-to-market value of the loan, and in exchange, RAB will get LIBOR + 30 basis points. Settlement payments are made annually. What is the cash flow for RAB on the first settlement date if the mark-to-market value of the loan falls by 2% and LIBOR is 6%?
- A. Net inflow of USD 0.3 million
 - B. Net outflow of USD 0.3 million
 - C. Net inflow of USD 1.7 million
 - D. Net outflow of USD 1.7 million

Answer: A

79. A firm has entered into a USD 20 million total return swap on the NASDAQ 100 index as the index payer with ABC Corporation, which will pay 1-year LIBOR + 2.5%. The contract will last 1 year, and cash flows will be exchanged annually. Suppose the NASDAQ 100 Index is currently at 2,900 and LIBOR is 1.25%. The firm conducts a stress test on this total return swap using the following scenario:

NASDAQ 100 in 1 year: 3,625

LIBOR in 1 year: 0.50%

For this scenario, what is the firm's net cash flow in year 1?

- A. A net cash outflow of USD 4.40 million.
- B. A net cash outflow of USD 4.25 million.
- C. A new cash inflow of USD 4.25 million.
- D. A new cash inflow of USD 4.40 million.

Answer: B

The NASDAQ will increase 25%, or $(3625/2900) - 1$, over the next year, so the index payer will pay USD 5 million (0.25×20 million) to ABC Corp. Since ABC Corp's payments depend on today's LIBOR, it will pay 3.75% ($1.25\% + 2.5\%$) or USD 0.75 (0.0375×20 million). So the firm's net cash flow would be 0.75 million – 5 million = -USD 4.25 million.

80. The credit protection buyer in a total return swap, where the protection seller pays LIBOR plus a spread, is hedged against each of the following risks except for:
- A. Credit deterioration in the reference.
 - B. Spread risk in the reference.
 - C. General level of interest rates.
 - D. Counterparty exposure to the protection seller.

Answer: D

The TRS provides a hedge against credit and market risk. In the case of LIBOR, a higher interest

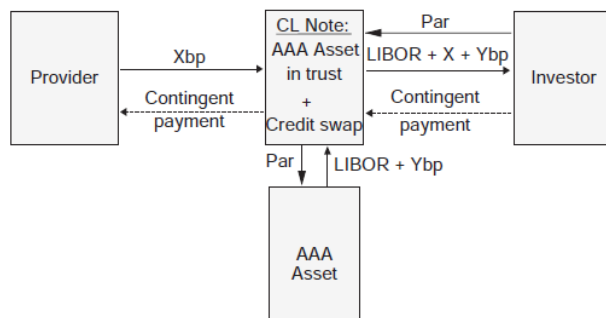
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rate implies a loss on the reference, however this is hedged by the protection sellers higher payments.

Key Point: Credit Derivatives 3 - Credit-Linked Notes

Credit-linked notes are not stand-alone derivatives contracts but instead combine a regular coupon-paying note with some credit risk feature.



Credit-Linked Note

81. Which of the following statements about credit-linked notes is true?

- A. The borrower receives an enhanced coupon.
- B. The borrower receives a reduced coupon.
- C. The lender receives an enhanced coupon.
- D. The lender receives a reduced coupon.

Answer: C

In a credit-Linked note, the lender (note holder) receives an enhanced coupon as compensation for bearing the credit risk of the issuer.

82. Investors in a credit-linked note (CLN) are most similar to:

- A. Credit default swap (CDS) protection buyers who have funded (prepaid) the contingent credit loss.
- B. Credit default swap (CDS) protection buyers who own (have an insurable interest in) the reference entity.
- C. Credit default swap (CDS) protection sellers who have funded (prepaid) the contingent credit loss.
- D. Credit default swap (CDS) protection sellers who own (have an insurable interest in) the reference entity.

Answer: C

A CLN is like a funded CDS; the investors are selling protection (synthetically short the reference). In regard to (d), neither counterparty needs to own the reference.

83. Which of the following types of credit derivatives creates the least counterparty credit exposure for the protection buyer?
- A. Total return swap
 - B. Equity default swap
 - C. Credit-linked note
 - D. Senior basket credit default swap

Answer: C

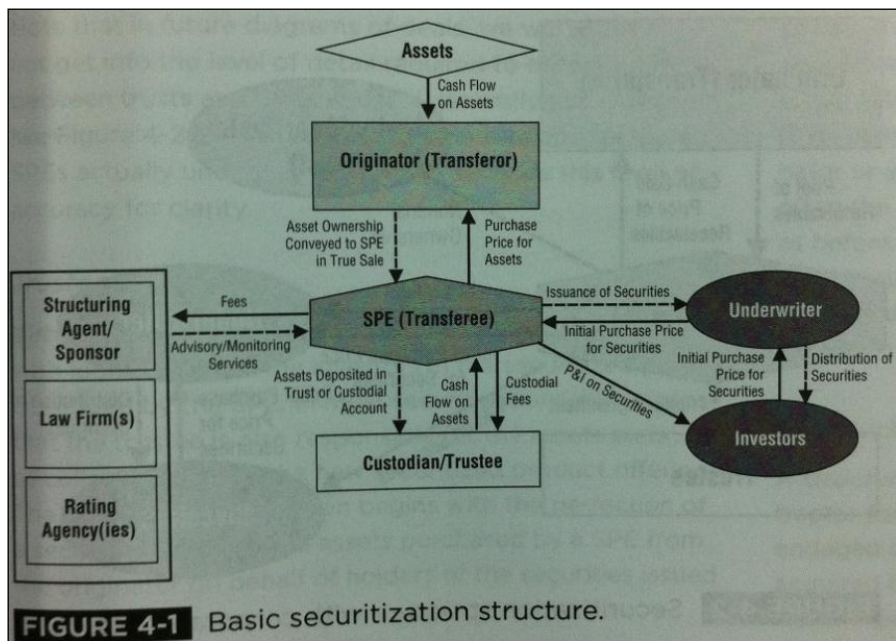
84. XYZ Hedge Fund wants to get exposure to a high-yield pool of commercial loans without actually investing in the loans. It wants a leverage ratio of 7.5. If the hedge fund is willing to invest \$35 million in this investment, which credit derivative is best for them and what is their expected return given that the reference asset earns LIBOR plus 285 basis points, the counterparty earns LIBOR plus 150 basis points, and the required collateral earns 3.5%?
- A. Total return swap with a 13.63% return.
 - B. Asset-backed credit-linked note with an 11.34% return.
 - C. Total return swap with an 11.34% return.
 - D. Asset-backed credit-linked note with a 13.63% return.

Answer: D

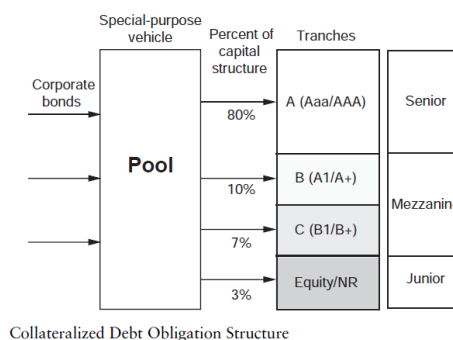
The best credit derivative for this hedge fund is an asset-backed credit-linked note. With leverage of 7.5 and an investment of \$35 million, we know that the notional value of the pool of commercial loans is \$262.5 million. The hedge fund will earn 3.5% on their \$35 million in collateral. This translates into \$1.225 million. They will also earn the 135 basis point spread on the entire \$262.5 million. This translates into \$3.54375 million. The hedge fund's percentage return is 13.63% [$(\$1.225 \text{ million} + \$3.54375 \text{ million}) / \35 million].

Key Point: Credit Derivatives 4 – Structured Products & CDO

- Types of Structured Finance
 - ◇ Securitization



- Structure
 - ◇ Tranching



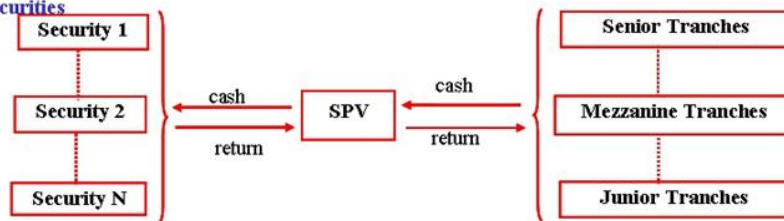
- ◇ Waterfall

The term “waterfall” is used because the capital structure is paid in a “top down” sequence with the senior debt receiving all of its promised payments before any lower tranche receives any monies.
- Structured Products
 - ◇ Covered Bond
 - ◇ MBS
 - ◇ CDO
- Types of CDO
 - ◇ Cash-Flow vs. Synthetic

CDO Market: Cash-flow CDOs VS Synthetic CDOs

➤ Cash-flow CDO with

N underlying securities



➤ Synthetic CDO with

N underlying securities



● Internal credit enhancement

Subordination

Over collateralization (O/C): more assets are pledged to back the structure and exceed the liabilities

Direct equity issue: issues debt with a face value less than the collateral in the pool and the difference could be made up by issuing equity

Holdback

Cash collateral account (CCA): reserves set aside by the originator to cover losses in the pool

Excess spread: a positive excess spread between the collateral assets and the liabilities (coupons) of the SPV, less fees and expenses.

● Effect of PD and Default Correlation

The mezzanine effect is mixed.

Constant Correlation: Increasing the probability of default will negatively impact the cash flows and, thus, the values of all tranches; Increasing default probability generally decreases the VaR for the equity tranches (less variation in returns) and increases the VaR for the senior tranches (more variation in returns).

Constant Probability of Default: The equity tranches increases in value from increasing correlation as the possibility of zero (or few) credit losses increases from the high correlation. Senior VaR increases with correlation. As the default correlation approaches one, the equity VaR increases steadily. The interpretation is that although the mean return is increasing so is the risk as the returns are more variable (large losses or very small losses).

● Performance Analysis

TABLE 19-2 Summary of Performance Measures

Performance Measure	Calculation	Typical Asset Class
Public Securities Association (PSA)	$PSA = [CPR / (.2)(months)] * 100$	mortgages, home-equity, student loans
Constant prepayment rate (CPR)	$1 - (1 - SMM)^{12}$	mortgages, home-equity, student loans
Single monthly mortality (SMM)	Prepayment/Outstanding pool balance	mortgages, home-equity, student loans
Weighted average life (WAL)	$\sum (a/365) \cdot PF(s)$ Where PF(s)	mortgages
Weighted average maturity (WAM)	Weighted maturity of the pool	mortgages
Weighted average coupon (WAC)	Weighted coupon of the pool	mortgages
Debt service coverage ratio (DSCR)	Net operating income/Debt payments	commercial mortgages
Monthly payment rate (MPR)	Collections/Outstanding pool balance	all non-amortising asset classes
Default ratio	Defaults/Outstanding pool balance	credit cards
Delinquency ratio	Delinquents/Outstanding pool balance	credit cards
Absolute prepayment speed (ABS)	Prepayments/Outstanding pool balance	auto loans, truck loans
Loss curves	Show expected cumulative loss	auto loans, truck loans

85. The Big Bank Corp has securitized a large pool of 100 mortgages as follows: \$75 million in senior AAA notes, \$20 million in mezzanine BB notes, and \$5 million in equity tranche. Big Bank Corp would like to provide a credit enhancement to the issue. Which of the following strategies would most effectively reinforce the credit rating of the AAA notes?

- A. 26th-to-default basket.
- B. Standard basket.
- C. Senior basket with \$25 million loss level.
- D. Subordinated basket with \$25 million loss level.

Answer: C

The senior basket provides compensatory payouts after \$25 million in loss is suffered by the pool. Because the goal is to enhance the AAA notes, \$25 million can be absorbed by the mezzanine and equity investors without impairing the AAA notes. Assuming all credits are of equal size, the 26th-to-default basket would provide minimal protection since all defaults above 26 would directly impair AAA claims. The standard basket would provide protection starting with the first default and thus would be very expensive if used to protect the AAA

86. A hedge fund is considering taking positions in various tranches of a collateralized debt obligation (CDO). The fund's chief economist predicts that the default probability will decrease significantly and that the default correlation will increase. Based on this prediction, which of the following is a good strategy to pursue?

- A. Buy the senior tranche and buy the equity tranche.
- B. Buy the senior tranche and sell the equity tranche.
- C. Sell the senior tranche and sell the equity tranche.

D. Sell the senior tranche and buy the equity tranche.

Answer: D

The decrease in probability of default would increase the value of the equity tranche. Also, a default of the equity tranche would increase the probability of default of the senior tranche, due to increased correlation, reducing its value. Thus, it is better to go long the equity tranche and short the senior tranche.

87. National united bank has recently increased the bank's liquidity through securitization of existing credit card receivables. The proposed securitization includes tranches with multiple internal credit enhancements as shown in Exhibit 1 below. The total value of the collateral for the structure is USD 600 million, no lockout period, and the subordinated tranche B bond is the first loss piece:

Exhibit 1: Proposed ABS Structure

Bond Class	par value
Senior tranche	USD 250 million
Junior tranche A	USD 200 million
Junior tranche B	USD 70 million
Subordinated tranche A	USD 50 million
Subordinated tranche B	USD 30 million
Total	USD 600 million

At the end of the fourteenth month after the securities were issued, the underlying credit card accounts have prepaid USD 300 million in principal in addition to regularly scheduled principal and interest payments. What is the amount of the prepaid principal paid out to the holders of the junior tranche A bond class?

- A. USD 0 million
- B. USD 50 million
- C. USD 120 million
- D. USD 230 million

Answer: B

USD 50 million is calculated by $USD300 - USD250 = USD50$, since prepayments are first distributed to the senior tranches.

88. An investor has sold default protection on the most senior tranche of a CDO. If the default correlation decreases sharply, assuming everything else is unchanged, the investor's position will
- A. Gain significant value since the probability of exercising the protection falls.
 - B. Lose significant value since his protection will gain value.

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- C. Neither gain nor lose value since only expected default losses matter and correlation does not affect expected default losses.
- D. It depends on the pricing model used and the market conditions.

Answer: A

89. King Motors Acceptance Corporation (KMAC), the finance arm of King Motors, issues an auto-loan asset-backed security that consists of a senior tranche, denoted Tranche A in the amount of \$50 million and an interest payment of 5 percent, and two subordinated tranches, denoted Tranches X and Z respectively, each with a face amount of \$35 million. Tranche X pays investors annual interest at a rate of 6.5 percent while Tranche Z pays investors annual interest at a rate of 7.5 percent. Which of the following methods of credit support would NOT affect the credit quality of subordinated Tranche X?
- A. The total amount of the auto loans that make up the asset-backed issue is \$125 million.
 - B. The weighted average interest rate on the auto loans making up the pool is 6.4 percent.
 - C. Any defaults on the part of King Motor's customers will be first absorbed by Tranche Z.
 - D. KMAC has a reserve in the amount of \$10 million that will remain on KMAC's balance sheet.

Answer: D

An investor's claim when purchasing an ABS is solely with the ABS and no longer with the originator. The fact that KMAC has \$10 million set aside means nothing for the ABS issue if it remains on KMAC's balance sheet and is not part of the ABS issue. The other answer choices all describe forms of credit support that will support at least Tranches X and A, if not all 3 tranches. By having Tranche Z be subordinate to Tranche X, Tranche X has additional support. Also, loans of \$125 million are used to back asset-backed securities worth $(\$50 + \$35 + \$35) = \120 million, which means the issue, is over-collateralized. The weighted average interest rate paid on the securities is approximately 6.2%. If the weighted average interest rate on the loans that make up the pool is 6.4% that means there is an excess spread between the loans and securities that also provides support for the entire issue.

90. A standard synthetic CDO references a portfolio of 10 corporate names. Assume the following. The total reference notional is X, and the term is Y years. The reference notional per individual reference credit name is $X/10$. The default correlations between the individual credit names are all equal to one. The single-name CDS spread for each individual name is 100 bp, for a term of Y years. The assumed recovery rate on default for all individual reference credits is zero in all cases. The synthetic CDO comprises two tranches, a 50% junior tranche priced at a spread J, and a 50% senior tranche priced at spread S. All else constant, if the default correlations between the individual reference credit names are reduced

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from 1.0 to 0.7, what is the effect on the relationship between the junior tranche spread J and the senior tranche spread S?

- A. The relationship remains the same
- B. S increases relative to J
- C. J increases relative to S
- D. The effect cannot be determined given the data supplied

Answer: C

If the correlation is one, all names will default at the same time, and the junior and senior tranche will be equally affected. Hence, their spread should be 100bp, which is the same as for the collateral. With lower correlations, the losses will be absorbed first by the junior tranche. Therefore, the spread on the junior tranche should be higher, which is offset by a lower spread for the senior tranches.

91. Assume the originator securitizes a \$100 million loan portfolio that pays LIBOR plus 200 bps. Senior expenses of the SPE amount to 20 bps. The SPE issues only two classes of securities: senior debt with face value of \$90 million and subordinated debt with face value of \$10 million, such that the subordinated debt “functions as equity”. The coupon on the senior debt is LIBOR plus 100 bps. The subordinated debt (equity) gets an interest rate equal to the realized net excess spread. What is the net excess spread?
- A. \$10 million \times (LIBOR + 3%)
 - B. \$10 million \times (LIBOR + 5%)
 - C. \$10 million \times (LIBOR + 7%)
 - D. \$10 million \times (LIBOR + 9%)

Answer: D

Excess spread = 100 million \times (LIBOR + 200 bps – 20bps) – 90 million \times (LIBOR + 100bps)
= 10 million \times (LIBOR + 9%)

92. Which of the following statements regarding frictions in the securitization of subprime mortgages is correct?
- A. The arranger will typically have an information advantage over the originator with regard to the quality of the loans securitized.
 - B. The originator will typically have an information advantage over the arranger, which can create an incentive for the originator to collaborate with the borrower in filing false loan applications.
 - C. The major credit rating agencies are paid by investors for their rating service of mortgage-backed securities, and this creates a potential conflict of interest.
 - D. The use of escrow accounts for insurance and tax payments eliminates the risk of

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foreclosure.

Answer: B

One of the key frictions in the process of securitization involves an information problem between the originator and arranger. In particular, the originator has an information advantage over the arranger with regard to the quality of the borrower. Without adequate safeguards in place, an originator can have the incentive to collaborate with a borrower in order to make significant misrepresentations on the loan application. Depending on the situation, this could be either construed as predatory lending (where the lender convinces the borrower to borrow too large of a sum given the borrower's financial situation) or predatory borrowing (the borrower convinces the lender to lend too large a sum).

The major rating agencies are not paid by the investors. Escrow accounts can forestall but not eliminate the risk of foreclosure.

93. EACH of the following is an example or element of predatory lending except for:

- A. Lender makes unaffordable loans based on borrower assets rather than ability to repay
- B. Lender induces borrower to repeatedly refinance ("loan flipping") in order to collect fees and charge high points
- C. Borrower misrepresents income or employment in mortgage application
- D. Lender engages in deception to conceal true nature of loan; e.g., deceives borrower into thinking loan is fixed-rate (FRM) when mortgage is actually an adjustable-rate (ARM)

Answer: C

94. Each of the following is an example or element of predatory borrowing except for:

- A. Borrower colludes with appraiser to inflate the appraised value of home.
- B. Borrower makes misrepresentations in regard to income, employment, credit history.
- C. Use of "nominee loans" that concealing the true identity of the true borrower.
- D. Borrower is required to pay a prepayment penalty for more than three years, or in an amount larger than six months interest.

Answer: D

In regard to (D), this is an example or sign of predatory lending. Ashcraft: "Predatory borrowing is defined as the willful misrepresentation of material facts about a real estate transaction by a borrower to the ultimate purchaser of the loan. This financial fraud might also involve cooperation of other insiders – realtors, mortgage brokers, appraisers, notaries, attorneys. The victims of this fraud include the ultimate purchaser of the loan (for example a public pension), but also include honest borrowers who have to pay higher interest rates for mortgage loans and prices for residential real estate."

95. In which of the below the assets remain on the balance sheet of the institution

- A. CMO
- B. CLO
- C. MBS
- D. Covered Bond

Answer: D

96. Each of the following is a valid difference between a covered bond and a true securitization except which is not true?

- A. In a covered bond, the cover pool remains on the balance sheet, but in a true securitization, loans (assets) are removed from the balance sheet.
- B. In a covered bond, principal and interest are paid from issuer's general cash flows, but in a securitization, principal and interest are paid from the collateral pool directly.
- C. Unlike a true securitization, there is not a "true sale" of assets to a bankruptcy-remote special purpose vehicle in the case of covered bond.
- D. Unlike a true securitization, a covered bond neither create securities nor is a genuine method for raising funds (i.e., borrowing) in capital markets.

Answer: D

Covered bond and securitization are similar in the sense that both methods do issue securities, which are backed by assets, as a means to raise funds (borrow) in capital markets

97. Which of the following statements about portfolio losses and default correlation are most likely correct?

- I. Increasing default correlation decreases senior tranche values but increases equity tranche values.
 - II. At high default rates, increasing default correlation decreases mezzanine bond prices.
- A. I only
 - B. II only
 - C. Both I and II
 - D. Neither I nor II

Answer: A

98. A collateralized mortgage obligation (CMO) has the characteristics below. Which of the following are most accurate regarding its credit enhancement?

Return on assets	8.75%
Senior tranche	\$400,000,000
Subordinated tranche A	\$120,000,000

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Subordinated tranche B	\$50,000,000
Value of collateral	\$600,000,000
Interest paid on liabilities of SPE	7.50%
Fees and expenses	0.60%

- I. There is overcollateralization.
- II. The investors gain credit enhancement through the excess spread.
- A. I only.
- B. II only.
- C. Both I and II.
- D. Neither I nor II.

Answer: C

The total value of the tranches is: $\$400 + \$120 + \$50 = \570 million. The value of the collateral is \$600 million, so the CMO is over collateralized by \$30 million.

The net excess spread is $8.75\% - 7.50\% - 0.60\% = 0.65\%$, so there is positive excess spread. This provides credit enhancement for the CMO investors.

99. Which of the following is an internal enhancements

- A. Overcollateralization
- B. CDS
- C. Put options on assets
- D. Letters of credit

Answer: A

Internal enhancements include: overcollateralization, direct equity issue, holdback, cash collateral account (CCA), excess spread.

External credit enhancement include, insurance, warps, and guaranties, letters of credit, CDS, put options on assets.

100. Consider a three-tier securitization structure with the following assumptions:

- The loans in the collateral pool and the liabilities are assumed to have a maturity of 5 years.
- Assets consist of 100 identical loans with par value of \$1 million each, priced at par, paying a fixed 8.5% (i.e., 350 bps over LIBOR flat at 5%).
- Senior debt (senior bonds) of \$85 million paying a coupon of LIBOR + 50 bps.
- Mezzanine debt (junior bonds) of \$10 million paying a coupon of LIBOR + 500 bps
- The scenario assumes a default rate of 10% per annum.
- The money market rate is 5%

Default			Survived	Loan Principal and Interest	Senior Interest	Junior Interest	Excess Spread	Overcollateral	Recovery	OC + Recovery	Equity Flow	OC a/c
t	Annual	Cum'l		0.085	4.675	1						
1	10	10	90	7.6500	4.675	1	1.9750	1.7500	4.0000	5.7500	0.225	5.7500
2	9	19	81	6.8850	4.675	1	1.2100	1.2100	3.6000	4.8100	0	10.8475
3	8	27	73	6.2050	4.675	1	0.5300	0.5300	3.2000	3.7300	0	15.1199
4	7	34	66	5.6100	4.675	1	-0.0650	-0.0650	2.8000	2.7350	0	18.6109
5	7	41	59	64.0150	4.675	1			2.8000			19.5414
Total Terminal Avail Funds												86.3564
Owed to Bond Tranches in Year 5												100.6750

Under this high-default scenario, which of the following statements is true?

- A. There is never a year in which either the junior or senior bonds are paid their full interest
- B. Both bond holders (senior and junior) realize all of their interest payments in the first four years, but neither recover their entire obligation in the fifth year (i.e., shortfall for both bond holders)
- C. Junior bond holder suffer interest payment shortfalls and a principal shortfall, but senior bond holders receive all of their interest and experience no principal shortfall
- D. Both bond holders realize all of their interest payments, in full, and get back the entirety of their principal

Answer: B

101. Which of the following statements describe part of the risk mitigation process for a collateralized debt obligation (CDO)?

- I. Default risk is restructured in such a way that previously lower-rated issues can be re-formulated into highly rated debt instruments.
 - II. The equity tranche has no certain return and bears the highest level of default risk.
- A. I only.
 - B. II only.
 - C. Both I and II.
 - D. Neither I nor II.

Answer: C

The default risk in a CDO is structured through various tranches in such a way that a pool of assets that were once lower rated could be AAA rated after the securitization process. The equity tranche is the most junior tranche. Therefore, it offers the highest return potential but with no certain return. The equity tranche also bears the highest level of default risk.

102. Securitized products are often customized to meet the needs of the investor as well as the originator. What type of asset-backed securities (ABSs) typically uses a revolving structure?

- A. Residential mortgage.
- B. Credit card debt.
- C. Commercial mortgage.

D. Commercial paper.

Answer: B

Revolving structures are used with products that are paid back on a revolving basis, such as credit card debt or auto loans. Credit card debt does not have a pre-specified amortization schedule; therefore the principal paid back to investors is in large lump sums rather than amortizing schedules.

103. A fixed-income portfolio manager purchases a seasoned 5.5% agency mortgage-backed security with a weighted average loan age of 60 months. The current balance on the loans is USD 20 million, and the conditional prepayment rate is assumed to be constant at 0.4% per year. Which of the following is closest to the expected principal prepayment this month?

- A. USD 1,000
- B. USD 7,000
- C. USD 10,000
- D. USD 70,000

Answer: B

$CPR = 0.4\%$, therefore, $SMM = 1 - (1 - CPR)^{(1/12)} = 0.03\%$

$I/Y = 5.5/12$, $N = 60$, $PV = 20,000,000$, $FV = 0 \rightarrow PMT = 382,023.24$

Interest payment = $20,000,000 \times 5.5\%/12 = 91,666.67$

Principal payment = $382,023.24 - 91,666.67 = 290,356.58$

$SMM = \text{prepayment}/(\text{beginning balance} - \text{scheduled principal payment}) = 0.03\% = \text{prepayment}/(20,000,000 - 290,356.58)$

Therefore, prepayment = 6,581.96

104. Assume an MBS is composed of the following four different pools of mortgages:

- \$2 million of mortgages that have a maturity of 90 days.
- \$3 million of mortgages that have a maturity of 180 days.
- \$5 million of mortgages that have a maturity of 270 days.
- \$10 million of mortgages that have a maturity of 360 days.

What is the weighted average maturity (WAM) of these mortgage pools?

- A. 167 days.
- B. 225 days.
- C. 252 days.
- D. 284 days.

Answer: D

The WAM is calculated as follows: $WAC = [90(2 \text{ million}) + 180(3 \text{ million}) + 270(5 \text{ million}) + 360(10 \text{ million})]/(2 \text{ million} + 3 \text{ million} + 5 \text{ million} + 10 \text{ million}) = 284 \text{ days}$

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2017 FRM Part II

百题巅峰班

操作风险测量与管理

2017 年 5 月

Operational and Integrated Risk Management

Key Point: Operational Risk Management

- The risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. The definition includes legal risk but excludes strategic and reputation risk.
 - Basel II classifies loss events into seven categories: Internal Fraud; External Fraud; Employment Practices and Workplace Safety; Clients, Products, and Business Practices; Damage to Physical Assets; Business Disruption and System Failures; Execution, Delivery, and Process Management
 - Three Lines of Defense: Business Line Management; Functionally Independent Corporate Operational Risk Function (CORF); Independent Review and Challenge of the bank's operational risk management controls, processes and systems.
 - Role of Board of Directors: establish, approve and periodically review the operational risk management framework
 - Role of Senior Management: develop a clear, effective and robust governance structure with well defined, transparent and consistent lines of responsibility; consistently implementing and maintaining throughout the organization policies, processes and systems for managing operational risk in all of the bank's material products, activities, processes and systems consistent with the risk appetite and tolerance.
-

1. All the following are operational risk loss events, except:
 - A. An individual shows up at a branch presenting a check written by a customer for an amount substantially exceeding the customer's low checking account balance. When the bank calls the customer to ask him for the funds, the phone is disconnected and the bank cannot recover the funds.
 - B. A bank, acting as a trustee for a loan pool, receives less than the projected funds due to delayed repayment of certain loans.
 - C. During an adverse market movement, the computer network system becomes overwhelmed, and only intermittent pricing information is available to the bank's trading desk, leading to large losses as traders become unable to alter their hedges in response to falling prices.
 - D. A loan officer inaccurately enters client financial information into the bank's proprietary credit risk model.

Answer: B

Statement a. represents external fraud, which is included in operational risk.

Statement c. represents a systems failure. Statement d. is a failure in internal processes.

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2. Which of the following is an example of an operational risk loss by Firm A?
- A. After a surprise announcement by the central bank that interest rates would increase, bond prices fall, and Firm A incurs a significant loss on its bond portfolio.
 - B. The data capture system of Firm A fails to capture the correct market rates causing derivative trades to be done at incorrect prices, leading to significant losses.
 - C. As a result of an increase in commodity prices, the share price of a company that Firm A invested in falls significantly causing major investment losses.
 - D. A counterparty of Firm A fails to settle their debt to Firm A, and in doing this, they are in breach of a legal agreement to pay for services rendered.

Answer: B

In (B), systems failure or incorrect systems caused the problem. The losses are directly due to an operational risk exposure, (A) and (C), an increase in interest rates and the fall in the value of an investment, are both examples of market risk exposure, (D), failure to repay debt, is an example of credit risk exposure.

3. Suppose a broker-dealer has a loss that occurs from a failure in properly processing and settling a transaction. According to Basel II operational risk categories, this type of event loss would be categorized as:
- A. Business Disruption and System Failures.
 - B. Clients, Products, and Business Practices.
 - C. Execution, Delivery, and Process Management.
 - D. Employment Practices and Workplace Safety

Answer: C

4. Which of the following strategies can contribute to minimizing operational risk?
- I. Individuals responsible for committing to transactions should perform clearance and accounting functions.
 - II. To value current positions, price information should be obtained from external sources.
 - III. Compensation schemes for traders should be directly linked to calendar revenues.
 - IV. Trade tickets need to be confirmed with the counterparty.
- A. I and II
 - B. II and IV
 - C. III and IV
 - D. I, II, and III

Answer: B

Answer I violates the principle of separation of functions. Answer III. may create problems of traders taking too much risk. Answer II. advises the use of external sources for valuing positions,

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as traders may affect internal price data.

5. A large investment bank has just acquired a smaller regional competitor and is extending its best practices in the field of operational risk to the newly acquired company. As part of this process, management of the new subsidiary is reviewing which responsibilities should be assumed by the board of directors and which should be assumed by senior management. For which of the following should the board of directors be responsible?
- A. Implementing operational risk management systems across the organization
 - B. Develop a clear, effective and robust governance structure
 - C. Assigning responsibilities to, and reporting relationships between, the bank's risk managers
 - D. Periodically reviewing and approving the operational risk management framework

Answer: D

Key Point: Loss Distribution Approach

- Loss Distribution Approach

The loss distribution approach (LDA) is used to meet the Basel II operational risk standards for regulatory capital. Under the loss distribution approach (LDA), the severity distribution of loss from a single event is coupled with a frequency distribution of events over a given horizon (typically one year), to arrive at the aggregate loss distribution for a given type of event over the horizon.

- Frequency Distributions

LDA models most often use the Poisson distribution, the negative binomial distribution, or the binomial distribution.

- Severity Distributions

The severity of each event follows a parametric distribution, such as a lognormal, Weibull, Gamma, Exponential distribution.

- Data Requirement

- ✧ Internal Data: Selection of Threshold
 - ✧ External Data: Bias
 - ✧ Scenario Analysis: Bias (Presentation; Availability; Anchoring; Huddle; Gaming; Confidence; Inexpert; Context)
 - ✧ Business Environment Internal Control Factors: RCSA; KRIs
-

6. Each of the following is a key issue related to external datasets in modeling operational losses except:

- A. The lack of any vendors with centralized database necessitates the manual collection of peer data.
- B. The relevance question of whether past loss events at other institutions seem likely or even plausible for the user bank going forward.
- C. The quantity question: there may not be enough data points in the external dataset that can supplement the internal loss data.
- D. The under-reporting problem that not all loss events reach the public domain.

Answer: A

7. Operational risk loss data is not easy to collect within an institution, especially for extreme loss data. Therefore, financial institutions usually attempt to obtain external data, but doing so may create biases in estimating loss distributions. Which of the following statements regarding characteristics of external loss data is incorrect?
- A. External loss data often exhibits scale bias as operational risk losses tend to be positively related to the size of the institution (i.e., scale of its operations).
 - B. External loss data often exhibits truncation bias as minimum loss thresholds for collecting loss data are not uniform across all institutions.
 - C. External loss data often exhibits data capture bias as the likelihood that an operational risk loss is reported is positively related to the size of the loss.
 - D. The biases associated with external loss data are more important for large losses in relation to a bank's assets or revenue than for small losses.

Answer: D

The biases associated with external loss data are important for all losses in relation to a bank's assets or revenue.

8. The Chief Risk Officer of your bank has put you in charge of operational risk management. As a first step, you collect internal data to estimate the frequency and severity of operational-risk-related losses. The table below summarizes your findings:

Frequency Distribution		Severity Distribution	
Number of Occurrences	Probability	Loss (USD)	Probability
0	0.6	1,000	0.5
1	0.3	100,000	0.4
2	0.1	1,000,000	0.1

Based on this information, what is your estimate of the expected loss due to operational risk?

- A. USD 20,000
- B. USD 70,250
- C. USD 130,600

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D. USD 140,500

Answer: B

Loss	Probability	L*P
-	0.60	-
1,000	0.15	150
2,000	0.03	50
100,000	0.12	12,000
101,000	0.04	4,040
200,000	0.02	3,200
1,000,000	0.03	30,000
1,001,000	0.01	10,010
1,100,000	0.01	8,800
2,000,000	0.00	2,000
	EL	70,250

9. Suppose you are given the following information about the operational risk losses at your bank.

Frequency distribution		Severity Distribution	
Probability	Frequency	Probability	Severity
0.5	0	0.6	USD 1,000
0.3	1	0.3	USD 10,000
0.2	2	0.1	USD 100,000

What is the estimate of the VaR at the 95% confidence level (including expected loss), assuming that the frequency and severity distributions are independent?

- A. USD 100,000
 B. USD 101,000
 C. USD 200,000
 D. USD 110,000

Answer: A

Loss	Probability	Cum. P
-	0.50	0.500
1,000	0.18	0.680
2,000	0.07	0.752
10,000	0.09	0.842
11,000	0.07	0.914
20,000	0.02	0.932
100,000	0.03	0.962
101,000	0.02	0.986
110,000	0.01	0.998
200,000	0.00	1.000

10. Gerard Kuper is modeling the number of operational risk loss events that could adversely

impact Bank ABC in 2010. He expects the number of operational risk loss events for the year to be relatively small. Which type of distribution is he least likely to use?

- A. Normal distribution
- B. Binomial distribution
- C. Negative binomial distribution
- D. Poisson distribution

Answer: A

The last three distributions require the number n to be positive, which is not the case for the normal distribution.

11. Consider a bank that wants to model processing errors in its retail banking business. The number of such errors in a given year is denoted by random variable N . The dollar loss amount when a processing error occurs is denoted by random variable S . Which of the following procedures is the most likely implementation of the first step of the loss distribution approach?

- A. Convolute a marginal Poisson distribution (to characterize N) with a Weibull (to characterize S)
- B. Convolute a marginal Poisson distribution (to characterize S) with a Weibull (to characterize N)
- C. Convolute a marginal lognormal distribution (to characterize N) with a Weibull (to characterize S)
- D. Convolute a marginal Poisson distribution (to characterize N) with a negative binomial (to Characterize S)

Answer: A

Poisson is a popular discrete distribution used to model frequency; Weibull is a typical continuous distribution, which generalizes the exponential distribution and has a positive domain, used to model severity.

12. Which of the following is true about modeling the severity distribution(s) of operational losses?

- A. A single parametric distribution is generally inadequate to capture the probabilistic behavior of severity over its range.
- B. The specification of the severity distribution(s) is less consequential than the specification of the frequency distribution(s).
- C. Due to the importance and firm-specific nature of loss severity data, empirical distributions are almost always recommended, especially for the “tail”.
- D. Most banks can (and should) rely on internal dataset(s) for the estimation of their

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severity distribution.

Answer: A

13. Scenario analysis is often used by financial institutions in determining the amount and frequency of losses. Because historical data is often limited for all possible losses, the opinions of experts are often obtained from workshops. These expert opinions are often subject to biases. Which of the following biases refers to the problem that can arise in this group setting where an expert may not be willing to share a conflicting opinion?

- A. Huddle bias.
- B. Context bias.
- C. Availability bias.
- D. Anchoring bias.

Answer: A

Huddle bias suggests that groups of individuals tend to avoid conflicts that can result from different viewpoints or opinions. Availability bias is related to the expert's experience in dealing with a specific event or loss risk. Anchoring bias occurs when an expert limits the range of a loss estimate based on personal knowledge. Context bias occurs when questions are framed in a way that influences the responses of those being questioned.

14. There are typically four steps used in designing the risk control self-assessment (RCSA) program for a large firm. Which of the following statements is least likely to be a step in the design of that program?

- A. Identify and assess risks associated with each business unit's activities.
- B. Controls are added to the RCSA program to mitigate risks identified for the firm.
- C. Risk metrics and all other OpRisk Initiatives are linked to the RCSA program.
- D. Reports to regulators are prepared that summarize the degree of OpRisk.

Answer: D

The last step in the design of a risk control self-assessment (RCSA) program involves control tests to assess how well the controls in place mitigate potential risks.

Key Point: Parametric Approaches (II): Extreme Value (New)

● Generalized Extreme-Value Theory (Block Maxima)

- ✧ Consider a sample of size n drawn from $F(x)$, and let the maximum of this sample be M_n . If n is large, we can regard M_n as an extreme value.
- ✧ Under relatively general conditions, as n gets large the distribution of extremes (i.e., M_n) converges to generalized extreme-value (GEV) distribution.
- ✧ This distribution has three parameters. μ , the location parameter of the limiting distribution.

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which is a measure of the central tendency of M_n , σ , the scale parameter of the limiting distribution, which is a measure of the dispersion of M_n , ξ , the tail index, gives an indication of the shape (or heaviness) of the tail of the limiting distribution. If $\xi > 0$, the GEV becomes the Frechet distribution. This case is particularly useful for financial returns because they are typically heavy-tailed.

● Peaks-Over-Threshold (POT) Approach

- ✧ If x is a random i.i.d. loss with distribution function $F(x)$, and u is a threshold value of x , we can define the distribution of excess losses over threshold u .
- ✧ The distribution of x itself can be any of the commonly used distributions and will usually be unknown to us. However, as u gets large, the distribution $F_u(x)$ converges to a generalized Pareto distribution.
- ✧ Two parameters: a positive scale parameter, β , and a shape or tail index parameter, ξ . This latter parameter is the same as the tail index encountered already with GEV theory.

● Differences

- ✧ Both are different manifestations of the same underlying EV theory.
- ✧ POT model exceedances over a high threshold while GEV theory model the maxima of a large sample.
- ✧ POT require fewer parameters.
- ✧ The block maxima approach can involve some loss of useful data, because some blocks might have more than one extreme in them.
- ✧ POT requires us to grapple with the problem of choosing the threshold

15. The generalized extreme value (GEV) generally requires:

- A. Fewer estimated parameters than the POT approach and does not share any parameters with the POT approach.
- B. Fewer estimated parameters than the POT approach and shares one parameter with the POT.
- C. More estimated parameters than the POT approach and shares one parameter with the POT.
- D. More estimated parameters than the POT approach and does not share any parameters with the POT approach.

Answer: C

The POT approach generally has fewer parameters, but GEV approaches share the tail parameter ξ .

16. In setting the threshold in the POT approach, which of the following statements is the most

accurate? Setting the threshold relatively high makes the model:

- A. Less applicable but increases the number of observations in the modeling procedure.
- B. Less applicable and decreases the number of observations in the modeling procedure.
- C. More applicable but decreases the number of observations in the modeling procedure.
- D. More applicable but increases the number of observations in the modeling procedure.

Answer: C

There is a trade-off in setting the threshold. It must be high enough for the appropriate theorems to hold, but if set too high; there will not be enough observations to estimate the parameters.

Key Point: Standardized Measurement Approach for Operational Risk (New)

● SMA Capital Requirement

- ✧ The SMA combines the Business Indicator (BI) Component and Internal Loss Component.
- ✧ BI is a financial statement proxy of operational risk exposure. To compute the BI for year t, bank must determine the 3 year average of the BI, as the sum of the 3 year average of its components.

$$BI = ILDC_{Avg} + SC_{Avg} + FC_{Avg}$$

- ✧ Banks are divided into five buckets according to the size of their BI.

BI buckets in the BI Component		
Bucket	BI Range	BI Component
1	€0 to €1 bn	0.11 * BI
2	€1 bn to €3bn	€110 m + 0.15(BI - €1 bn)
3	€3 bn to €10 bn	€410 m + 0.19(BI - €3 bn)
4	€10 bn to €30 bn	€1.74 bn + 0.23(BI - €10bn)
5	€30 bn to +∞	€6.34 bn + 0.29(BI - €30 bn)

- ✧ Internal Loss Component: The Committee proposes that internal losses should be used by banks in buckets 2-5, but not by banks in bucket 1.

$$\text{Internal Loss Multiplier} = \text{Ln} \left(\exp(1) - 1 + \frac{\text{Loss Component}}{\text{BI Component}} \right)$$

Loss Component

= 7 * Average Total Annual Loss

+ 7 * Average Total Annual Loss only including loss events above €10 million

+ 5 * Average Total Annual Loss only including loss events above €100 million

- ✧ Capital Requirement Calculation

$$= \begin{cases} \text{BI Component, if Bucket 1} \\ 110\text{Mln} + (\text{BI Component} - 110\text{Mln}) \cdot \text{Ln} \left(\exp(1) - 1 + \frac{\text{Loss Component}}{\text{BI Component}} \right), \text{ if Buckets 2-5} \end{cases}$$

17. Which of the following statements best describes a difference between the SMA and the older operational risk capital approaches?
- A. The SMA was more flexible in its application than the advanced measurement approach (AMA).
 - B. The SMA uses a model-based methodology, while the AMA was more flexible and principles-based.
 - C. The standardized approach (TSA) and the alternative standardized approach (ASA) were older approaches rather than variations of the SMA.
 - D. The SMA accounts for internal loss experiences that were not factored into the AMA.

Answer: C

Because banks were able to use a wide range of models for calculating the AMA, there was more flexibility to these approaches than under the new SMA. TSA and ASA were older approaches rather than variations of the SMA. AMA did account for internal losses. The SMA is non-model-based, whereas the AMA did incorporate bank-specific models

Key Point: Model Risk

● Types of Model Risk – Model Error

- ✧ Assume the distribution of the underlying asset is stationary (volatility).
- ✧ Underestimate the number of risk factors
- ✧ Perfect capital market assumption.
- ✧ Liquidity or rather the absence of liquidity
- ✧ Models be misapplied to a given situation.

● Types of Model Risk – Implementing a Model Wrongly

- ✧ Inaccurate data
- ✧ Inappropriate length of sampling period
- ✧ Problems with liquidity and the bid/ask spread

● Model Vetting

- ✧ Documentation
- ✧ Soundness of model
- ✧ Independent access to financial rates
- ✧ Benchmark modeling
- ✧ Health check and stress test the model
- ✧ Build a formal treatment of model risk into the overall risk management procedures, and periodically reevaluate model.

- **Case Study – The 2005 Credit Correlation Episode:** The critical flaw was that the correlation assumption was static.

- **Case Study – Subprime Default Models:** The models assumed positive future house price appreciation rates. Low (geographical) correlation assumption.
- **Case Study – London Whale Trading Loss:** Adopted an alternative VaR model which immediately lowered the VaR by 50% enabling the CIO not only to end its breach, but to engage in substantially more risky derivatives trading.
- **Case Study – LTCM:**
 - ✧ Time horizon for economic capital should be the time it takes to raise new capital or the time period over which a crisis scenario will unfold.
 - ✧ Liquidity risk is not factored into traditional static VaR models.
 - ✧ Correlation and volatility risks can be captured only through stress testing..

18. You are the head of the Independent Risk Oversight (IRO) unit of XYZ bank, Your first task is to review the following existing policies relating to model implementation.

- I. The remuneration of the staff of the IRO unit is dependent on how frequently the traders of XYZ bank use models vetted by the IRO.
- II. Model specifications assume that markets are perfectly liquid.

Which of the existing policies are sources of model risk?

- A. Statement I only
- B. Statement II only
- C. Both statements are correct
- D. Both statements are incorrect

Answer: B

I. Incorrect. Even though this is a risk that can increase exposure to model risk, the policy itself is regarding compensation and not the model itself.

II. Correct. This assumption can lead to major error where market liquidity is limited.

19. The risk management group estimates the 1-day 99% VaR on a long-only, large-cap equity portfolio using a variety of approaches. A daily risk report shows the following information:

1-day 99% VaR Estimates (by approach):

- Delta-normal VaR: 321,890
- Monte Carlo Simulation VaR: 353,851
- Historical Simulation VaR: 375,534

Which of the following is the most likely explanation for the variation in VaR estimates?

- A. Data problems
- B. Differences in model assumptions
- C. Endogenous model risk
- D. Programming errors

Answer: B

VaR measures will vary according to the approach (delta-normal, historical simulation, Monte Carlo simulation). The variation in these values does not suggest bigger problems with data or programming/implementation nor is there any reason to suspect endogenous model risk. (e.g., traders gaming the system to lower risk values)

20. The role of senior managers in managing model risk includes all of the following except

- A. Becoming expert modelers.
- B. Establishing an organizational framework that implements sound risk management procedures.
- C. Questioning model features.
- D. Understanding the fundamentals of model risk.

Answer: A

Senior managers need not be expert modelers, but they do need to understand the fundamentals of model risk so that they can ask the right questions and implement sound risk management procedures.

21. Which of the following actions could worsen rather than reduce model risk?

- A. Require documentation of the model so that the risk manager can produce the same prices as the user of the model.
- B. Use a simulation benchmark model to assess a model that has a closed-form solution.
- C. Make the model for the dynamics of the underlying fit past data better by making the price of the underlying depend on additional variables.
- D. Plot model prices against parameter values.

Answer: C

The other three are procedures that help to monitor the model and can help to reduce model risk.

22. Gamma Investments, LLC (Gamma) uses monthly model vetting to mitigate potential model risk. Gamma's managers recently accepted the use of a model for valuing short-term option on 30-year corporate bonds, but rejected the same model to value short-term options on three-year government bonds. The managers also frequently test proposed analytical models against a simulation approach. These model vetting techniques are examples of which of the following vetting phases?

- | | |
|------------------------------|-----------------------------------|
| Accepting/rejecting a model | Testing models against simulation |
| A. Health check of the model | Stress testing |
| B. Soundness of a model | Stress testing. |
| C. Health check of the model | Benchmark modeling |

D. Soundness of a model

Benchmark modeling

Answer: D

Accepting the model for one use but rejecting it for another (inappropriate) use is an example of vetting the soundness of the model. In other words, the model vetter (in this case the risk manager) should ensure that the mathematical model reasonably represents the asset being valued.

Testing a proposed analytical model against a simulation approach or a numerical approximation technique is an example of benchmark modeling.

Health check of the model ensures that the model contains all of the necessary properties.

Stress testing a model uses simulations to check the model's reaction to different situations.

23. A profitable derivatives trading desk at a bank decides that its existing VaR model, which has been used broadly across the firm for several years, is too conservative. The existing VaR model uses a historical simulation over a three-year look-back period, weighting each day equally. A quantitative analyst in the group quickly develops a new VaR model, which uses the delta normal approach. The new model uses volatilities and correlations estimated over the past four years using the RiskMetrics EWMA method.

For testing purposes, the new model is used in parallel with the existing model for four weeks to estimate the 1-day 95% VaR. After four weeks, the new VaR model has no exceedances despite consistently estimating VaR to be considerably lower than the existing model's estimates. The analyst argues that the lack of exceedances shows that the new model is unbiased and pressures the bank's model evaluation team to agree. Following an overnight examination of the new model by one junior analyst instead of the customary evaluation that takes several weeks and involves a senior member of the team, the model evaluation team agrees to accept the new model for use by the desk.

Which of the following statements about the risk management implications of this replacement is correct?

- A. Delta-normal VaR is more appropriate than historical simulation VaR for assets with non-linear payoffs.
- B. Changing the look-back period and weighting scheme from three years, equally weighted, to four years, exponentially weighted, will understate the risk in the portfolio.
- C. The desk increased its exposure to model risk due to the potential for incorrect calibration and programming errors related to the new model.
- D. A 95% VaR model that generates no exceedances in four weeks is necessarily conservative.

Answer: C

Given the quick implementation of the new VaR model and the insufficient amount of testing that

was done, the desk has increased its exposure to model risk due to the increased potential for incorrect calibration and programming errors. This situation is similar to the JP Morgan London Whale case in 2012, where a new VaR model was very quickly introduced for its Synthetic Credit Portfolio response to increasing losses and multiple exceedances of the earlier VaR model limit in the portfolio.

24. Which of the following scenarios is the best example of a model error?

- A. Assuming a non-normal distribution of returns.
- B. Assuming perfectly liquid markets.
- C. Assuming variable distribution of asset price.
- D. Assuming imperfect capital markets.

Answer: B

Six common model errors include: (1) assuming constant volatility, (2) assuming a normal distribution of returns, (3) underestimating the number of risk factors, (4) assuming perfect capital markets, (5) assuming adequate liquidity, and (6) misapplying a model.

25. Consider the following four statements about value at risk (VaR):

- I. If there were standardization of both the confidence interval and the time horizon, VaR estimates would be highly consistent across users.
- II. There is not much uniformity of practice as to confidence interval and time horizon; as a result, intuition on what constitutes a large or small VaR is underdeveloped.
- III. There are a number of computational and modeling decisions that can greatly influence VaR results, such as the length of time series used for historical simulation or to estimate moments; and the technique used for estimating moments.
- IV. There are a number of computational and modeling decisions that can greatly influence VaR results, such as mapping techniques and the choice of risk factors.

Which of the above statements is/are true?

- A. None are true.
- B. I and II are true.
- C. II, III, and IV are true.
- D. All are true.

Answer: C

The risk manager has a great deal of discretion in actually computing a VaR. The VaR techniques can be mixed and matched in different ways. Within each mode of computation, there are major variants, for example, the so-called “hybrid” approach of using historical simulation with exponentially weighted return observations. This freedom is a mixed blessing. On the one hand, the risk manager has the flexibility to adapt the way he is calculating VaR to the needs of the firm,

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its investors, or the nature of the portfolio.

On the other hand, it leads to two problems with the use of VaR in practice:

1. There is not much uniformity of practice as to confidence interval and time horizon; as a result, intuition on what constitutes a large or small VaR is underdeveloped.
2. Different ways of measuring VaR would lead to different results, even if there were standardization of confidence interval and time horizon. There are a number of computational and modeling decisions that can greatly influence VaR results, such as:

- ✧ Length of time series used for historical simulation or to estimate moments
- ✧ Technique for estimating moments
- ✧ Mapping techniques and the choice of risk factors, for example, maturity bucketing
- ✧ Decay factor if applying EWMA
- ✧ In Monte Carlo simulation, randomization technique and the number of simulations

26. Which of the following two model errors in the RMBS valuation and risk models are considered to have contributed the most to a significant underestimation of systematic risk in subprime RMBS returns during 2008-2009?

- A. The assumption of future house price appreciation and the assumption of high correlations among regional housing markets.
- B. The assumption of future house price declines and the assumption of high correlations among regional housing markets.
- C. The assumption of future house price appreciation and the assumption of low correlations among regional housing markets.
- D. The assumption of future house price declines and the assumption of low correlations among regional housing markets.

Answer: C

The two model errors considered to have contributed the most to a significant underestimation of systematic risk were (1) the assumption of future house price appreciation, and (2) the assumption of low correlations among regional housing markets.

27. About the long-equity tranche, short-mezzanine credit trade in 2005, Malz writes "A widespread trade among hedge funds, as well as proprietary trading desks of banks and brokerages, was to sell protection on the equity tranche and buy protection on the junior mezzanine tranche of the CDX.NA.IG. The trade was thus long credit and credit-spread risk through the equity tranche and short credit and credit-spread risk through the mezzanine. It was executed using several CDX.NA.IG series, particularly the IG3 introduced in September 2004 and the IG4 introduced in March 2005.

The trade was designed to be default-risk-neutral at initiation; by sizing the two legs of the

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trade so that their credit spread sensitivities were equal. The motivation of the trade was not to profit from a view on credit or credit spreads, though it was primarily oriented toward market risk. Rather, it was intended to achieve a positively convex payoff profile. The portfolio of two positions would then benefit from credit spread volatility. In addition, the portfolio had positive carry; that is, it earned a positive net spread. Such trades are highly prized by traders, for whom they are akin to delta-hedged long option portfolios in which the trader receives rather than paying away time value. "

But, of course, many of these traders suffered large losses. According to Malz, which of the following was the critical error in the trade?

- A. The model ignored correlation altogether
- B. The model failed to adequately capture and anticipate individual defaults
- C. The model assumed a static implied correlation: deltas were partial derivatives that did not account for changing correlation, which drastically altered the hedge ratio
- D. The recovery amount was at risk; in the event of a default on one or more of the names in the index, the recovery amount was not fixed but a random variable

Answer: C

Malz: "The relative value trade was set up in the framework of the standard copula model, using the analytics described in Chapter 9. These analytics were simulation-based, using riskneutral default probabilities or hazard-rate curves derived from single-name CDS. The timing of individual defaults was well modeled. Traders generally used a normal copula. The correlation assumption might have been based on the relative frequencies of different numbers of joint defaults, or, more likely, on equity return correlations or prevailing equity implied correlations, as described at the end of Chapter 10.

In any event, the correlation assumption was static. This was the critical flaw, rather than using the 'wrong' copula function, or even the 'wrong' value of the correlation. The deltas used to set the proportions of the trade were partial derivatives that did not account for changing correlation. Changing correlation drastically altered the hedge ratio between the equity and mezzanine tranches, which more or less doubled to nearly 4 by July 2005. In other words, traders needed to sell protection on nearly twice the notional value of the mezzanine tranche in order to maintain spread neutrality in the portfolio.... The model did not ignore correlation, but the trade thesis focused on anticipated gains from convexity. The flaw in the model could have been readily corrected if it had been recognized. The trade was put on at a time when copula models and the concept of implied correlation generally had only recently been introduced into discussions among traders, who had not yet become sensitized to the potential losses from changes in correlation. Stress testing correlation would have revealed the risk. The trade could also have been hedged against correlation risk by employing an overlay hedge: that is, by going long single-name

protection in high default-probability names. In this sense, the 'arbitrage' could not be captured via a two-leg trade, but required more components."

28. Which of the following flaws in Long-Term Capital Management's (LTCM) value at risk (VaR) calculations were most evident following its collapse in 1998?

- I. The calculated 10-day VaR period was too short.
 - II. The fund's VaR model assumed strong positive correlation.
- A. I only.
 - B. II only.
 - C. Both I and II.
 - D. Neither I nor II.

Answer: A

LTCM's collapse highlighted several flaws in its regulatory VaR calculations. The fund relied on a VaR model that: (1) used a 10-day horizon, which proved to be too short to sufficiently model the time to raise new capital, (2) did not factor in liquidity risk (in other words, it assumed markets were perfectly liquid), and (3) did not incorporate correlation and volatility risks, where in fact markets exhibited strong positive correlation during periods of stress in 1997 and 1998.

Key Point: Validating Rating Models

- **Qualitative and Quantitative Processes**

✧ Qualitative validation ensures proper application of quantitative methods and proper usage of ratings. Quantitative validation comprises validation procedures of ratings in which statistical indicators are calculated and interpreted on the basis of an empirical dataset.

- **Qualitative Validation – Rating Systems Design**

- ✧ Obtaining PD
- ✧ Completeness
- ✧ Objectivity
- ✧ Acceptance
- ✧ Consistency

- **Qualitative Validation – Data Quality**

- ✧ Completeness of data
- ✧ Volume of available data
- ✧ Representativeness of samples
- ✧ Consistency and integrity of data sources
- ✧ Adequacy of procedures used to ensure data quality

- **Quantitative Validation**

- ✧ Sample representativeness
- ✧ Discriminatory power
- ✧ Dynamic properties
- ✧ Calibration

29. Which of the following areas of quantitative validation would focus on rating systems stability?

- A. Sample representativeness.
- B. Dynamic properties.
- C. Discriminatory power.
- D. Obtaining PD

Answer: B

Dynamic properties include rating systems stability and attributes of migration matrices. Calibration looks at the relative ability to estimate probability of default (PD). Discriminatory power is the relative ability of a rating model to accurately differentiate between defaulting and non-defaulting entities for a given forecast period. Sample representativeness is demonstrated when a sample from a population is taken and its characteristics match those of the total population.

Key Point: Liquidity Risk

- Liquidity Risk
 - ✧ Transaction liquidity risk
 - ✧ Balance Sheet Risk or Funding Liquidity Risk
 - ✧ Systemic Risk
- Liquidity-Adjusted VaR

$$\text{spread} = \frac{(\text{ask price} - \text{bid price})}{(\text{ask price} + \text{bid price})/2}$$

$$\text{LVAR} = V(z_{\alpha} \times \sigma - \mu) + \frac{1}{2} \times S \times V$$

$$\text{LVAR} = V(z_{\alpha} \times \sigma - \mu) + \frac{1}{2} \times V \times (\mu_s + z_{\alpha}' \times \sigma_s)$$

$$\text{LVAR} = \text{VaR} \times \left(1 - \frac{\Delta P}{P}\right) = \text{VaR} \times \left(1 - E \times \frac{\Delta N}{N}\right)$$

30. Which of the following statements regarding liquidity risk is correct?

- A. Asset liquidity risk arises when a financial institution cannot meet payment obligations.
- B. Flight to quality is usually reflected in a decrease in the yield spread between corporate

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and government issues.

- C. Yield spread between on-the-run and off-the-run securities mainly captures the liquidity premium, and not the market and credit risk premium.
- D. Funding liquidity risk can be managed by setting limits on certain asset markets or products and by means of diversification.

Answer: C

The yield spread between on-the-run and off-the-run reflects a liquidity premium.

Because the bonds are otherwise nearly identical. In answers a. and d., asset and funding risk should be interchanged. Finally, for b., a flight to quality increases the yield spread.

31. Gilbert has been analyzing bid-ask spreads on over-the-counter equities for the last several years in his job as an equity analyst. He notes that with the exception of the 2007—2008 financial crisis, spreads have generally narrowed over his period of study. If Gilbert is correct, this is an indication that
- A. Liquidity has improved over the period.
 - B. The market has become more resilient over the period.
 - C. The depth of the market has improved over the period.
 - D. Credit risk has fallen over the period.

Answer: A

Factors such as tightness, depth, and resiliency are characteristics used to measure market liquidity. Tightness (Or width) refers to the cost of a round-trip transaction, measured by the bid-ask spread and brokers' commissions. The narrower the spread, the tighter it is. The tighter it is, the greater the liquidity. Depth describes how large an order must be to move the price adversely. In other words, can the market absorb the sale? Resiliency refers to the length of time it takes "lumpy orders" to move the market away from the equilibrium price. In other words, what is the ability of the market to "bounce back" from temporary incorrect prices? In this case, narrowing spreads is indicative of a more liquid market.

32. The owner of USD 200 million portfolio wants to estimate the 1-day 99% liquidity-adjusted VaR using the random spread approach. The portfolio daily mean return is zero with daily volatility of 1.4%. The bid-ask spread on the portfolio has a daily mean of 0.1% and standard deviation of 0.2%. If the confidence parameter of the spread is equal to 3, what is the daily liquidity cost adjustment that should be added to VaR?
- A. USD 0.30 million
 - B. USD 0.60 million
 - C. USD 0.70 million
 - D. USD 1.50 million

Answer: C

33. You are a manager of a renowned hedge fund and are analyzing a 1,000 share position in an undervalued but illiquid stock BNA, which has a current stock price of USD 80 (expressed as the midpoint of the current bid-ask spread). Daily return for BNA has an estimated volatility of 1.54%. The average bid-ask spread is USD 0.10. Assuming returns of BNA are normally distributed, what is the estimated liquidity-adjusted daily 95% VaR, using the constant spread approach?

- A. USD 1,389
- B. USD 2,076
- C. USD 3,324
- D. USD 4,351

Answer: B

The constant spread approach adds half of the bid-ask spread (as a percent) to the VaR calculation:

Daily 95% VaR = $80,000 (1.645 \times 0.0154) = \text{USD } 2026.64$

Liquidity cost (LC) = $80,000 \times (0.5 \times 0.10/80) = 50$

LVaR = VaR + LC = 2076.64

34. Suppose that portfolio XYZ has a \$1,000,000 portfolio invested in a stock that has a daily standard deviation of 2%. The current bid-ask spread of that stock is 1%. Assuming a constant spread, what is the liquidity-adjusted VaR (LVaR) at the 95% confidence level?

- A. \$5,000
- B. \$38,000
- C. \$44,200
- D. \$43,000

Answer: B

35. You are holding 100 SkyTrek Company shares with a current price of \$30. The daily mean and volatility of the stock return are 2% and 3%, respectively. VaR should be measured relative to initial wealth. The bid-ask spread of the stock varies over time, and the daily mean and volatility of this spread are 0.5% and 1%, respectively. The return are normally distributed. What is the daily liquidity-adjusted VaR (LVaR) at a 99% confidence level assuming the confidence parameter of the spread is equal to 2.58?

- A. \$193.15
- B. \$172.62
- C. \$103.50
- D. \$195.90

Answer: D

36. Assuming the following parameters: $\mu = 0$, $\sigma = 0.006$, spread = 0.01, and a 95% confidence level, the ratio of LVaR to VaR (lognormal VaR) is closest to:

- A. 1.08
- B. 1.51
- C. 1.66
- D. 2.04

Answer: B

37. Major Investments is an asset management firm with USD 25 billion under management. It owns 20% of the stock of a company. Major Investments' risk manager is concerned that, in the event the entire position needs to be sold, its size would affect the market price. His estimate of the price elasticity of demand is -0.5. What is the increase in Major Investments' Value-at-Risk estimate for this position if a liquidity adjustment is made?

- A. 4%
- B. 10%
- C. 15%
- D. 20%

Answer: B

What is needed is a liquidity adjustment that reflects the response of the market to a possible trade.

The formula to use is the ratio of LVaR to VaR

$$\frac{\text{LVaR}}{\text{VaR}} = 1 - \frac{\Delta P}{P} = 1 - E \frac{\Delta N}{N}$$

The ratio of LVaR to VaR depends on the elasticity of demand E and the size of the trade, relative to the size of the market ($\Delta N/N$). We are given: $\Delta N/N = 0.2$ and that the price elasticity is -0.5.

Thus $\Delta P/P = \text{elasticity} \times \Delta N/N = -0.1$. Therefore $\text{LVaR}/\text{VaR} = 1 - \Delta P/P = 1 + 0.1 = 1.1$

The liquidity adjustment increases the VaR by 10%.

38. Dowd defines a ratio of LVaR/VaR. Which of the following should be true about this ratio?

- A. It should fall in proportion with the assumed spread
- B. It should fall as the confidence level increases
- C. It should rise as the holding period increases
- D. It should be invariant to assumed spread, confidence level and holding period

Answer: B

Dowd: "It is easy to show that the liquidity adjustment (a) rises in proportion with the assumed spread, (b) falls as the confidence level increases, and (c) falls as the holding period increases. The

first and third of these are obviously ‘correct’, but the second implication is one that may or may not be compatible with one’s prior expectations.”

39. A risk manager who has been using a lognormal VaR as the risk measure is considering the inclusion of liquidity into the measure. He decides to use the constant spread approach. Which combination of confidence level and holding period will result in the highest ratio of LVaR to VaR?

	Confidence Level	Holding Period
A.	95%	1-day
B.	99%	1-day
C.	95%	10-day
D.	99%	10-day

Answer: A

40. Which of the following factors might be (or are likely to be) incorporated into a liquidity-adjusted value at risk (LVaR) model where the liquidity risk is specifically endogenous, not exogenous?

- I. Bid-ask spread
 - II. Size of the trade/size of market
 - III. Price elasticity of demand
- A. I only
 - B. II Only
 - C. I and II.
 - D. II and III.

Answer: D

Dowd’s basic approach uses (i) size of the trade/size of market and (ii) price elasticity of demand. The bid-ask spread can be used (is used in the basic approach) to incorporate exogenous liquidity.

41. Jeremy Park and Brian Larksen are both portfolio managers who hold identical long positions worth GBP 100 million in the FTSE 1000 index. To hedge their respective portfolios, Park shorts TSE 1000 futures contracts while Larksen buys put options on the FTSE 1000. Who has a higher Liquidity-at-Risk (LaR) measure?

- A. Larksen
- B. Park
- C. Both have the same LaR
- D. Insufficient information to determine

Answer: B

The futures positions are exposed to margin calls in the event that the FTSE 1000 increases. Park, with the short futures position, is thus exposed more to liquidity risk (cash flow risk). The Park portfolio, hedged with the short futures contract, will thus have the higher LaR.

42. The CEO of a regional bank understands that failing to anticipate cash flow needs is one of the most serious errors that a firm can make and demands that a good liquidity-at-risk (LaR) measurement system be an essential part of the bank's risk management framework. Which of the following statements concerning LaR is correct?
- A. Reducing the basis risk through hedging decreases LaR.
 - B. Hedging using futures has the same impact on LaR as hedging using long option positions.
 - C. For a hedged portfolio, the LaR can differ significantly from the VaR.
 - D. A firm's LaR tends to decrease as its credit quality declines.

Answer: C

The LaR can differ substantially from the VaR in a hedged portfolio, and in different situations can be larger or smaller than the VaR. For example, consider a portfolio where futures contracts are used to hedge. While the hedge can reduce the VaR of the portfolio, the LaR can be larger than the VaR as the futures contracts create an exposure to margin calls and the potential for cash outflows. Alternatively, in situations where the hedging instruments do not result in potential cash outflows over the measurement period (e.g., a portfolio of European options which do not expire during the period), the LaR can be smaller than the VaR.

Key Point: Repurchase Agreements

- Repurchase agreements, or repos, are bilateral contracts where one party sells a security at a specified price with a commitment to buy back the security at a future date at a higher price.
- Repo refers to the transaction from the borrower's side; that is, from the side that sold the security with a promise to buy it back. When we examine the same transaction from the lender's side, the transaction is referred to as a reverse repurchase agreement.
- Settlement Calculation

$$\text{Re purchase Price} = \text{Contract Price} \times \left(1 + \frac{\text{Interest Rate} \times \text{Maturity}}{360} \right)$$

- General Collateral vs. Special Collateral

43. Pasquini Investments (Pasquini) is a private brokerage looking for 30-day financing of \$25 million of its accounts payable but is unsure whether the appropriate investment is a term repurchase agreement (repo) or a term reverse repo agreement. Pasquini is willing to post AAA-rated government bonds as collateral. The bonds have a face value of \$27 million and a

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market value of \$25 million. The firm is quoted a rate of 0.5% for the transaction. Which of the following choices most accurately reflects the contract type and the repurchase price needed by Pasquini?

	Contract type	Repurchase price
A.	Repo	\$27,011,250
B.	Reverse Repo	\$25,010,417
C.	Repo	\$25,010,417
D.	Reverse Repo	\$27,011,250

Answer: C

Given that Pasquini is a borrower in the repo market, the transaction is a repo from the perspective of the firm (but a reverse repo from the perspective of the lender). The repurchase price is calculated as follows:

$$\$25,000,000 \times (1 + 0.5\% \times 30/360) = \$25,010,417$$

44. At initiation of a repurchase agreement (repo), counterparty A sells a security to counterparty B for settlement on June 1st, 2015 at an invoice price of USD 180 million. At the same time, counterparty A agrees to repurchase the security three months later, for settlement on September 1st, 2015, at a purchase price equal to the original invoice price plus interest at a repo rate of 0.90%. Using the actual/360 convention of most money market instruments, which is nearest to the repurchase price?

- A. \$414,000
- B. \$180,000,000
- C. \$180,414,000
- D. \$181,620,000

Answer: C

$$180,000,000 \times (1 + 0.0090 \times 92/360) = \$180,414,000$$

45. In a presentation to management, a bond trader makes the following statements about repo collateral:

Statement 1: The difference between the federal funds rate and the general collateral rate is the special spread.

Statement 2: During times of financial crises, the spread between the federal funds rate and the general collateral rate widens.

Which of the trader's statements are accurate?

- A. Both statements are incorrect.
- B. Only statement 1 is correct.
- C. Only statement 2 is correct.

D. Both statements are correct.

Answer: C

The trader's first statement is incorrect. The difference between the federal funds rate and the general collateral (GC) rate is known as the fed funds-GC spread. The special spread is the difference between the GC rate and the special rate for a particular security.

The trader's second comment is correct. During times of financial crises, the spread between the federal funds rate and the general collateral rate widens as the willingness to lend Treasury securities declines, lowering the GC rate (thereby increasing the spread).

46. In contrast to general collateral (GC) repo rates, which of the following is true about special repo rates?

- A. Special rates are typically less than general collateral rates.
- B. If the counterparty's primary motivation is to lend cash rather than borrow a security, the special rate applies.
- C. Special rates are well-suited to repo investors who are looking to obtain the highest rate for the collateral they are willing to accept.
- D. The most commonly cited special rates are for overnight repos where any U.S. Treasury collateral is acceptable.

Answer: A

Repo trades can be divided into those using general collateral (GC) and those using special collateral or specials. In the former, the lender of cash is willing to take any particular security, although the broad categories of acceptable securities might be specified with some precision. In specials trading, the lender of cash initiates the repo in order to take possession of a particular security.

Key Point: Risk-Adjusted Return on Capital and Economic Capital

- The RAROC measure is essential to successful integrated risk management. Its main function is to relate the return on capital to the riskiness of firm investments. The RAROC is the risk-adjusted return divided by risk-adjusted capital (e.g., economic capital).

$$\text{RAROC} = \frac{\text{revenues} - \text{EL} - \text{expenses} + \text{return on economic capital} \pm \text{transfer price}}{\text{economic capital}}$$

- The hurdle rate is computed as follows:

$$h_{AT} = \frac{(CE \times R_{CE}) + (PE \times R_{PE})}{CE + PE}$$

- ✧ If RAROC > hurdle rate, there is value creation from the project and it should be accepted.
- ✧ If RAROC < hurdle rate, there is value destruction from the project and it should be rejected.

- An adjusted RAROC (ARAROC) measure was developed to better align the risk of the business with the risk of the firm's equity.

$$\text{Adjusted RAROC} = \text{RAROC} - \beta_E(R_M - R_F)$$

- ✧ If adjusted RAROC $> R_F$, then accept the project
- ✧ If adjusted RAROC $< R_F$, then reject the project

47. Suppose that a business line of a bank has a loan book of USD 100 million. The average interest rate is 10%. The book is funded at a cost of USD 5.5 million. The economic capital against these loans is USD 7.5 million (7.5% of the loan value) and is invested in low risk securities earning 5.5% per annum. Operating costs are USD 1.5 million per annum and the expected loss on this portfolio is assumed to be 1% per annum (i.e., USD 1 million). The firm's cost of capital is 15%. The RAROC for this business line is:

- A. 26.7%
- B. 37.1%
- C. 21.2%
- D. 32.2%

Answer: D

The RAROC for this business line is:

Risk-adjusted return / Risk-adjusted capital = $(100 \times 0.1 - 5.5 - 1.5 - 1 + 7.5 \times 0.055) / 7.5 = 2.4125 / 7.5 = 32.2\%$

48. A risk manager is considering a HKD 400 million loan that will be fully funded by deposits paying an average annual interest rate of 1.0%. The risk manager has estimated the following regarding the loan:

Expected annual revenue:	HKD 16 million
Expected loss:	HKD 1.0 million
Unexpected loss:	HKD 48.0 million
Economic capital required:	HKD 47.0 million
Annual operating expenses:	HKD 2.0 million

Assuming the economic capital can be invested so that it earns 2% per year, the risk manager correctly calculates the risk-adjusted return on capital (RAROC) to be 21.1%. Assuming nothing else changes, which of the following would increase the RAROC estimate the most?

- A. Annual operating expenses decrease by 50%.
- B. Expected annual revenue increases by 20%.
- C. The economic capital can be invested so that it earns 4% per year.

D. The loan is fully funded by deposits paying an average annual interest rate of 0.5%.

Answer: B

	Initial	Operating Expenses ↓	Revenue ↑	Return on EC ↑	Interest Expenses ↓
Expected Revenue	16.00	16.00	19.2	16.00	16.00
Return on EC	0.94	0.94	0.94	1.88	0.94
Interest Expenses	4.00	4.00	4.00	4.00	2
Operating Expenses	2.00	1	2.00	2.00	2.00
Expected Loss	1.00	1.00	1.00	1.00	1.00
EC	47.00	47.00	47.00	47.00	47.00
RAROC	21.15%	23.28%	27.96%	23.15%	25.40%

49. Which of the following statements regarding the risk-adjusted return on capital (RAROC) methodology is correct?

- A. In the context of performance measurement, RAROC uses accounting profits.
- B. In the numerator of the RAROC equation, expected loss is added to the return.
- C. If a business unit's cost of equity is greater than its RAROC, then the business unit is not adding value to shareholders.
- D. RAROC is useful for determining incentive compensation but it lacks the flexibility to consider deferred or contingent compensation.

Answer: C

The cost of equity represents the minimum rate of return on equity required by shareholders. Therefore, if RAROC is below the cost of equity, then there is no value being added.

50. Widget, Inc. is considering an investment in a new business line. The company calculates the RAROC for the new business line to be 12%. Suppose the risk-free rate is 5%. The expected rate of return on the market is 11.0%. And the systematic risk of the company is 1.5. If the company only invests in new businesses for which the ARAROC (adjusted RAROC) exceeds the expected excess rate of return on the market. What return will this new business earn for Widget, Inc.?

- A. 0.0%
- B. 12.0%
- C. 4.7%
- D. 6.0%

Answer: A

Since $ARAROC < r_f$, we reject the project.

51. Assume a bank's \$2.0 billion corporate loan portfolio offers a return of 6% per annum. The expected loss on the portfolio is estimated to be 1.5% per annum; i.e., \$30 million. The portfolio is funded by \$2 billion in retail deposits with a transfer-priced interest rate charge of

2%. The bank has a direct operating cost of \$16 million per annum and an effective tax rate of 25%. Risk analysis of unexpected losses associated with the portfolio tell us we need to set aside economic capital of \$200 million against the portfolio; i.e., 10% of the loan amount. The bank's economic capital must be invested in risk-free securities and, unfortunately in the regime of ultra low interest rates, the risk-free rate on government securities is only 1%. Although the loan portfolio's risk-adjusted return on capital (RAROC) is positive and seemingly high, the bank wants to adjust the traditional RAROC calculation to obtain a RAROC measure that takes into account the systemic riskiness of the expected returns. If the risk-free rate is 1%, and the expected rate of return on the market portfolio is 8% such that the equity risk premium is 7%, and the beta of the firm's equity is 1.6, which of the following is the correct adjusted RAROC and is the project advisable?

- A. RAROC is 6.25% but no, the project is bad because ARAROC is below the risk-free rate.
- B. RAROC is 8% but no, the project is bad because ARAROC is below the risk-free rate.
- C. RAROC is 9.8% and yes, the project is good because ARAROC is above the risk-free rate.
- D. RAROC is 13.5% and yes, the project is good because ARAROC is above the risk-free rate.

Answer: D

Expected revenue = \$2.0 billion loan portfolio \times 6.0% = \$120.0 million

Expected losses = \$2.0 billion loan portfolio \times 1.5% = \$30.0 million

Interest expense = \$2.0 billion borrowed funds \times 2.0% = \$40.0 million

Operating cost = \$16.0 million (given as an assumption)

Economic capital = \$200.0 million = 10.0% \times \$2.0 billion (given as an assumption)

Return on economic capital (EC) = \$2.0 million = \$200.0 EC \times 1.0%

Tax rate = 0.25 (given as assumption)

Such that RAROC = $[(\$120.0 - 30.0 - 40.0 - 16.0 + 2.0) \times (1.0 - 0.25 \text{ tax rate})] / 200.0 = 13.50\%$

Adjusted RAROC = RAROC - $\beta(e) \times [R(m) - R_f] = 13.50\% - 1.60 \times [8.0\% - 1.0\%] = 2.30\%$ and 2.30% is greater than the risk-free rate.

52. Which of the following statements is most likely correct?

- A. The internal controls policy of BHCs requires that senior management should furnish the board of directors with sufficient information to comprehend the BHC risk exposures.
- B. A governance policy offers fundamental guidelines and principles to BHCs for the capital issuance, use, distribution, and planning purposes.

- C. Suspension or reduction in dividends or repurchase programs do not fall under the capital policy of BHCs.
- D. Designing and testing a scenario-related default of a major counterparty is an example of BHC stress testing and a stress scenario design policy.

Answer: D

The first statement is the requirement of the governance policy and not the internal control policy. The second statement falls under capital policy and not the governance policy. Regarding the third statement, capital contingency plans (e.g., suspension or reduction in dividends or repurchase programs) are a key part of capital policies of BHCs detailing the actions intended to be taken under deficiencies in capital position. The fourth statement is correct. Many different scenarios, including counterparty default, fall under the BHCs stress testing and scenario design policy.

Key Point: Enterprise Risk Management (ERM) and Firm-wide VaR

- In developing an ERM system, management should follow the following framework:
 - ✧ Determine the firm's acceptable level of risk.
 - ✧ Based on the firm's target debt rating, estimate the capital (i.e., buffer) required to support the current level of risk in the firm's operations.
 - ✧ Determine the ideal mix of capital and risk that will achieve the appropriate debt rating.
 - ✧ Give individual managers the information and the incentive they need to make decisions appropriate to maintain the risk/capital trade-off.
- Firm-wide VaR
 - ✧ Firms that use value at risk (VaR) to assess potential loss amounts will have multiple VaR measures to manage.
 - ✧ Market risk, credit risk, and operational risk will each produce its own VaR measures.
 - ✧ Due to diversification effects, firm-wide VaR will be less than the sum of the VaRs from each risk category.

53. In its efforts to enhance its enterprise risk management function, Countryside Bank introduced a new decision-making process based on economic capital that involves assessing sources of risk across different business units and organizational levels. Which of the following statements regarding the correlations between these risks is correct?
- A. Correlations between the risks in the asset and liability sides of the balance sheet can be changed by management decisions.
 - B. Generally, correlations between broad risk types such as credit, market, and operational risk are well understood and are easy to estimate at the individual firm level.
 - C. Correlations between business units are only relevant in deciding total firm-wide

economic capital levels and are not relevant for decisions at the individual business unit or project level.

- D. The introduction of correlations into firm-wide risk evaluation will result in a total VaR that, in general, is greater than or equal to the sum of individual business unit VaRs.

Answer: A

Management has the ability to influence the correlations between these risks by changing the asset/Liability mix, so management decision-making is indeed quite relevant.

54. While building the bank's enterprise risk management system, a risk analyst takes an inventory of firm risks and categorizes these risks as market, credit, or operational. Which of the following observations of the bank's data should be considered unexpected if compared to similar industry data?

- A. The operational risk loss distribution has a large number of small losses and therefore, a relatively low mode.
B. The operational risk loss distribution is symmetric and fat-tailed.
C. The credit risk distribution is asymmetric and fat-tailed.
D. The market risk distribution is similar to the distribution of the return on a portfolio of securities.

Answer: B

Statements (A), (C), and (D) are consistent with industry data. However, with operational risk, there tends to be large numbers of small losses and a small number of large losses, so the distribution is asymmetric (and fat-tailed)

55. ABC Company is implementing the enterprise risk management framework to quantify and manage the risk-return tradeoff for the entire firm. Which of the following statements about the ERM framework is/are correct?

- I. The performance of each business unit should be evaluated on a stand-alone basis and the unit should be allocated more capital if its net income is positive.
II. The ERM framework tries to minimize the aggregate risk taken by the firm.
A. Statement I only
B. Statement II only
C. Both statements are correct.
D. Both statements are incorrect.

Answer: D

56. A bank holds a portfolio of loans denominated in a foreign currency. The banks separately measures the credit risk and market risk of the portfolio, then determines the portfolio's

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economic capital by adding (aggregating) the two risk components. Specifically, the bank determines the portfolio's economic capital is \$30 million because the market risk component is \$10 million per a value at risk method and the credit risk component is \$20 million per a CVaR method. Consider four statements about this aggregation:

- I. As VaR is not subadditive, it is technically possible for the portfolio's VaR to exceed \$10 plus \$20 million.
- II. As this summation implicitly assumes zero correlation (and zero covariance) between market and credit risk, if their correlation is actually positive, \$30 million understates economic capital.
- III. There may be “wrong way” risk between the credit and market risk components, in which case the portfolio's economic capital may be higher than \$30 million.
- IV. VaR is a quantile, not a tail risk measure. Expected shortfall (ES) should be used, in which case, by definition the portfolio's economic capital (EC) must be higher than \$30 million.

Which of the above are true?

- A. I only
- B. I and III
- C. II and IV
- D. All four

Answer: B

The most important point is the wrong-way risk: “A more important reason why aggregate risk may be larger than the sum of its components is independent of the choice of metric (i.e. it applies to metrics other than VaR) and relates to the economic underpinnings of the portfolios that are pooled. The logic outlined above assumes that covariance (a linear measure of dependence) fully captures and summarizes the dependencies across risks. While this may be a reasonable approximation in many cases, there are instances where the risk interactions are such that the resulting combination may represent higher, not lower, risk. For example, measuring separately the market and credit risk components in a portfolio of foreign currency denominated loans can underestimate risk, since probabilities of obligor default will also be affected by fluctuation in the exchange rate, giving rise to a compounding effect. Similar types of “wrong-way” interactions could occur in the context of portfolio positions that may be simultaneously affected by directional market moves and the failure of counterparties to a hedging position. From a more “macro” perspective, asset price volatility often interacts with the risk appetite of market participants and feeds back to market liquidity leading to a magnification of risk rather than diversification.”

In regard to (II), this is false: summation assumes perfect correlation (1.0) not independence. Summation confers no diversification benefit.

In regard to (IV), VaR is a quantile but that neither disqualifies it, per se, as a tail risk measure nor as a EC metric; e.g., a 99.9% VaR is likely higher than a 95% ES.

Key Point: Information Risk and Data Quality Management (New)

● Key Dimensions of Data Quality

- ✧ Accuracy
- ✧ Completeness
- ✧ Consistency
- ✧ Reasonableness
- ✧ Currency
- ✧ Uniqueness

● Data Quality Scorecard

- ✧ Simple metrics based on measuring against defined dimensions of data quality can be referred to as “base-level” metrics, and they quantify specific observance of acceptable levels of defined data quality rules.
 - ✧ Complex metric representing a rolled-up score computed as a function (such as a sum) of applying specific weights to a collection of existing metrics, both base-level and complex. Complex data quality metrics can be accumulated for reporting in a scorecard in one of three different view: by issue, by business process, or by business impact (Data Quality Issues View; Business Process View; Business Impact View).
-

57. Which of the following data issues is likely to increase risk for an organization?

- I. Data transformations.
 - II. Duplicate records.
 - III. Data normalization.
 - IV. Nonstandard formats.
- A. I and II
 - B. only III
 - C. I, II and IV
 - D. II and IV

Answer: C

Data normalization is a process to better organize data in order to minimize redundancy and dependency, so it is least likely to increase risk. All of the other data issues are likely to increase risk, especially complex data transformations.

58. Which of the following viewpoints regarding data quality scorecards is/are best described as

providing a high-level understanding of the risks embedded in data quality problems?

- I. Data process issues view.
- II. Business impact view.
- III. Business process view.
- IV. Data quality issues view.
- A. I and II
- B. Only II
- C. I, II and III
- D. II and IV

Answer: B

With the business impact view, the scorecard provides a high-level understanding of the risks embedded in data quality problems (i.e., a combined and summarized view). It considers various data quality problems that occur in various business processes.

Key Point: Guidance on Managing Outsourcing Risk (new)

● **Risks Arising through Outsourcing Activities**

- ✧ Compliance risks
- ✧ Concentration risks
- ✧ Reputational risks
- ✧ Country risks
- ✧ Operational risks
- ✧ Legal risks

● **Core Elements of Effective Programs**

- ✧ Risk assessments
 - ✧ Due diligence and selection of service providers
 - ✧ Contract provisions and considerations
 - ✧ Incentive compensation review
 - ✧ Oversight and monitoring of service providers
 - ✧ Business continuity and contingency plans
-

59. ABC Bank operates in the US and has a service contract in place with XYZ (Service), which operates in France. Service manages a significant amount of confidential customer data for Bank, and recently a computer glitch at Service resulted in the accidental public disclosure of confidential customer data. As a result of the data breach, which of the following risks is Bank least likely to face?
- A. Legal risk.

- B. Credit risk.
- C. Operational risk.
- D. Country risk.

Answer: D

Country risk refers to using a service provider based in a foreign country and subjecting the financial institution to potential economic and political risks in that country. Clearly, it is not a relevant risk arising from the breach of confidential customer data. Compliance risk is a possibility given the apparent lack of security controls of the service provider that resulted in the data breach. Operational risk is clearly a relevant risk to the financial institution here given the data breach caused by the service provider. Legal risk is clearly a relevant risk given that the customers affected by the data breach may sue the financial institution as a result of the breach.

Key Point: Stress Test

Problem of coherence when designing scenarios: problems are inherently multi-factored, making it more difficult to design a coherent stress test. It is not sufficient to specify one potential problem because the others do not remain fixed.

60. Piper Hook, a bank examiner, is trying to make sense of stress tests done by one of the banks she examines. The stress tests are multi-factored and complex. The bank is using multiple extreme scenarios to test capital adequacy, making it difficult for Hook to interpret the results. One of the key stress test design challenges that Hook must deal with in her examination of stress tests is:
- A. Multiplicity
 - B. Efficiency
 - C. Coherence
 - D. Efficacy

Answer: C

61. Nordlandia is a country with a developed economy maintaining its own currency, the Nordlandian crown (NLC), and whose most important export is domestically produced oil and natural gas. In a recent stress test of Nordlandia's banking system, several scenarios were considered. Which of the following is most consistent with being part of a coherent scenario?
- A. An increase in domestic inflation and appreciation of the NLC.
 - B. A significant increase in crude oil prices and a decrease in the Nordlandian housing price index.
 - C. A drop in crude oil prices and appreciation of the NLC.

D. A sustained decrease in natural gas prices and a decrease in the Nordlandian stock index.

Answer: D

A scenario is coherent when a change in one factor influences other factors in a logical manner. In this case, choice d is a coherent scenario since the Nordlandian economy depends heavily on exports of oil and natural gas, so therefore a sustained decrease in natural gas prices should lead to a decrease in stock prices as the domestic economy weakens. In stress testing banks, it is often challenging to develop scenarios where all factors behave coherently.

Key Point: The Failure Mechanics of Dealer Banks

- Large dealer banks are active participants in over-the counter (OTC) derivatives, repo, and securities markets. Their functions in these markets, as well as asset managers and prime brokers, result in a variety of liquidity risks when their solvency is questioned and counterparties reduce their exposure with them.
- Failure Mechanism:
 - ✧ Reaction by OTC Derivative counterparties: reduce exposure
 - ✧ Flight of short-term creditors: repurchase agreements counterparties can raise haircuts
 - ✧ Flight of prime brokerage clients
 - ✧ Loss of cash settlement privileges: clearing bank

62. In recent years, large dealer banks financed significant fractions of their assets using short-term, often overnight repurchase (repo) agreements in which creditors held bank securities as collateral against default losses. The table below shows the quarter-end financing of four broker-dealer banks. All values are in USD billions:

	Bank A	Bank B	Bank C	Bank D
Financial instruments owned	823	629	723	382
Pledged as collateral	272	289	380	155

In the event that repo creditors become nervous about a bank's solvency, which bank is least vulnerable to a liquidity crisis?

- A. Bank A
- B. Bank B
- C. Bank C
- D. Bank D

Answer: A

A liquidity crisis could materialize if repo creditors become nervous about a bank's solvency and choose not to renew their positions. If enough creditors choose not to renew, the bank could likely be unable to raise sufficient cash by other means on such short notice, thereby precipitating a crisis. However, this vulnerability is directly related to the proportion of assets a bank has pledged

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as collateral.

Bank A is least vulnerable since it has the least dependence on short-term repo financing (i.e. the lowest percentage of its assets out of the four banks is pledged as collateral: 272/823, or 33%.

63. The classic bank run occurred when depositors became nervous about the solvency of a bank and raced to withdraw their money, which prompted other depositors to take similar action. In recent years, dealer banks have experienced new forms of bank runs which have quickly eroded their liquidity position and ultimately caused their failure. Which of the following describes a key mechanism which leads to the failure of a dealer bank in this modern version of bank run?
- A. A large group of a dealer bank's repo creditors simultaneously renew their positions.
 - B. Many of a dealer bank's prime brokerage clients sell securities in order to increase their cash balance.
 - C. A significant portion of a dealer bank's over-the-counter derivatives counterparties reduce their exposure to the dealer.
 - D. The clearing bank of a dealer bank continues making cash payments to the dealer.

Answer: C



2017 FRM Part II

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2017 年 5 月

Basel Accord

Key Point: Three Pillar

Pillar 1: Minimum Capital Requirements

● Capital Ratio:

$$\frac{\text{Total Capital}}{\text{Credit Risk} + \text{Market Risk} + \text{Operational Risk}} = \text{Bank's Capital Ratio} \geq 8\%$$

$$\frac{\text{Total Capital}}{\text{RWA}_{\text{Credit}} + (\text{MRC}_{\text{Market}} \times 12.5) + (\text{ORC}_{\text{Opri}} \times 12.5)} \geq 8\%$$

● Capital Requirements:

Basel III increases the minimum capital ratio for core tier 1 capital from 2% to 4.5%. Tier 1 capital is increased from 4% to 6%. Total capital is still kept at a minimum of 8%.

● Common Equity Tier 1 Capital:

- ✧ Common shares issued by the bank.
- ✧ Stock surplus (paid-in capital)
- ✧ Retained earnings.
- ✧ Minority interests.
- ✧ Accumulated and other comprehensive income and other disclosed reserves.
- ✧ Regulatory adjustments applied to the calculation of Common Equity Tier 1 capital.

Pillar 2: Supervisory Review Process

Pillar 3: Market Discipline

1. Assume a bank determines credit risk-weighted assets (credit RWA) of \$10 million, a market risk charge (MRC) of \$300,000 and an operational risk charge (ORC) of \$500,000. To meet Basel III requirements, the bank has determined it holds \$2.0 million in eligible total (Tier 1 plus Tier 2) regulatory capital. What is the bank's total capital ratio?
 - A. 5.0 %
 - B. 6.25%
 - C. 8.0%
 - D. 10.0%

Answer: D

10.0% RWA = \$10,000,000 + \$300,000 × 12.5 + \$500,000 × 12.5 = \$20,000,000 RWA; \$2 MM / \$20 MM = 10.0%

2. Which statement is true regarding Common Equity Tier 1 capital?
 - A. Common Equity Tier 1 capital to risk-weighted assets must be 6% beginning January 1,

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- B. Preferred stock will make up the bulk of Common Equity Tier 1 capital because shareholders cannot force the bank into bankruptcy.
- C. Common Equity Tier 1 capital has the least-stringent requirements for what constitutes capital.
- D. To qualify as common shares that may be used for Common Equity Tier 1 capital, investors of the shares must have a residual claim to the assets.

Answer: D

Common Equity Tier 1 capital to risk-weighted assets must be 4.5% beginning January 1, 2015. Common stock plus retained earnings, not preferred stock, must make up the bulk of Common Equity Tier 1 capital. The requirements for Common Equity Tier 1 capital are the most-stringent, not the least-stringent. Investors of the common shares must have a residual claim to the assets.

3. Your bank is implementing the advanced Internal Rating Based Approach of Basel II for credit risk, and the Advanced Measurement Approach for operational risk. The bank uses the Internal Model Approach for market risk. The Chief Risk Officer (CRO) wants to estimate the bank's total risk by adding up the regulatory capital for market risk, credit risk, and operational risk. The CRO asks you to identify the problems with using this approach to estimate the bank's total risk. Which of the following statements about this approach is incorrect?
- A. It assumes market, credit, and operational risks have zero correlation.
 - B. It uses a 10-day horizon for market risk.
 - C. It ignores strategic risks.
 - D. It ignores the interest risk associated with the bank's loans.

Answer: A

It is the perfect correlation.

4. Which of the following statements would be considered a drawback of Basel II/III?
- A. Procyclicality is a concern, and no countercyclical buffer is provided.
 - B. It does not consider diversification effects among risk classes.
 - C. Level 1 diversification benefits are not acknowledged.
 - D. There are no detailed disclosure requirements for risk management policies concerning credit risk.

Answer: B

Basel II/III only considers Level 1 diversification benefits. It considers the sum of the risks but not the interrelationships among risk factors.

5. In regard to Basel II minimum capital requirements, which of the following is false?
- A. Banks can reduce their capital charge, subject to a limit, if they can demonstrate diversification benefit due to imperfect correlation between the major risk buckets: credit, operational and market risk.
 - B. Pillar Two explicitly encourages national authorities (supervisors) to supplement Pillar One with additional capital requirements at their discretion if they deem appropriate
 - C. Under the advanced/internal approaches, all three risk categories (credit, market, and operational risk) employ value at risk (VaR) concepts
 - D. Basel II had no explicit charge for liquidity risk

Answer: A

False: The capital charges are added (CRC + MRC + ORC); Basel II gives no recognition for potential diversification benefits at this level of analysis.

In regard to (b), (c) and (d), each are true. In regard to (b), please note the “mutually reinforcing” aspect of the framework; and that Pillar One implies only minimum capital requirements

6. Thrift Bank carries risk-weighted assets (RWA) of \$40.0 billion. In regard to its eligible regulatory capital, the bank holds:
- \$2.8 billion of Common Equity Tier 1 Capital (“Core Tier 1”)
 - \$0.2 billion of Additional Tier 1 Capital
 - \$1.4 billion of Tier 2 Capital (“Gone concern”)
- Does Thrift Bank meet the Basel III capital requirements?
- A. No, because Tier 1 Capital is not at least 8.5%
 - B. No, because Total Capital is not at least 10.5%
 - C. Yes, because Tier 1 is at least 4.0%
 - D. Yes, because Tier 2 is at least 2.5%

Answer: A

No, because Tier 1 Capital is not at least 8.5%

Basel III requires Core Tier 1 (Common Equity) of 7.0%, Tier 1 of 8.5%, and Total Capital of 10.5%:

Core Tier 1 (Common Equity) ratio of at least 7.0% = 4.5% + 2.5% Conservation Buffer. Thrift Bank holds exactly sufficient Common Equity: $2.8/40.0 = 7.0\%$.

Tier 1 (Common Equity + Additional Tier 1) ratio of at least 8.5% = 6.0% Tier 1 + 2.5% Conservation buffer. Thrift Bank only holds Tier 1: $3.0/40.0 = 7.5\%$

Total Capital ratio of 10.5% = 8.0% total capital + 2.5% Conservation Buffer. Thrift Bank holds Total Capital: $4.4/40.0 = 11.0\%$

7. Each of the following is a required disclosure element (i.e., must be disclosed by the bank) of

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the Third Pillar (Pillar 3) except for:

- A. The bank's capital structure including a break-down of Tier 1 capital, deductions, and total eligible capital
- B. Details of the bank's compensation (remuneration) program including performance metrics, risk metrics, and variable pay plan elements
- C. The bank must disclose securitization special purpose entities (SPEs) even if the bank is only a sponsor (i.e., only "manages or advises" on the placement of securities)
- D. The bank's long-term strategy and a mapping of new product development initiatives to planned target markets and customers

Answer: D

The bank's long-term strategy and a mapping of new product development initiatives to planned target markets and customers.

The Third Pillar does not ask the bank to reveal such strategic insights (the nearest to this is likely indirect by way of remuneration-related disclosures)

From Basel II: 819. Proprietary information encompasses information (for example on products or systems), that if shared with competitors would render a bank's investment position. Information about customers is often confidential, in that it is provided under the terms of a legal agreement or counterparty relationship. This has an impact on what banks should reveal in terms of information about their customer base, as well as details on their internal arrangements, for instance methodologies used, parameter estimates, data etc...

Key Point: Credit Risk Capital Requirements

The **standardized approach** incorporates risk weights based on external credit rating assessments. The amount of capital that a bank must hold is specific to the risk of credit-risky assets, the type of institution the claim is written on, and the maturity of those assets.

The **internal ratings-based (IRB)** approaches (foundation and advanced) use a bank's own internal estimates of creditworthiness to determine the risk weightings in the capital calculation.

- ✧ **Foundation approach:** bank estimates probability of default (PD).
- ✧ **Advanced approach:** bank estimates not only PD, but also loss given default (LGD), exposure at default (EAD), and effective maturity (M).

8. John Smith is a bank supervisor responsible for the oversight of Everbright Group, a large banking conglomerate. Everbright Group now determines its credit risk profile according to the foundation IRB approach and assesses operational risk according to the standardized approach as described in the Basel II Capital Accord. Which of the following are specific issues that should be addressed as part of Smith's supervisory review process of Everbright

Group?

- I. Review the bank's internal control systems.
 - II. Check compliance with transparency requirements as described in Pillar 3 of Basel II Accord.
 - III. Make sure that the bank estimates for LGD and EAD for its corporate loans are in compliance with supervisory estimates.
 - IV. Evaluate the impact of interest rate risk by assessing the impact of a 200 basis Point interest rate shock to the bank's capital position.
- A. I and III only
 - B. II and IV only
 - C. I, II, and IV only
 - D. I, II, III, and IV

Answer: C

The supervisor's duties as part of the supervisory review process include:

Check compliance with Pillars I and III of Basel II Accord. Which would include credit risk mitigation and transparency requirements. Review internal control systems. Access internal capital management methods employed by the bank. So I and II are correct. Note that the foundation IRB approach. The bank provides its estimates for PD but uses supervisory estimates for LGD and EAD for corporate loans. So III is incorrect. Also, the impact of interest rate risk on the bank's capital position must be assessed by determining the impact of a 200 basis Point shock or its equivalent. So IV is also correct. Therefore, the correct answer for this question is choice C.

9. Each of the following is true about the internal ratings-based (IRB) approaches to credit risk under Basel III, except which is false?
- A. In both approaches (FIRB and AIRB) each debt is assigned a probability of default (PD) according to the bank's internal rating system
 - B. In both approaches (FIRB and AIRB) the goal is to compute a credit risk charge that supports unexpected credit losses at a 99.9% confidence level over a one-year horizon
 - C. In both approaches (FIRB and AIRB) the credit risk function is a multi-factor(APT) model which does not assume the credit portfolio is diversified
 - D. In both Foundation IRB approach, only default probability (PD) is assigned by the bank's internal model; but exposure at default (EAD) is based on credit conversion factors (CCF), LGD is set to either 45% or 75%, and residual maturity is generally fixed at 2.5 years

Answer: C

Perhaps the critical assumption of the internal ratings-based models is so-called portfolio

invariance: individual exposure charges do not depend on the rest of the credit portfolio, but rather depend on their presumed correlation to a single factor. This is achieved with the dubious assumption of a well-diversified (“infinitely granular”) portfolio and exposure to a single common risk factor (the asymptotic risk factor, ASRF).

In regard to (A), (B) and (D), each is true.

10. Each of the following is true about the foundation/advanced internal ratings-based (IRB) approach to credit risk in Basel II and Basel III, except:

- A. The risk weight function estimates a 99.9% confident one-year horizon credit value-at-risk (CVaR)
- B. The capital charge intends to cover unexpected losses (UL) and not expected losses (EL) with $UL = CVaR - EL$
- C. The risk weight function includes PD, EL, EAD, LGD and asset correlations but does not include a maturity (M) adjustment
- D. Asset (default) correlations are included in the risk weight function but cannot be specified by the bank's own internal estimates (in either FIRB or AIRB)

Answer: C

The risk-weight function does indeed include an effective maturity adjustment (M) that is equal to a generic 2.5 years in FIRB and which is defined for each facility in AIRB. In general, longer maturities imply higher charges.

In regard to (A), (B), and (D), all are TRUE.

Key Point: Operational Risk Capital Requirements

Basic indicator approach: measures the capital charge on a firm-wide basis. Banks will hold capital for operational risk equal to a fixed percentage of the bank's average annual gross income over the prior three years. The Basel Committee has proposed a fixed percentage equal to 15%.

$$ORC^{BIA} = \left[(GI_{1,...,n} \times \alpha) \right] / n, \quad \alpha = 15\%$$

Standardized approach: allows banks to divide activities along standardized business lines. Within each business line, gross income will be multiplied by a fixed beta factor. The capital charge for operational risk is the sum of each business line's charges. The beta factors for the eight business lines are as follows:

- ✧ Trading and sales: 18%
- ✧ Corporate finance: 18%
- ✧ Payment, settlement: 18%
- ✧ Commercial banking: 15%
- ✧ Agency services: 15%
- ✧ Retail banking: 12%

- ✧ Retail brokerage: 12%
- ✧ Asset management: 12%

$$ORC^{TSA} = \left\{ \sum_{\text{years } 1-3} \max \left[\sum (GI_{t-8} \times \beta_{t-8}), 0 \right] \right\} / 3$$

Advanced Measurement Approach (AMA): If a bank can meet more rigorous supervisory standards, it may use the AMA for operational risk capital calculations. The capital charge for AMA is calculated as the bank's operational value at risk (Op VaR) with a one-year horizon and a 99.9% confidence level. Having insurance can reduce this capital charge by as much as 20%.

11. A bank uses the basic indicator approach (BIA) to determine their capital charge for operational risk under Basel II (or Basel III). The bank's annual gross income (GI) over the previous three years was +\$130 million (T-3), -\$60 million loss (T-2), and +\$230 million (T-1). What is the bank's operational risk capital charge?
- A. \$15.0 million
 - B. \$18.0 million
 - C. \$27.0 million
 - D. \$34.5 million

Answer: C

The loss year is excluded, so the charge is AVERAGE $(130,230) \times 15\%$ alpha = \$27 million

12. A bank uses the standardized approach (SA) to determine their capital charge for operational risk under Basel II (or Basel III). The bank has three (3) business lines and each business line contributes one-third toward the total gross income. For a given total gross income, which business mix will produce the largest capital charge?
- A. Corporate finance; trading and sales; payment and settlement
 - B. Retail banking; retail brokerage; and asset management
 - C. Commercial banking; agency services; asset management
 - D. Retail banking; Commercial banking; and Payment and settlement

Answer: A

Trading and sales: 18%

Corporate finance: 18%

Payment, settlement: 18%

Commercial banking: 15%

Agency services: 15%

Retail banking: 12%

Retail brokerage: 12%

Asset management: 12%

13. Each of the following is true about the Basic Indicator Approach (BIA) to operational risk under Basel III except which is false?
- A. Operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events
 - B. The definition of operational risk includes strategic and reputational risk, but excludes legal risk
 - C. Bank's using the Basic Indicator Approach (BIA) must hold capital for operational risk equal to the average over the previous three years of a fixed percentage (denoted alpha) of positive annual gross income
 - D. Under the Basic Indicator Approach (BIA), Gross Income is defined as net interest income plus net non-interest income

Answer: B

As stated, the TRUE statement is: "This definition [of operational risk] includes legal risk, but excludes strategic and reputational risk."

In regard to (A), (C) and (D) each is true .

In regard to (C), please note that under BIA, "Fingers for any year in which annual gross income is negative or zero should be excluded from both the numerator and denominator when calculating the average."

14. Each of the following is true about the Standardized Approach (SA) to operational risk under Basel III except which is false?
- A. Whereas the Basic Indicator Approach (BIA) uses Gross Income for the whole institution as a proxy for the scale of business operations, the standardized approach (SA) calculates the capital charge for each business line by multiplying its gross income by a factor (denoted beta) assigned to that business line
 - B. The beta factor in the Standardized Approach (SA) serves as a proxy for the industrywide relationship between the operational risk loss experience for a given business line and the aggregate level of gross income for that business line
 - C. Under the standardized approach (SA), business units that fail to provision expected operational losses must calibrate their risk charge based on the unexpected loss at 99.99% confidence level (i.e., rather than 99.9%) over a one-year horizon
 - D. A national supervisor can allow a bank to use the Alternative Standardized Approach (ASA) which replaces gross income with loans and advances for retail and commercial banking business lines

Answer: C

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Both non-advanced approaches, including the standardized approach, multiply factors (alpha or beta) by gross income. Instead, the advanced measurement approaches (AMA) instead obtain a risk charge by internally estimating the unexpected loss (UL) at 99.9% confidence over one year; i.e., an OpRisk VaR approach.

15. Each of the following is true about Advanced Measurement Approach (AMA) to operational risk under Basel III except which is false?
- A. Under the AMA, a bank must develop specific policies and have documented criteria for mapping gross income for current business lines and activities into the AMA framework
 - B. Under the AMA, a bank can use its own internal model(s) but the quantitative standards include a charge for unexpected losses at 99.9% confidence over one-year horizon
 - C. To qualify for the AMA, the bank must have an independent operational risk management function that is responsible for the design and implementation of the bank's operational risk management framework
 - D. To qualify for the AMA, the bank must : use internal loss data; use scenario analysis; and take into account key business environment and internal control factors

Answer: A

The standardized approach maps gross Income for business lines; the AMA allows banks to estimate unexpected operational losses with their own, presumably more accurate, internal models conditional on supervisor approval and meeting the associated quantitative and qualitative criteria.

Key Point: Market Risk Capital Requirements

Standardized method: determines capital charges associated with various market risk exposures (equity risk, interest rate risk, foreign exchange risk, commodity risk, and option risk). The market risk capital charge for each market risk is computed as 8% of its market-risky assets.

Internal models approach (IMA): allows a bank to use its own risk management systems to determine its market risk capital charge. The market risk charge is the higher of (1) the previous day's VaR or (2) the average VaR over the last 60 business days adjusted by a multiplicative factor (subject to a floor of 3).

$$\begin{aligned} \text{MRC}_t^{\text{IMA}} = & \text{Max} \left(k \frac{1}{60} \sum_{i=1}^{60} \text{VAR}_{t-i}, \text{VAR}_{t-1} \right) \\ & + \text{Max} \left(k_s \frac{1}{60} \sum_{i=1}^{60} \text{SVAR}_{t-i}, \text{SVAR}_{t-1} \right) + \text{SRC}_t + \text{IRC}_t \end{aligned}$$

- ✧ SVaR is the Stress VaR.
- ✧ SRC is the specific risk charge, which is a buffer against idiosyncratic factors, including basis risk and event risk.
- ✧ IRC is an incremental risk charge that covers: (1) default risk, (2) credit migration risk for debt instruments. IRC is calibrated to a 99.9% confidence level over one year, computed on at least a

weekly basis. The IRC is computed from the maximum of the 12-week average and the most recent value:

$$IRC_t = \text{Max} \left(\frac{1}{12} \sum_{i=1}^{12} IRM_{t-i}, IRM_{t-1} \right)$$

16. As a result of the credit crisis, the Basel Committee revised the market risk framework and introduced a stressed VaR requirement. A bank uses the internal models approach for market risk and has generated the following risk measures (in USD million) for the current trading book positions:

Confidence Level	Latest Available 10-day VaR	Latest Available 10-day Stressed VaR	Average 10-day VaR of Previous 60 Days	Average 10-day Stressed VaR of Previous 60 Days
95%	210	588	198	574
99%	407	1275	390	1208
99.9%	593	1687	541	1566

The supervisory authority has set the multiplication factors for both the VaR and Stressed VaR values to three. What is the capital requirement for general market risk?

- A. USD 2,316 million
- B. USD 4,794 million
- C. USD 6,321 million
- D. USD 6,480 million

Answer: B

17. As a risk manager for Bank ABC, John is asked to calculate the market risk capital charge of the bank's trading portfolio under the 1996 internal models approach. The VaR (95%, one-day) of the last trading day is USD 30,000; the average VaR (95%, one-day) for the last 60 trading days is USD 20,000. The multiplier is $k = 3$. Assuming the return of the bank's trading portfolio is normally distributed, what is the market risk capital charge of the trading portfolio?

- A. USD 84,582
- B. USD 189,737
- C. USD 268,200
- D. USD 134,594

Answer: C

18. In the latest guidelines for computing capital for incremental risk in the trading book, the incremental risk charge (IRC) addresses a number of perceived shortcomings in the 99 %/10-day VaR framework. Which of the following statements about the IRC are correct?
- I. For all IRC-covered positions, the IRC model must measure losses due to default and migration over a one-year horizon at a 99% confidence level.
 - II. A bank can incorporate into its IRC model any securitization positions that hedge underlying credit instruments held in the trading account.
 - III. A bank must calculate the IRC measure at least weekly, or more frequently as directed by its supervisor.
 - IV. The incremental risk capital charge is the maximum of (1) the average of the IRC measures over 12 weeks and (2) the most recent IRC measure.
- A. I and II
 - B. III and IV
 - C. I, II, and III
 - D. II, III, and IV

Answer: B

Confidence level is 99.9%. Securitizations are subject to the banking book capital requirements.

19. Which of the following characteristics outlined describe the measurement of stressed value at risk?
- A. The stressed VaR is calculated on a monthly basis.
 - B. Historical bank data from the same portfolio is used in measuring SVaR.
 - C. The stressed confidence interval is a 95% one-tailed test.
 - D. The multiplication factor used in calculating SVaR is the same as that for VaR.

Answer: B

The stressed value at risk should be calculated on a weekly basis. This measure is calculated by combining current portfolio performance data based on the 10-day, 99% confidence interval with firm's historical data from a significantly financially stressed period of the same portfolio.

20. Which of the following is true about the standardized measurement method for the calculation of market risk under Basel III?
- A. Tier 3 capital is eligible to support market risks calculated by the standardized approach in Basel III
 - B. The capital charge is an arithmetic sum of charges across categories, including interest rate risk, equity position risk, foreign exchange risk, commodities risk, and options risk
 - C. For trading portfolios, according to the Third Pillar disclosure requirements, the high, mean and low value at risk (VaR) values over the reporting period must be

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disclosed

- D. If an equities portfolio is both liquid portfolio is both liquid and well-diversified, the capital charge for general market risk and specific risk is 4.0%

Answer: B

The capital charge is an arithmetic sum of charges across categories including interest rate risk, equity position risk, foreign exchange risk, commodities risk, and options risk. This is why a key criticism of the standardized approach is that it overcharges by ignoring the benefits of any diversification.

In regard to (A), this is false: Basel III abolished Tier 3 capital

In regard to (C), this is false: Third Pillar does require these VaR disclosure, but for the internal models approach (IMA) as they would not be necessary under the standardized approach

In regard to (D), this is false: Basel III eliminated this provision.

21. Under Basel III, each of the following is true about the internal models approach (IMA) to market risk except which is false?

- A. Value at risk (VaR) must be computed on a daily basis with a one-tailed confidence level of 99.0% and a minimum holding period of ten (10) days
- B. Banks must update their data sets at least once a year which corresponds to the maximum historical observation (sample) period
- C. A bank must support their VaR model with all three of the following: a stress testing program, a back-testing program, and on-going validation
- D. Market risk factors that are deemed relevant for pricing should be included as risk factors in the value-at-risk (VaR) model

Answer: B

The sample period is a minimum of one year and the data set must be updated at least monthly: "The choice of historical observation period (sample period) for calculating value-at-risk will be constrained to a minimum length of one year...Banks must update their data sets no less frequently than once every month and reassess them whenever market prices are subject to material changes. This updating process must be flexible enough to allow for more frequent updates."

In regard to (A), (C) and (D), each is true.

22. The following formula defines the capital requirement (c) under the internal models approach to the calculation of market risk under Basel III:

$$C = \max \{ VaR_{t-1}, m_c \times VaR_{avg} \} + \max \{ sVaR_{t-1}, m_s \times sVaR_{avg} \}$$

About this calculation, each of the following is true EXCEPT which is false?

- A. The first term is the higher of (i) the previous day's VaR and (ii) an average of the daily

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- VaR measures on each of the preceding sixty business days, multiplied by a multiplication factor
- B. The second term is the higher of (i) the latest available stressed VaR and (ii) an average of the stressed VaR numbers over the preceding sixty business days, multiplied by a multiplication factor
- C. The multiplication factors $m(c)$ and $m(s)$ will be set by individual supervisory authorities but subject to an absolute minimum of three (3)
- D. The bank can choose to conduct an ex-post backtest on the stressed VaR only; if the test is successful, both multiplicative factors can be reduced to one

Answer: D

The ex-post backtest applies only to the VaR, not the stressed VaR. Further, the backtest increases (via a “plus”) the $m(c)$ factor by a factor of zero to 1.0; it does not reduce the minimum of 3.0. Essentially, a yellow-zone backtest result can imply a minimum factor, $m(c)$, of at least four ($4.0=3.0+1.0$), or more if the supervisor requires.

To review, the capital requirement (c) is given by the following formula:

$$C = \max \{ \text{VaR}_{t-1}, m_c \times \text{VaR}_{\text{avg}} \} + \max \{ s\text{VaR}_{t-1}, m_s \times s\text{VaR}_{\text{avg}} \}$$

i.e., the sum of:

The higher of (1) its previous day's value-at-risk number, $\text{VaR}(t-1)$; and (2) an average of the daily value-at-risk measures on each of the preceding sixty business days, $\text{VaR}(\text{avg})$, multiplied by a multiplication factor, $m(c)$, plus

The higher of (1) its latest available stressed-value-at-risk $s\text{VaR}(t-1)$; and (2) an average of the stressed value-at-risk over the preceding sixty business days, $s\text{VaR}(\text{avg})$, multiplied by a multiplication factor, $m(s)$

In regard to (A), (B) and (C), each is true.

23. Which of the following risks is specifically recognized by the incremental risk charge (IRC)?
- A. Expected shortfall risk, because it is important to understand the amount of loss potential in the tail.
- B. Jump-to-default risk, as measured by 99% VaR, because a default could cause a significant loss for the bank.
- C. Equity price risk, because a change in market prices could materially impact mark-to-market accounting for risk.
- D. Interest rate risk, as measured by 97.5% expected shortfall, because an increase in interest rates could cause a significant loss for the bank

Answer: B

The two types of risk recognized by the incremental risk charge are: (1) credit spread risk, and (2)

jump-to-default risk. Jump-to-default risk is measured by 99% VaR and not 97.5% expected shortfall.

Key Point: Backtesting VaR

An exception occurs if the day's change in value exceeded the VaR estimate of the previous day. When backtesting VaR, the number of exceptions is determined for a 250-day testing period. Based on the number of exceptions, the bank's exposure is categorized into one of three zones and VaR is scaled up by the appropriate multiplier.

- ✧ Green zone: 0-4 exceptions, increase in exposure multiplier is 0.
 - ✧ Yellow zone: 5-9 exceptions, exposure multiplier increases between 0.4 and 0.85.
 - ✧ Red zone: Greater than or equal to 10 exceptions, multiplier increases by 1.
-

24. The Basel II accord requires a supervisory backtesting framework with all of the following components except:
- A. Seven zones with different plus factors.
 - B. Verifies daily deviations from estimated VaR.
 - C. Extends over a 1-year period (i.e., 250 trading days).
 - D. A multiplier that is subject to a floor of three

Answer: A

The backtesting framework only includes three zones: green, yellow, and red. The plus factor determined from these zones is added to the multiplier floor of three.

25. Saugatuck National Bank uses the internal model-based approach to set market risk capital as prescribed by the 1996 Amendment to the 1988 Basel Accord. The bank has backtested its 99%, one-day VaRs against the actual losses over the last 250 trading days. Based on the results of the backtesting, the bank recorded 11 exceptions. Based on these results, the multiplicative factor (m_c) in the model should be set:
- A. Less than 3
 - B. Equal to 3
 - C. Between 3.1 and 3.9
 - D. Equal to 4

Answer: D

Saugatuck National Bank must compare the VaR calculated using its current method for each of the 250 trading days to the actual loss over the same period to determine the multiplicative factor. If the actual loss is greater than the estimated loss, an exception is recorded. If, over the previous 250 days, the number of exceptions is:

- Less than 5, m_c is usually set equal to three.
- 5, 6, 7, 8, or 9, m_c is set equal to 3.4, 3.5, 3.65, 3.75, and 3.85, respectively.
- Greater than 10, m_c is set equal to four.

Therefore, with 11 exceptions recorded, m_c should be set equal to four.

Key Point: Fundamental Review of the Trading Book

Expected Shortfall

The FRTB is proposing a change to the measure used for determining market risk capital. Instead of VaR with a 99% confidence level, expected shortfall (ES) with a 97.5% confidence level is proposed.

26. Which of the following statements regarding the differences between Basel I, Basel II.5, and the Fundamental Review of the Trading Book (FRTB) for market risk capital calculations is incorrect?
- Both Basel I and Basel II.5 require calculation of VaR with a 99% confidence interval.
 - FRTB requires the calculation of expected shortfall with a 97.5% confidence interval.
 - FRTB requires adding a stressed VaR measure to complement the expected shortfall calculation.
 - The 10-day time horizon for market risk capital proposed under Basel I incorporates a recent period of time, which typically ranges from one to four years

Answer: C

Basel I and Basel II.5 use VaR with a 99% confidence interval and the FRTB uses the expected shortfall with a 97.5% confidence interval. Basel I market risk capital requirements produced a very current result because the 10-day horizon incorporated a recent period of time. The FRTB does not require adding a stressed VaR to the expected shortfall calculation. It was Basel II.5 that required the addition of a stressed VaR.

Key Point: Capital Conservation Buffer

This will be required to provide an extra cushion against loss in times of stress. The buffer will be an additional 2.5% Common Equity Tier 1 capital requirement.

27. The capital conservation buffer:
- Will provide an extra 2.5% Common Equity Tier 1 capital buffer in times of stress.
 - Will be used exclusively to protect banks from the losses garnered from OTC derivatives trading.
 - Is required only for banks with inadequate liquidity coverage and net stable funding source ratios.

- D. Is covered in the increased Common Equity Tier 1 capital to risk-weighted assets ratio that will increase to 4.5% from the current 2% over the next few years.

Answer: A

The capital conservation buffer is intended to provide an extra cushion against loss in times of stress. It is 2.5% Common Equity Tier 1 capital to risk-weighted assets, which in effect increases the total Common Equity Tier 1 capital ratio to 7%.

28. The capital conservation buffer:

- A. Is intended to protect banks from the countercyclical nature of bank earnings.
B. Can be set between 0.0% and 2.5% of risk-weighted assets, and is at the discretion of the regulators in individual countries.
C. Causes the Tier 1 equity capital ratio requirement to increase to 7% of risk-weighted assets in normal economic periods.
D. Requires that total capital to risk-weighted assets must be 10.5% at all times.

Answer: C

The capital conservation buffer is meant to protect banks in times of financial distress. Banks are required to build up a buffer of Tier 1 equity capital equal to 2.5% of risk-weighted assets in normal times, which will then be used to cover losses in stress periods. This means that in normal times, a bank should have a minimum 7% Tier 1 equity capital to risk-weighted assets ratio, an 8.5% total Tier 1 capital to risk-weighted assets ratio, and a 10.5% Tier 1 plus Tier 2 capital to risk-weighted assets ratio. The capital conservation buffer is a requirement and is not left to the discretion of individual country regulators. It is not a requirement at all times but is built up to that level in normal economic periods and declines in stress periods.

29. Which is true about the capital conservation buffer?

- A. When a bank's capital levels fall within this range, the bank can continue to conduct (operate) business
B. When a bank's capital levels fall within this range, the bank is constrained (restricted) with respect to dividends, share buybacks, and discretionary bonus payments to staff
C. When a bank's capital levels fall within this range, the bank is "severely restricted" with respect to conducting business (operations)
D. The bank can elect to draw down the buffer in normal times if competitive demands warrant, including the need to maintain market share

Answer: B

When a bank's capital levels fall within this range, the bank is constrained (restricted) with respect to dividends, share buybacks, and discretionary bonus payments to staff

In regard to (A), (C) and (D), each are false.

30. Capital conservation buffers have been established by the Basel Committee as part of measures designed to ensure that banks have enough capital to handle stress situations. Assuming no regulatory add-ons have been imposed, which of the following is correct?
- A. If the bank has 8% Common Equity Tier 1(CET1) capital with no Additional Tier 1 or Tier 2 capital. It would have zero conservation buffer and therefore be subject to a 100% constraint on capital distributions.
 - B. If the bank has 8% CET1 with no Additional Tier1 or Tier 2 capital, it would satisfy the zero conservation buffer and therefore not be subjected to a constraint on capital distributions.
 - C. If the bank has 7% CET1 with no Additional Tier1 or Tier 2 capital; it would have a 2.5% conservation buffer and therefore not be subjected to a constraint on capital distributions.
 - D. If the bank has 9.5% CET1 with no Additional Tier 1 or Tier 2 capital, it would have a 2.5% conservation buffer and therefore not be subjected to a constraint on capital distributions.

Answer: A

Core tier 1	$4.5\% + 2.5\% = 7\%$
Tier 1	$6\% + 2.5\% = 8.5\%$
Total	$8\% + 2.5\% = 10.5\%$

A is the correct answer.

Key Point: Countercyclical Buffer

Banks will be subject to a countercyclical buffer if regulatory authorities deem it necessary. The buffer is intended to protect the banking sector by ensuring that capital requirements take into account macro-environment factors. Procyclical amplification refers to the vicious cycle that ensues when a downturn leads to losses in the financial sector, which spreads to the real economy and then back to the financial sector. Countercyclical buffers are intended to dampen the effect of procyclical amplification and will only be implemented if credit growth is excessive or some other system-wide risk is evident.

31. A measure intended to protect the banking sector by taking macro-environment factors into consideration is the:
- A. Leverage ratio.
 - B. Procyclical deleveraging ratio.
 - C. Countercyclical buffer.
 - D. Counterparty credit risk adjustor.

Answer: C

The countercyclical buffer requires that banking authorities monitor credit growth and other system-wide factors. If system-wide risks increase, authorities can require banks to hold additional capital, called the countercyclical buffer.

32. Which is true about the countercyclical conservation buffer?

- A. The countercyclical buffer is primarily a micro-prudential measure
- B. The countercyclical buffer can only be zero (0%) during the phase-in period, as eventually it achieves a constant of 2.5% regardless of environment
- C. Its primary goal is to avoid destabilizing losses subsequent to a period of excess credit growth
- D. A bank will be required to maintain this buffer if the bank falls under a jurisdiction identified and designated by the Basel Committee

Answer: C

Its primary goal is to avoid destabilizing losses subsequent to a period of excess credit growth

“136. Losses incurred in the banking sector can be extremely large when a downturn is preceded by a period of excess credit growth. These losses can destabilize the banking sector and spark a vicious circle, whereby problems in the financial system can contribute to a downturn in the real economy that then feeds back on to the banking sector. These interactions highlight the particular importance of the banking sector building up additional capital defenses in periods where the risks of system-wide stress are growing markedly.”

In regard to (A), this buffer is quintessentially MACRO-prudential; e.g., “137. The countercyclical buffer aims to ensure that banking sector capital requirements take account of the macro-financial environment in which banks operate.”

In regard to (B), this is false as the countercyclical buffer is only meant to apply during excess credit regimes. “This requirement will be released when system-wide risk crystallizes or dissipates.”

In regard to (D), the requirement for this buffer (from 0 to 2.5%) is delegated to the respective national authorities, not Basel.

“139. Each Basel Committee member jurisdiction will identify an authority with the responsibility to make decisions on the size of the countercyclical capital buffer. If the relevant national authority judges a period of excess credit growth to be leading to the buildup of system-wide risk, they will consider, together with any other macroprudential tools at their disposal, putting in place a countercyclical buffer requirement. This will vary between zero and 2.5% of risk weighted assets, depending on their judgment as to the extent of the build-up of system-wide risk.”

Key Point: Leverage Ratio

The committee has introduced a non-risk based leverage ratio that will act as a supplementary measure to risk-based capital standards. The goals of the leverage ratio are to constrain the build-up of leverage in the banking sector and to provide a simple “back-stop” measure of leverage that supplements and reinforces risk-based capital standards. The leverage ratio of 3% (Tier 1 capital to on- and off-balance sheet items and exposures) is targeted to take effect January 1, 2018.

33. Which of the following statements is false regarding the leverage ratio? The leverage ratio:

- A. Acts as a supplementary measure to risk-based capital standards
- B. Is defined as Tier 1 capital to on-and-off-balance sheet items and exposures.
- C. Allows banks to lend approximately 33 times their capital.
- D. Is risk-based.

Answer: D

The leverage ratio is simple and non-risk based and meant to act as a “backstop” measure of leverage.

34. The CFO at a bank is preparing a report to the board of directors on its compliance with Basel requirements. The bank’s average capital and total exposure for the most recent quarter is as follows:

REGULATORY CAPITAL	USD MILLION
Total Common Equity Tier 1 Capital	108
Additional Tier 1 Capital	28
Prior to regulatory adjustments	34
Regulatory adjustments	6
Total Tier 1 Capital	136
Tier 2 Capital	36
Prior to regulatory adjustments	45
Regulatory adjustments	9
Total Capital	172
Total Average Exposure	3678

Using the Basel III framework, which of the following is the best estimate of the bank’s current leverage ratio?

- A. 2.94%
- B. 3.70%
- C. 4.68%

D. 5.08%

Answer: B

For Basel III purposes, the leverage ratio is Tier 1 Capital/Total Exposure = 136/3,678 = 3.70%

Key Point: Liquidity Coverage Ratio

Goal: ensure banks have adequate, high-quality liquid assets to survive short-term stress scenario.

$$\text{LCR} = \frac{\text{stock of high-quality liquid assets}}{\text{total net cash outflows over the next 30 calendar days}} \geq 100\%$$

HQLA:

- Level 1 Assets: can be included without limit
 - ✧ Coin and banknotes
 - ✧ Central bank reserves
 - ✧ Marketable securities representing claims on or guaranteed by sovereigns, central banks, the Bank for International Settlements, the International Monetary Fund, the European Central Bank and European Community, or multilateral development banks, and satisfying all of the following conditions: assigned a 0% risk-weight under the Basel II Standardized Approach for credit risk; not an obligation of a financial institution or any of its affiliated entities
 - ✧ Where the sovereign has a non-0% risk weight, sovereign or central bank debt securities issued in domestic currencies
 - ✧ Where the sovereign has a non-0% risk weight, domestic sovereign or central bank debt securities issued in foreign currencies
- Level 2 Assets: can only comprise up to 40% of the stock
 - ✧ Level 2A: Marketable securities representing claims on or guaranteed by sovereigns, central banks, multilateral development banks (20% risk weight); Corporate debt securities and covered bonds (at least AA-)
 - ✧ Level 2B: RMBS; Corporate debt securities (BBB- ~ A+); Common equity shares

35. Given the following information, what is Bank A's liquidity coverage ratio?

✧ High-quality liquid assets	\$100
✧ Required amount of stable funding	\$200
✧ Cash outflows over the next 30 days	\$130
✧ Net cash outflows over the next 30 days	\$90
✧ Available amount of stable funding	\$210
✧ High-quality liquid assets in each major currency	\$75

- A. 83%
- B. 90%

- C. 111%
- D. 130%

Answer: C

36. Canzone International Bank carries \$3.0 billion in Level 1 assets plus \$2.0 billion in Level 2A assets. With respect to expected cash outflows over the next 30 days, the bank carries “less stable” deposits (liabilities) of \$80.0 billion with an average run-off rate (factor) of 10%; expected cash inflows are \$10.0 million. Please note per Basel III:

- ✧ Level 1 assets can comprise an unlimited share of the pool and are not subject to a haircut under the LCR
- ✧ A 15% haircut is applied to the current market value of each Level 2A asset held in the stock of HQLA
- ✧ Level 2 assets (comprising Level 2A assets and any Level 2B assets permitted by the supervisor) can be included in the stock of HQLA, subject to the requirement that they comprise no more than 40% of the overall stock after haircuts have been applied
- ✧ Definition: Total net cash outflows over the next 30 calendar days = Total expected cash outflow - Min{total expected cash inflows; 75% of total expected cash outflows}

Which is nearest to Canzone’s liquidity coverage ratio (LCR)?

- A. 87.5%
- B. 136.5%
- C. 235.0%
- D. 360.0%

Answer: C

High quality liquid assets (HQLA) = L1 + L2 × (1 – haircut) = 3.0 + 2.0 × (100% - 15%) = \$4.7 billion. As 2/(3+2) = 40%, the 40% cap on L2 assets implies a post-haircut L2 max of \$2.0 billion, but post-haircut L2 assets are only valued at \$1.7 such that cap does not apply.

Total net cash outflows = (\$80.0 × 10.0%) - Min{10.75% × 8.0} = 8 - 6 = \$2.0 billion

Therefore, LCR = \$4.7/2.0 = 235.0%. Note this is greater than the LCR ratio requirement of 100%.

In summary, the liquidity coverage ratio (LCR) = (Stock of HQLA)/(Total net cash outflows over the next 30 calendar day) and LCR must be equal to or greater than 100%.

· Stock of HQLA refers to unencumbered high-quality liquid assets (HQLA) that can be converted easily and immediately in private markets into cash to meet their liquidity needs for a 30 calendar day liquidity stress scenario.

· Total net cash outflows is defined as the total expected cash outflows minus total expected cash inflows in the specified stress scenario for the subsequent 30 calendar days.

Total expected cash outflows are calculated by multiplying the outstanding balances of various categories or types of liabilities and off-balance sheet commitments by the rates at which they are expected to run off or be drawn down.

Total expected cash inflows are calculated by multiplying the outstanding balances of various categories of contractual receivables by the rates at which they are expected to flow in under the scenario up to an aggregate cap of 75% of total expected cash outflows.

37. Each of the following is a characteristic of a high-quality liquid asset except for:

- A. Active and sizeable market with evidence of market breadth (price impact per unit of liquidity) and market depth (units of the asset that can be traded for a given price impact)
- B. High market concentration among a limited set group of buyers and sellers
- C. Low correlation with risky assets; i.e., not subject to wrong-way risk
- D. Asset class has shown historical tendency to be a “flight to quality” destination

Answer: B

NOT HIGH, but rather: Low market concentration among a limited set group of buyers and sellers

“Characteristics of high-quality liquid assets

(a) Fundamental characteristics

- Low credit and market risk: assets that are less risky tend to have higher liquidity. High credit standing of the issuer and a low degree of subordination increases an asset’s liquidity. Low duration, low volatility, low inflation risk and denomination in a convertible currency with low foreign exchange risk all enhance an asset’s liquidity.

- Ease and certainty of valuation: an asset’s liquidity increases if market participants are more likely to agree on its valuation. The pricing formula of high-quality liquid asset must be easy to calculate and not depend on strong assumptions. The inputs into the pricing formula must also be publicly available. In practice, this should rule out the inclusion of most structured or exotic products.

- Low correlation with risky assets: the stock of high-quality liquid assets should not be subject to wrong-way (highly correlated) risk. For example, assets issued by financial institutions are more likely to be illiquid in times of liquidity stress in the banking sector.

- Listed on a developed and recognized exchange market: being listed increases an asset’s transparency.

(b) Market-related characteristics

- Active and sizable market: the asset should have active outright sale or repurchase agreement (repo) markets at all times (which means having a large number of market participants and a high

trading volume). There should be historical evidence of market breadth (price impact per unit of liquidity) and market depth (units of the asset that can be traded for a given price impact).

- Presence of committed market makers: quotes will most likely be available for buying and /or selling a high-quality liquid asset.
- Low market concentration: a diverse group of buyers and sellers in an asset's market increases the reliability of its liquidity.
- Flight to quality: historically, the market has shown tendencies to move into these types of assets in a systemic crisis."

Key Point: Net Stable Funding Ratio

Goal: protect banks over a longer time horizon than LCR.

$$\text{NSFR} = \frac{\text{available amount of stable funding}}{\text{required amount of stable funding}} \geq 100\%$$

38. Given the following information, what is Bank A's net stable funding ratio?

✧ High-quality liquid assets	\$100
✧ Required amount of stable funding	\$200
✧ Cash outflows over the next 30 days	\$130
✧ Net cash outflows over the next 30 days	\$90
✧ Available amount of stable funding	\$210
✧ High-quality liquid assets in each major currency	\$75

A. 65%

B. 89%

C. 105%

D. 125%

Answer: C

The longer-term funding ratio is equal to the available amount of stable funding divided by the required amount of stable funding. Under Basel III, this ratio must exceed 100%. Bank A's net stable funding ratio = \$210 / \$200 = 105%

39. The liquidity requirement designed to improve bank resiliency to liquidity shocks over a one-year horizon is called the:

- A. Liquidity coverage ratio.
- B. Net stable funding ratio.
- C. Contractual maturity mismatch ratio.
- D. Available unencumbered assets ratio.

Answer: B

The net stable funding ratio is intended to promote medium-and long-term funding of the bank's activities. It is defined as the available amount of stable funding divided by the required amount of stable funding, and it must be greater than 100%.

Key Point: Solvency II**SCR and MCR**

- ✧ If its capital falls below the SCR level, an insurance company should, at minimum, deliver to the supervisor a plan to restore capital to above the SCR level. The supervisor might require the insurance company to take particular measures to correct the situation.
- ✧ The MCR is regarded as an absolute minimum level of capital. If capital drops below the MCR level, supervisors may prevent the insurance company from taking new business. It might force the insurance company into liquidation, transferring its policies to another company. The MCR will typically be between 25% and 45% of the SCR.
- ✧ Two ways to calculate the SCR: the standardized approach and the internal models approach.

40. Which of the following statements is correct regarding capital requirements for insurance companies?
- A. Basel II includes the regulation of banks and insurance companies in the three pillars.
 - B. The minimum capital requirement is likely to be higher than the solvency capital requirement for insurance companies.
 - C. The repercussion for violating the solvency capital requirement is likely liquidation and the transfer of company insurance policies to another firm.
 - D. The internal models approach to calculating the solvency capital requirement is similar to internal ratings based approach under Basel II in that the firm must calculate a VaR with a one-year time horizon.

Answer: D

Solvency II, not Basel II, establishes capital requirements for insurance companies. The minimum capital requirement (MCR) is just that, a true floor and is thus likely to be lower than the solvency capital requirement (SCR). The repercussion for violating the MCR is likely the prohibition of taking new business and possible liquidation. The repercussion for violating the SCR is the requirement of a plan to remedy the situation and bring the capital back to the required level. The internal models approach is similar to the internal ratings based approach under Basel II in that the insurance company must calculate a one-year VaR with a 99.5% confidence level (versus 99.9% confidence for banks under Basel II).

Key Point: Comprehensive Questions

41. Each of the following was both (i) a deficiency or omission of Basel II but is, at the same time, (ii) explicitly addressed by new requirement in Basel III except for
- A. Basel II did not formally include liquidity risk, but Basel III explicitly covers liquidity risk
 - B. Basel II could arguably create a procyclical effect, but Basel III explicitly adds a buffer to address this
 - C. Basel II did not require external credit ratings, but Basel III seeks to increase the reliance on external ratings
 - D. Basel II allowed many banks to show strong risk-based regulatory capital ratios despite high on- and off-balance sheet leverage; Basel III adds a simple leverage ratio to act as a backstop to the risk-based capital ratio

Answer: C

This is extremely false: Basel II relies heavily on external credit ratings and the Committee has a focus to REDUCE reliance on external ratings.

In regard to (A), Basel III will add the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). In regard to (B), Basel III will phase-in the countercyclical buffer requirement. In regard to (D), this is TRUE. The new leverage ratio (Tier 1/Total Exposure) will begin in 2013 as an additional measure.

42. With respect to Basel II, Basel III immediately (i.e., effective in 2011 regardless of phase-in arrangements) changes or adds each of the following except for:
- A. Eliminated Tier 3 capital
 - B. Restricted the definition of Tier 1 capital
 - C. Increased the (Pillar One) Minimum Total Capital (Tier 1 + Tier 2) requirement
 - D. Adds a capital conservation buffer (CCB) where none existed in Basel II

Answer: C

Minimum total Tier 1 + Tier 2 capital REMAINS at 8.0% through January 2019. Additional capital requirements are achieved by other means; e.g., Minimum Tier 1 phases up to 6.0%, capital conservation buffer (CCB), minimum common equity capital ratio. In regard to (A), (B), and (D), these are TRUE about Basel III.

43. In updating the Basel II regulatory framework, the Committee asserted that Basel III introduced “a number of fundamental reforms to the international regulatory framework.” Each of the following was a brand new introduction by Basel III (with respect to Basel II) except which was not?

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- A. Liquidity ratios were newly introduced in Basel III
- B. A leverage ratio was newly introduced in Basel III
- C. A concentration in operational risk charge (COCR) was newly introduced in Basel III
- D. A credit value adjustment (CVA) charge was newly introduced in Basel III

Answer: C

Operational risk was unaffected by Basel III; COCR does not exist (Basel 2.5 updated concentration risk)

In regard to (A), (B) and (D), each is true.

The primary, new elements in Basel III include: liquidity ratios (LCG and NSFR), the leverage ratio, CVA and wrong-way (counterparty) risk.

44. According to the Basel Committee, “During the early liquidity phase of the financial crisis, many banks—despite adequate capital levels—still experienced difficulties because they did not manage their liquidity in a prudent manner. The crisis again drove home the importance of liquidity to the proper functioning of financial markets and the banking sector. Prior to the crisis, asset markets were buoyant and funding was readily available at low cost. The rapid reversal in market conditions illustrated how quickly liquidity can evaporate and that illiquidity can last for an extended period of time...the Committee has further strengthened its liquidity framework by developing two minimum standards for funding liquidity.”

Consider the following statements:

- I. The two mentioned standards - which aim to strengthen the liquidity framework - are the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR)
- II. The LCR tries to ensure short-term liquidity resilience (one month) while the NSFR promotes longer-term liquidity resilience (one year)
- III. The LCR anticipates an acute stress scenario by defining total net cash outflows under a stress scenario, while the NSFR does not explicitly simulate a stress scenario

Which of the above is (are) true?

- A. None are true
- B. I only
- C. II only
- D. All are true

Answer: D

All are true

“These standards have been developed to achieve two separate but complementary objectives. The first objective is to promote short-term resilience of a bank’s liquidity risk profile by ensuring that it has sufficient high quality liquid resources to survive an acute stress scenario lasting for one

month. The Committee developed the Liquidity Coverage Ratio (LCR) to achieve this objective. The second objective is to promote resilience over a longer time horizon by creating additional incentives for a bank to fund its activities with more stable sources of one year and has been developed to provide a sustainable maturity structure of assets and liabilities.”

45. Among these two buffers, which does Basel 3 implement to reduce procyclicality and “promote the conservation of capital and the build-up of adequate buffers above the minimum that can be drawn down in periods of stress?”

- I. Basel 3 will phase-in a capital conservation buffer of 2.5% (of RWA) comprised of common equity Tier 1
- II. Basel 3 will phase-in a countercyclical buffer of between 0% and 2.5% (of RWA) to be determined by supervisors (national authorities)
- A. Neither I nor II.
- B. Only I but not II.
- C. Only II but not I.
- D. Both I and II.

Answer: D

Both I and II.

QUESTION 46 THROUGH 49 REFER TO THE FOLLOWING INFORMATION

ABC Bank operates in a G-20 country that has mandated full compliance with the Basel III Accord. ABC Bank’s current assets and capital are provided in the table below. The values in the grey cells can be derived from the data provided.

Regulatory Capital	USD Millions
Total Common Equity Tier 1 Capital	74
Prior to regulatory adjustments	83
Regulatory adjustments	9
Additional Tier 1 Capital	13
Prior to regulatory adjustments	16
Regulatory adjustments	3
Tier 1 Capital	87
Tier 2 Capital	36
Prior to regulatory adjustments	45
Regulatory adjustments	9
Tier 3 Capital	8
Total Capital	

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Risk-Weighted Assets	USD Millions
Total Risk-Weighted Assets for Credit Risk	889
RWA for Credit Risk – Basel III IRB Approach	809
CVA Capital Charge	80
Total Capital Charge for Market Risk	26
Total Capital Charge for operational Risk	20
Other Pillar 1 Capital Requirements	0
Total Risk-Weighted Assets	

Capital Ratios	
Common Equity Tier 1 Capital Ratio	
Tier 1 Capital Ratio	
Total Capital Ratio	

Total Exposure for the Calculation of the Leverage Ratio	2,519
Leverage Ratio	

46. An increase in which of the following would increase ABC Bank's Common Equity Tier 1 capital under the Basel III framework?
- Defined benefit pension fund liabilities.
 - Investment in its own common shares.
 - Unrealized gains on available for sale items.
 - Goodwill and other intangibles.

Answer: B

Tier 1: Predominant form must be common shares and retained earnings

- Common shares issued by the bank that meet the criteria for classification as common shares for regulatory purposes;
- Stock surplus (share premium) resulting from the issue of instruments included Common Equity Tier 1;
- Retained earnings;
- Accumulated other comprehensive income and other disclosed reserves;
- Minority interest
- Regulatory adjustments applied in the calculation of Common Equity Tier 1.

47. With respect to the Basel III accord, what is ABC Bank's current ratio of total regulatory capital to risk-weighted assets?

- A. 5.94%
- B. 8.40%
- C. 8.95%
- D. 13.16%

Answer: B

Regulatory Capital = 87 + 36 = 123

Risk-weighted assets = (26 + 20)/8% + 889 = 575 + 889 = 1,464

The ratio of total regulatory capital to risk-weighted assets = 123/1464 = 8.40%

48. With respect to the Basel III minimum capital requirements, which of the following statements about ABC Bank's current capital and assets is correct?

- A. ABC Bank currently satisfies the minimum requirement for both the Common Equity Tier 1 capital ratio and the Tier 1 capital ratio.
- B. ABC Bank currently satisfies the minimum requirement for Common Equity Tier 1 capital ratio, but not the Tier 1 capital ratio.
- C. ABC Bank currently satisfies the minimum requirement for Tier 1 capital ratio, but not the Common Equity Tier 1 capital ratio.
- D. ABC Bank currently does not satisfy the minimum requirement for either the Common Equity Tier 1 capital ratio or the Tier 1 capital ratio.

Answer: B

Basel III capital requirement:

- Common Equity Tier 1 must be at least 4.5% of risk-weighted assets at all times.
- Tier 1 Capital must be at least 6.0% of risk-weighted assets at all times.
- Total Capital (Tier 1 Capital plus Tier 2 Capital) must be at least 8.0% of risk-weighted assets at all times.

Common Equity Tier 1 capital charge = 74/1,464 = 5.05%

Tier 1 Capital = 87/1,464 = 5.94%

49. With respect to the Basel III accord, what is ABC Bank's current leverage ratio and does it satisfy the minimum requirement?

- A. 2.94%; yes, this satisfies the minimum required leverage ratio.
- B. 2.94%; no, this does not satisfy the minimum required leverage ratio.
- C. 3.45%; yes, this satisfies the minimum required leverage ratio.
- D. 3.45%; no, this does not satisfy the minimum required leverage ratio.

Answer: C

Leverage ratio = Capital / Total Exposure

Capital is Tier 1 capital

Leverage = $87/2,519 = 3.45\%$

The Committee will test a minimum Tier 1 leverage ratio of 3% during the parallel run period from 1 January 2013 to 1 January 2017.