金程教育
GOLDEN FUTURE
可信赖的财经培训专家

2016 FRM PART II

百题巅峰班讲义

市场风险测量与管理

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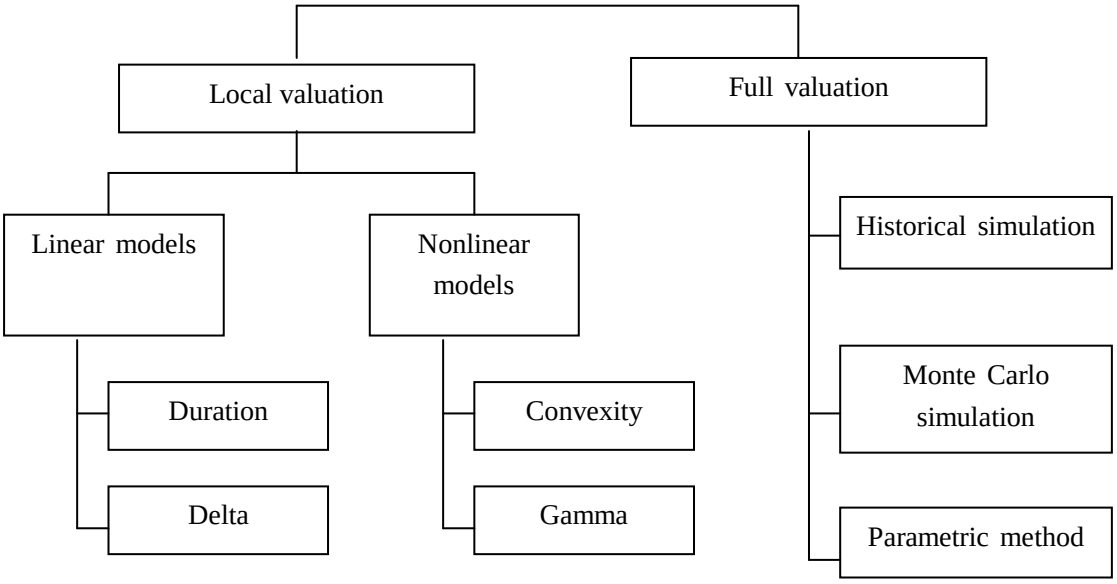
Market Risk Measurement and Management

Key Point: Estimating VaR

Risk Methods



Normal VaR:

$$VaR(\alpha\%) = (-\mu + \sigma \times z_{\alpha}) \times P_{t-1}$$

$$VaR_{T\text{-days}} = VaR_{1\text{-days}} \times \sqrt{T}$$

$$VaR_{p}^{2} = VaR_{1}^{2} + VaR_{2}^{2} + 2\rho \times VaR_{1} \times VaR_{2}$$

$$VaR(dP) = -D^{*}P \times VaR(dy)$$

$$VaR(df) = \Delta \times VaR(dS)$$

$$VaR(dP) = -D^{*}P \times VaR(dy) + (1/2)(C \times P) \times VaR(dy)^{2}$$

$$VaR(df) = \Delta \times VaR(dS) + (1/2)\Gamma \times VaR(dS)^{2}$$

Lognormal VaR:

$$VaR(\alpha\%) = P_{t-1} \times (1 - e^{\mu - \sigma \times z_{\alpha}})$$

Expected Shortfall/ Conditional VaR (CVaR)/Tail Conditional Expectation/Conditional Loss/Expected Tail Loss: expected value of the loss when it exceeds VaR

1. The VaR at a 95% confidence level is estimated to be 1.56 from historical simulation of 1,000

observations. Which of the following statements is most likely true?

A. The parametric assumption of normal returns is correct

B. The parametric assumption of lognormal returns is correct

C. The historical distribution has fatter tails than a normal distribution.

D. The historical distribution has thinner tails than a normal distribution.

Answer: D

2. A risk analyst is comparing the use of parametric and non-parametric approaches for calculating VaR and is concerned about some of the characteristics present in the loss data. Which of the following distribution characteristics would make parametric approaches the favored method to use?

A. Skewness in the distribution

B. Fat tails in the distribution

C. Scarcity of high magnitude loss events

D. Heteroskedasticity in the distribution

Answer: C

Non-parametric approaches can accommodate fat tails, skewness, and any other non-normal features that can cause problems for parametric approaches. However, if the data period that is used in estimation includes few losses or losses with low magnitude, non-parametric methods will often produce risk measures that are too low. Hence parametric methods would be more appropriate in those situations.

3. A portfolio manager owns a portfolio of options on a non-dividend paying stock RTX. The portfolio is made up of 10,000 deep in-the-money call options on RTX and 50,000 deep out-of-the money call options on RTX. The portfolio also contains 20,000 forward contracts on RTX. RTX is trading at USD 100. If the volatility of RTX is 30% per-year, which of the following amounts would be closest to the 1-day VaR of the portfolio at the 95 percent confidence level, assuming 252 trading days in a year?

A. USD 932

B. USD 93,263

C. USD 111,122

D. USD 131,892

Answer: B

We need to map the portfolio to a position in the underlying stock RTX. A deep in-the-money call has a delta of approximately 1, a deep out-of-the-money call has delta of approximately 0 and forwards have a delta of 1. The net portfolio has a delta of about 30,000 and is approximately

gamma neutral. The 1-day VaR estimate at 95 percent confidence level is computed as follows:

$$\alpha \times S \times \Delta \times \sigma \times \text{sqrt}(1/T) = 1.645 \times 100 \times 30{,}000 \times 0.30 \times \text{sqrt}(1/252) = 93{,}263$$

4. A portfolio consists of options on Microsoft and AT&T. The options on Microsoft have a delta of 1000, and the options on AT&T have a delta of 20000. The Microsoft share price is $120, and the AT&T share price is $30. Assuming that the daily volatility of Microsoft is 2% and the daily volatility of AT&T is 1% and the correlation between the daily changes is 0.3, the 5-day 95% VaR is

   A. 26193

   B. 25193

   C. 27193

   D. 24193

Answer: A

$VaR_{Mic} = 1.65 \times 2\% \times 120 \times 1000 = 3960$

$VaR_{AT\&T} = 1.65 \times 1\% \times 30 \times 20000 = 9900$

$$VaR_{P(5\text{–day, }95\%)} = \sqrt{3960^2 + 9900^2 + 2 \times 0.3 \times 3960 \cdot 9900} \times \sqrt{5} = 26193$$

5. After estimating the 99%, 1-day VaR of a bank's portfolio to be USD 1,484 using historical simulation with 1000 past trading days, you are concerned that the VaR measure is not providing enough information about tail losses. You decide to re-examine the simulation results and sort the simulated daily P&L from worst to best giving the following worst 15 scenarios:

Scenario Rank	Daily P/L
1	USD -2,833
2	USD -2,333
3	USD -2,228
4	USD -2,084
5	USD -1,960
6	USD -1,751
7	USD -1,679
8	USD -1,558
9	USD -1,542
10	USD -1,484
11	USD -1,450
12	USD -1,428

13	USD -1,368
14	USD -1,347
15	USD -1,319

What is the 99%, 1-day expected shortfall of the portfolio?

A. USD 433

B. USD 1,285

C. USD 1,945

D. USD 2,833

Answer: C

Expected Shortfall = Average of the worst 10 daily P&L= USD 1945

6. The bank's trading book consists of the following two assets:

Asset	Annual Return	Volatility of Annual Return	Value
A	10%	25%	100
B	20%	20%	50

Correlation (A, B) = 0.2

How would the daily VaR at 99% level change if the bank sells 50 worth of asset A and buys 50 worth of asset B?

Assume there are 250 trading days in a year.

A. 0.2286

B. 0.4581

C. 0.7705

D. 0.7798

Answer: B

The trade will decrease the VaR by 0.4581

7. A trader has an option position in crude oil with a delta of 100000 barrels and gamma of -50000 barrels per dollar move in price. Using the delta-gamma methodology, compute the VaR on this position, assuming the extreme move on crude oil is $2.00 per barrel.

A. $100,000

B. $200,000

C. $300,000

D. $400,000

Answer: C

$$\mathrm{VaR}(df) = \Delta \times \mathrm{VaR}(dS) + (1/2)\Gamma \times \mathrm{VaR}(dS)^2$$

$$\mathrm{VaR}(df) = 100{,}000 \times (-2.00) + (1/2)(-50{,}000) \times (-2.00)^2 = -\$300{,}000$$

8. The annual mean and volatility of a portfolio are 10% and 40%, respectively. The current value of the portfolio is GBP 1,000,000. How does the 1-year 95% VaR that is calculated using a normal distribution assumption (normal VaR) compare with the 1-year 95% VaR that is calculated using the lognormal distribution assumption (lognormal VaR)?

A. Lognormal VaR is greater than normal VaR by GBP 13,040

B. Lognormal VaR is greater than normal VaR by GBP 17,590

C. Lognormal VaR is less than normal VaR by GBP 13,040

D. Lognormal VaR is less than normal VaR by GBP 17,590

Answer: C

$$\text{Normal VaR} = 0.1 - (1.645 \times 0.4) = 0.558$$

$$\text{Lognormal VaR} = 1 - \exp\left[0.1 - (1.645 \times 0.4)\right] = 0.4276$$

Hence, lognormal VaR is smaller than Normal VaR by 13.04% per year. With a portfolio of GBP 1,000,000, this translates to GBP 13,040.

9. What is a key weakness of the value at risk (VaR) measure? VaR:

A. Does not consider the severity of losses in the tail of the returns distribution.

B. Is quite difficult to compute.

C. Is subadditive.

D. has an insufficient amount of backtesting data

Answer: A

VaR does not consider losses beyond the VaR threshold level.

10. A mutual fund has USD 50 billion in assets. The risk manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (USD)
95.5%	787,000,000
96.0%	800,000,000
96.5%	835,000,000
97.0%	865,000,000
97.5%	895,000,000
98.0%	931,000,000
98.5%	979,000,000
99.0%	1,042,000,000
99.5%	1,139,000,000

What is the closest estimate of the daily expected shortfall at the 97.5% confidence level?

A. USD 821 million

B. USD 895 million

C. USD 919 million

D. USD 1023 million

Answer: D

An estimate of the expected shortfall can be obtained by taking the average of the VaRs for the various confidence levels that are greater than 97.5%.This leads to an estimate of USD 1,023,000,000.

11. A large commercial bank is using VaR as its main risk measurement tool. Expected shortfall (ES) is suggested as a better alternative to use during market turmoil. What should be understood regarding VaR and ES before modifying current practices?

A. Despite being more complicated to calculate, ES is easier to backtest than VaR.

B. Relative to VaR, ES leads to more required economic capital for the same confidence level.

C. While VaR ensures that the estimate of portfolio risk is less than or equal to the sum of the risks of that portfolio's positions, ES does not.

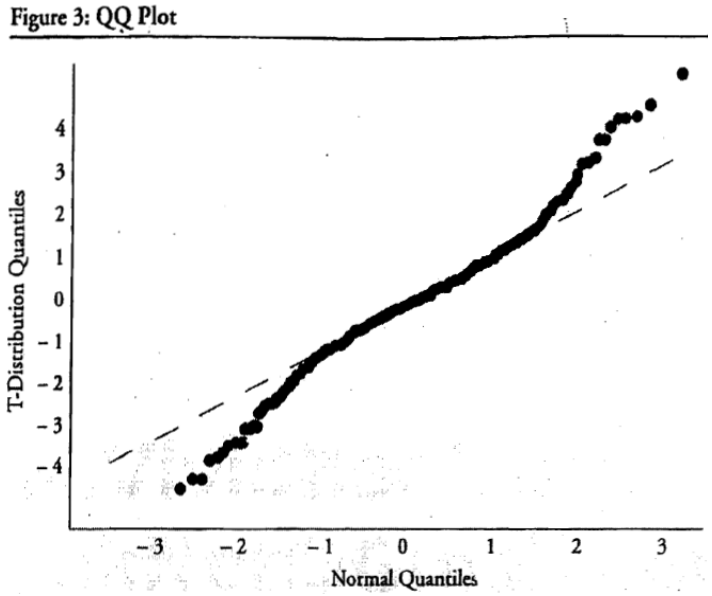
D. Both VaR and ES account for the severity of losses beyond the confidence threshold.

Answer: B

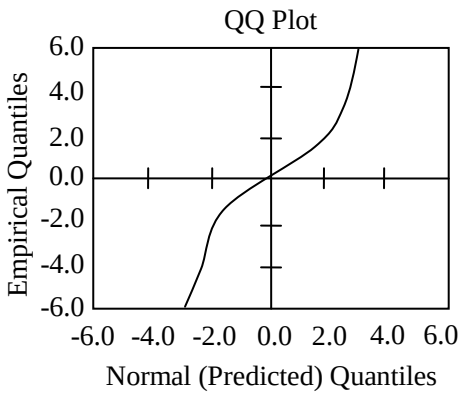
Expected shortfall is always greater than or equal to VaR for a given confidence level, since ES accounts for the severity of expected losses beyond a particular confidence level, while VaR measures the minimum expected loss at that confidence level. Therefore, ES would lead to a higher level of required economic capital than VaR for the same confidence level. In practice, however, regulators often correct for the difference between ES and VaR by lowering the required confidence level for banks using ES compared to those using VaR.

Key Point: Quantile-Quantile Plots

The quantile-quantile (QQ) plot is a visual inspection of an empirical quantile relative to a hypothesized theoretical distribution. If the empirical distribution closely matches the theoretical distribution, the QQ plot would be linear.



12. Consider the following QQ plot:



Which is the most likely true statement about the QQ plot?

A. The empirical distribution is actually parametric.

B. The empirical distribution has positive skew.

C. The empirical distribution has leptokurtosis (kurtosis>0)

D. If we perform a linear transformation of location and scale, the distribution is approximately normal.

Answer: C

Heavy tails: the steeper slope - i.e., greater than 1.0 - at the tails indicates the tails are heavier than the reference distribution

Key Point: Coherent Risk Measures

1. **Monotonicity:** if $X_1 \le X_2$, $\rho(X_1) \ge \rho(X_2)$.

In other words, if a portfolio has systematically lower values than another (in each state of the world), it must have greater risk. Standard deviation violates the monotonicity condition.

2. **Translation Invariance:** $\rho(X+k) = \rho(X) - k$.

In other words, adding cash k to a portfolio should reduce its risk by k. This reduces the lowest portfolio value. As with X, k is measured in dollars.

3. **Homogeneity:** $\rho(bX) = b\rho(X)$.

In other words, increasing the size of a portfolio by a factor b should scale its risk measure by the same factor b. This property applies to the standard deviation.

4. **Subadditivity:** $\rho(X_1 + X_2) \leq \rho(X_1) + \rho(X_2)$.

In other words, the risk of a portfolio must be less than the sum of separate risks. Merging portfolios cannot increase risk. VaR violates the subadditivity condition.

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13. It is not always apparent how risk should be quantified for a given bank when there are many different possible risk measures to consider. Prior to defining specific measures, one should be aware of the general characteristics of ideal risk measures. Such measures should be intuitive, stable, easy to understand, coherent, and interpretable in economic terms. In addition, the risk decomposition process must be simple and meaningful for a given risk measure. Standard deviation, value at risk (VaR), expected shortfall (ES), and spectral and distorted risk measures are commonly used measures to calculate economic capital. However, it is not easy to select a risk measure to calculate economic capital, as each measure has its respective pros and cons. Which of the following statements pertaining to the pros and cons of these risk measures is not accurate?

    A. Standard deviation does not have the property of monotonicity, and therefore, it is not coherent.

    B. VaR does not have the property of subadditivity, and therefore; it is not coherent.

    C. ES is not stable regardless of the loss distribution.

    D. Spectral and distorted risk measures are neither intuitive nor commonly used in practice.

Answer: C

Expected shortfall's stability as a measure of risk depends on the loss distribution.

14. Consider a trader with an investment in a corporate bond with face value of $100,000 and default probability of 0.5%. Over the next period, we can either have no default, with a return of zero, or default with a loss of $100,000. The payoffs are thus −$100,000 with probability of 0.5% and +$0 with probability of 99.5%. Since the probability of getting $0 is greater than 99%, the VaR at the 99% confidence level is $0, without taking the mean into account. This is consistent with the definition that VaR is the smallest loss, such that the right-tail

probability is at least 99%. Now, consider a portfolio invested in three bonds (A, B, C) with the same characteristics and independent payoffs. Please compute the portfolio VaR at the 99% confidence level (using loss distribution method):

A. $0

B. $100,000

C. $200,000

D. $300,000

Answer: B

State	Bonds	Probability	Payoff
No default		$0.995 \times 0.995 \times 0.995 = 0.9850749$	$0
1 default	A,B,C	$3 \times 0.005 \times 0.995 \times 0.995 = 0.0148504$	−$100,000
2 defaults	AB,AC,BC	$3 \times 0.005 \times 0.005 \times 0.995 = 0.0000746$	−$200,000
3 defaults	ABC	$0.005 \times 0.005 \times 0.005 = 0.0000001$	−$300,000

Here, the probability of zero or one default is 0.9851 + 0.0148 = 99.99%. The portfolio VaR is therefore $100,000, which is the lowest number, such that the probability exceeds 99%. Note that the portfolio VaR is greater than the sum of individual VaRs. In this example, VaR is not sub additive. This is an undesirable property because it creates disincentives to aggregate the portfolio, since it appears to have higher risk.

15. Which of the following statements comparing VaR with expected shortfall is true?

A. Expected shortfall is sub-additive while VaR is not.

B. Both VaR and expected shortfall measure the amount of capital an investor can expect to lose over a given time period and are, therefore, interchangeable as risk measures.

C. Both VaR and expected shortfall depend on the assumption of a normal distribution of returns.

D. VaR can vary according to the confidence level selected, but expected shortfall will not.

Answer: A

VaR measures the expected amount of capital one can expect to lose within a given confidence level over a given period of time. One of the problems with VaR is that it does not provide information about the expected size of the loss beyond the VaR. VaR is often complemented by the expected shortfall, which measures the expected loss conditional on the loss exceeding the VaR. Note that since expected shortfall is based on VaR, changing the confidence level may change both measures. A key difference between the two measures is that VaR is not sub-additive, meaning that the risk of two funds separately may be lower than the risk of a portfolio where the two funds are combined. Violation of the sub-additive assumption is a problem with VaR that does not exist with expected shortfall.

16. Assume that an operational process has a 5% probability of creating a material loss and, otherwise, no material loss is experienced (i.e., Bernoulli). If the material loss occurs, the severity is normally distributed with a mean of $4 million and standard deviation of $2 million. What is the 95% expected shortfall?

A. $0.71 million

B. $3.29 million

C. $4.00 million

D. $7.29 million

Answer: C

ES = E(L | L > VaR). In this case, the 95% ES is the expected loss conditional on the loss occurring, which coincides with the mean of the normal distribution.

17. Assume position (X) contains risk of R(X) and position (Y) contains risk of R(Y). Our analysis finds that the risk of the combined portfolio R(X+Y) is greater than the sum of the individual positions risks; i.e., we find R(X+Y) > R(X) + R(Y). This illustrates a violation of which coherence property?

A. Monotonicity

B. Subadditivity

C. Positive Homogeneity

D. Translational invariance

Answer: B

The diversification should make the portfolio less risky, or at the very least, equally risky. But the combination should not penalize diversification in terms of the risk metric.

18. Which of the following is a true statement about expected shortfall (ES)?

A. ES is a coherent spectral measure which gives equal weight to the tail quantiles

B. ES is a coherent spectral measure which gives increasingly greater weight to higher tail quantiles

C. ES is a coherent spectral measure but gives decreasingly less weight to higher tail quantiles

D. ES is coherent, VaR is not coherent, and neither are spectral measures

Answer: A

ES is a coherent spectral measure which gives equal weight to the tail quantiles. The general class is spectral measures, which contain a weighting function. Both ES and VaR are special cases of a spectral measure (the spectral function generalized both ES & VaR). Spectral measures are coherent under conditions that are met by ES but not by VaR; “Spectral” is associated with, but

does not necessarily imply, coherence.

Key Point: Non-Parametric Approach (Computing VaR)

Bootstrap historical simulation approach: involves repeated sampling with replacement, the 5% VaR is recorded from each sample draw. The average of the VaRs from all the draws is the VaR estimate. Note: empirical analysis demonstrates that the bootstrapping technique consistently provides more precise estimates of coherent risk measures than historical simulation on raw data alone.

Weighted historical simulation approach:

- Age-weighted historical simulation:

$$w(i) = \frac{\lambda^{i-1}(1-\lambda)}{1-\lambda^{n}}$$

- Volatility-weighted historical simulation:

$$r_{t,i}^{*} = \left(\frac{\sigma_{T,i}}{\sigma_{t,i}}\right) \times r_{t,i}$$

- Correlation-weighted historical simulation: Intuitively, the historical correlation matrix needs to be adjusted to the new information environment. This is accomplished, loosely speaking, by "multiplying" the historic returns by the revised correlation matrix to yield updated correlation-adjusted returns.
- Filtered historical simulation: Combines the traditional historical simulation model with GARCH model.

19. Johanna Roberto has collected a data set of 1,000 daily observations on equity returns. She is concerned about the appropriateness of using parametric techniques as the data appears skewed. Ultimately, she decides to use historical simulation and bootstrapping to estimate the 5% VaR. which of the following steps is most likely to be part of the estimation procedure?
    A. Filter the data to remove the obvious outliers.
    B. Repeated sampling with replacement.
    C. Identify the tail region from reordering the original data.
    D. Apply a weighting procedure to reduce the impact of older data.

Answer: B

Bootstrapping from historical simulation involves repeated sampling with replacement. The 5% VaR is recorded from each sample draw. The average of the VaRs from all the draws is the VaR estimate. The bootstrapping procedure does not involve filtering the data or weighting observations. Note that the VaR from the original data set is not used in the analysis.

20. Jack has collected a large data set of daily market returns for three emerging markets and he want to compute the VaR. He is concerned about the non-normal skew in the data and is considering non-parametric estimation methods. Which of the following statements about Age-weighted historical simulation approach is most accurate?

A. The age-weighted procedure incorporate estimates from GARCH model.

B. If the decay factor in the model is close to 1, there is persistence within the data set.

C. When using this approach, the weight assigned on day i is equal to:

$$w(i) = \lambda^{i-1}(1-\lambda)/1-\lambda^{i}$$

D. The number of observation should at least exceed 250.

Answer: B

If the intensity parameter (i.e., decay factor) is close to 1, there will be persistence (i.e., slow decay) in the estimate. The expression for the weight on day *i* has *i* in the exponent when it should be *n*. While a large sample size is generally preferred, some of the data may no longer be representative in a large sample.

21. If volatility (0) is the current (today's) volatility estimate and volatility (t) is the volatility estimate on a previous day (t), which best describes volatility-weighted historical simulation?

A. First conduct typical historical simulation (HS) on return series. Then multiply VaR by volatility(0)/volatility(t)

B. First conduct typical historical simulation (HS) on return series. Then multiply VaR by volatility(t)/volatility(0)

C. Each historical return (t) is replaced by: return (t)*volatility (0)/volatility (t). Then conduct typical historical simulation (HS) on adjusted return series.

D. Each historical return (t) is replaced by: return (t)*volatility (t)/volatility (0). Then conduct typical historical simulation (HS) on adjusted return series.

Answer: C

Each historical return (t) is replaced by: return(t) × volatility(0)/volatility(t). Then conduct typical historical simulation (HS) on adjusted return series

For example, if on the historical day (t), the return(t) was -2.0% and volatility(t) was 10%, while today's volatility estimate is 20%, then the adjusted return is -2.0% × 20%/10% = - 4.0% . In this way, "Actual returns in any period t are therefore increased (or decreased), depending on whether the current forecast of volatility is greater (or less than) the estimated volatility for period t. We now calculate the HS P/L using [the adjusted returns] instead of the original data set, and then proceed to estimate HS VaRs or ESs in the traditional way (i.e., with equal weights, etc.).

22. All of the following approaches improve the traditional historical simulation approach for

estimating VaR except the:

A. Volatility-weighted historical simulation.

B. Age-weighted historical simulation.

C. Market-weighted historical simulation.

D. Correlation- weighted historical simulation.

Answer: C

Market-weighted historical simulation is not discussed in this topical. Age-weighted historical simulation weights observations higher when they appear closer to the event date. Volatility-weighted historical simulation adjusts for changing volatility levels in the data. Correlation- weighted historical simulation incorporates anticipated changes in correlation between assets in the portfolio.

23. Which of the following statements about volatility-weighting is true?

A. Historic returns are adjusted, and the VaR calculation is more complicated.

B. Historic returns are adjusted, and the VaR calculation procedure is the same.

C. Current period returns are adjusted, and VaR calculation is more complicated.

D. Current period returns are adjusted, and VaR calculation is the same.

Answer: B

The volatility-weighting method adjusts historic returns for current volatility. Specifically, return at time t is multiplied b (current volatility estimate/ volatility estimate at time t). However, the actual procedure for calculating VaR using a historical simulation method is unchanged; it is only the inputted data that changes.

24. All of the following items are generally considered advantages of non-parametric estimation methods except:

A. Ability to accommodate skewed data.

B. Availability of data.

C. Use of historical data.

D. Little or no reliance on covariance matrices.

Answer: C

The use of historical data in non-parametric analysis is a disadvantage, not an advantage. If the estimation period was quiet (volatile) then the estimated risk measures may understate (overstate) the current risk level. Generally, the largest VaR cannot exceed the largest loss in the historical period. On the other hand, the remaining choices are all considered advantages of non-parametric methods. For instance, the non-parametric nature of the analysis can accommodate skewed data, data points are readily available, and there is no requirement for estimates of covariance matrices.

Key Point: Modeling Dependence: Correlations and Copulas

Correlation: $\rho(X,Y)=\frac{Cov(X,Y)}{\sigma(X)\sigma(Y)}$

Spearman's rank correlation:

$$\rho_S=1-\frac{6\sum_{i=1}^{n}d_i^2}{n(n^2-1)}$$

Kendall's τ:

$$\tau=\frac{n_c-n_d}{n(n-1)/2}$$

Copula:

$C_{GD}[Q_i(t), \ldots, Q_n(t)] = M_n [N^{-1}(Q_1(t)), \ldots, N^{-1}(Q_n(t)); \rho_M]$

- Qi(t): cumulative default probability of asset i at time t
- C_{GD}: Gaussian default time copula
- M_n : the joint, n-variate cumulative standard normal distribution
- ρ_M: the n*n symmetric, positive-definite correlation matrix of the n-variate normal distribution M_n

25. Which of the following statements about correlation and copula are correct?

I. Copula enables the structures of correlation between variables to be calculated separately from their marginal distributions.

II. Transformation of variables does not change their correlation structure.

III. Correlation can be a useful measure of the relationship between variables drawn from a distribution without a defined variance.

IV. Correlation s a good measure of dependence when the measured variables are distributed as multivariate elliptical.

A. I and IV only

B. II, III, and IV only

C. I and III only

D. II and IV only

Answer: A

"I" is true. Using the copula approach, we can calculate the structures of correlation between variables separately from the marginal distributions. "IV" is also true. Correlation is a good measure of dependence when the measured variables are distributed as multivariate elliptical.

"II" is false. The correlation between transformed variables will not always be the same as the

correlation between those same variables before transformation. Data transformation can sometimes alter the correlation estimate. “III” is also false. Correlation is not defined unless variances are finite.

26. A risk manager uses the past 480 months of correlation data from the Dow Jones Industrial Average (Dow) to estimate the long-run mean correlation of common stocks and the mean reversion rate. Based on historical data, the long-run mean correlation of Dow stocks was 32%, and he regression output estimates the following regression relationship: Y = 0.215 - 0.75 X. Suppose that in April 2014, the average monthly correlation for all Dow stocks was 36%. What is the expected correlation for May 2014 assuming the mean reversion rate estimated in the regression analysis?

    A. 32%

    B. 33%

    C. 35%

    D. 37%

Answer: B

There is a -4% difference from the long-run mean correlation and April 2014 correlation (32% - 36% = -4%). The inverse of the β coefficient in the regression relationship implies a mean reversion rate of 75%. Thus, the expected correlation for May 2014 is 33.0%:

$S_t = a(\mu - S_{t-1}) + S_{t-1}$

$S_t = 0.75(32\% - 36\%) + 0.36 = 0.33$

27. A risk manager uses the past 480 months of correlation data from the Dow Jones Industrial Average (Dow) to estimate the long-run mean correlation of common stocks and the mean reversion rate. Based on historical data, the long-run mean correlation of Dow stocks was 34%, and he regression output estimates the following regression relationship: Y = 0.215 - 0.77X. Suppose that in April 2014, the average monthly correlation for all Dow stocks was 33%. What is the estimated one-period autocorrelation for this time period based on the mean reversion rate estimated in the regression analysis?

    A. 23%

    B. 26%

    C. 30%

    D. 33%

Answer: A

The autocorrelation for a one-period lag is 23% for the same sample. The sum of the mean reversion rate (77% given the beta coefficient of -0.77) and the one-period autocorrelation rate

will always equal 100%.

28. A risk manager gathers five years of historical returns to calculate the Spearman rank correlation coefficient for stocks X and Y from 2010 to 2014 are as follows:

Year	X	Y
2010	5.0%	-10.0%
2011	50.0%	-5.0%
2012	-10.0%	20.0%
2013	-20.0%	40.0%
2014	30.0%	15.0%

What is the Spearman rank correlation coefficient for stocks returns of X and Y?

A. -0.7

B. -0.5

C. 0.3

D. 0.7

Answer: A

The following table illustrate the calculation used to determine the sum of squared ranking deviations:

Year	X	Y	X Rank	Y Rank	d_i	di^2
2013	-20.0%	40.0%	1	5	-4	16
2012	-10.0%	20.0%	2	4	-2	4
2010	5.0%	-10.0%	3	1	2	4
2014	30.0%	15.0%	4	3	1	1
2011	50.0%	-5.0%	5	2	3	9
					Sum	34

Thus, the Spearman rank correlation coefficient is -0.7:

$$\rho_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n\left(n^2-1\right)} = 1 - \frac{6\times 34}{5\left(25-1\right)} = -0.7$$

29. The dependence structure between the returns of financial assets plays an important role in risk measurement. For liquid markets, which of following statements is incorrect?

A. Correlation is a valid measure of dependence between random variables for only certain types of return distributions.

B. Even if the return distributions of two assets have a correlation of zero, the returns of these assets are not necessarily independent.

C. Copulas make it possible to model marginal distributions and the dependence structure separately.

D. With short time horizons (3 months or less), correlation estimates are typically very stable.

Answer: D

Correlation estimates tend to be very volatile when short term time horizons are considered.

30. The long-term mean of the correlation data is 35%. In January 2014, the averaged correlation of the 30 × 30 Dow correlation matrices was 27%.From the regression function from 1972 to 2012, the average mean reversion was 77.5%. Using the simple s(t) - s(t-1) = alpha × [μ - s(t - 1)] model, what is the expected correlation for February 2014?

A. 27.75%

B. 28.80%

C. 33.20%

D. 37.50%

Answer: C

33.20% = 27.0% + 77.5% × (35.0% - 27.0%)

31. The annual returns of two assets, X(i) and Y(i), are shown below for the five years from 2010 to 2103. The returns have been sorted with respect to X(i); for example, in 2010 X(i) returned 6.0% which ranked 4th among its annual returns (ranking is from worst to best). The Pearson correlation coefficient, taken from the actual return pairs - for example, (X, Y) = (-12.5%, 4.3%) - is about 0.756. But we are interested instead in a rank correlation. Which is nearest to the Spearman's rank correlation?

A. 0.25

B. 0.33

C. 0.60

D. 0.85

Year	Ranked Return of X(i)	Assigned (same year) Return of Y(i)
2013	-12.5%	4.3%
2011	-9.6%	2.5%
2010	4.3%	6.0%
2014	8.7%	6.2%
2012	16.0%	5.5%

Answer: C

Spearman's rank correlation = 1 - (6 × [sum of $d(i)^2$]/[$n(n^2-1)$] = 1 - (6 × 8)/[5 × (5^2 - 1)] = 1 -

48/120 = 0.60

32. What is a copula function?

A. A copula correlates a stock price and its volatility which allows it to model equity implied volatility skew.

B. A copula function joins univariate distribution to one multivariate distribution.

C. A copula function solve for the conditional P[X|Y] as function of the product of P[Y|X] and the ratio of marginal probabilities P[X]/P[Y].

D. A copula function is a limiting (special) case of the Pearson model, such that it only analyzes linear relationship between variables.

Answer: B

A copula function joins (n) univariate distributions to one multivariate (n-dimensional) distribution

In regard to false (A), this refers to the original Heston (1993) model.

In regard to false (C), this is a Bayes Theorem

In regard to false (D), this refers to the binomial correlation model

33. About correlation measures including Pearson's, Spearman's and Kendall's tau, each of the following is true accept which is false?

A. Pearson is a cardinal correlation measure while Spearman's and Kendall's tau are ordinal correlation measures.

B. The problem with applying ordinal rank correlations to cardinal observations is that ordinal correlation are less sensitive to outliers (an unwelcome property in risk management)

C. An advantage of Pearson's correlation coefficient is that it is invariance to transformations: e.g., Pearson's correlation between pairs [x, y] will equal Pearson's correlation between [ln(x), ln(y)]

D. Pearson's correlation coefficient is a natural (good) dependence measure when variables are distributed as multivariate elliptical (e.g., normal, student's t); however, we know many financial variables are not elliptically distributed.

Answer: C

False. Pearson's is strictly not invariant to transformation. For example, Pearson's correlation between pairs [x, y] will not equal Pearson's between[ln(x), ln(y)]. In regard to (A), (B) and (D), each is TRUE.

34. In estimating correlation matrices, risk managers often assume an underlying distribution for

the correlations. Which of the following statements most accurately describes the best fit distributions for equity correlation distributions, bond correlation distributions, and default probability distribution? The best fit distribution for the equity, bond, and default probability correlation distributions, respectively are:

A. Lognormal, generalized extreme value, and normal.

B. Johnson SB, generalized extreme value, and Johnson JB.

C. Beta, normal, and beta.

D. Johnson SB, normal, and beta.

Answer: B

Equity correlation distributions and default probability correlation distributions are best fit with the Johnson SB distribution. Bond correlation distributions are best fit with the generalized extreme value distribution.

35. A risk manager is using a copula correlation model to perform stress tests of financial risk during systemic economic crises. If the risk manager is concerned about extreme outliers, which of the following correlation coefficient measures should be used?

A. Kendall's τ correlation

B. Ordinal correlation

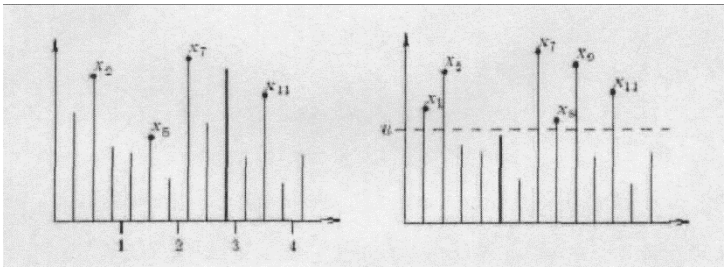
C. Pearson correlation

D. Spearman's rank correlation

Answer: C

The Pearson correlation coefficient is preferred to ordinal measures when outliers are a concern. Spearman's rank correlation and Kendall's τ are ordinal correlation coefficients that should not be used with cardinal financial variables because they underestimate risk by ignoring the impact of outliers.

Key Point: Extreme Value



Generalized Extreme Value Distribution (Block Maxima Method)

$$F(x) = e^{-\left(1+\xi\cdot\frac{x-\mu}{\sigma}\right)^{-1/\xi}}, \quad 1+\xi\cdot\frac{x-\mu}{\sigma} > 0$$

When $\xi > 0$, that is Fréchet distribution, the tails are "heavy".

When $\xi = 0$, that is Gumbel distribution, the tails are "light" as is the case for normal.

When $\xi < 0$, that is Weibull distribution, the tails are "lighter".

Generalized Pareto Distribution (Peaks over Threshold)

In this distribution, the tail (or shape) index parameter, ξ, is the same as it is in GEV distribution.

For the POT approach, the VaR and expected shortfall formulas are as follows:

$$VaR = u + \frac{\beta}{\xi}\left[\left[\frac{n}{N_u}(1-\text{confidence level})\right]^{-\xi} - 1\right]$$

where:

ξ = shape parameter

β = scale parameter

u = threshold(in percentage terms)

n = number of observations

N_u = number of ovservations that exceed threshold

$$ES = \frac{VaR}{1-\xi} + \frac{\beta - \xi u}{1-\xi}$$

36. Which of the following statements regarding extreme value theory (EVT) is incorrect?

A. In contrast to conventional approaches for estimating VaR, EVT only considers the tail behavior of the distribution.

B. Conventional approaches for estimating VaR that assume that the distribution of returns follows a unique distribution for the entire range of values may fail to properly account for the fat tails of the distribution of returns.

C. EVT attempts to find the optimal point beyond which all values belong to the tail and then models the distribution of the tail separately.

D. By smoothing the tail of the distribution, EVT effectively not ignores extreme events and losses that can generally be labeled outliers.

Answer: D

EVT only uses information in the tail, so statement a. is correct. Conventional approaches such as delta-normal VaR assume a fixed p.d.f. for the entire distribution, which may understate the extent of fat tails. So, statement b. is correct. The first step in EVT is to choose a cutoff point for the tail, then to estimate the parameters of the tail distribution, so statement c. is correct. Finally, EVT does not ignore extreme events (as long as they are in the sample).

37. You are a quantitative analyst at an insurance company. Given some large losses incurred by the company recently, your boss is interested in determining the expected number of extreme losses per year. As well, your boss is quite certain that the company is now more likely to

experience an extreme event than before. Based on the information provided by your boss, to model the frequency and severity of extreme events, which of the following distributions would be most appropriate to use?

	Frequency	Severity
A.	Poisson distribution	Frechet distribution
B.	Poisson distribution	Gumbel distribution
C.	Weibull distribution	Frechet distribution
D.	Weibull distribution	Gumbel distribution

Answer: A

38. The peaks-over-threshold approach generally requires:

A. More estimates parameters than the GEV approach and shares one parameter with the GEV.

B. Fewer estimates parameters than the GEV approach and shares one parameter with the GEV.

C. More estimates parameters than the GEV approach and does not shares any parameter with the GEV approach.

D. Fewer estimates parameters than the GEV approach and does not shares any parameter with the GEV approach.

Answer: B

The POT approach generally has fewer parameters, but both POT and GEV approaches share the tail parameterξ

39. According to extreme value theory (EVT), when examining distributions of losses exceeding a threshold value, which of the following is correct?

A. To apply EVT, the underlying loss distribution must be either normal or lognormal.

B. The threshold value is typically chosen near the estimated mean of the underlying loss distribution.

C. The number of exceedances decreases as the threshold value decreases, which causes the reliability of the parameter estimates to increase.

D. As the threshold value is increased, the distribution of exceedances converges to a generalized Pareto distribution.

Answer: D

A key foundation of EVT is than as the threshold value is increased, the distribution of loss exceedances converges to a generalized Pareto distribution. Assuming the threshold is high enough, excess losses can be modeled using the Generalized Pareto distribution.

To apply EVT, the underlying loss distribution can be any of the commonly used distributions: normal, lognormal, t, etc., and will usually be unknown.

Choosing the threshold value near the estimated mean of the underlying loss distribution is arbitrary and this method is not typically employed.

As the threshold value is decreased, the number of exceedances increases.

40. 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. More applicable but decreases 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 increases the number of observations in the modeling procedure.
    D. Less applicable but increases the number of observations in the modeling procedure.

Answer: A

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.

41. Let X be a random variable representing the daily loss of your portfolio. The "peaks over threshold" (POT) approach considers a threshold value, u, of X and the distribution of excess losses over this threshold. Which of the following statements about this application of extreme value theory is correct?
    A. To apply the POT approach, the distribution of X must be elliptical and known.
    B. If X is normally distributed, the distribution of excess losses requires the estimation of only one parameter, β, which is a positive scale parameter.
    C. To apply the POT approach, one must choose a threshold, u, which is high enough that the number of observations in excess of u is zero.
    D. As the threshold, u, increases, the distribution of excess losses over u converges to a generalized Pareto distribution.

Answer: D

The distribution of excess losses over u converges to a generalized Pareto distribution as the threshold value u increases.

The distribution of X itself can be any of the commonly used distribution: normal, lognormal, t, etc., and will usually be known. The distribution of excess losses requires the estimation of two parameters, a positive scale parameter β and a shape or tail index parameter ξ. One must choose a threshold u that is high enough so that the theory applies but also low enough so that there are observations in excess of u.

Key Point: Backtesting VaR

Using Failure Rates in Model Verification N/T

H_0: accurate model H_a: inaccurate model

Test statistic:

$$LR_{uc} = -2\ln\left[(1-p)^{T-N}p^N\right] + 2\ln\left\{\left[1-(N/T)^{T-N}(N/T)^N\right]\right\}$$

- P: the probability of exception, p=1-c
- N: the number of exceptions
- T: the number of samples

If LR > 3.84, we would reject the hypothesis that the model is correct.

$$MRC_t^{IMA} = \text{Max}\left(k\frac{1}{60}\sum_{i=1}^{60}VAR_{t-i},\ VAR_{t-1}\right) + SRC_t$$

Basel Penalty Zones		
Zone	**Number of Exceptions**	**Multiplier(k)**
Green	0 to 4	3.00
Yellow	5	3.40
	6	3.50
	7	3.65
	8	3.75
	9	3.85
Red	10 or more	4.00

42. Which of the following statements regarding verification of a VaR model by examining its failure rates is false?

I. The frequency of exceptions should correspond to the confidence level used for the model.

II. According to Kupiec (1995), we should reject the hypothesis that the model is correct if the LR > 3.84.

III. Backtesting VaR models with lower confidence levels is difficult because the number of exceptions is not high enough to provide meaningful information.

IV. The range for the number of exceptions must strike a balance between the chances of rejecting an accurate model (a type 1 error) and the chance of accepting an inaccurate model (a type2 error)

A. I and IV
B. II only
C. III only
D. II and IV

Answer: C

Backtesting VaR models with higher confidence levels is difficult because the number of exceptions is not high enough to provide meaningful information.

43. Basel II requires a backtest of a bank's internal value at risk (VaR) model (IMA). Assume the bank's ten-day 99% VaR is $1 million (minimum of 99% is hard-wired per Basel). The null hypothesis is: the VaR model is accurate. Out of 1,000 observations, 25 exceptions are observed (we saw the actual loss exceed the VaR 25 out of 1000 observations). (Binomial CDF)
    A. We will probably call the VaR model good (accurate) but we risk a Type I error.
    B. We will probably call the VaR model good (accurate) but we risk a Type II error.
    C. We will probably call the model bad (inaccurate) but we risk a Type I error.
    D. We will probably call the model bad (inaccurate) but we risk a Type II error.

Answer: C

The probability of 25 or more exceptions will only be observed 1 – 99.996%. So, we reject the model.

Null = good model. To decide the model is bad model is to reject null and this implies a risk of type I error.

44. A bank conducted a backtest of its 95% daily value at risk (VaR) and observed 19 exceptions - i.e., the number of days where the daily P&L loss exceeded the VaR - over the last year which included 250 trading days (T = 250). If we use the normal distribution to approximate the binomial for purposes of model verification, what is our accept/reject opinion of the model under a 90% two-tailed test?
    A. Accept with a test statistic of 1.25
    B. Accept with a test statistic of 1.89
    C. Reject with a test statistic of 1.25
    D. Reject with a test statistic of 1.89

Answer: D

Null hypothesis is H0: Model is good with E[exceptions] = (1 - 95%) × 250 = 12.5 exceptions

The standard error (standard deviation) of the binomial variable = SQRT[p(1-p)T] = SQRT(5% × 95% × 250) = 3.446

The test statistic is [19 - 12.5] / 3.446 = 1.89

In words, we observed 6.5 more exceptions (19 - 12.5) than expected if the model is good, which is 1.89 standard deviations away from the expected number of exceptions. Since we know that a 95% one-tailed normal confidence interval implies a 1.645 cutoff, we know that 1.645 is also the cutoff for a 90% two-tailed since the normal is symmetrical, this falls outside the acceptance region. We reject the null, assuming that luck does not explain this, and find the model faulty.

45. You are backtesting a bank's VaR model. Currently, the bank calculates a 1-day VaR at the 99% confidence level, and you are recommending that is switch to a 95% confidence level. Which of the following statements concerning this switch is correct?
    A. The 95% VaR model is less likely to be rejected using backtesting than the 99% VaR model.
    B. When validating with backtesting at the 90% confidence level, there is a smaller probability of incorrectly rejecting a 95% VaR model when it is valid than a 99% VaR model.
    C. The decision to accept or reject a VaR model based on backtesting results is more reliable with a 95% confidence level VaR model than with a 99% confidence level model.
    D. When backtesting using a 90% confidence level, there is a smaller probability of committing a type I error when backtesting a 95% VaR model than with a 99% VaR model.

Answer: C

The concept tested here is the understanding of the difference between the VaR parameter for confidence (here, namely 95% vs 99%) and the validation procedure confidence level, and how they interact with one another. Using a VaR confidence level creates a narrower rejection region by allowing a greater number of exceptions to be generated. This in turn increases the power of the backtesting process and makes for a more reliable test.

46. Based on Basel II rules for backtesting, a penalty is given to banks that have more than four exceptions to their 1-day 99%VaR over the course of 250 trading days. The supervisor gives these penalties based on four criteria. Which of the following causes of exceptions is most likely to lead to a penalty?
    A. The bank increases its intraday trading activity.
    B. A large move in interest rates was combined with a small move in correlations.
    C. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.

D. A sudden market crisis in an emerging market leads to losses in the equity positions in that country.

Answer: C

In the case of a bank that changed positions more frequently during the day, a penalty should be considered, but it is not necessarily given. In the case of bad luck, no penalty is given, as would be the case for a bank affected by unpredictable movements in rates or markets. However, when risk models are not precise enough, a penalty is typically given since model accuracy could have easily been improved.

47. A risk manager is analyzing a 1-day 99% VaR model. Assuming 225 days in a year, what is the maximum number of daily losses exceeding the 1-day 99% VaR that is acceptable in a 1-year backtest to conclude, at a 95% confidence level, that the model is calibrated correctly?

A. 3

B. 5

C. 8

D. 10

Answer: B

The risk manager will reject the hypothesis that the model is correctly calibrated if the number x of losses exceeding the VaR is such that:

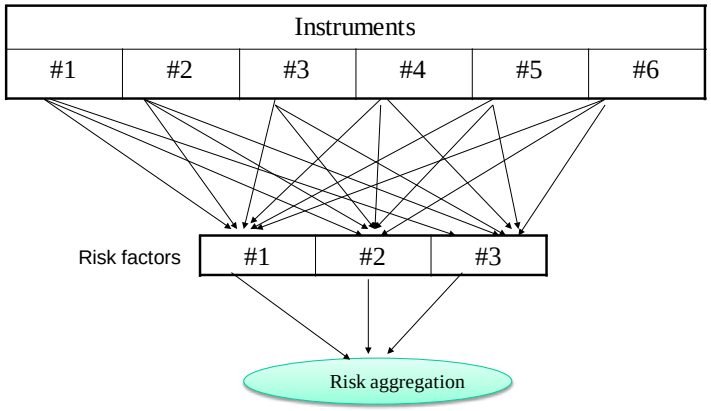
$$\frac{x - pT}{\sqrt{p(1-p)T}} > z = 1.96$$

where p represents the failure rate and is equal to 1 – 99%, or 1%; and T is the number of observations = 225. And z = 1.96 is the two-tail confidence level quantile. If:

$$\frac{x - 0.01 \times 225}{\sqrt{0.01 \times (1-0.01) \times 225}} = 1.96$$

Then, x = 5.18. So the maximum number of exceedances would be 5 to conclude that the model is calibrated correctly.

Key Point: VaR Mapping



Three approaches for mapping a fixed income portfolio onto the risk factors.

- Principal mapping. Only the risk associated with the return of principal at the maturity of the bond is mapped. Principal mapping includes only the risk of repayment of the principal amounts.
- Duration mapping. The risk of the bond is mapped to a zero-coupon bond of the same duration. Duration mapping uses the duration of the portfolio to calculate the VaR.
- Cash flow mapping. The risk of the bond is decomposed into the risk of each of the bonds' cash flows. Cash flow mapping is the most precise method because we map the present value of the cash flows (face amount discounted at the spot rate for that maturity) onto the risk factors for zeros of the same maturities and include the inter-maturity correlations.

Mapping Approaches for Linear Derivatives

Delta-normal method:

$$VaR(dP) = |-D^{*}P| \times VaR(dy)$$

Mapping Approaches for Nonlinear Derivatives

Delta-Gamma method:

$$VAR(df) = |\Delta| \times VAR(dS) - (1/2)\Gamma \times VAR(dS)^2$$

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48. An analyst is using the delta-normal method to determine the VaR of a fixed income portfolio. The portfolio contains a long position in 1-year bonds with a $1 million face value and a 6% coupon that is paid semi-annually. The interest rates on six-month and twelve-month maturity zero-coupon bonds are, respectively, 2% and 2.5%. Mapping the long position to standard positions in the six-month and twelve-month zeros, respectively, provides which of the following mapped positions?

A. $30,000 and 1,030,000

B. $29,500 and 975,610

C. $29,703 and 1,004,878

D. $30,300 and 1,035,000

Answer: C

The long position is mapped into a combination of market values of the zero-coupon bonds that provide the same cash flows:

$$X_{six} = \frac{30,000}{1+(0.02/2)} = 29,703$$

$$X_{twelve} = \frac{1,030.000}{1+(0.025)} = 1,004,878$$

49. Which of the following can be considered a general risk factor?

I. Exchange rate

II. Mortgage-backed securities

III. Zero-coupon bond

IV. Interest rate

A. I only

B. II and III

C. III only

D. I and IV

Answer: D

50. Delta-normal VaR will provide accurate estimates for option contracts when:

A. Deltas are stable

B. Options are at the money

C. The correlation matrix is available

D. The delta-normal method can never be used for option contracts

Answer: A

Delta-normal VaR methods will provide accurate estimates of VaR for options only over those ranges in which the deltas of the contracts are stable. Deltas are normally unstable near the money and close to expiration.

51. Under these assumptions - in particular: a flat yield curve and constant yield volatility of 1.0% - why can we expect cash flow mapping to produce a lower diversified VaR than either duration and principal mapping?

A. The risk measures are non-linear.

B. Due to imperfect correlations between pairwise risk factors.

C. Fewer total cash flows will be mapped.

D. We cannot expect a lower diversified VaR.

Answer: B

The diversified VaR is lower due to two factors. First, risk measures are not perfectly linear with maturity. Second, correlations are below unity, which reduces risk even further.

52. Which of these statements regarding risk factor mapping approaches is/are correct?

I. Under the cash flow mapping approach, only the risk associated with the average maturity of a fixed-income portfolio is mapped.

II. Cash flow mapping is the least precise method of risk mapping for a fixed-income portfolio.

III. Under the duration mapping approach, the risk of a bond is mapped to a zero-coupon bond of the same duration.

IV. Using more risk factors generally leads to better risk measurement but also requires more time to be devoted to the modeling process and risk computation.

A. I and II

B. I, III, and IV

C. III and IV

D. IV only

Answer: C

Under the cash flow mapping approach, each payment (and not only the last one) is associated with a different risk factor, so statement I. is incorrect. Statement II. is incorrect because the CF mapping approach is more correct than duration or maturity mapping.

53. There is a short position in 1-year bonds with a $150 million face value and a 6% annual interest rate, with interest paid semiannually. The annualized interest rate on zero-couple bonds is 3.8% for a 6-month maturity and 4.1% for a 12-month maturity. Decompose the bond into the cash flows of the two standard instruments. What are the present values of each cash flow?

	PV of CF1	PV of CF2
A.	- $4,117,945	-$139,882,651
B.	- $4,226,094	-$143,873,919
C.	- $4,416,094	-$148,355,095
D.	- $4,879,542	-$144,224,783

Answer: C

The standard instruments are -150,000,000 × 0.06/2 = $4,500,000 for six months, and -$4,500,000 - 150,000,000 = -$154,500,000 for 12 months.

The present values are -$4,500,000/1.019 = -$4,416,094 and -$154,500,000/$(1 + 0.041/2)^2$ = -$148,355,095.

54. Computing VaR on a portfolio containing a very large number of positions can be simplified by mapping these positions to a smaller number of elementary risk factors. Which of the following mappings would be adequate?

A. USD/EUR forward contracts are mapped on the USD/JPY spot exchange rate.

B. Each position in a corporate bond portfolio is mapped on the bond with the closest maturity among a set of government bounds.

C. Government bounds paying regular coupons are mapped on zero-coupon government bonds.

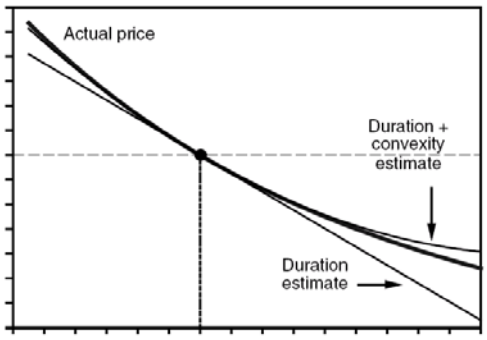
D. A position in the stock market index is mapped on a position in a stock within that index.

Answer: C

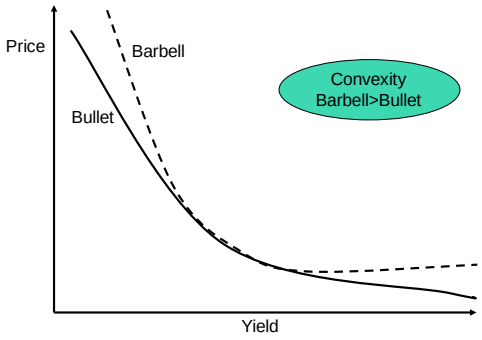
Mapping government bonds paying regular coupons onto zero coupon government bonds is an adequate process, because both categories of bonds are government issued and therefore have a very similar sensitivity to risk factors. However, this is not a perfect mapping since the sensitivity of both classes of bonds to specific risk factors (i.e., changes in interest rates) may differ.

Key Point: Measures of Pricing Sensitivity Based on Parallel Yield Shifts

$$\Delta P \approx -D^{*} \times P \times \Delta y + \frac{1}{2} \times C \times P \times (\Delta y)^{2}$$



Barbell vs. Bullet



If a bullet and barbell have the same duration, the barbell portfolio will have greater convexity because convexity is related to the square of maturity.

55. John Snows portfolio has a fixed-income position with market value of USD 70 million with modified duration of 6.44 years and yielding 6.7% compounded semiannually. If there is a positive parallel shift in the yield curve of 25 basis points, which of the following answers best estimates the resulting change in the value of John's portfolio?

A. USD -11,725

B. USD -1,127,000

C. USD -1,134,692

D. USD -1,164,755

Answer: B

A: is correct. By definition, D_{mod} = (-l/P) (dP/dy). So as a linear approximation,

$\Delta P = -D_{mod} \times P \times \Delta y = -6.44 \times 70 \text{ million} \times 0.0025 = -1,127,000$

56. A bond portfolio consists of five bonds:

- Bond 1: 5%, annual-pay bond with a 10-year maturity and a yield of 4.5%.
- Bond 2: 5%, semiannual-pay bond with a 10-year maturity and a yield of 4.5%.
- Bond 3: A zero-coupon bond with a 10-year maturity and a yield of 4.5%.
- Bond 4: 4%, semiannual-pay bond with a 10-year maturity and a yield of 4.5%.
- Bond 5: 5%, annual-pay bond with a 10-year maturity and a yield of 5.5%.

Which of the following statements about these bonds is Correct?

A. Bond 1 has a shorter duration than Bond 2.

B. The Macaulay duration of Bond 3 is five years.

C. Bond 4 has a shorter duration than Bond 2.

D. The DV01 of Bond 5 is lower than the DV01 of Bond 1.

Answer: D

Choice D is correct. Increasing the yield will lower the DV01. Since Bond 5 has a higher yield than Bond 1, it must have a lower DV01. Choice B is incorrect. The Macaulay duration of a zero-coupon bond will be equal to its maturity Choices A and C are incorrect. All else equal, a semiannual-pay bond will have a shorter duration than an annual-pay bond, so Bond 2 has a shorter duration than Bond 1. A premium bond will have a shorter duration than a discount bond, so Bond 2 will have a shorter duration than Bond 4.

57. Given the following bond portfolios:

Bond Maturity	Portfolio I Duration Contribution	Portfolio 2 Duration Contribution
2-year bonds	1.32	0.52
5-year bonds	1.37	3.18
10-year bonds	3.95	1.05
20-year bonds	1.51	3.40
Effective portfolio duration	?	?

Which of the following statements is correct?

A. Portfolio 1 is a barbell portfolio.

B. Portfolio 2 is a bullet portfolio.

C. It is impossible for Portfolios 1 and 2 to have the same duration.

D. Portfolio 2 will have greater convexity than Portfolio 1.

Answer: D

Since Portfolio 2 has more long-term bonds than short-term bonds and since convexity is related to the square of maturity, Portfolio 2 will have greater convexity. The other statements are incorrect. Portfolio 1 is a bullet portfolio (concentrated in intermediate maturities), and Portfolio 2 is a barbell. It is possible for a bullet and a barbell to have the same duration. In fact, adding the duration contribution of both portfolios gives a duration value of 8.15.

Key Point: Interest Rate Tree (Binominal) Model

Using backward induction, the value of a bond at a given node in a binomial tree is the average of the present values of the two possible values from the next period. The appropriate discount rate is the forward rate associated with the node under analysis.

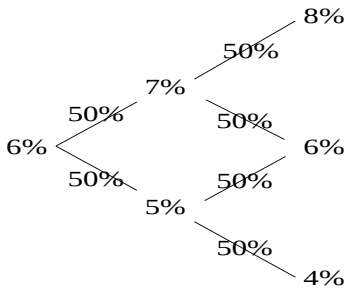
There are three basic steps to valuing an option on a fixed-income instrument using a binomial tree:

Step 1: Price the bond value at each node using the projected interest rates.

Step 2: Calculate the intrinsic value of the derivative at each node at maturity.

Step 3: Calculate the expected discounted value of the derivative at each node using the risk- neutral probabilities and work backward through the tree.

58. Suppose investors have interest rate expectations as illustrated in the decision tree below where the 1-year rate is expected to be 8%, 6%, or 4% in the second year and either 7% or 5% in the first year for a zero-coupon bond.



If investors are risk-neutral, what is the price of a $1 face value 2-year zero-coupon bond today?

A. $0.88113

B. $0.88634

C. $0.89007

D. $0.89032

Answer: C

$$\left(\frac{1}{1+7\%}\times 50\% + \frac{1}{1+5\%}\times 50\%\right) \Big/ (1+6\%) = 0.89007$$

59. A European put option has two years to expiration and a strike price of $101.00. The underlying is a 7% annual coupon bond with three years to maturity. Assume that the risk-neutral probability of an up move is 0.76 in year 1 and 0.60 in year 2. The current interest rate is 3.00%. At the end of year 1, the rate will either be 5.99% or 4.44%. If the rate in year 1 is 5.99%, it will either rise to 8.56% or rise to 6.34% in year 2. If the rate in one year is 4.44%, it will either rise to 6.34% or rise to 4.70%. The value of the put option today is closet to:

A. $1.17

B. $1.30

C. $1.49

D. $1.98

Answer: A

This is the same underlying bond and interest rate tree as in the call option example from this topic. However, here we are valuing a put option.

The option value in the upper node at the end of year 1 is computed as:

$$\frac{(\$2.44\times 0.6)+(\$0.38\times 0.4)}{1.0599}=\$1.52$$

The option value in the lower node at the end of year 1 is computed as:

$$\frac{(\$0.38\times 0.6)+(\$0.00\times 0.4)}{1.0444}=\$0.22$$

The option value today is computed as:

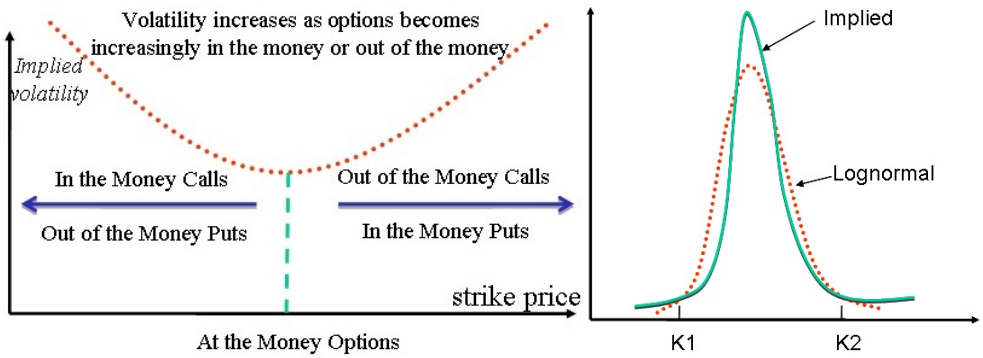
$$\frac{(\$1.52\times 0.76)+(\$0.22\times 0.24)}{1.0300}=\$1.17$$

Key Point: Volatility Smile

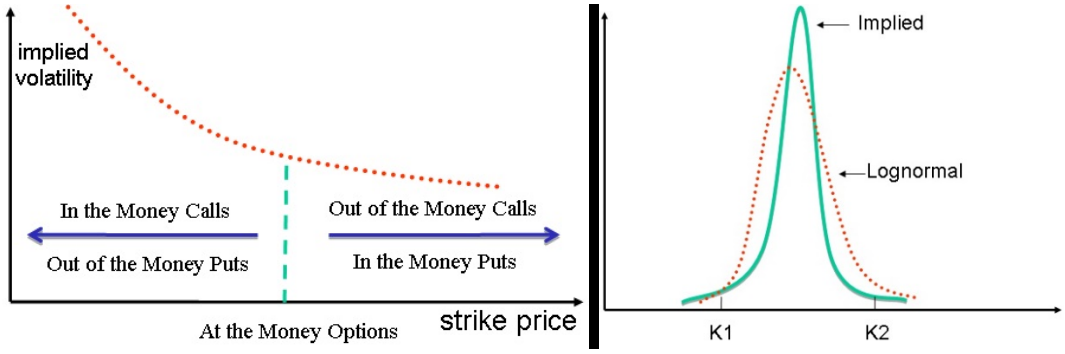
Put-call parity indicates that the deviation between market prices and Black-Scholes-Merton prices will be equivalent for calls and puts. Hence, implied volatility will be the same for calls and puts.

$$p_{BS}-p_{mkt}=c_{BS}-c_{mkt}$$

For foreign exchange options:



For stock options:



60. The Chief Risk Officer of Martingale Investments Group is planning a change in methodology for some of the risk management models used to estimate risk measures. His aim is to move from models that use the normal distribution of returns to models that use the distribution of returns implied by market prices. Martingale Group has a large long position in the German equity stock index DAX which has a volatility smile that slopes downward to the right. How will the change in methodology affect the estimate of expected shortfall (ES)?

A. ES with the updated models will be larger than the old estimate.

B. ES with the updated models will be smaller than the old estimate.

C. ES will remain unchanged.

D. Insufficient information to determine.

Answer: A

A volatility smile is a common graphical shape that results from plotting the strike price and implied volatility of a group of options with the same expiration date. Since the volatility smile is downward sloping to the right, the implied distribution has a fatter left tail compared to the lognormal distribution of returns. This means that an extreme decrease in the DAX has a higher probability of occurrence under the implied distribution than the lognormal. The ES will therefore be larger when the methodology is modified.

61. With all other things being equal, a risk monitoring system that assumes constant volatility

for equity returns will understate the implied volatility for which of the following positions by the largest amount:

A. Short position in an at-the-money call

B. Long position in an at-the-money call

C. Short position in a deep in-the-money call

D. Long position in a deep in-the-money call

Answer: D

A plot of the implied volatility of an option as a function of its strike price demonstrates a pattern known as the volatility smile or volatility skew. The implied volatility decreases as the strike price increases. Thus, all else equal, a risk monitoring system which assumes constant volatility for equity returns will understate the implied volatility for a long position in a deep-in-the-money call.

62. Which of the following regarding equity option volatility is true?

A. There is higher implied price volatility for away-from-the-money equity options.

B. "Crashophobia" suggests actual equity volatility increases when stock prices decline.

C. Compared to the lognormal distribution, traders believe the probability of large down movements in price is similar to large up movements.

D. Increasing leverage at lower equity prices suggests increasing volatility.

Answer: D

There is higher implied price volatility for low strike price equity options. "Crashophobia" is based on the idea that large price declines are more likely than assumed in Black-Scholes-Merton prices, not that volatility increases when prices decline. Compared to the lognormal distribution, traders believe the probability of large down movements in price is higher than large up movements. Increasing leverage at lower equity prices suggests increasing volatility.

63. You are asked to mark to market a book of plain vanilla stock options. The trader is short deep out-of-money options and long at-the-money options. There is a pronounced smile for these options. The trader's bonus increases as the value of his book increases. Which approach should you use to mark the book?

A. Use the implied volatility of at-the-money options because the estimation of the volatility is more reliable.

B. Use the average of the implied volatilities for the traded options for which you have data because all options should have the same implied volatility with Black-Scholes and you don't know which one is the right one.

C. For each option, use the implied volatility of the most similar option traded on the market.

D. Use the historical volatility because doing so corrects for the pricing mistakes in the option market.

Answer: C

The prices obtained with C are the right ones because they correspond to prices at which you could sell or buy the options.

64. The market price of a European call is $3.00 and its Black-Scholes price is $3.50.The Black-Scholes price of a European put option with the same strike price and time to maturity is $2.00.What should the market price of this option be?

A. $1.50

B. $2.00

C. $1.00

D. $0.50

Answer: A

Based on the put-call parity, $c_{bs} + Ke^{-rT} = p_{bs} + S_0e^{-qT}$ and $c_{mkt} + Ke^{-rT} = p_{mkt} + S_0e^{-qT}$

We can know that:

$c_{bs} - c_{mkt} = p_{bs} - p_{mkt}$

And c_{bs} = $3.50, c_{mkt} = $3.00, p_{bs} = $2.00.

So p_{mkt} = $1.50.

Choose A

65. An empirical distribution of equity price derived from the price of options of such stock based on BSM that exhibits a fatter right tail than that of a lognormal distribution would indicate:

A. Equal implied volatilities across low and high strike prices.

B. Greater implied volatilities for low strike prices.

C. Greater implied volatilities for high strike prices.

D. Higher implied volatilities for mid-range strike prices.

Answer: C

Explanation: An empirical distribution with a fat right tail generates a higher implied volatility for higher strike prices due to the increased probability of observing high underlying asset prices.

66. Which of the following statements is true regarding volatility similes?

I. Currency options exhibit volatility smiles because at the money options have higher implied volatility than away from the money options.

II. Volatility frowns result when jumps occur in asset prices.

III. Equity options exhibit a volatility smirk because low strike price options have greater implied volatility.

IV. Relative to currency traders, it appears that equity trader's expectations of extreme price movements are more asymmetric.

A. I and II

B. I and IV

C. II and III

D. II, III, and IV

Answer: D

67. Compared to at-the-money currency options, out-of-the-money currency options exhibit which of the following volatility traits?

A. Lower implied volatility

B. A frown

C. A smirk

D. Higher implied volatility

Answer: D

Away-from-the-money currency options have greater implied volatility than at-the-money currency options, this pattern in a volatility smile.

68. Which of the following statement is incorrect regarding volatility smiles?

A. Currency options exhibit volatility smiles because the at-the-money option have higher implied volatility away-from-the-money options.

B. Volatility frowns result when jumps occur in asset prices

C. Equity options exhibit a volatility smirk because low strike price options have grater implied volatility.

D. Relative to currency traders, it appears that equity traders' expectations of extreme price movements are more asymmetric.

Answer: A

Currency options exhibit volatility smiles because the at-the-money options have lower implied volatility than away-from-the-money options.

Equity traders believe that the probability of large price decrease is greater than the probability of large price increase. Currency trades' beliefs about volatility are more symmetric as there is no large skew in the distribution of expected currency values (i.e. there is a greater chance of large price movements in either direction).

69. A risk manager is examining a firm's equity index option price assumptions. The observed volatility skew for a particular equity index slopes downward to the right. Compared to the lognormal distribution, the distribution of option prices on this index implied by the Black-Scholes-Merton (BSM) model would have:

A. A fat left tail and a thin right tail.

B. A fat left tail and a fat right tail.

C. A thin left tail and a fat right tail.

D. D .A thin left tail and a thin right tail.

Answer: A

A downward sloping volatility skew indicates that out of the money puts are more expensive than predicted by the Black-Scholes-Merton model and out of the money calls are cheaper than expected predicted by the Black-Scholes-Merton model. The implied distribution has fat left tails and thin right tails.

70. A committee of risk management practitioner discusses the difference between pricing deep out-of-the-money call options on FBX stock and pricing deep out-of-the-money call options on the EUR/JPY foreign exchange rate using the Black-Scholes-Merton (BSM) model. The practitioners price these options based on two distinct probability distributions of underlying asset prices at the option expiration date:

- A lognormal probability distribution
- An implied risk-neutral probability distribution obtained from the volatility smile for options of the same maturity

Using the lognormal instead of the implied risk-neutral probability distribution will tend to:

A. Price the option on FBX relatively high and price the option on EUR/JPY relatively low.

B. Price the option on FBX relatively low and price the option on EUR/JPY relatively high.

C. Price the option on FBX relatively low and price the option on EUR/JPY relatively high.

D. Price the option on FBX relatively high and price the option on EUR/JPY relatively high.

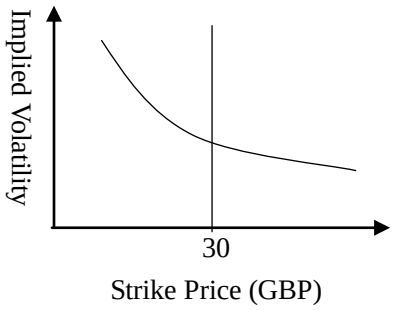
Answer: A

The implied distribution of the underlying equity prices derived using the general volatility smile of equity options has a heavier left tail and a less heavy right tail than a lognormal distribution of underlying prices. Therefore, using the lognormal distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively high.

The implied distribution of underling foreign currency prices derived using the general volatility smile of foreign currency options has heavier tail than a lognormal distribution of underlying prices. Therefore, using the lognormal distribution of prices causes deep-out-of-the-money call

options on the underlying to be priced relatively low.

71. A risk manager is in the process of valuing several European option positions on a non-dividend-paying stock XYZ that is currently priced at GBP 30.The implied volatility skew, estimated using the Black-Scholes-Merton model and the current prices of actively traded European-style options on stock XYZ at various strike prices, is



Assuming that the implied volatility at GBP 30 is used to conduct the valuation, which of the following long positions will be undervalued?

A. An out-of-the-money call

B. An in-the-money call

C. An at-the-money put

D. An in-the-money put

Answer: B

An in-the-money call has a strike price below 30.Therefore, using the chart above .its implied volatility is greater than the at-the-money volatility, so using the at-the-money volatility would result in pricing an in-the-money call option lower than its fair price.

Key Point: Empirical Approaches to Risk Metrics and Hedge

Denoting the face amounts of the real and nominal bonds by F^R and F^N and their DV01s by $DV01^R$ and $DV01^N$, the regression-based hedge, characterized earlier as the DV01 hedge adjusted for the average change of nominal yields relative to real yields, can be written as follows:

$$F^R = -F^N \times \frac{DV01^N}{DV01^R} \times \hat{\beta}$$

The hedge of the first equation minimizes the variance of the P&L in over the data set and used to estimate the regression parameters.

72. Assume that a trader is making a relative value trade, selling a U.S. Treasury bond and correspondingly purchasing a U.S. Treasury TIPS. Based on the current spread between the two securities, the trader shorts $100 million of the nominal bond and purchases $89.8

million of TIPS. The trader then starts to question the amount of the hedge due to changes in yields on TIPS in relation to nominal bonds. He runs a regression and determines from the output that the nominal yield changes by 1.0274 basis points per basis point change in the real yield. Would the trader adjust the hedge, and if so, by how much?

A. No

B. Yes, by $2.46 million (purchase additional TIPS).

C. Yes, by $2.5 million (sell a portion of the TIPS).

D. Yes, by $2.11 million (purchase additional TIPS)

Answer: B

The trader would need to adjust hedge as follows:

$89.8 million × 1.0274 = $92.26 million

Thus, the trader needs to purchase additional TIPS worth $2.46 million.

73. Assume that a trader wishes to set up a hedge such that he sells $100,000 of a Treasury bond and buys Treasury TIPS as a hedge. Using a historical yield regression framework, assume the DV01 on the T-bond is 0.072, the DV01 on the TIPS is 0.051, and the hedge adjustment factor (regression beta coefficient) is 1.2. What is the face value of the offsetting TIPS position needed to carry out this regression hedge?

A. $138,462

B. $169,412

C. $268,499

D. $280,067

Answer: B

Defining F^R and as F^N the face amounts of the real and nominal bonds, respectively, and their corresponding DV01 as $DV01^R$ and $DV01^N$, a DV01 hedge is adjusted by the hedge adjustment factor, or beta, as follow:

$$F^R = F^N \times \left[\frac{DV01^N}{DV01^R}\right] \times \beta$$

$$F^R = 100{,}000 \times \left[\frac{0.072}{0.051}\right] \times 1.2 = 169{,}412$$

Key Point: Term Structure Models

Model 1: assumes no drift and that interest rates are normally distributed:

$$dr = \sigma d\omega$$

Model 2: adds a positive drift term to Model 1 that can be interpreted as a positive risk premium associated with longer time horizons:

$$dr = \lambda dt + \sigma d\omega$$

where: λ = interest rate drift

Ho-Lee Model: generalizes drift to incorporate time-dependency:

$$dr = \lambda(t)dt + \sigma d\omega$$

Vasicek Model: assumes a mean-reverting process for short-term interest rates:

$$dr = k(\theta - r)dt + \sigma d\omega$$

where:

k = a parameter that measures the speed of reversion adjustment.

θ = long-run value of the short-term rate assuming risk neutrality.

r = current interest rate level.

Model 3: assigns a specific parameterization of time-dependent volatility:

$$dr = \lambda(t)dt + \sigma e^{-\alpha t} d\omega$$

where:

σ = volatility at t = 0, which decreases exponentially to 0 for α > 0

Cox-Ingersoll-Ross (CIR) Model: mean-reverting model with constant volatility, σ, and basis-point volatility, $\sigma\sqrt{r}$, that increases at a decreasing rate:

$$dr = k(\theta - r)dt + \sigma\sqrt{r}d\omega$$

Model 4 (lognormal model): yield volatility, σ, is constant, but basis-point volatility, σ_r, increases with the level of the short-term rate. There are two lognormal models of importance:

- Lognormal with deterministic drift

$$d[\ln(r)] = a(t)dt + \sigma d\omega$$

- Lognormal with mean reversion

$$d[\ln(r)] = k(t)[\ln\theta(t) - \ln(r)]dt + \sigma(t)d\omega$$

Jensen's Inequality

$$E\left(\frac{1}{1+r}\right) > \frac{1}{E(1+r)} = \frac{1}{1+E(r)}$$

---

74. Model 1 assumes zero drift and is also called a normal model. Model 2 add a term for drift. Each of the following is true about these two models except for:
    A. A weakness of Model 1 is that the short-term rate can become negative.
    B. Model 1 implies a term structure that is perfectly flat at the current rate for all maturities, including the long-term rates.
    C. Model 2 is more capable of producing an upward-sloping term structure, which is often observed.
    D. Model 2 is an equilibrium model, rather than an arbitrage-free model, because no attempt is made to match the term structure closely.

Answer: B

Under Model 1, it is true that the middle node recombines to the same current node. But these are future short-term rates; they are not the term structure: the term structure is spot rates at all maturities. Models that take the initial term structure implied by market prices are called arbitrage-free models. A different approach, however, is to start with assumptions about the interest rate process and about the risk premium demanded by the market for bearing interest rate risk and then derive the risk-neutral process. Models of this sort do not necessarily match the initial term structure and are called equilibrium models.

75. John Jones, FRM, is discussing the appropriate usage of mean-reverting models relative to no-drift models, models that incorporate drift, and Ho-Lee models. Jones makes the following statements:

Statement 1: Both Model 1 (no drift) and the Vasicek model assume parallel shifts from changes in the short-term rate.

Statement 2: The Vasicek model assumes decreasing volatility of future short-term rates while Model 1 assumes constant volatility of future short-term rates.

Statement 3: The constant drift model (Model 2) is a more flexible model than the Ho-Lee model.

How many of his statements are correct?

A. 0

B. 1

C. 2

D. 3

Answer: B

Only statement 2 is correct. The Vasicek model implies decreasing volatility and non-parallel shifts from changes in short-term rates. The Ho-Lee model is actually more general than Model 2 (the no drift and constant drift models are special cases of the Ho-Lee model).

76. Using Model 1, assume the current short-term interest rate is 5%, annual volatility is 80bps, and dω, a normally distribution random variable with mean 0 and standard deviation $\sqrt{dt}$, has an expected value of zero. After one month, the realization of dω is -0.5. What is the change in the spot rate and the new spot rate?

	Change in Spot	New Spot Rate
A.	0.40%	5.40%
B.	-0.40%	4.60%
C.	0.80%	5.80%

D. -0.80% 4.20%

Answer: B

Model 1 has a no-drift assumption. Using this model, the change in the interest rate is predicted as:

$dr = \sigma d\omega$

$dr = 0.8\% \times (-0.5) = -0.4\% = -40 \text{ basis points}$

Since the initial rate was 5% and dr = -0.40%, the new spot rate in one month is:

5% - 0.40% = 4.60%

77. An analyst is modeling spot rate changes using short rate term structure models. The current short-term interest rate is 5% with a volatility of 80 bps. After one month passes the realization of dω, a normally distributed random variable with mean 0 and standard deviation $\sqrt{dt}$, is -0.5. Assume a constant interest rate drift, λ, of 0.36%. What should the analyst compute as the new spot rate?

A. 5.37%

B. 4.63%

C. 5.76%

D. 4.24%

Answer: B

This short rate process has an annualized drift of 0.36%, so it requires the use of Model 2 (with constant drift). The change in the spot rate is computed as:

$dr = \lambda dt + \sigma d\omega$

$dr = (0.36\% / 12) + (0.8\% \times -0.5) = -0.37\% = -37 \text{bps}$

Since the initial short-term rate was 5% and dr is -0.37%, the new spot rate in one month is:

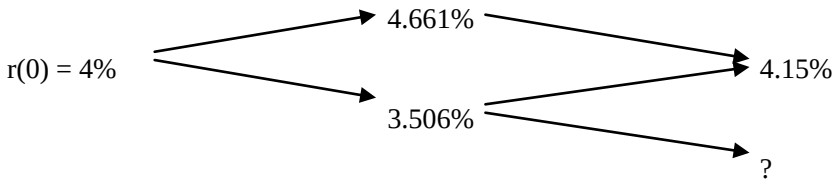
5% - 0.37% = 4.63%

78. The current short-term rate, r(0) is 4%. Under a Ho-Lee Model with time-dependent drift, the time step is monthly and the annualized drifts are as follows: +100 basis points in the first month and +80 basis points in the second month. The annual basis point volatility is 200bps.

Ho-Lee Assumptions	
Month (dt)	0.0833
Annualized drift, first month, λ_1	100 bps
Annualized drift, second month, λ_2	80 bps
Volatility, annual	2%

Ho-Lee Model: Time-dependent drift

$dr = \lambda_t dt + \sigma dw$	Month 1	Month 2
		5.305%



What is the value of the missing node [2, 0] in this Ho-Lee interest rate tree?

A. 2.447%

B. 2.677%

C. 2.995%

D. 3.256%

Answer: C

node[2,0] = 4% + (1% + 0.8%) × 1/12 – 2 × 2% × sqrt(1/12) = 2.995%

79. A risk manager is constructing a term structure model and intends to use the Cox-Ingersoll-Roll model. Which of the following describes this model?

A. The model presumes that the volatility of the short rate will increase at a predetermined rate.

B. The model presumes that the volatility of the short rate will decline exponentially to a constant level.

C. The model presumes that the basis-point volatility of the short rate will be proportional to the rate.

D. The model presumes that the basis-point volatility of the short rate will be proportional to the square root of the rate.

Answer: D

In the CIR model, the basis-point volatility of the short rate is not independent of the short rate as other simpler models assume. The annualized basis-point volatility equals $\sigma\sqrt{r}$ and therefore increases as a function of the square root of the rate.

80. An investor expects the current 1-year rate for a zero-coupon bond to remain at 6%, the 1-year rate next year to be 8%, and the 1-year rate in two years to be 10%. What is the 3-year spot rate for zero-coupon bond with face value of $1, assuming all investor have the same expectations of future 1-year rates for zero-coupon bonds?

A. 7.888%

B. 7.98%

C. 8.000%

D. 8.088%

Answer: B

The 3-year spot rate can be solved for using the following equation:

$$\frac{\$1}{(1.06)(1.08)(1.10)} = \frac{\$1}{(1+r(3))^3}$$

$$r(3) = \sqrt[3]{(1.06)(1.08)(1.10)} - 1 = 7.988\%$$

81. Suppose an investor expects that 1-year rate will remain at 6% for the first year for a 2-year zero-coupon bond. The investor also projects a 50% probability that the 1-year spot rate will be 4% in one year. Which of the following inequalities most accurately reflects the convexity for this 2-year bond using Jensen's inequality formula?

A. \$0.89031 > \$0.89000

B. \$0.89000 > \$0.80000

C. \$0.94340 > \$0.89031

D. \$0.94373 > \$0.94340

Answer: A

The left-hand side of Jensen's inequality is the expected price in one year using the 1-year spot rates of 8% and 4%.

$$E\left(\frac{\$1}{(1+r)}\right) = 0.5 \times \frac{\$1}{(1.08)} + 0.5 \times \frac{\$1}{(1.04)} = 0.5 \times 0.92593 + 0.5 \times 0.96154 = 0.94373$$

The expected price in one year using an expected rate of 6% computes the right-hand side of the inequality as:

$$\frac{\$0.94373}{0.5 \times 1.08 + 0.5 \times 1.04} = \frac{\$1}{1.06} = 0.94340$$

Next, divide each side of the equation by 1.06 to discount 1-year zero-coupon bond price for one more year at 6%. The price of the 2-year zero-coupon bond equals \$0.89031(calculated as 0.94373/1.06), which is greater than \$0.89000 (the price of a 2-year zero-coupon bond discounted for two years at the expected rate of 6%). Thus, Jensen's inequality reveal that \$0.89031 > \$0.89000.

82. Which of the following statements best characterizes the differences between the Ho-Lee model with drift and the lognormal model with drift?

A. In the Ho-Lee model and the lognormal model the drift terms are multiplicative.

B. In the Ho-Lee model and the lognormal model the drift terms are additive

C. In the Ho-Lee model the drift terms are multiplicative, but in the lognormal model the drift terms are additive

D. In the Ho-Lee model the drift terms are additive, but in the lognormal model the drift terms are multiplicative.

Answer: D

The Ho-Lee model with drift is very flexible, allowing the drift terms each period to vary. Hence, the cumulative effect is additive. In contrast, the lognormal model with drift allows the drift terms to vary, but the cumulative effect is multiplicative.

83. A risk manager is pricing a 10-year Treasuries using a successfully tested pricing model. Current interest rate volatility is high and the risk manager is concerned about the effect this may have on short-term rates when pricing the option. Which of the following actions would best address the potential for negative short-term interest rates to arise in the model?
    A. The risk manager uses a normal distribution of interest rates.
    B. When short-term rates are negative, the risk manager adjusts the risk-neutral probabilities.
    C. When short-term rates are negative, the risk manager increases the volatility.
    D. When short-term rates are negative, the risk manager sets the rate to zero.

Answer: D

Negative short-term interest rates can arise in models for which the terminal distribution of interest rates follows a normal distribution. The existence of negative interest rates does not make much economic sense since market participants would generally not lend cash at negative interest rates when they can hold cash earn a zero return. One method that can be used to address the potential for negative interest rates when constructing interest rates trees is to set all negative interest rates to zero. This localizes the change in assumptions to points in the distribution corresponding to negative interest rates and preserves the original rate free for all other observations. In comparison, adjusting the risk neutral probabilities would alter the dynamics across the entire range of interest rates and therefore not be an optimal approach.

When a model displays the potential for negative short-term interest rates, it can still be a desirable model to use in certain situations, especially in cases where the valuation depends more on the average path of the interest rate, such as in valuing coupon bonds. Therefore, the potential for negative rates does not automatically rule out the use of the model.

84. An analyst is looking at various models used to incorporate drift into term structure models. The Ho-Lee Model:
    A. Incorporates no-risk premium to the interest rate model allowing rates to vary according to their volatility.
    B. Incorporates drift as a premium to interest rates that remains constant over time.
    C. Allows for a risk premium to be applied to interest rates that changes over time.
    D. Incorporates drift into the model following the assumption that rates revert to the

long-run equilibrium value.

Answer: C

Choice c is correct: the Ho-Lee model incorporates a premium to each rate change that can be different at each point in time.

Key Point: Discount Rate Selection

- Prior to the credit crisis, market participants usually used LIBOR/swap rates as proxies for risk-free rates.
- During the credit crisis, LIBOR rates soared because banks were reluctant to lend to each other.
- Following the credit crisis, most banks have changed their risk-free discount rates to overnight indexed swap (OIS) rates.
- But for non-collateralized transactions they continue to use LIBOR, or an even higher discount rate.
- An overnight indexed swap (OIS) is a swap where a fixed rate for a period (e.g., 1 month or 3 months) is exchanged for the geometric average of the overnight rates during the period.
- The fixed rate in an OIS is referred to as the OIS rate.
- Overnight indexed swaps tend to have relatively short lives (often 3 months or less).
- An OIS lasting longer than 1 year is typically divided into 3-month subperiods.
- At the end of each subperiod the geometric average of the overnight rates during the subperiod is exchanged for the OIS rate.
- The OIS rate is a continually refreshed overnight rate, earned by a financial institution from a series of overnight loans to other financial institutions.

85. The current edition of the monthly research report of an investment bank is dedicated to discussing the risk-free rate and contains the following statements:

"In the United States, rates of Treasury securities may not be considered the best proxy for a risk-free rate because financial institutions are required to purchase Treasury securities due to various regulatory requirements, which may result in an artificially low yield for these securities. Another proxy for the risk-free rate is LIBOR, which has been increasingly used in collateralized transactions following 2007-2009 financial crisis."

With respect to Treasury securities and LIBOR, are these statements considered accurate?

	Treasury securities	**LIBOR**
A.	No	No
B.	No	Yes
C.	Yes	Yes

D. Yes No

Answer: D

Only the first statement is correct. The second statement is incorrect because LIBOR has been increasingly used in non-collateralized transactions following the 2007-2009 financial crisis.

86. An analyst notes in a presentation to management that the U.S. three-month LIBOR-OIS spread declined from 150 basis points a year ago to 80 basis points today. Regarding this scenario, which of the following statements is considered most accurate?

A. The decline in spread represents a decline in credit quality in the markets.

B. A payment of 80 basis points must be made by the floating-rate payer of the OIS.

C. The LIBOR rate is now a better proxy for the risk-free rate than the OIS rate.

D. Stress in the financial markets has declined.

Answer: D

The LIBOR-OIS spread is used as a measure of stress in financial markets. A decline in the spread indicates a decline in stress, or an improvement in credit quality, in markets. The spread is not a measure of payment on an overnight indexed swap. The spread also does not imply that the LIBOR rate would be superior to the OIS rate as a proxy for the risk-free rate.

87. Mikey Parizeau, FRM, is a fixed income analyze at a large financial institution. Parizeau states to a colleague that while the OIS rate is not entirely risk-free, it is considered the best proxy for the risk-free rate when used in valuing collateralized derivatives. Is Parizcau's observation correct?

A. Yes.

B. No, because the OIS rate is considered entirely risk-free.

C. No, because the OIS rate is considered the best proxy for the risk-free rate for valuing both collateralized and non-collateralized derivatives.

D. No, because the OIS rate is considered the best proxy for the risk-free rate for valuing only non-collateralized derivatives.

Answer: A

Parizeau s statement is correct. Although the OIS rate is not entirely risk-free, it is considered the best proxy for the risk-free rate to be used in valuing collateralized derivatives because the OIS rate provides a good estimate of the funding cost of collateral. LIBOR rates continue to be used for valuing non-collateralized derivatives.

88. Assume that the one-, two- and three-year LIBOR-for-fixed swaps trade at a spread of 15, 18, and 20 basis points, respectively, above the corresponding OLSs. If the 10-year

LIBOR-for-fixed swap rate is 4.5%, what is the best estimate for the 10-ycar OIS rate?

A. 0.2%

B. 4.3%

C. 4.5%

D. 4.7%

Answer: B

It is common for OISs not to trade for maturities that are as long as LIBOR-for-fixed swaps. Given a lack of" reliable data for OIS maturities beyond three years in our example, a common approach is to assume that the spread (between the LIBOR swap rate and the OIS rate for the longest maturity with reliable data) remains constant for all longer maturities. As a result, all OIS rates beyond three years are assumed to be 20 basis points below LIBOR swap rates. The best estimate of the 10-year OIS rate is therefore 4.5% - 0.2% = 4.3%.

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2016 FRM PART II

百题巅峰班讲义

信用风险测量与管理

讲师：梁震宇

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2016 年 5 月

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 coring 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

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. A risk officer of a bank is evaluating the four rules for credit scoring model performance measurement. Which of the following is correct?

A. The “Minimum-Risk” decision rule tries to minimize both type I and type II errors.

B. The Neyman-Pearson rule minimizes type II error with type I error remaining constant.

C. The Neyman-Pearson rule minimizes type I error with type II error remaining constant.

D. The “Minimum-Risk” decision rule tries to minimize both credit and market risks.

Answer: C

The Neyman-Pearson rule minimizes type I error with type II error remaining constant. There are four rules “Minimum-Error”, “Minimum-Risk”, Neyman-Pearson, and Minimax. The “Minimum-Risk” decision rule tries to minimize the risk of misclassification. It has nothing to do with market risk. Hence d is wrong.

Key Point: Expected and Unexpected Loss

Type of Credit Loss	Description	Formula
Expected Credit Loss	Represent the expected value of the credit loss	EL = PD × LGD × EAD
Unexpected Credit Loss	Quantile of the credit loss in excess of the expected loss	UL = Credit VaR = WCL - EL

3. Use the following table to answer the question blow. Which loan below has the highest expected credit loss? (Assume that all of the loans are due at maturity without amortization

and recovery rate is zero).

Default Probabilities		
Rating	3 year	5 year
AAA	0.05%	0.15%
AA	0.22%	0.48%
A	0.30%	0.72%
BBB	0.92%	1.98%
BB	6.91%	11.83%
B	20.37%	28.00%
CCC	31.63%	40.15%

A. A 3-year loan of $50,000,000 to a counterparty with a credit rating of "A".

B. A 5-year loan of $1,500,000 to a counterparty with a credit rating of "BB".

C. A 5-year loan of $40,000,000 to a counterparty with a credit rating of "AA".

D. A 3-year loan of $20,000,000 to a counterparty with a credit rating of "BBB".

Answer: C

4. 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+

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

5. Suppose there is a $1,000,000 portfolio with n = 50 credits that each has a default probability of π = 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 π = 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 × 0.02). If there are three defaults, the credit loss is $60,000 (3 × $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. Suppose there is a $1,000,000 portfolio with n credits that each have a default probability, π = 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 π = 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 × $1,000,000/1,000). The expected loss is $20,000 ($1,000,000 × 0.02). The credit VaR is then $8,000 ($28,000 - $20,000).

7. 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% × 0 + 1.0119% × $1.0 million + 0.0034% × $2.0 million + 0% × $3.0 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 million - $10,188 = $989,812.

8. 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.

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% × 3%)/[sqrt(2% × 98%) × sqrt(3% × 97%)] = 0.142365

Key Point: Binomial Trees of PD

10. 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

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

11. A corporate bond will mature in three years. The marginal probability of default in year one is 3%. The marginal probability of default in year two is 4%. The marginal probability of default in year three is 6%. What is the cumulative probability that default will occur during the three-year period?

A. 12.47%

B. 12.76%

C. 13%

D. 13.55%

Answer: A

This is one minus the survival rate over three years: $S_3(R) = (1 - d_1)(1 - d_2)(1 - d_3) = (1 - 0.03)(1 - 0.04)(1 - 0.06) = 0.8753$. Hence, the cumulative default rate is 0.1247.

12. You are the risk manager at Vision, a small fixed-income hedge fund that specializes in bank debt. Vision's strategy utilizes both relative value and long-only trades using credit default swaps (CDS) and bonds. One of the new traders has the positions described in the table below.

Bank	Position	Credit Rating
SBU	Long USD 10 million CDS	A
Stanos	Long USD 5 million bond	BB+
CAB	Short USD 10 million CDS	A

Some of Vision's newest clients are restricted from withdrawing their funds for three years. You are currently evaluating the impact of various default scenarios to estimate future asset liquidity. You have estimated that the marginal probability of default of the Stanos bond is 5% in Year 1, 10% in Year 2, and 15% in Year 3. What is the probability that the bond makes coupon payments for 3 years and then defaults at the end of Year 3?

A. 13%

B. 15%

C. 27%

D. 73%

Answer: A

The probability that the bond defaults in year 3 can be modeled as a Bernoulli trial given by the following equation where MP stands for marginal probability:

$P(\text{Default at end of year 3}) = (1\text{-}MP_{\text{year 1 default}}) \times (1 - MP_{\text{year 2 default}}) \times MP_{\text{year 3 default}}$

$= (1- 0.05) \times (1 - 0.10) \times 0.15 = 0.1283$ or 12.83%.

13. 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: $(1-0.08)^6 = 60.6\%$

14. 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.

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

15. 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%

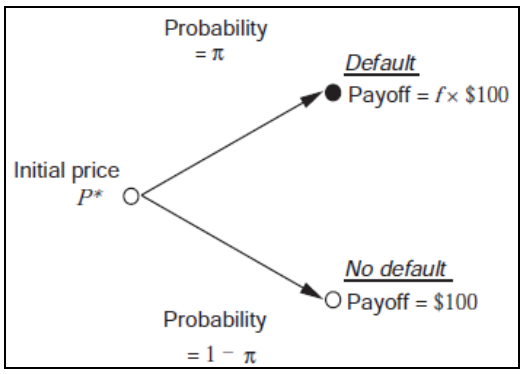
D. 23.5%

Answer: D

Key Point: Using Spread to price Default Risk

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

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



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.

16. 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 $\pi = 1 - (800{,}000 \times 1.05)/1{,}000{,}000 = 0.16$.

17. 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

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

18. 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:

$$1-\frac{\$86\times1.05}{\$100}=9.70\%$$

19. 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

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.

20. 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 =

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%.

21. 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 = $(1 + R_f)[(1 – PD) + PD \times (1 – LGD)] – 1 = 1.02/[0.95 + 0.05 \times 0.35] – 1 = 1.02/0.96750 – 1 = 5.4264\%$

22. An analyst is reviewing a bond for investment purposes. The bond is expected to have a default probability of 2%, with an expected loss of 80 bps in the event of default. If the current risk-free rate is 4%, what is the minimum coupon spread needed on the bond for its expected return to match the risk-free rate?
    A. 90 bps
    B. 120 bps
    C. 200 bps
    D. 280 bps

Answer: A

The credit risky bond is preferable when:

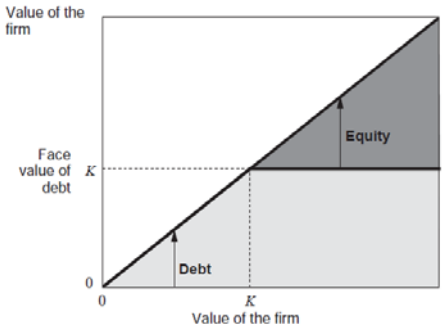
$(1 – PD) \times (1 + r + z) + PD \times RR > 1 + r$

$RR = 1 – EL /PD = 0.6$

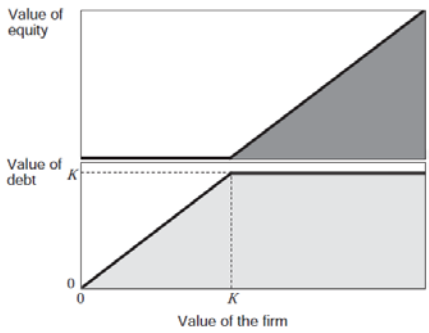
$(1 – 2\%) \times (1 + 4\% + z) + 2\% \times 60\% = 1 + 4\%$

$z > 0.00897$

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

$$\text{Long bond}_{\text{risk}} = \text{long bond}_{\text{risk-free}} + \text{short put}$$

- Merton Model

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

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

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

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

- Risk-Neutral vs. Real World

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23. 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(risk-free debt) – put = 80 × exp(-0.04 × 5) – 6.95 = 58.55

24. 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.

25. 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.

26. 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 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 = $N(-d_2)$ where d_2 is the distance to default.

d_2 = [Ln(20/15) + 12% × 1 - 0.5 × 35%^{2} × 1] /(35% × SQRT[1]) = 0.99

Such that $N(-d_2)$ = 16.11%

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

27. 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) × 5]/(30% × sqrt(5)) = 2.74%

28. 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

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

29. 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

30. 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.

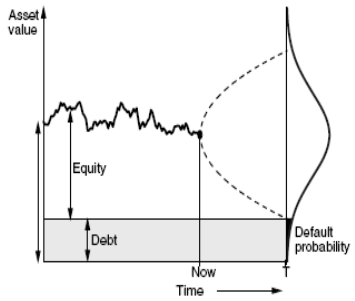
Key Point: Moody – KMV Model

- 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.



31. 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% × 70 million = 14 million. DD = (70 million - 50 million) / 14 million = 1.429 standard deviations

32. 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?

	Default Point	Distance to Default
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

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

33. 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:

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

---

34. Given a hazard rate of 0.15, find the probability when a company defaults in year two after 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	$1 - e^{-0.15(2)} = 0.2592$	$1 - 0.2592 = 0.7408$	$0.2592 - 0.1393 = 0.1199$	$0.1199/0.8607 = 0.1393$

35. 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 defaults/12 month = 0.5 defaults per month.

P = 1 – exp(-0.5) = 39.35%

36. 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.

Key Point: Single-Factor Model

$$\alpha = \beta m + \sqrt{1-\beta^2}\varepsilon$$
$$E(\alpha) = 0$$
$$Var(\alpha) = \beta^2 + 1 - \beta^2 = 1$$

Conditional cumulative default probability function:

$$p = \phi\left(\frac{k_i - \beta_i \overline{m}}{\sqrt{1-\beta_i^2}}\right) \quad i = 1, 2, \ldots$$

37. 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

The probability that the firm defaults in the second year is conditional on its surviving the first year.

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 (-λ), which equals 0.09516.

Then, the cumulative probability that the firm defaults in the second year is equal to 1-exp(-2 × λ) or 0.18127, and the conditional one year default probability given that the firm survived the first year is the difference between the two year cumulative probability of default and the one year probability: 0.18127 - 0.09516 = .08611.

38. 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 × (-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:

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

39. 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 characterizes 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: 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.

40. 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.

41. Which of the following two transactions increases counterparty credit exposure?

I. Selling a forward contract to the counterparty

II. Selling a call option to the counterparty

A. I only

B. II only

C. Both

D. Neither

Answer: A

I. Selling of forward contract creates credit risk exposure to the counterparty as it is subject to the performance of the counterparty, which may default to pay at expiry date,

II. Selling an option (for both call and put) does not create credit risk as it is not subject to the performance of the counterparty. The option premium has already been collected when the transaction is made and default of the counterparty will have no negative impact on the seller.

42. 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: Credit Exposure

43. 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

44. 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.

45. 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.

46. 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 form this transaction?

A. USD 0.00

B. USD 0.38

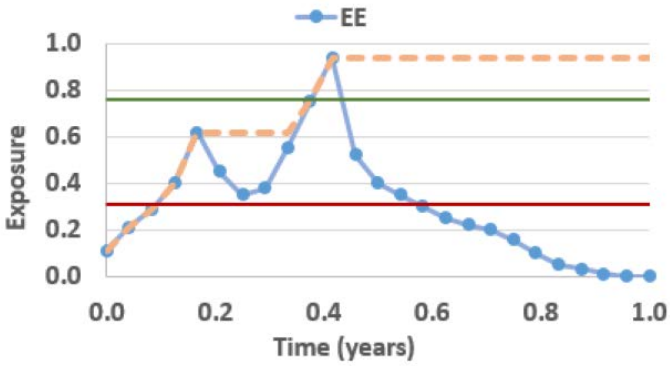
C. USD 1.75

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 option with one year to expiration.

47. 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.

Key Point: Credit Exposure of Financial Products

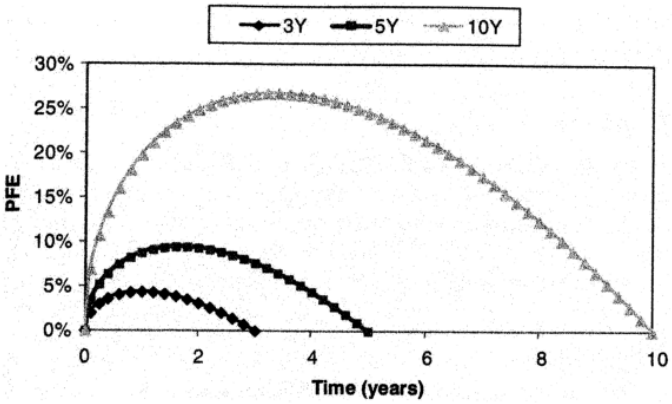


FIGURE 12-9 Illustration of the PFE of swaps of different maturities.

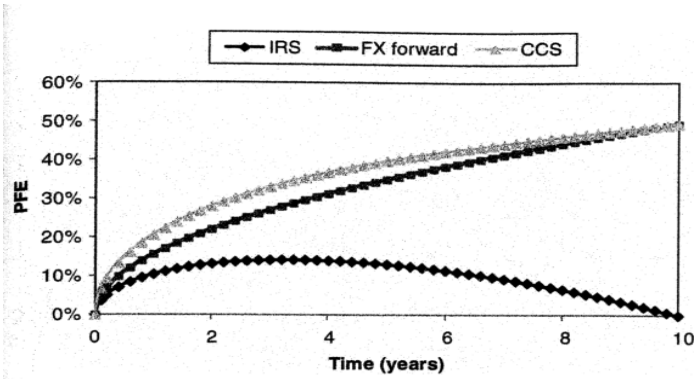


FIGURE 12-16 Illustration of a cross-currency swap (CCS) profile as a combination of an interest rate swap (IRS) and FX forward.

48. 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

49. 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.

50. 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

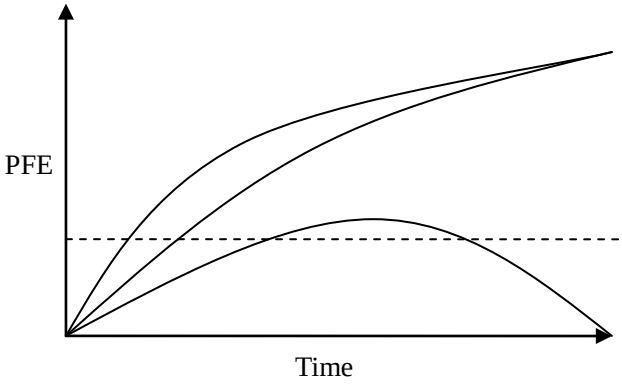
C. Decrease for both BNP Paribas and Credit Agricole

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 lately. 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.

51. 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

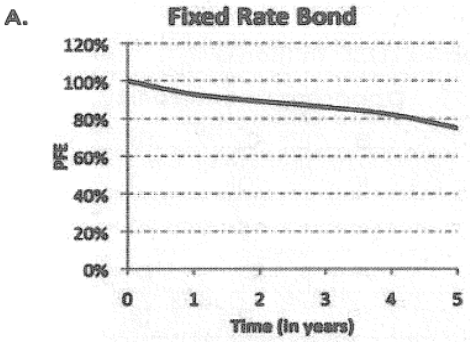
D. Average PFE of interest rate swap

Answer: C

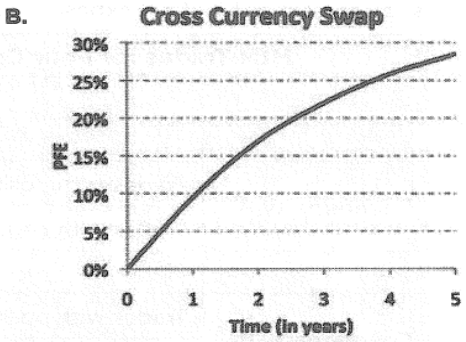
PFE of cross-currency swap, which combines the exposure of an interest rate swap and the FX forward. The dotted must be the average PFE (aka, AWCE) since it is a flat line.

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

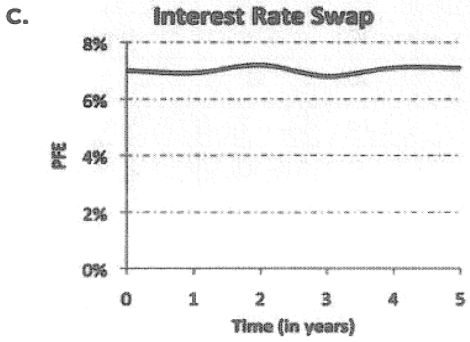
A.



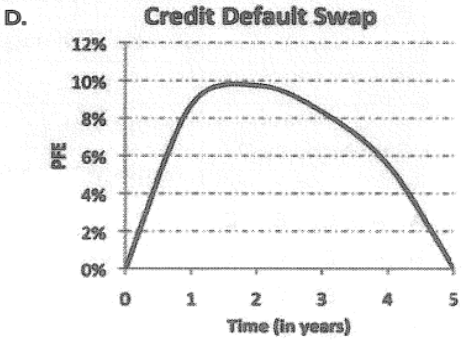
B.



C.



D.



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.

53. 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:

A. Incremental CVA because it accounts for the change in CVA once the new trade is priced, accounting for netting.

B. Marginal CVA because he could break down netted trades into trade level contributions.

C. 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.

54. 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 × counterparty credit spread – ENE × institution credit spread

=5% × 300 – 3% × 200 = 9 bps

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

55. 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

56. 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 × 0.64 - 100 × exp(-3%) × 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 × 5% × 75% = $24.32

57. 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 EE (writer) × 10% PD × 40% 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.

58. 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

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
  - ✧ The CCP performs the following six functions: valuation and settlement, trade netting, collateral management, transparency, loss mutualization, and auction process.
  - ✧ Strengths: multilateral netting, loss mutualization, legal efficiency, operational efficiency, liquidity, transparency, and default management through an auction process.
  - ✧ Weaknesses: inability to eliminate counterparty risk, possibility of increased systemic risk, and undesirable consequences of CCP roles, such as moral hazard and adverse selection.
  - ✧ Challenging: standardization, complexity, liquidity, and wrong-way risk are characteristics of OTC derivative products that make CCP clearing challenging.
  - ✧ Clearing Members: clear their own trades directly with a CCP; Non-Clearing Members: can only trade through a general clearing member, which has the authority to clear trades for third parties.

- ✧ 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

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59. Which of the following are methods of credit risk mitigation?

I. Collateral agreements

II. Netting

A. I only

B. II only

C. Both

D. Neither

Answer: C

Both collateral and netting agreements are methods of mitigation credit risk.

60. 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

61. 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.

62. 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.

63. 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%

64. 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.

65. 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

66. 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.

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

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 ABCO
D. Increase collateral.

Answer: D

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

68. 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 (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.

69. 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.

70. Assume a two-way CSA with the following identical parameters for both counterparties:

- Threshold is equal to $1,000,000.
- Independent amount is equal to zero for both.
- Minimum transfer amount is equal to $100,000
- Rounding up equal to $25,000, and
- Initial collateral held equal to zero.

As noted, the initial collateral held is zero for both counterparties. Consider the next two days, from the perspective of Party A.

1) The portfolio mark to market increases to $1,430,000 (1.430 million) on the first day, T(1)
2) The portfolio mark to market decreases to $1,030,000 (1.030 million) on the second day, T(2)

Which of the following is the correct sequence of collateral calls (returns) from the perspective of Party A?

A. On first day $450,000 collateral called (received) by Party A; on second day $400,000 collateral returned by Party A.

B. On first day $225,000 collateral posted by Party A; on second day additional $100,000 collateral posted by Party A.

C. On first day $175,000 collateral called (received) by Party A; on second day $200,000 collateral returned by Party A.

D. Neither call nor post (return) collateral on either the first or second day.

Answer: A

On the first day, the portfolio value minus the threshold (which is not collateralized) is equal to $1.430 million minus $1.0 million or $430,000. Because this is above the minimum transfer

amount, there is a collateral call, and it is rounded up to $450,000.

On the second day, the portfolio value minus the collateral held equals $1.030 million minus $450,000 equals $580,000 which is $420,000 below the threshold, such that (rounded) $400,000 is returned.

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 summarizes the key challenges f or 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.

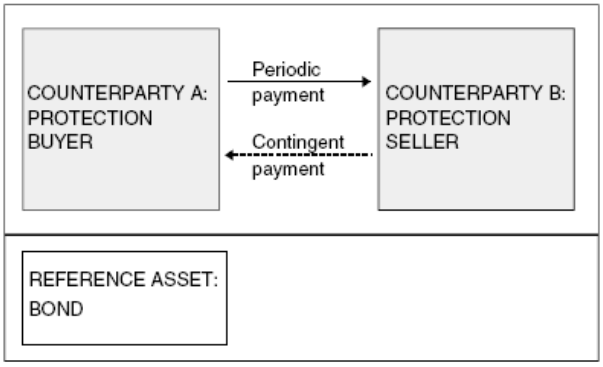
Answer: C

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: C

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 [(Par Value) – (Market Value of Reference Asset)]; deliver the reference asset.

C. Receive [(Par Value) – (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 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%.

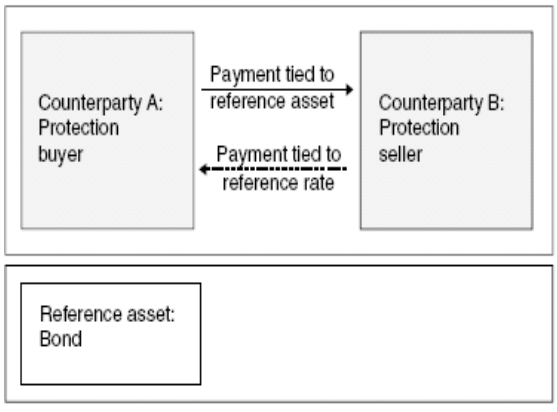
D. There is no arbitrage opportunity as any apparent risk-free profit is necessarily compensation for being exposed to the credit risk of the issuer.

Answer: A

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

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.



77. 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 USD1.7 million

D. Net outflow of USD 1.7 million

Answer: A

78. 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 × 20million). So the firm's net cash flow would be 0.75 million – 5 million = -USD 4.25 million.

79. 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.

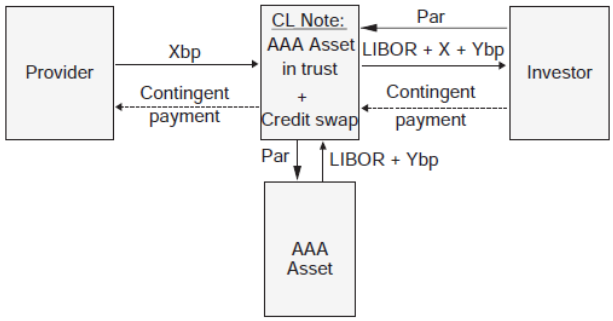
Answer: D

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

80. 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.

81. 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.

82. A three-year, credit-linked note (CLN) with underlying company Z has a LIBOR + 60bps

semi-annual coupon. The face value of the CLN is USD 100. LIBOR is 5% for all maturities. The current three-year CDS spread for company Z is 90bps. The fair value of the CLN is closest to

A. USD 100.00

B. USD 111.05

C. USD 101.65

D. USD 99.19

Answer: D

Because the current CDS spread is greater than the coupon, the CLN must be selling at a discount. The only solution is D.

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 million + $3.54375 million)/$35 million]).

Key Point: Credit Derivatives 4 – Structured Products & CDO

- Types of Structured Finance
  - ✧ Securitization

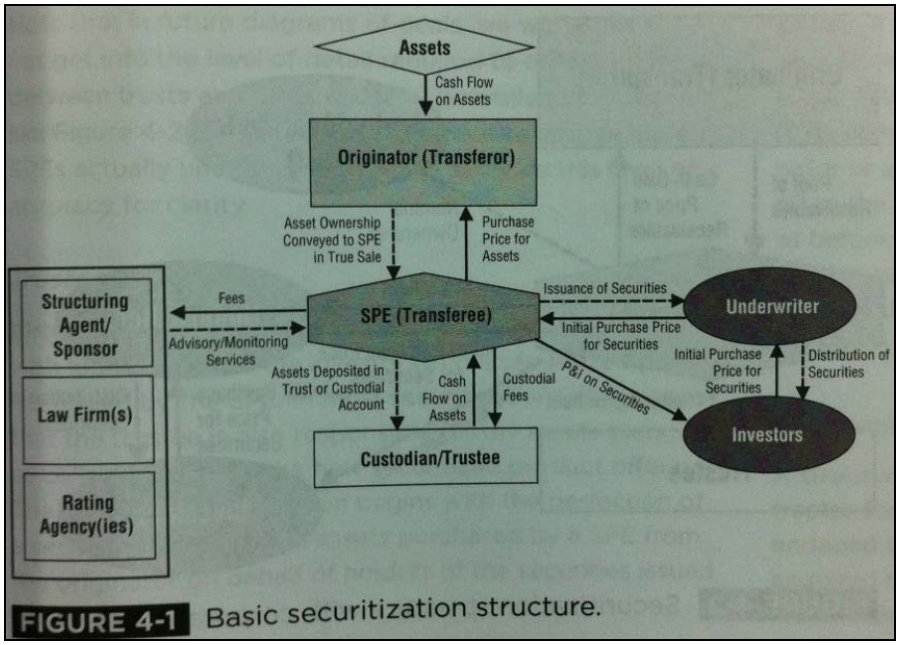
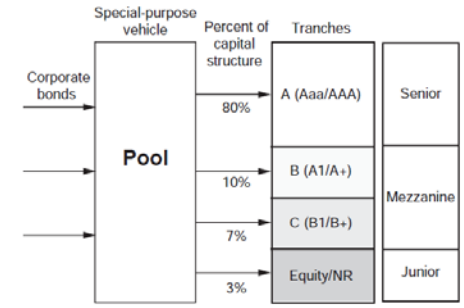


FIGURE 4-1 Basic securitization structure.

- Structure
  - ✧ Tranching

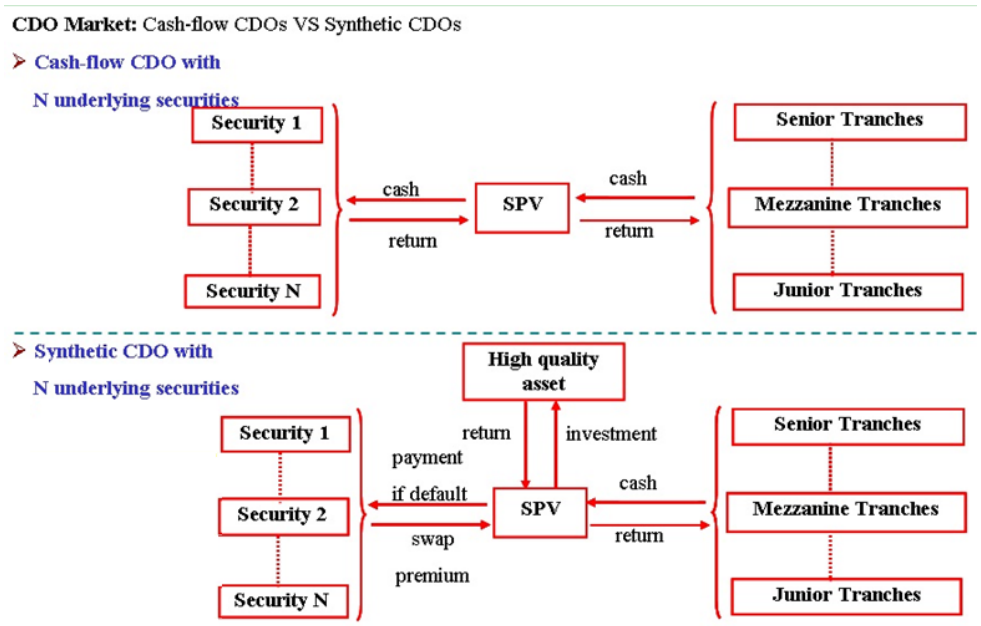


Collateralized Debt Obligation Structure

  - ✧ 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



✧ Balance Sheet vs. Arbitrage

	Balance Sheet CDOs	*Arbitrage CDOs*
Typical underlying assets	Loans	Bonds
Asset origination	Originator's balance sheet	Open market
Management	Passive	Active
Purpose	Credit risk management	Profit
Residual interest	Retained by originator	May be sold to investors

- 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

Subordination

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 – (I – SMM)12	mortgages, home-equity. student loans
Single monthly mortality (SMM)	Prepayment/Outstanding pool balance	mortgages, home-equity, student loans
Weighted average life (WAL)	Σ (a/365).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.
    C. Neither gain nor lose value since only excepted 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 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 × (LIBOR + 3%)

B. $10 million × (LIBOR + 5%)

C. $10 million × (LIBOR + 7%)

D. $10 million × (LIBOR + 9%)

Answer: D

Excess spread = 100 million × (LIBOR + 200 bps – 20bps) – 90 million × (LIBOR + 100bps)

=10 million × (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 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
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	Overcollater	Recovery	OC +	Equity	OC a/c
t	Annual	Cum'l		0.085	4.675	1	Spread			Recovery	Flow	
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. 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.

102. 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.

103. A major benefit of securitization for a financial institution is the ability to remove assets from the balance sheet, which lowers risk and the required regulatory capital. While a large portion of the risk is removed from the balance sheet, the originating financial institution often maintains a portion of the risk. Which of the following terms best identify the risk that is maintained by the originator?

A. Correlation.

B. Excess spread.

C. First-loss piece.

D. Guarantor of collateral value

Answer: C

The originator often maintains ownership of the first-loss piece, which is the class of assets with the lowest credit quality and is the most junior level where losses are first absorbed in the event of a default.

104. 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.

105. Which of the following measures are most likely to be used by a securitized product backed by student loans?

A. Single monthly mortality (SMM), constant prepayment rate (CPR), and Public Securities Association (PSA).

B. Loss curves and absolute prepayment speed (APS).

C. Weighted average life (WAL), weighted average maturity (WAM), and weighted average coupon (WAC).

D. Debt service coverage ratio (DSCR) and monthly payment rate (MPR).

Answer: A

The constant prepayment rate (CPR) and the Public Securities Association (PSA) method are common methodologies used to estimate prepayments for student loans and mortgages.

106. 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 million) + 180(3 million) + 270(5 million) + 360(10 million)]/(2 million + 3 million + 5 million + 10 million) = (180 million + 540 million + 1,350 million + 3,600 million)/20 million = 5,670 million/20 million = 284 days

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2016 FRM PART II

百题巅峰班讲义

操作风险测量与管理

讲师：梁震宇

金程资深培训师

2016 年 5 月

Operational and Integrated Risk Management

Key Point: Definition of Operational Risk

- 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.
- Two Kinds of events: LFHS & HFLS
- Two Kinds of methods: top-down & Bottom-up
- Basel II classifies loss events into seven categories. Loss events in the Execution, Delivery, and Process Management category have a small dollar amount but a very large frequency of occurrence. Losses are more infrequent but very large in the Clients, Products, and Business Practices category.
- Risk control self-assessment (RCSA) requires the assessment of risks that provides a rating system and control identification process for the OpRisk framework. Key risk indicators (KRIs) are used to quantify the quality of the control environment with respect to specific business unit processes.

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.

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. What can be said about the impact of operational risk on both market risk and credit risk?

A. Operational risk has no impact on market risk and credit risk.

B. Operational risk has no impact on market risk but has impact on credit risk.

C. Operational risk has impact on market risk but no impact on credit risk.

D. Operational risk has impact on market risk and credit risk.

Answer: D

Operational risk can lead to market or credit risk. Operational errors in the settlement process may result in credit risk and market risk since the settlement amount may be dependent on market movements.

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,

as traders may affect internal price data.

5. 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: 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. Practitioners-suggest only using internal data because it is most relevant, and it is difficult to ensure the completeness of external data. Modeling the frequency distribution requires less data when compared to modeling severity.

- Severity Distributions

The severity of each event follows a parametric distribution, such as a lognormal, Weibull, Gamma, Exponential distribution. Severity distributions are generally considered more important than frequency distributions. One problem with modeling severity is that recent internal loss data may not be sufficient for calibrating the tails of the distribution. Using external data usually requires scaling the data and combining data from several sources.

- Internal Data, External Data and Scenario Analysis

- Expert opinions are drawn from structured workshops and used as inputs in scenario analysis models. A challenge for scenario analysis is that these expert opinions may contain the following biases: presentation, context, availability, anchoring, huddle, gaming, confidence, and inexpert opinion.

- Thresholds for collecting loss data should not be set too low if there are business units that have a very large number of smaller losses.

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. Please find the right order of LDA structure process.
   1) Assign every data point in the matrix an equal weight except for split losses, old loss and external losses.
   2) Model a loss distribution in each cell of the business line/event type matrix.
   3) Organize and group loss data into a business line/event type matrix.
   4) Determine the operating risk capital requirement for each business line by combining

empirical distributions and parametric tail distributions.

A. (4) (2) (3) (1)

B. (3) (1) (4) (2)

C. (3) (1) (2) (4)

D. (4) (1) (3) (2)

Answer: C

9. 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

D. USD 140,500

Answer: B

The expected loss can be calculated by multiplying the expected frequency and the expected severity. Expected frequency is equal to: $(0 \times 0.6) + (1 \times 0.3) + (2 \times 0.1) = 0.5$,

Expected severity is equal to: $(1000 \times 0.5) + (100{,}000 \times 0.4) + (1{,}000{,}000 \times 0.1) = 140{,}500$

The expected loss is therefore: $0.5 \times 140{,}500 = 70{,}250$

10. 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 1000
0.3	1	0.3	USD 10000
0.2	2	0.1	USD 1001000

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	Prob.
0	0.5 = 0.5
1,000	0.3 × 0.6 = 0.18
2,000	0.2 × 0.6 × 0.6 = 0.072
10,000	0.3 × 0.3 = 0.09
11,000	0.2 × 0.6 × 0.3 + 0.2 × 0.3 × 0.6 = 0.072
20,000	0.2 × 0.3 × 0.3 = 0.018
100,000	0.3 × 0.1 = 0.03
101,000	0.2 × 0.6 × 0.1 + 0.2 × 0.1 × 0.6 = 0.024
110,000	0.2 × 0.1 × 0.3 + 0.2 × 0.3 × 0.1 = 0.012
200,000	0.2 × 0.1 × 0.1 = 0.002

11. 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.

12. 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.

13. 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 severity distribution.

Answer: A

Key Point: Model Risk

- The risk associated with using financial models to simulate complex relationships. Sources of model risk include:
  - ✧ Incorrect model specification
  - ✧ Incorrect model application
  - ✧ Implementation risk
  - ✧ Calibration error
  - ✧ Programming errors
  - ✧ Data problems
- Six common model errors include:
  - ✧ Assuming constant volatility.
  - ✧ Assuming a normal distribution of returns.
  - ✧ Underestimating the number of risk factors.
  - ✧ Assuming perfect capital markets.
  - ✧ Assuming adequate liquidity.
  - ✧ Misapplying a model.
- Common valuation and estimation errors include:
  - ✧ Inaccurate data.
  - ✧ Incorrect sampling period length.

✧ Liquidity and valuation problems.

● Model risk can be mitigated either through investing in research to improve the model, or through an independent vetting process. Vetting consists of six phases:

✧ Documentation

✧ Vetting the soundness of the model

✧ Ensuring independent access to rates

✧ Benchmark selection

✧ Health check and stress testing of the model

✧ Incorporating model risk into the risk management framework

● 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: The collapse of LTCM in 1998 highlights three important lessons:

✧ Utilizing a 10-day VaR period as a proxy for the time horizon for economic capital is too short. A time horizon is needed that is sufficiently long enough to model the time to raise new capital.

✧ The fund's VaR models ignored the possibility that liquidity may decline or even completely dry up in periods of extreme stress.

✧ The fund's risk models ignored correlation and volatility risks. Specifically, the fund did not account for stressed scenarios with material rises in volatility or an increase in positive market correlation as contagion risk spread across international economies.

14. You are the head of the Independent Risk Oversight (IRO) unit of XYZ bank, Your first task is to review the following existing polices 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.

15. 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)

16. An important source of model risk is incorrect model specification. Which of the following is not an example of model specification error?

    A. Omitting an important risk factor from the model.

    B. Assuming that variables are independent when significant correlations exist.

    C. Assuming data is from a particular distribution when a more accurate distribution is available.

    D. Estimating the model using data from an inappropriate sample period.

Answer: D

Using data from an inappropriate sample period is an example of calibration error.

17. 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.

18. 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.

19. Even though risk managers cannot eliminate model risk, there are many ways managers can protect themselves against model risk. Which of the following statement about managing model risk is correct?
    A. Models should be test against known problems.
    B. It is not advisable to estimate model risk using simulations.
    C. Complex models are generally preferable to simple models.
    D. Small discrepancies in model outputs are always acceptable.

Answer: A

One way to protect against model risk is to test a model against known problems. It is always a good idea to check a model against simple problems to which one already knows the answer, and many problems can be distilled to simple special cases that have known answers. If the model fails to give the correct answer to a problem whose solution is already known, then this indicates that there is something wrong with it.

20. As a risk practitioner. Leo realizes that model risk can never be eliminated, although he may find some ways to protect against it. Which of the following measures help reduce model risk?
    I. All else equal, choose the model with the fewest parameters.
    II. Have regularly scheduled model reviews that involve careful back-testing and stress-testing.
    III. Identify and evaluate key model assumptions, and ignore small but persistent problems.
    IV. Validate the model using simple Problems for which answers are independently known.

A. II only
B. I, II, and III
C. I, II, and IV
D. III and IV

Answer: C

I. is correct. First and foremost, practitioners should simply be aware of the model risk: It is true that unnecessary complexity is never a virtue in model selection.

II. is correct. Practitioners should evaluate model adequacy using stress tests and backtests: models should be recalibrated and re-estimated on a regular basis and the methods used should be kept up to date.

III. is incorrect. Users should explicitly set out the key assumptions on which a model is based. Evaluate the extent to which the model's results depend on these assumptions: But he should never ignore the small problems because small discrepancies are often good warning signals of larger Problems.

II. is correct. It is always a good idea to check a model on simple Problems to which one already knows the answer and many Problems can be distilled to simple special cases that have knows answers.

21. 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.

22. 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.

23. 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

Malz: "The risk manager has a great deal of discretion in actually computing a VaR. The VaR techniques we described in Chapter 3—modes of computation and the user-defined parameters—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, 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"

24. 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 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."

25. 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.

26. 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.

27. 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: Liquidity Risk

- Liquidity Risk
  - ✧ Transaction liquidity risk
  - ✧ Balance Sheet Risk or Funding Liquidity Risk
  - ✧ Systemic Risk
- 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 tight 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?

- Liquidity-Adjusted VaR

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

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

$$LVAR = V(z_\alpha \times \sigma - \mu) + \frac{1}{2} \times V \times (\mu_S + z'_\alpha \times \sigma_S)$$

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

- 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.

✧ Repos give rise to both counterparty risk and liquidity risk. Counterparty risk is the risk of borrower default or non-payment of its obligations. Liquidity risk is the risk of an adverse change in the value of the collateral. Counterparty risk is mitigated with collateral, while liquidity risk is mitigated with haircuts, margin calls, shorter repo terms, and higher quality collateral.

✧ During the recent financial crisis, lenders were increasingly demanding higher quality collateral and larger haircuts and even withdrew liquidity altogether. Borrowers experienced collateral liquidations and capital declines, leading to several high profile company failures and bankruptcies. The failures of Bear Stearns and Lehman Brothers illustrate these events.

28. 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.

29. 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.

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 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 × 0.0154) = USD 2026.64

Liquidity cost (LC) = 80,000 × (0.5 × 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%, reactively. 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 (ΔN/N). We are given: Δ

Thus ΔP/P = Elasticity. Therefore LVaR/VaR = 1 – ΔP/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. 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 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 contract price needed by Pasquini?

	Contract type	Contract 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 contract price is calculated as follows:

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

42. 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 × (1 + 0.0090 × 92/360) = $180,414,000

43. 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).

44. The Basel Committee recommends that banks use a set of early warning indicators in order to identify emerging risks and potential vulnerabilities in their liquidity position. Which of the following is an early warning indicator of a potential liquidity problem?

A. Rapid asset growth.

B. Positive publicity.

C. Credit rating upgrade.

D. Increased asset diversification.

Answer: A

Rapid asset growth is an early warning of a potential liquidity problem. Positive publicity, credit rating upgrade, and increased asset diversification are all not early warnings of a potential liquidity problem.

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).

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

- The hurdle rate is computed as follows:

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

Once the hurdle rate and the RAROC are calculated, the following rules apply:

✧ 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/discontinued.

- In computing RAROC, the focus is often on a one-year time horizon. However, it is possible to look at multi-period RAROC to obtain a more accurate RAROC measure for Longer-term transactions and loans.

✧ A point-in-time (PIT) probability of default could be used for short-term expected losses and to price financial instruments with credit risk exposure. A through-the-cycle (TTC) probability of default is more commonly used for computations involving economic capital, profitability, and strategic decisions.

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

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

Or

$$\text{ARAROC} = \frac{\text{RAROC} - R_F}{\beta}$$

Therefore, the revised business decision rules are as follows:

✧ If adjusted RAROC > R_F, then accept the project

✧ If adjusted RAROC < R_F, then reject the project

- Loan Equivalent Approach

To allocate capital to non-traditional products, we can refer to their risk in "loan equivalent" terms. The RARCO capital for each non-loan product is computed by multiplying the loan equivalent amount by a capital factor that is related to the risk rating and tenor.

- For financial institutions, there are four major reasons for using economic capital to allocate risk capital:

✧ Capital is used extensively to cushion risk.

✧ Financial institutions must be creditworthy.

✧ Difficulty in providing an external assessment of a financial institution's creditworthiness.

✧ Profitability is greatly impacted by the cost of capital.

- A business unit with earnings or cash flows that are highly correlated to the overall firm should be allocated more risk capital than a business unit with earnings or cash flows that are negatively correlated (assuming similar volatility).

45. 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 × 0.1 - 5.5 - 1.5 - 1 + 7.5 × 0.055)/7.5 = 2.4125 / 7.5 = 32.2%

46. Given the following data for a project, which of the following statements is most accurate regarding the use of the RAROC?

Equity beta	1.20
Market return	13%
Variance of returns	5%
RAROC	16%
Risk-free rate	4%

I. Using the adjusted RAROC, the project should be accepted because its adjusted RAROC is higher than the risk-free rate.

II. Using the second-generation RAROC, the project should be accepted because its adjusted RAROC is higher than the market risk premium.

A. I only.

B. II only.

C. Both I and II.

D. Neither I nor II.

Answer: B

The adjusted RAROC (ARAROC) or second-generation RAROC compares the adjusted RAROC to the market risk premium. So Statement I is incorrect.

The ARAROC is the RAROC minus the risk-free rate divided by the beta:(16% - 4%) / 1.20 = 10%. The project should be accepted because the ARAROC is greater than the excess market return: 13% - 4% = 9%. So Statement II is correct.

47. 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

A. is correct. ARAROC = (12% - 5%)/1.5 = 0.047 = 4.7% the expected excess rate of return on the market = 11% - 5% = 6%. 4.7% < 6%. So as a rational company, it will reject the project. The contribution will be 0.

B. is incorrect. There is no reason for 5% - 4.7% = 0.3%

C. is incorrect 4.7% is ARAROC.

D. is incorrect. 6% is the expected excess rate of return on the market.

48. In calculating its risk-adjusted return on capital, your bank uses a capital charge of 2.50% for revolving credit facilities with a loan equivalent factor of 0.35 assigned to the undrawn portion. Recently, you have become concerned that the protective covenants embedded in these loans are weak and may not prevent customers from drawing on the facilities during times of stress. As such, you have recommended doubling the loan equivalent factor to 0.70. This recommendation has met with resistance from the loan origination team, and senior management has asked you to quantify the impact of your recommendation. For a typical facility that has an original principal of USD 1 billion and is 30% drawn, how much additional economic capital would have to be allocated if you increase the loan equivalent factor from 0.35 to 0.70?

A. USD 3.50 million
B. USD 6.13 million
C. USD 8.75 million
D. USD 13.63 million

Answer: B

The required economic capital to support a loan in the RAROC model can be calculated using the following formula:

Required Capital= $[B_{DRAWN} + (B_{UNDRAWN} \times LEF)] \times CF$

Where LEF represents the loan equivalent factor and CF represents the capital factor.

Therefore the initial required economic capital is calculated as follows:

[(1 billion × 0.3) + (1 billion × 0.7 × 0.35)] × 2.5% = USD 13.625 million,

And the required capital if the change is implemented would be:

[(1 billion × 0.3) + (1 billion × 0.7 × 0.70)] × 2.5% = USD 19.75 million.

Hence the additional required economic capital would be 19.75 - 13.625 or 6.13 million.

49. Suppose a bank loan has the following characteristics:

- Gross revenues are $1.3 million.
- Interest expense is $0.3 million.
- The return on the $5 million economic capital invested in T-bills is $100,000.
- The firm's beta is 1.5.
- The unexpected loss for the loan is estimated at $500,000.
- The adjusted RAROC is equal to 8%.

What is the worst-case loss for this loan?

A. $1.6 million.

B. $2.3 million.

C. $0.9 million.

D. $0.75 million.

Answer: C

First, determine RAROC as follows:

$RAROC = \beta_E \times ARAROC + R_F$

The RF is calculated as the return from economic capital, which is $100,000/$5,000,000 = 2%.

RAROC = 1.5 × 0.08 + 0.02

RAROC = 14%

Second, determine the expected loss for the loan as follows:

EL = -(RAROC × EC – revenues + expenses – return on EC)

EL = -(0.14 × $5 - $1.3M + $0.3M - $0.1M) = $400,000

Finally, compute the worst-case loss as the sum of expected and unexpected loss:

Worst-case loss = expected loss + unexpected loss

Worst-case loss = $400,000 + $500,000

Worst-case loss = $0.9M

50. 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 fell 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.

51. 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.

52. Which of the following statements regarding the choice of default probability approaches in computing economic capital is correct?

A. A through-the-cycle (TTC) approach should be used to price financial instruments with credit risk exposure.

B. A point-in-time (PIT) approach is more commonly used for computations involving profitability and strategic decisions.

C. A TTC approach is more likely to result in a lower volatility of capital compared to the PIT approach.

D. A firm's rating will not change when analyzed under the PIT approach versus the TTC approach.

Answer: C

A firm's rating is more likely to change when analyzed under the point-in-time (PIT) approach compared to the through-the-cycle (TTC) approach. As a result, the TTC approach results in a lower volatility of economic capital compared to the PIT approach.

A PIT approach should be used to price financial instruments with credit risk exposure and to compute short-term expected losses. A TTC approach is more commonly used for computations involving profitability, strategic decisions, and economic capital.

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. 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.

56. 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

57. 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 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 ture?

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: 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.
- Large dealer banks are security underwriters in the primary securities market and provide liquidity as important counterparties in the OTC derivatives market and repo markets. They are prime brokers to hedge funds and are involved in many off-balance sheet activities, such as special purpose entities (SPEs). The systemic risk in these markets is increased by the fact dealer banks are often counterparties to other dealer banks.

58. 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 banks 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 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%.

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2016 FRM PART II

百题巅峰班讲义

风险管理与投资管理

讲师：梁震宇

金程资深培训师

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Risk Management and Investment Management

Key Point: Portfolio Management

- Portfolio Construction Techniques
  - ✧ Screens
  - ✧ Stratification
  - ✧ Linear Programming
  - ✧ Quadratic Programming

1. Which statement about risk control in portfolio construction is correct?
   A. Quadratic programming allows for risk control through parameter estimation but generally requires many more inputs estimated from market data than other methods require.
   B. The screening technique provides superior risk control by concentrating stocks in selected sectors based on expected alpha.
   C. When using the stratification technique, risk control is implemented by overweighting the categories with lower risks and underweighting the categories with higher risk.
   D. When using the linear programming technique, risk is controlled by selecting the portfolio with the lowest level of active risk.

Answer: A

Quadratic programming requires many more inputs than other portfolio construction techniques because it entails estimating volatilities and pair-wise correlations between all assets in a portfolio. Quadratic programming is a powerful process, but given the large number of inputs it introduces the potential for noise and poor calibration given the less than perfect nature of most data.

On the other hand, the screening technique strives for risk control by including a sufficient number of stocks that meet the screening parameters and by weighting them to avoid concentrations in any particular stock. However, screening does not necessarily select stocks evenly across sectors and can ignore entire sectors or classes of stocks entirely if they do not pass the screen. Therefore, risk control in a screening process is fragmentary at best.

Stratification separates stocks into categories (for example, economic sectors) and implements risk control by ensuring that the weighting in each sector matches the benchmark weighting. Therefore, it does not allow for overweighting or underweighting specific categories.

Linear programming does not necessarily select the portfolio with the lowest level of active risk. Rather, it attempts to improve on stratification by introducing many more dimensions of risk control and ensuring that the portfolio approximates the benchmark for all these dimensions.

2. Based on 60 monthly returns, you estimate an actively managed portfolio alpha = 1.24% and standard error of alpha = 0.1278%. The portfolio manager wants to get due credit for producing positive alpha and believes that the probability of observing such a large alpha by chance is only 1%. Calculate the t-statistic, and based on the estimated t-value would you accept (or reject) the claim made by the portfolio manager.

   A. t = 9.70, accept

   B. t = 2.66, accept

   C. t = 2.66, reject

   D. t = 9.70, reject

Answer: A

$$t = \frac{\text{alpha}}{\text{S.E.}(\text{alpha})}$$

$$t = \frac{1.24\%}{0.1278\%} = 9.702$$

With 60 observations and such a large t value, you would have rejected H_0 (alpha = 0). The manager should receive credit for the statistically significant alpha.

3. An analyst regresses the returns of 100 stocks against the returns of a major market index. The resulting pool of 100 alphas has a residual risk of 18% and an information coefficient of 9%. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 3.18% or less than -3.18%?

   A. 5

   B. 10

   C. 20

   D. 25

Answer: A

The standard deviation of the alphas = residual risk × Information Coefficient (IC) = 0.18 × 0.09 = 0.0162. The alphas are normally distributed with a mean of 0, therefore there are 5% of the alphas are out of the interval. The total number of stocks is 100, so roughly there are 5 alphas that are out of the range.

Key Point: Portfolio Performance

- Performance Analysis

$$S_P = \frac{E(R_P) - R_F}{\sigma_P}$$

$$T_P = \frac{E(R_P) - R_F}{\beta_P}$$

$$SOR = \frac{E(R_P) - R_F}{\sigma_L(R_P)}$$

$$\alpha_P = E(R_P) - R_F - \beta_P\left(E(R_M) - R_F\right)$$

$$IR = \frac{E(R_p) - E(R_B)}{\sigma_{e_p}}$$

$$\sigma^2_{e_p} = \sigma^2_{(P-B)} = \sigma^2_P + \sigma^2_B - 2 \times \rho \times \sigma_P \times \sigma_B$$

- **Performance Attribution**

Refers to the set of techniques used by performance analysts to identify the sources of value addition to the portfolio. For example, how much of the performance (excess returns above benchmark) is attributable to the selection of the right asset classes or how much is attributable to selection of right sector or security within an asset class.

4. A manager who obtains an average alpha of 2.5% with a tracking-error of 4%. If he wish the result to be significant to 95%, how many years it is necessary to observe the portfolio return?

   A. 8.8 years

   B. 9.8 years

   C. 10.8 years

   D. 11.8 years

Answer: B

$$IR \approx \frac{t_{stat}}{\sqrt{T}} \rightarrow T = \left[\frac{t_{stat}}{IR}\right]^2 = \left[\frac{1.96}{2.5\% / 4\%}\right]^2 = 9.8 \text{ years}$$

5. You are evaluating the performance of Valance, an equity fund designed to mimic the performance of the Russell 2000 Index. Based upon the information provided below, what is the best estimate of the tracking error of Valance relative to the Russell 2000 Index?

   - Annual volatility of Valance: 35%
   - Annual volatility of the Russell 2000 Index: 40%
   - Correlation between Valance and the Russell 2000 Index: 0.90

   A. 3.1%

   B. 17.5%

   C. 39.6%

   D. 53.2%

Answer: B

$$\omega^2 = \sigma(p-B)^2 = \sigma(p)^2 + \sigma(B)^2 - 2\times\sigma(p)\times\sigma(B)\times\rho$$
$$= 0.35^2 + 0.4^2 - 2\times 0.35\times 0.4\times 0.9 = 0.0305$$
$$\omega = 17.5\%$$

6. Rick Masler is considering the performance of the managers of two funds, the HCM Fund and the GRT Fund. He uses a linear regression of each manager's excess returns (r_i) against the excess returns of a peer group (r_B):

   $r_i = a_i + b_i * r_B + e_i$

   The information he compiles is as follows:

Fund	Initial Equity	Borrowed Funds	Total Investment Pool	a_i	b_i
HCM	USD 100	USD 0	USD 100	0.0150	0.9500
				(t = 4.40)	(t = 12.1)
GRT	USD 500	USD 3,000	USD 3,500	0.0025	3.4500
				(t = 0.002)	(t = 10.20)

   Based on this information, which of the following statements is correct?

   A. The regression suggests that both managers have greater skill than the peer group.

   B. The a_i term measures the extent to which the manager employs greater or lesser amounts of leverage than do his/her peers.

   C. If the GRT Fund were to lose 10% in the next period, the return on equity (ROE) would be -60%.

   D. The sensitivity of the GRT fund to the benchmark return is much higher than that of the HCM fund.

Answer: D

Statement d is correct as can be seen from the b coefficient. It. is higher for GRT and lower for HCM. This indicates that the sensitivity of the GRT fund to the benchmark return is much higher than that of the HCM fund.

7. A fund manager recently received a report on the performance of his portfolio over the last year. According to the report, the portfolio return is 9.3%, with a standard deviation of 13.5%, and beta of 0.83. The risk-free rate is 3.2%, the semi-standard deviation of portfolio is 8.4%, and the tracking error of the portfolio to the benchmark index is 2.8%. What is the difference between the value of the fund's sortino ratio (computed relative to the risk-free rate) and its Sharpe ratio?

   A. 1.727

   B. 0.274

C. -0.378

D. 0.653

Answer: B

Sharp ratio = (9.3% - 3.2%)/13.5% = 0.4519, Sortino ratio = (9.3% - 3.2%)/8.4% = 0.7262, so Sortino ratio - sharp ratio = 0.274

8. A portfolio has an average return over the last year of 13.2%. Its benchmark has provided an average return over the same period of 12.3%. The portfolio's standard deviation is 15.3%, its beta is 1.15, its tracking error volatility is 6.5% and its semi-standard deviation is 9.4%. Lastly, the risk-free rate is 4.5%. Calculate the portfolio's information Ratio (IR).

A. 0.569

B. 0.076

C. 0.138

D. 0.096

Answer: C

9. Market portfolio's sharp ratio is 40%, the correlation between the market portfolio and the stock is 0.7, the stock's sharp ratio is

A. 12%

B. 28%

C. 32%

D. 30%

Answer: B

$$E(R_i) - R_f = \beta_i \times [E(R_M) - R_f]$$

$$\frac{E(R_i) - R_f}{\sigma_i} = \frac{\beta_i \times [E(R_M) - R_f]}{\sigma_i} = \frac{\beta_i}{\sigma_i}\sigma_M \times \frac{[E(R_M) - R_f]}{\sigma_M} = \rho_i \times \frac{[E(R_M) - R_f]}{\sigma_M} = 0.7 \times 40\% = 28\%$$

10. Portfolio Q has a beta of 0.7 and an expected return of 12.8%. The market risk premium is 5.25%. The risk-free rate is 4.85%. Calculate Jensen's Alpha measure for Portfolio Q.

A. 7.67%

B. 2.70%

C. 5.73%

D. 4.27%

Answer: D

Jensen's alpha is defined by:

$$\alpha_P = E(R_P) - R_F - \beta_P(E(R_M) - R_F) = 0.128 - 0.0485 - 0.7 \times 0.0525 = 4.27\%$$

11. Over the past year, the HIR Fund had a return of 7.8%, while its benchmark, the S&P 500 index, had a return of 7.2%. Over this period, the fund's volatility was 11.3%, while the S&P index's volatility was 10.7% and the fund's TEV was 1.25%. Assume a risk-free rate of 3%. What is the information ratio for the HIR Fund and for how many years must this performance persist to be statistically significant at a 95% confidence level?

A. 0.480 and approximately 16.7 years

B. 0.425 and approximately 21.3 years

C. 3.840 and approximately 0.2 years

D. 1.200 and approximately 1.9 years

Answer: A

12. A risk manager runs a performance attribution analysis on an actively managed portfolio using a selected benchmark. The weights and performance of the different market sectors within the portfolio and the benchmark are given below:

	Benchmark		Portfolio	
Market Sector	Weight	Annual Return	Weight	Annual Return
Equity	20%	8%	40%	6%
Fixed Income	50%	4%	55%	5%
Cash	30%	2%	5%	3%

What conclusion can be drawn from the data above by using common performance attribution analysis?

A. The portfolio outperforms the benchmark primarily because of the contribution of asset allocation.

B. The portfolio outperforms the benchmark primarily because of the contribution of security selection within market sectors.

C. The portfolio underperforms the benchmark primarily because of the contribution of asset allocation.

D. The portfolio underperforms the benchmark primarily because of the contribution of security selection within market sectors.

Answer: A

Key Point: Portfolio Risk Management

- Portfolio VaR

VaR for uncorrelated positions (ρ=0):

$$VaR_P = \sqrt{VaR_1^2 + VaR_2^2}$$

Undiversified VaR (ρ=1)

$$VaR_P = VaR_1 + VaR_2$$

- Marginal VaR, Incremental VaR and Component VaR

$$\text{Marginal VAR} = MVAR_i = \frac{VAR}{P} \times \beta_i$$
$$\text{Incremental } VaR_i \approx MVaR_i \times W_i$$
$$\text{Component } VaR_i \approx MVaR_i \times W_i'$$
$$\text{Global Minimum Portfolio}: MVaR_i = MVaR_j$$
$$\text{Optimal Portfolio}:$$
$$\frac{\text{Position}_i \text{ return - risk free rate}}{MVaR_i} = \frac{\text{Position}_j \text{ return - risk free rate}}{MVaR_j}$$

- Liquidity Duration: It is an approximation of the number of days necessary to dispose of a portfolio's holdings without a significant market impact.

$$LD = \frac{\text{number of shares of a security}}{[\text{desired max daily volume(\%)} \times \text{daily volume}]}$$

- Risk Budgeting

1) Budget Risk across Asset Classes: Budgeting risk across asset classes means selecting assets whose combined VaRs are less than the total allowed. The budgeting process would examine the contribution each position makes to the portfolio VaR.

2) Budget Risk across Active Managers: For allocating across active managers, if the tracking errors of the managers are independent of each other, it can be shown that the optimal allocation is achieved with the following formula:

$$\text{weight of portfolio managed by manager i} = \frac{IR_i \times (\text{portfolio's Vol tracking error})}{IR_p \times (\text{manager's Vol tracking error})}$$

For a given group of active managers, the weights may not sum to one. The remainder of the weight can be allocated to the benchmark, which has no tracking error.

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13. Consider a USD 1 million portfolio with an equal investment in two funds, Alpha and Omega, with the following annual return distributions:

Fund	Expected Return	Volatility
Alpha	5%	20%
Omega	7%	25%

Assuming the returns follow the normal distribution and that there are 252 trading days per year, what is the maximum possible daily 95% Value-at-Risk (VaR) estimate for the portfolio?

A. USD 16,587

B. USD 23,316

C. USD 23,459

D. USD 32,973

Answer: B

This question tests that the candidate understands correlation in calculating portfolio VaR. From the table, we can get daily volatility for each fund:

Fund Alpha volatility: $0.20 / 252^{0.5} = 1.260\%$

Fund Omega volatility: $0.25 / 252^{0.5} = 1.575\%$

Portfolio variance:

$0.5^2 \times 0.01259^2 + 0.5^2 \times 0.01574^2 + 2 \times 0.5 \times 0.5 \times 0.01259 \times 0.01574 \times \rho$

Portfolio volatility = (portfolio variance)$^{0.5}$

Portfolio volatility is least when $\rho = -1 \rightarrow$ portfolio volatility = 0.1575%

Portfolio volatility is greatest when $\rho = 1 \rightarrow$ portfolio volatility = 1.4175%

Therefore, 95% VaR maximum is $1.645 \times 0.014175 \times 1{,}000{,}000$ = USD23, 316

14. A portfolio consists of two positions. The VaR of the two positions are $10 million and $20million. If the returns of the two positions are not correlated. The VaR of the portfolio would be closest to:

A. $5.48million

B. $15.00million

C. $22.36million

D. $25.00million

Answer: C

For uncorrelated positions, the answer is the square root of the sum of the spread VaRs:

$VAR_p = \sqrt{(10^2 + 20^2)} = \$22.36\text{million}$

15. A portfolio is composed of two securities and has the following characteristics:

Investment in X:	USD 1.8 million
Investment in Y:	USD 3.2 million
Volatility of X:	8%
Volatility of Y:	4%
Correlation between X and Y:	15%

The portfolio diversified VaR at the 95% confidence level is closest to:

A. $14,074

B. $206,500

C. $404,740

D. $340,725

Answer: D

$VaR_P = 1.65 \times \sqrt{(1.8 \times 0.08)^2 + (3.2 \times 0.04)^2 + 2 \times 15\% \times (1.8 \times 0.08) \times (3.2 \times 0.04)} = 0.340754$

16. A portfolio has USD 2 million invested in Stock A and USD 1 million invested in Stock B. The 95% 1-day VaR for each individual position is USD 40,000. The correlation between the returns of Stock A and Stock B is 0.5. While rebalancing, the portfolio manager decides to sell USD 1 million of Stock A to buy USD 1 million of Stock B. Assuming that returns are normally distributed and that the rebalancing does not affect the volatility of the individual stocks, what effect will this have on the 95% 1-day portfolio VaR?

    A. There will be no effect.

    B. It will increase by USD 20,370

    C. It will increase by USD 21,370

    D. It will increase by USD 22,370

Answer: D

VaR(before) = sqrt(40000^2+40000^2+2 × 0.5 × 40000 × 40000) = USD 69282

VaR(after) = sqrt(20000^2+80000^2+2 × 0.5 × 20000 × 80000) = USD 91652

So the VaR will increase by (91,652 – 69,282) = 22,370

17. The manager of the BetaBalance fund, a balanced global equity and fixed-income portfolio, believes that globalization is causing the correlations of equity and fixed-income returns across different markets to rise over time. He decides to adjust the correlations in his VaR analysis for the coming year to reflect the higher correlations he expects. If his expectation turns out to be incorrect, what is the most likely result?

    A. There will be no impact on the portfolio because VaR is only a prediction, and portfolio return depends on what actually happens.

    B. The portfolio return will be lower than it should have been, given the expected risk level, because asset allocation will not have been optimal.

    C. The risk of the portfolio will have been understated because of the incorrect estimate of correlation among global markets.

    D. The portfolio return will be higher than it should have been, given the expected risk level, because of the higher correlation among asset classes

Answer: B

An error in predicting correlation among asset classes will cause the calculation of optimal asset allocation to be in error as well. Thus, the asset allocation of the portfolio will be less than optimal. Any portfolio that does not have optimal asset allocation will, by definition, have returns that are too low for the expected level of risk. The risk of the portfolio will be overstated because the estimates of correlation among markets were too high.

The next two questions are based on the following information.

A risk manager assumes that the joint distribution of returns is multivariate normal and calculates the following risk measures for a 2-asset portfolio:

Asset	Position	Individual VaR	Marginal VaR	VaR Contribution
1	USD 100	USD 23.3	0.176	USD 17.6
2	USD 100	USD 46.6	0.440	USD 44.0
Portfolio	USD 200	USD 61.6		USD 61.6

18. If asset 1 is dropped from the portfolio, what will be the reduction in portfolio VaR?

A. USD 15.0

B. USD 38.3

C. USD 44.0

D. USD 46.6

Answer: A

A is correct: The new portfolio VaR is that of asset 2 alone (USD 46.6), which implies a reduction in portfolio VaR of USD 61.6 - USD 46.6 = USD 15.0

19. Let $\beta_i = \rho\sigma_i/\sigma_p$, where ρ denotes the correlation between the return of asset i and the return of the portfolio, σ_i is the volatility of the return of asset i and σ_p is the volatility of the return of the portfolio. What is β_2?

A. 0.714

B. 1.429

C. 1.513

D. Cannot determine from information provided.

Answer: B

Marginal $VaR_i = \beta_i \times$ Portfolio VaR / Portfolio Value

So, β_i = Marginal $VaR_i \times$ Portfolio Value/Portfolio VaR

β_2= 0.44*200/ 61.6 = 1.429

20. Consider the following two asset portfolios:

Asset	Position Value (In Thousands of USD)	Return Standard Deviation (%)	Beta
A	400	3.60	0.5
B	600	8.63	1.2
Portfolio	1,000	5.92	1

Calculate the component VaR of asset A and marginal VaR of asset B, respectively, at the 95% confidence level.

A. USD 21,773 and 0.1306

B. USD 21,773 and 0.1169

C. USD 19,477 and 0.1169

D. USD 19,477 and 0.1306

Answer: C

$$\text{VaR}_P = \alpha \times \text{portfolio standard deviation} \times \text{portfolio value}$$
$$= 1.645 \times 0.0592 \times \text{USD}1{,}000{,}000$$
$$= \text{USD } 97{,}384$$

$$\text{Component VaR}_A = \text{USD}97{,}384 \times 0.5 \times \frac{400}{1000} = \text{USD}19{,}477$$

$$\text{Marginal VaR}_B = \text{USD}97{,}384 \times 1.2/\text{USD}1{,}000{,}000 = 0.1169$$

21. A risk analyst is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at EUR 200 million and contains EUR 15 million in stock A. The standard deviation of returns of stock A is 16% annually and that of the overall portfolio is 21% annually. The correlation of returns between stock A and the portfolio is 0.37. Assuming the risk analyst uses a 1-year 99% VaR and that returns are normally distributed, how much is the component VaR of stock A?

A. EUR 2.066 million

B. EUR 2.326 million

C. EUR 5.582 million

D. EUR 7.327 million

Answer: A

$$\beta = \rho \frac{\sigma_i}{\sigma_P} = 0.37 \times \frac{16\%}{21\%} = 0.2819$$

$$\text{Component VaR} = 0.2819 \times 2.326 \times 21\% \times 15 = 2.066\text{m}$$

22. The AT&T pension fund has 68%, or about $13 billion invested in equities. Assume a normal distribution and volatility of 15% per annum. The fund measures absolute risk with a 95%, one-year VaR, which gives $3.2 billion. The pension plan wants to allocate this risk to two equity managers, each with the same VaR budget. Given that the correlation between managers is 0.5, the VaR budget for each should be

A. $3.2 billion

B. $2.4 billion

C. $1.9 billion

D. $1.6 billion

Answer: C

Call x the risk budget allocation to each manager. This should be such that:

$x^2 + x^2 + 2\rho xx = \$3.2^2$.

Solving for:

$x\sqrt{1+1+2\rho} = x\sqrt{3} = \$3.2$, we find x = $1.85billion.

Answer A) is incorrect because it refers to the total VaR. Answer B) is incorrect because it assumes a correlation of zero. Answer D) is incorrect because it simply divides the $3.2 billion VaR by 2, which ignores diversification effects.

23. A portfolio manager currently holds 20,000 shares of Costiuk Inc. in a particular portfolio. The daily volume of Costiuk shares traded on the stock exchange is 50,000. Additionally, on any given day, the portfolio manager wishes to trade no more than 15% of the daily trading volume of Costiuk. Which of the following amounts is closest to the liquidity duration of Costiuk in this portfolio?

A. 0.06

B. 0.375

C. 2.67

D. 16.67

Answer: C

Liquidity duration is an approximation of the number of days necessary to dispose of a portfolio's holdings (of a particular share in this case) without a significant market impact. It is calculated as: 20,000 /(0.15 × 50,000) = 2.67.

24. A portfolio manager wants to invest a small amount of new money that has recently come into a fund. The fund is benchmarked to an index and, rather than adding a new holding, the manager is considering increasing the holdings of one of the four assets described in the following table:

Asset	Expected Return	Beta to the Index	Beta to the Portfolio
A	12%	1.2	0.90
B	10%	0.7	0.90
C	10%	0.6	0.85
D	8%	0.3	1.10

The portfolio manager wants to select the asset that has the lowest marginal VaR as long as its Treynor ratio is at least 0.1. Assuming the risk free rate is 2%, which asset should the portfolio manager select?

A. Asset A

B. Asset B

C. Asset C

D. Asset D

Answer: C

$TR_A = (12\% - 2\%)/1.2 = 0.0833$

$TR_B = (10\% - 2\%)/0.7 = 0.1143$

$TR_C = (10\% - 2\%)/0.6 = 0.1333$

$TR_D = (8\% - 2\%)/0.3 = 0.2$

Asset B, C, D have Treynor measures greater than 0.1. Of these, C has the lowest marginal VaR as its Beta to the portfolio is the lowest.

Key Point: Surplus at Risk

Surplus (S) is the difference between the value of the assets (A) and the liabilities (L). The change in the surplus (ΔS) is equal to the change in assets (ΔA) minus the change in liabilities (ΔL). If we normalize by the assets, the return on the surplus is given by:

$$R_{surplus} = \frac{\Delta Surplus}{Assets} = \frac{\Delta Assets}{Assets} - \left(\frac{\Delta Liabilities}{Liabilities}\right)\left(\frac{Liabilities}{Assets}\right)$$

$$= R_{Asset} - R_{Liabilities}\left(\frac{Liabilities}{Assets}\right)$$

Funding risk should be measured as the potential shortfall in surplus over the horizon, this is sometimes called surplus at risk.

25. On January 1, 2006, a pension fund has assets of EUR 100 billion and is fully invested in the equity market. It has EUR 85 billion in liabilities. During 2006, the equity market declined by 15% and yields increases by 1.2%. If the modified duration of the liabilities is 12.5, what is the pension fund's surplus on December 31, 2006?

A. EUR 15.00 billion

B. EUR 12.93 billion

C. EUR 12.75 billion

D. EUR 12.57 billion

Answer: C

The surplus at the beginning of the year was 100 – 85 = 15 billion EUR. During the year, the equity portfolio declines 15%, or 15 billion EUR, to 85 billion EUR. Due to the increase in yields, the dollar value of the liabilities decrease by 12.5 × 1.2% × 85 billion EUR, or 12.75. Thus at the end of the year, the assets are worth (100-15)=85billion EUR and the liabilities (85 - 12.75) = 72.25 billion. The surplus is the 12.75, a decrease of 2.25 billion EUR.

26. SkyLine Airways has a defined benefit pension scheme with assets of $165 million and liability of $150 million. The annual growth of the liabilities is expected to be 4.5% with 2.4% volatility. The annual return on the pension assets has an expected value of 7.8% with

12% volatility. The correlation between asset return and liability growth is 0.35. What is the 95% surplus at risk for SkyLine?

A. $24.97million

B. $54.81million

C. $18.84million

D. $6.12million

Answer: A

Expected surplus growth = ($165m × 0.078) - ($150m × 0.045)

Expected surplus growth = $12.87m - $6.75m = $6.12m

Variance of surplus = 355.104，Standard Deviation = 18.84m

Surplus at risk = expected growth in surplus – 1.65 × Standard Deviation of Surplus

Surplus at risk = $6.12m - $31.086m = -$24.97m

Note: Although it is a negative, it is usually expressed as a positive figure as it is assumed that it is a shortfall.

27. At the end of 2007, Chad & Co.'s pension had USD 350 million worth of assets that were fully invested in equities and USD 180 million in fixed-income liabilities with a modified duration of 14. In 2008, the wide spread effects of the subprime crisis hit the pension fund, causing its investment in equities to loss 50% of their market value. In addition, the immediate response from the government – cutting interest rates – to salvage the situation, caused bond yields to decline by 2%. What was the change in the pension fund's surplus in 2008?

A. USD -55.4 million

B. USD -124.6 million

C. USD -225.4 million

D. USD -230.4 million

Answer: C

The change in the pension fund's surplus for the year 2008 is equal to the initial surplus S_0 at the end of 2007 less the ending surplus S_1 at the end of 2008.

The initial surplus is calculated as $S_0 = 350 – 180 = 170$.

Next we have to calculate the surplus at the end of 2008. Given the 50% decline in the equity market, the new level of assets A_1 at the end of 2008 is equal to:

$(1 – 0.5) \times 350 = 175$

The new level of liabilities L_1 can be calculated as:

$L1 = (1 – 14 \times (-0.02)) \times 180 = 230.4$

Therefore the 2008 surplus S_1 is equal to $A_1 – L_1 = 175 – 230.4 = -55.4$ (which implies the pension

fund is actually in a deficit situation at the end of 2008). The change in surplus for 2008 is hence $S_1 – S_0 = -55.4 – 170 = -225.4$ million.

28. An analyst reports the following fund information to the advisor of a pension fund that currently invests in government and corporate bonds and carries a surplus of USD 10 million

Pension Assets	Pension	Liabilities
Amount (in USD million)	100	90
Expected Annual Growth	6%	7%
Modified Duration	12	10
Annual Volatility of Growth	10%	5%

To evaluate the sufficiency of the fund's surplus, the advisor estimates the possible surplus values at the end of one year. The advisor assumes that annual returns on assets and the annual growth of the liabilities are jointly normally distributed and their correlation coefficient is 0.8. The advisor can report that, with a confidence level of 95%, the surplus value will be greater than or equal to:

A. USD -11.4 million

B. USD -8.3 million

C. USD -1.7 million

D. USD 0 million

Answer: C

The lower bound of the 95% confidence interval is equal to: Expected Surplus – (95% confidence factor × Volatility of Surplus). The required variables can be calculated as follows:

Variance of the surplus = $100^2 \times 10\%^2 + 90^2 \times 5\%^2 – 2 \times 100 \times 90 \times 10\% \times 5\% \times 0.8 = 48.25$

Volatility of the surplus = 6.94

The expected surplus = 9.7

Therefore, the lower bound of the 95% confidence interval = $9.7 – 1.645 \times 6.94 = -1.725$

Key Point: Hedge Fund Trading Strategy

- Equity long/short strategy: go long and short similar securities to exploit mispricing-decreases market risk and generates alpha.
- Global macro strategy: makes leveraged bets on anticipated price movements in broad equity and fixed-income markets, interest rates, foreign exchange, and commodities.
- Emerging markets strategy: invests in developing countries' securities or sovereign debt.
- Fixed-income arbitrage strategy: long/short strategy that looks for pricing inefficiencies between various fixed-income securities.
- Convertible arbitrage strategy: investor purchases a convertible bond and sells short the underlying stock.

- Merger arbitrage strategy: involves purchasing shares in a target firm and selling short shares in the purchasing firm.
- Distressed investing strategy: purchase bonds of distressed company and sell short the stock, antic bating that the shares will eventually be worthless.
- Fund of hedge funds: perform screening and due diligence of other funds. Fees can be extensive, and the due diligence does not always identify fraud. A key advantage is diversification benefit without large capital commitment.

29. What critical shift occurred in the hedge fund industry following the collapse of LTCM in 1998 and the dot-com bubble burst in 2001?
    A. There was a significant drop in assets under management in the hedge fund industry.
    B. There was a large influx of institutional investors investing in hedge funds.
    C. Reporting within the hedge fund industry became more regulated than mutual funds.
    D. There was a significant increase in hedge fund failures.

Answer: B

30. Which of the following statements about convertible arbitrage hedge fund strategies is correct?
    A. Credit risk plays only a minor role in convertible arbitrage hedge funds.
    B. Investing in convertible arbitrage does not require an understanding of liquidity considerations as the market for convertible securities is sufficiently liquid today.
    C. Gamma trading entails significant directional exposure to the equity markets.
    D. Re-hedging after a large gain yields trading gains for a typical hedged position in convertible arbitrage hedge funds.

Answer: D

Re-hedging after significant moves of the underlying stock price is the essence of gamma trading. Credit risk plays an important role in the risk profile of convertible arbitrage hedge funds. Liquidity considerations are essential. Ignorance of this risk can lead to devastating losses as the 2008 financial crisis showed. Gamma trading means frequent re-hedging of directional exposure after market moves.

31. Identify the risks in a convertible arbitrage strategy that takes long positions in convertible bonds hedged with short positions in Treasuries and the underlying stock.
    A. Short implied volatility
    B. Long duration
    C. Long stock delta
    D. Positive gamma

Answer: D

This position is hedged against interest rate risk, so B) is wrong. It is also hedged against directional movements in the stock, so C) is wrong. The position is long an option (the option to convert the bond into the stock) and so is long implied volatility, so A) is wrong. Long options positions have positive gamma.

32. George Smith, a hedge fund manager, has just established a short position in short-term Swiss government bonds that are currently yielding 3.5% and a long position in short-term Italian government bonds that are yielding 4.2%. Smith believes the market has underestimated the probability that the Swiss Franc will appreciate relative to the euro. Which of the following hedge fund strategies is most similar to Smith's strategy?
    A. Pair trading strategy.
    B. Managed futures strategy.
    C. Global macro strategy.
    D. Event-driven strategy.

Answer: C

Global macro strategies take long and short positions based on expectations regarding fundamental changes in global capital markets. The manager in this scenario is engaging in a carry trade by taking a long position in a high-yielding currency (euros) and a short position in a low-yielding currency (Swiss Francs). The manager also expects a fundamental change in the exchange rate between the currencies. Managed futures strategies have a similar philosophy but use futures rather than the underlying assets to execute the strategy.

33. A fund of hedge funds combines a mix of strategy sectors, managers, and styles, and therefore fund of funds risk managers need to understand the common attributes of hedge fund strategies. Which of the following statements is incorrect?
    A. Equity market neutral funds aim to generate returns that have low correlation with the overall equity market and to insulate their portfolios from broad market risk factors.
    B. Convertible arbitrage funds typically purchase securities that are convertible into the issuer's stock and simultaneously short the underlying stock. These funds earn returns in part form gamma trading on the stock's volatility.
    C. Merger arbitrage funds buy the stock of an acquisition target company and simultaneously short the bidding company's stock. These funds have large exposure to deal risk.
    D. Equity short-selling funds sell stocks not currently owned by the seller in order to take a directional bet that the stock price will decline. These funds tend to be uncorrelated with

traditional long-only equity portfolios.

Answer: D

34. An acquisition has been announced by Company A to merge with Target Company T. Before the announcement, Aquirer A's shares traded at $21 and Target T's shares traded at $6 price. The proposed share-for-share exchange ratio was 1:2. Subsequent to the announcement, Aquirer A's shares trade down to $20 and Target T's shares trade up to $8. At this time, a merger arbitrage hedge fund takes a short position in Aquirer's A's stock hedged by a long position in Target T's stock. The merger is successful and the prices close at $28 (Acquirer) and $14 (Target). What is the gain per each single shorted share of Acquirer A?

A. Zero per share of Acquirer A

B. -$2 loss per share of Acquirer A

C. +$1 gain per share of Acquirer A

D. +$4 gain per share of Acquirer A

Answer: D

The merger arbitrage is long 2.0 shares of Target T, at $8.00 per share, for each short 1.0 share of Acquirer A, at $20.00 share.

The net gain = 2.0 × ($14 - $8) - 1.0 × ($28 - $20) = $12 - $8 = +$4 per share of Target T.

Any 2:1 price outcome will produce a +$4 per (Target T's) share gain; e.g., $30/15, $32/$16.

35. How would the risk in a merger arbitrage strategy best be characterized?

A. The arbitrage can be structured so there is a gain no matter the outcome.

B. The arbitrageur's loss if the deal does not go through is much greater than the gain if the deal goes through.

C. The arbitrage can be structured as riskless, assuming no other bidders come forward after the initial offer.

D. The arbitrageur's gain on the deal if it does go through is much greater than the loss if the deal does not go through.

Answer: B

Typically, the arbitrage is to go long in the target's stock and short the acquirer's stock. The arbitrage is not really a hedge protecting a loss if the deal does not go through. The target stock could fall below pre-announcement price, and the acquirer stock could substantially increase.

36. The Big Bucks Hedge fund has the following description of its activities. It uses simultaneous long and short positions in equity with a net beta close to zero. Which of the following statements about Big Bucks are correct?

I. It uses a directional strategy.

II. It is a relative value hedge fund.

III. This fund is exposed to idiosyncratic risks.

A. I and II

B. II and III

C. I and III

D. II only

Answer: B

Key Point: Hedge Fund Risk

- Liquidity Risk
  - ✧ More liquid assets should exhibit less serial autocorrelation than illiquid assets.
  - ✧ A Q-statistic is used as a summary measure of the overall statistical significance of autocorrelations.
  - ✧ This create two biases: Low correlations; Low volatility
- Style Drift
  - ✧ Changes in the risk factor exposures
  - ✧ Changes in the overall risk of the fund
- Phase-Locking Phenomenon

37. Every year Business Week reports the performance of a group of existing equity mutual funds, selected for their popularity. Taking the average performance of this group of funds will create

A. Survivorship bias only

B. Selection bias only

C. Both survivorship and selection bias

D. Instant-history bias only

Answer: C

The publication lists existing funds, so it must be subject to survivorship bias, because dead funds are not considered. In addition, there is selection bias because the publication focuses on just the popular funds, which are large and likely to have done well. Answers a) and b) are incomplete. Answer d) is also incomplete.

38. A factor analysis of returns for hedge funds employing a equity market-neutral strategy produces strongly positive performance information for the strategy (for example, impressive Sharpe ratios). However, the analysis is guilty of neglecting the effects of survivorship bias.

If the problem is survivorship bias, which of the following criticisms of the methodology is best?

A. The sample is too small
B. The historical window is too short
C. Risk metrics needs to be included along with return metrics
D. Past performance is no guarantee of future performance

Answer: A

The sample is too small: survivorship bias implies that certain non-performing funds (e.g., funds that went out of business) are not included in the sample, it is an issue of the sample.

Answer (D) is closely related and answer (D) is probably true, but (D) relates to interpretation and (A) is more directly the implied methodological flaw. So, (D) is fine, but (A) is a little better.

39. A significant percentage of hedge funds stop trading each year and drop out of hedge fund databases. Which one of the following best describes the impact this has historically had on hedge fund analyses performed using these databases?

A. The average performance of hedge funds is overstated.
B. The average volatility of hedge funds is overstated.
C. The average correlation of hedge fund returns is understated.
D. The average Sharpe ratio of hedge fund returns is understated.

Answer: A

As poor performers drop out of the database, the average performance increases. The removal of poor performers could actually reduce average volatility and the correlation of returns. The Sharpe Ratio tends to get inflated due to survivorship bias.

40. Which of the following statements are true?

I. Hedge fund manager compensation is often symmetric (i.e., a dollar of gain has the opposite impact on compensation as a dollar of loss), while the compensation of mutual fund managers is almost always asymmetric.
II. Leverage obtained through lines of credit increases the risk of a hedge fund more than leverage obtained by issuing debt, because unexpected cancellation of a line of credit by a lender during troubled times can force a fund to liquidate its positions in illiquid markets.
III. A hedge fund investor should pay performance-based compensation to the manager for producing alpha, but should not pay performance-based compensation to a hedge fund manager who has done well because the fund invests in risk factors that mirror the performance of his style or strategy, and the style or strategy has performed well.

IV. The lack of hedge fund transparency is particularly Problematic for investors with fiduciary responsibilities such as pension fund managers, and to secure funding from these investors, hedge fund managers often have to provide more information to these investors.

A. I, II, and IV only.

B. II, III, and IV only.

C. II and IV only.

D. I and III only.

Answer: B

Statements II, III, and IV are true. Statement I is false — the opposite is true.

41. For a portfolio of illiquid assets, hedge fund managers often have considerable discretion in portfolio valuation at the end of each month and may have incentives to smooth returns by marking values below actual in high-return months and above actual in low-return months. Which of the following is not a consequence of return smoothing over time?

A. Higher Sharpe ratio

B. Lower volatility

C. Higher serial correlation

D. Higher market beta

Answer: D

42. The Peyton Formika Fund is a global macro asset allocation hedge fund designed to provide low correlations with U.S. assets. Dominic James is a fund of hedge funds manager that is analyzing the Peyton Formika Fund for signs of style drift. James makes note of the following findings about the fund:

I. The R^2 of the fund versus the global macro peer group has changed from 0.72 to 0.78 over the past 12 months.

II. Due to outstanding returns, assets in the fund have increased from $70 million to $430 million over the past 12 months.

III. The fund made a major shift in allocation by moving 40 percent of its holdings from Eastern European equities to Asian equities.

IV. After a recent trip to India, the fund manager gained confidence in his existing Indian equity holdings and levered his existing 5% weighting in India only by a 10 to 1 ratio.

Which of James' findings are indicators that the Peyton Formika Fund is at risk for style drift?

A. II and IV only

B. I and II only

C. II and III only

D. I, III and IV only

Answer: A

Hedge fund style drift occurs when there are changes in the risk factor exposures of the fund or changes in the overall risk of the fund, notably through leverage. Using leverage only for his Indian equity position would definitely be an indicator of style drift. Even though the initial position is small, a 10 to 1 leverage ratio would significantly change the risk of the fund. An excessive cash inflow which may be more money than the manager can sustain is also a potential indicator of style drift. The change in allocation from Eastern European equities to Asian equities is within the objectives of a global allocation fund, so that would not indicate style drift. Also, style drift would be a concern with a decrease, not an increase in the R-squared measure against the peer group.

43. In performing due diligence on a potential investment manager, which of the following factors is the least important for the investor to consider?

A. Risk controls

B. Business model

C. Past performance

D. Investment process

Answer: C

Investors should assess potential managers and their investment strategies with an objective and unbiased mind. They should not be unduly concerned with a manager's past successes given that past performance is not always indicative of future performance. Risk controls, the business model, and the investment process are all fundamental parts of the due diligence process.

44. A due diligence specialist is evaluating the risk management process of a hedge fund in which his company is considering making an investment. Which of the following statements best describes criteria used for such an evaluation?

A. Because of the overwhelming importance of tail risk, the company should not invest in the fund unless it fully accounts for fat tail using extreme value theory at the 99.99% level when estimating VaR.

B. Today's best practices in risk management require that a fund employ independent risk service providers and that these service providers play important roles in risk-related decisions.

C. When considering a leveraged fund, the specialist should assess how the fund estimates risks related to leverage, including funding liquidity risks during periods of market

stress.

D. It is crucial to assess the fund's valuation policy, and in general if more than 10% of asset prices are based on model prices or broker quotes, the specialist should recommend against investment in the fund regardless of other information available about the fund.

Answer: C

Generally speaking, with a leveraged fund, an investor will need to evaluate historical and current changes in leverage, as well as the level of liquidity of the portfolio, particularly during times of market stress. Certain strategies may in fact expose an investor to tail risk, so while an investor should inquire whether the manager believes that tail risk exists, and whether or not it is hedged, it is then up to the investor to decide whether to accept the risk unhedged or hedge it on their own. Many funds employ independent risk service providers to report risks to investors, but these firms do not get involved in risk related decision making. And finally, while it is important to know what percentage of the assets is exchange-traded and marked to market, what might be acceptable may differ depending on the strategy of the fund.

Key Point: Illiquid Assets

- In general, investor should be skeptical of reported returns in illiquid asset markets as they are generally overstated. There are reporting biases that result in artificially inflated returns. The three main biases that impact reported illiquid asset returns are:
  - ✧ Survivorship bias.
  - ✧ Selection Bias.
  - ✧ Infrequent trading.
- There is little evidence that there are large illiquidity risk premiums across asset classes. However, there are large illiquidity risk premiums within asset classes. There are four primary ways that investors can harvest illiquidity premiums:
  - ✧ Allocating a portion of the portfolio to illiquid asset classes like real estate. This is passive allocation to illiquid asset classes.
  - ✧ Choosing more illiquid assets within an asset class. This means engaging in liquidity security selection.
  - ✧ Acting as a market maker for individual securities.
  - ✧ Engaging in dynamic factor strategies at the aggregate portfolio level. This means taking long positions in illiquid assets and short positions in liquid assets to harvest the illiquidity risk premium. Of the four ways investors can harvest illiquidity premiums, this is the easiest to implement and can have the greatest effect on portfolio returns.
- There are several points to consider when deciding to allocate portfolio resources to illiquid

assets:

- ✧ Studies show that illiquid assets do not deliver higher risk-adjusted return.
- ✧ Investors are subject to agency problems because one must rely on the talents and skills of portfolio managers.
- ✧ In many firms, illiquid assets are managed separately from the rest of the portfolio.
- ✧ Illiquid asset investors face high idiosyncratic risks.

45. Blue Sky Funds, a private equity fund, has suffered low returns for the last five years. As a result, the fund has decided to quit reporting returns. The fund did report returns each year for the last 10 years when performance was strong. This problem of reporting leads to:

A. Survivorship bias.
B. Sample selection bias.
C. Infrequent trading bias.
D. Attrition bias.

Answer: A

There are no requirements for certain types of funds, like private equity funds, to report returns. As such, poorly performing funds have a tendency to stop reporting. Additionally, many poorly performing funds ultimately fail. Performance studies generally include only those funds that were successful enough to survive over the entire period of analysis, leaving out the returns of funds that no longer exist. Both of these factors result in reported returns that are too high. This is called survivorship bias.

46. Which of the following variables is not an illiquidity factor that affects equity returns?

A. Measures of adverse selection.
B. The number of recorded positive returns.
C. Turnover.
D. Volume.

Answer: B

There are several variables related to illiquidity that are shown to impact equity returns. They are bid-ask spreads, volume, turnover, volume measured by whether the trade was initiated by buyers or sellers, the ratio of absolute returns to dollar volume, the price impact of large trades, informed trading measures (i.e., adverse selection), quote size and depth, the frequency of trades, the number of zero returns, and return autocorrelations. It is not the number of recorded positive returns, but the number of recorded zero returns, that are relevant.

47. Rick Faircloth, a general partner and portfolio manager with Faircloth Funds, is considering

ways in which his company can profit from illiquidity risk premiums. He has studied several alternative methods for harvesting illiquidity risk premiums. Which of the following strategies might Faircloth implement that will likely have the greatest effect on portfolio returns?

A. Acting as a market maker for individual securities.

B. Choosing the most illiquid assets within an asset class, even if the asset class is generally considered to be liquid.

C. Allocating a portion of a portfolio to illiquid asset classes.

D. Using dynamic factor strategies at the aggregate portfolio level.

Answer: D

金程教育
GOLDEN FUTURE
可信赖的财经培训专家

2016 FRM PART II

百题巅峰班讲义

巴塞尔协议

讲师：梁震宇

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Basel Accord

Key Point: Basel II-Three Pillars

Pillar 1: **Minimum capital requirements**. Banks should maintain a minimum level of capital to cover credit, market, and operational risks.

Pillar 2: **Supervisory review process**. Banks should assess the adequacy of capital relative to risk, and supervisors should review and take corrective action if problems occur.

Pillar 3: **Market discipline**. Risks should be adequately disclosed in order to allow market participants to assess a bank's risk profile and the adequacy of its capital.

Key Point: Basel II - Forms of Capital

Tier 1: shareholder's equity, retained earnings; nonredeemable, noncumulative preferred stock.

Tier 2: undisclosed reserves, revaluation reserves, general provisions/general loan-loss reserves, hybrid debt capital instruments, and subordinated term debt.

Tier 3: short-term subordinated debt; can only be used to offset market risks.

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).

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).

$$MRC_t^{IMA} = Max\left(k\frac{1}{60}\sum_{i=1}^{60}VAR_{t-i},\ VAR_{t-1}\right)$$
$$+ Max\left(k_s\frac{1}{60}\sum_{i=1}^{60}SVAR_{t-i},\ SVAR_{t-1}\right) + SRC_t + IRC_t$$

- ✧ 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:

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

Basel 2.5 – Comprehensive Risk Measure (CRM)

- ✧ The CRM is a single capital charge replacing the incremental risk charge and the specific risk charge for instruments dependent on credit correlation.
- ✧ CRM is very important measure for a portfolio of instruments such as asset-backed securities (ABSs) and collateralized debt obligations (CDOs) that are sensitive to the correlation between the default risks of different assets.

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.

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%.

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%

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%.

Credit Risk	Market Risk	Operational Risk
Standardized Approach (Modified Version)	Standardized Approach	Basic Indicator Approach
Foundation Internal Rating Based Approach	Internal Models Approach	Standardized Approach
Advanced Internal Rating Based Approach		Advanced Measurement Approach

Key Point: Stressed Value at Risk

SVaR is calculated by combining current portfolio performance data with the firm's historical data from a significantly financial stressed period in the same portfolio. Calculation of SVaR is defined as follows:

Max ($SVaR_{t-1}$, multiplicative factor × $SVaR_{avg}$)

Key Point: Basel III Changes

Basic Changes:

- ✧ Raise capital standards (both quality and quantity).
- ✧ Improving the transparency and consistency of bank capital.
- ✧ Strengthen risk coverage of capital framework.
- ✧ Require leverage ratio to supplement risk-based capital requirements.
- ✧ Promote countercyclical buffers to offset the procyclical amplification of financial shocks.
- ✧ Institute policies to address systemic risk and interconnectedness of the financial sector.
- ✧ Institute global liquidity standard (liquidity, funding, and monitoring metrics).

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.

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.

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.

Key Point: Liquidity Coverage Ratio

Goal: ensure banks have adequate, high-quality liquid assets to survive short-term stress scenario.

$$\text{LCR} = \frac{\text{stock of high-quality liquid assets}}{\text{total net cash outflows over the next 30 calendar days}} \geq 100\%$$

Key Point: Net Stable Funding Ratio

Goal: protect banks over a longer time horizon than LCR.

$$\text{NSFR} = \frac{\text{available amount of stable funding}}{\text{required amount of stable funding}} \geq 100\%$$

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.

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.

1. As a risk manager for Bank ABC is asked to calculate the market risk capital charge of the bank's trading portfolio under the internal models approach using the information given in the table below. Assuming the return of the banks trading portfolio is normally distributed, what is the market risk capital charge of the trading portfolio?

VaR (95%, 1-day) of last trading day	USD 30,000
Average VaR (95%, 1-day) for last 60 trading days	USD 20,000
Multiplication Factor	3

A. USD 84,582
B. USD 134,594
C. USD 189,737
D. USD 267,471

Answer: D

Market Risk Capital Charge

MAX (30,000 × SQRT(10)/1.65 × 2.326, 3 × 20,000 × SQRT (10)/1.65 × 2.326) = 267,471

Candidate is required to convert the VaR (95%, 1-day) to a 95% 10-day VaR.

2. 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

3. Banks are required to maintain 8 percent of their assets as "Tier 1 Capital". Which of the following count towards this capital requirement?

I. Shareholders equity.
II. Sovereign debt held in the trading book.
III. Common stock of other banks.
IV. Subordinated debt issued by the bank in question (subject to certain qualifying rules).

A. I, II, and IV
B. II and III
C. I and IV
D. I only

Answer: D

Only equity capital and disclosed rescues (primarily after the retained earnings) qualify as Tier 1 capital.

4. According to the Basel II Accord. “At the discretion of their national authority, banks may also use a third tier of capital (Tier 3). Consisting of short-term subordinated debt for the sole purpose of meeting a proportion of the capital requirements” for which of the following?

A. Market risk charges only
B. Credit risk charges only
C. Market risk and credit risk charges
D. All types of risk charges

Answer: A

Tier 3 capital can only be used to satisfy capital requirements resulting from market risk charges and cannot be applied to credit risk charges. Other choices are incorrect except choice A.

5. 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 Dart 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 Dart 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 accessed 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.

6. 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 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.

7. 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

8. 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

9. 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%

10. 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.

11. The capital conservation buffer:

A. Will provide an extra 2.5% Common Equity Tier 1 capital buffer in times of stress.

B. Will be used exclusively to protect banks from the losses garnered from OTC derivatives trading.

C. 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%.

12. 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.

13. 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.

14. 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.

15. 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, 2015.
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.

16. 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

17. 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 in2013 as an additional measure.

18. 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) × 15% alpha = $27 million

19. 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%

20. 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%

21. 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.

22. Michigan One Bank and Trust has entered a $200 million interest rate swap with a corporation. The remaining maturity of the swap is six years. The current value of the swap is $3.5 million. Using the table below to find the add-on factor for the interest rate swap, the equivalent risk-weighted assets (RWA) under Basel Ⅰ is closest to:

Add-on Factors as a Percentage of Principal for Derivatives		
Remaining Maturity in Years	Interest Rate	Equity
<1 year	0.0	6.0

1 to 5 years	0.5	8.0
>5 years		

A. $3,000,000

B. $3,250,000

C. $3,500,000

D. $6,500,000

Answer: B

The add-on factor is 1.5% of the interest rate swap principal for swaps with a maturity greater than five years.

Credit equivalent amount = max (V, 0) + a × L

Where:

V = current value of the derivative to the bank

a = add-on factor

L = principal amount

Credit equivalent amount = $3.5+ (0.015 × $200) = $6,500,000

The risk-weight factor for a corporate counterparty under Basel Ⅰ is 50% for derivatives and 100% for corporate loans. This means the risk-weighted assets (RWA) are:

RWA = 0.50 × $6,500,000 = $3,250,000

23. The capital conversation 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 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 conversation 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.

24. Highlands Bank has estimated stable funding in the bank to be $100 million. The bank estimates that net cash outflows over the coming 30 days will be $137 million. The bank has capital of $5 million and a total exposure of $140 million. The bank estimates that it has high-quality liquid assets of $125 million. What is the bank's liquidity coverage ratio (LCR)?

A. 89.3%

B. 91.2%

C. 73.0%

D. 3.6%

Answer: B

Basel III requires a minimum liquidity coverage ratio of 100%. The LCR focuses on the bank's ability to weather a 30-day period of reduced/disrupted liquidity. The formula is computed as follows:

High-quality liquid assets / net cash outflows in a 30-day period

LCR = $125 million /$137 million = 0.912 or 91.2%

In this case, Highlands Bank does not meet the minimum 100% requirement and is in violation of the rule.

25. 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.

26. 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, and 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.

27. The Supervisory Review Process does not include which of the following elements?
    A. Verifying compliance with Pillar 2.
    B. Reviewing internal control systems.
    C. Assessing operational risks.
    D. Assessing credit concentration risk.

Answer: A

The Supervisory Review Process is Pillar 2and should include verifying compliance with Pillars 1 and 3.

28. 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.

29. 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%.

30. 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.

31. In calculating the market risk capital requirement, the following statements are all true except:
    A. Both VaR ad stressed VaR are considered in calculating capital charge of market risk.
    B. The average value of VaR in the preceding 60 business days is taken into account.
    C. The equation for calculating the market risk capital requirement uses a 99% two-tail confidence interval.
    D. Only VaR is used when generating backtest results.

Answer: C

The equation for calculating market risk capital requirement uses a 99% two-tail confidence interval.

32. Pillar 1 of the Basel II framework allows banks to use various approaches to calculate the capital requirements for credit risk, operational risk and market risk. Which of the following Basel II approaches allows a bank to explicitly recognize diversification benefits?
    A. The internal models approach for market risk
    B. The internal ratings based approach for credit risk
    C. The basic indicator approach for operational risk
    D. The standardized approach for operational risk

Answer: A

The internal models approach allows banks to use risk measures derived from their own internal risk management models, subject to a set of qualitative conditions and quantitative standards. In terms of risk aggregation within market risk, banks are explicitly allowed to recognize empirical

correlations across broad market risk categories, and,thus, diversification benefits.

33. 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%

34. 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 issuer 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 invarlance:individual exposure charges do not depend on the rest of the credit portfolio, but rather depend on their presumed correlation to a singer 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.

35. Each of the following is true about the Basic Indictor 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 Indictor 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 in 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."

36. Each of the following is true about the Standardized Approach (SA) to operational risk under Basel III except which is false?

A. Wheres the Basic Indicator Approach (BIA) use 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

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.

37. 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 equlify 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.

38. 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 approah in Basel III

B. The capital charge is an arithmetic sum of charges across categories, including interest

rate risk,equity position risk,foreign exchange fisk,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 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 requires 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.

39. 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 updated 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.

40. 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 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 reducted 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 resultcan 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:

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

i.e.,the sum of:

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

The higher of (1) its latest avaliable stressed-value-at-risk sVaR(t-1); and (2)an average of the stressed value-at-risk over the preceding sixty business days,sVaR(avg), multiplied by a muitiplication factor, m(s)

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

41. 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?

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 (CORC) 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.

42. 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 Tobal 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% Conversation Buffer. Thrift Bank holds Total Capital:4.4/40.0 = 11.0%

43. Each of the following is a required disclosure element (i.e., must be disclosed by the bank) of 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 (renumeration) 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 ti this is likely indirect by way of renumeration-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 ofa lega 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 ect…

44. 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 a 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 regara to (A), (B), and (D), all are TRUE.

45. Thrift Bank carries risk-weighted assets (RWA) of $100.0 billion.In regard to its eligible regulatory capital, the bank holds:

- ✧ $5.0billion of Common Equity Tier 1 Capital (“Core Toer 1”)
- ✧ $2.0billion of Additional Tier1 Capital
- ✧ $3.5billion of Tier 2 Capital (“Gone concern”)

Does Thrift Bank meet the Basel III capital requirements?

A. Yes, because its Total Capital Ratio of 10.5% is sufficient
B. No, because it does not hold enough Common Equity Capital
C. No, because its Tier 1 Capital Ratio is insufficient
D. No, because the bank has no buffer-quality capital to contribute to its Capital Conservation Buffer

Answer: B

No, because it does not hold enough Common Equity Capital

The minimum Common Equity Capital Ratio is 4.5% but the Capital Conservation Buffer (which requires Common Equity) is 2.5%, such that the "Minimum common equity plus capital conservation buffer" is 7.0%.

In regard to (C), the Minimum Tier 1 Capital Ratio is 6.0%

In regard to (D), the Tier 1 Capital Requirement is 6.0%, and the bank has 7.0%, which implies that 1.0% is available toward the Conservation buffer (but it needs 2.5%).

Plase note:The Capital Conservation Buffer must be Common Equity Tier 1 and "Common Equity Tier 1 must first be used to meet the minimum capital requirements (including the 6% Tier 1 and 8% Total capital requirements if necessary), before the remainder can contribute to the capital conservation buffer."

46. According to the Basel Committee, "During the early liquidity phase of the finacial 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 objectives is to promote short-term resilience of a bank's lipuidity 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."

47. 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.

48. 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.

49. 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 it the bank falls under a jurisdiction identified and designated by the Basel Committee

Answer: C

Its primary goal is to avoid destabilizing losses sybsequent 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 finacial 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 countercylical 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 cinsider,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."

50. 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 haircits 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) = L19 + L2 × (1 – haircut) = 3.0 + 2.0 × (100% - 15%) = $4.7 billion. As 2/(3+2) = 40%T, 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 biollion

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.

51. Each of the following is a characteristic of a high-quality 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 selleers

“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 grope of buyders and sellers in an asset's market increases the reliability of its liquidity.s

· Flight to quality: historically, the matket has shown tendencies to move into these types of assets in a systemic crisis."

52. 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.

53. 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?
    A. Both Basel I and Basel II.5 require calculation of VaR with a 99% confidence interval.
    B. FRTB requires the calculation of expected shortfall with a 97.5% confidence interval.
    C. FRTB requires adding a stressed VaR measure to complement the expected shortfall calculation.
    D. 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 11.5 that required the addition of a stressed VaR.

54. 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 captial 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).

金程教育
GOLDEN FUTURE
可信赖的财经培训专家

2016 FRM PART II

百题巅峰班讲义

当前金融市场风险案例

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2016 年 5 月

Current Issues in Financial Markets

Key Point: Forging Best Practices in Risk Management

- The trends and developments within the areas of risk management that have been most affected by the 2007-2009 financial crisis are as follows:
  - ✧ Longer term view of risk.
  - ✧ Greater controls over counterparty risk.
  - ✧ Lack of short-term funding has resulted in more stringent rules pertaining to repos and money market funds and the imposition of liquidity buffers on banks.
  - ✧ Increased use of the credit value adjustment (CVA) in derivatives markets.
  - ✧ Less reliance on credit ratings.
  - ✧ Increased overall levels of sovereign risk.
  - ✧ Increased focus on stress scenarios.
  - ✧ Increased regulatory activity.
- Volatility regimes are often difficult to detect if market participants are only looking back the usual two to four years when making risk estimates. Instead, a longer period of time, say 20 years or more, may be required.
- Examples of specific risk-mitigating steps taken by many individuals and firms at the same time include bank runs, portfolio insurance, deleveraging of hedge funds, collateral calls, and credit default swaps.
- Key best practices to address and alleviate amplified risk include: looking back and forward over longer time periods, more stress testing scenarios that take into account regime changes, and considering the simultaneous risk-mitigating actions of other firms.
- Ultimately, firms want to have accurate risk measurement as well as protection from the amplified risk resulting from simultaneous responses from other firms. Two activities that help in achieving both objectives include the use of provisions for loan losses and the clearing of derivatives through a central counterparty.

1. Which of the following statements regarding the impact on risk management as a result of the 2007-2009 financial crisis is most likely accurate?
   A. The level of sovereign risk has remained relatively stable.
   B. There has been a noticeable decrease in the three-month LIBOR-OIS spread.
   C. Credit ratings are a part of regulatory requirements per the Dodd-Frank Act.
   D. For over-the-counter (OTC) derivatives, it is normal to have different quoted prices

based on different funding rates.

Answer: D

Within OTC derivatives, it is now the norm to have differing quoted prices based on differing funding rates; pricing is a function of the funding and collateral arrangements. Response A is not correct because downgrades in the United States and Europe have increased overall sovereign risk levels. Response B is not correct because there has actually been a noticeable increase in the three-month LIBOR-OIS spread (once in August 2007 and then in September 2008). Response C is not correct because the Dodd-Frank Act removes credit ratings from regulatory requirements.

2. Which of the following statements regarding volatility regimes is most likely accurate?
   A. In order to detect volatility regimes, a period of at least 20 years is suggested.
   B. A GARCH model is superior to a regime-switching model because only a GARCH model is able to capture persistence in volatility.
   C. A regime-switching model approach requires an analysis of a long historical period that includes at least two or three regime changes in order to have accurate calculations.
   D. With respect to the historical returns of the S&P 500 that exhibit volatility regimes, the measured level of kurtosis is higher for shorter intervals of time compared to longer ones.

Answer: A

Volatility regimes are often difficult to detect if market participants are only looking back at the usual two to four years when making risk estimates. Instead, a longer period of time, say 20 years or more, may be required.

Response B is not correct because both a regime-switching model and a GARCH model capture the persistence in volatility. Response C is not correct because the historical record should have more than five regime changes in order to have accurate calculations. Response D is not correct because the measured level of kurtosis is lower for shorter intervals of time compared to longer ones. The higher level of kurtosis results from mixing periods of low volatility and high volatility (i.e., volatility regimes).

3. Which of the following risk-mitigating steps is most likely associated with the stock market crash of 1987?
   A. Collateral calls.
   B. Portfolio insurance.
   C. Deleveraging of hedge funds.
   D. Hedging counterparty risk through the use of credit default swaps.

Answer: B

The use of put options that promote selling in a falling market is often associated with the stock market crash of 1987. Although it is a useful investment strategy when used by only a few market participants, it may be disastrous to the financial system if used extensively.

Response A is not correct because collateral calls are associated with the financial crisis of 2007-2009. Response C is not correct because the simultaneous deleveraging of many hedge funds was associated with the financial crisis of 2007-2009. Response D is not correct because credit default swaps did not exist in 1987; they originated in 1994.

4. Which of the following statements regarding best practices in addressing and alleviating amplified risk is most likely accurate?
   A. Stress tests should focus on rare or outlier events.
   B. The Basel 11.5 regulations assume that portfolios remain constant over the relevant market risk horizon.
   C. When developing more accurate and sensitive risk measures, one of the problems is that these measures may have a procyclical effect.
   D. The clearing of derivatives through a central counterparty reduces risk for all parties involved and reduces the incentive for all parties to monitor counterparty risk.

Answer: C

One of the problems with having more accurate and sensitive risk measures is that such measures may have a procyclical effect in that risk is amplified if all firms are taking the same risk-mitigating actions in response to the measurement results.

Response A is not correct because stress tests should also consider the possibility of longer periods of high volatility in multiple markets. Response B is not correct because the Basel 11.5 regulations assume that portfolios are rebalanced to a specific level. Response D is not correct because the need for default fund contributions and margin payments encourages all parties to monitor counterparty risk.

Key Point: Case Studies on Disruptions during the Crisis

- Funding mechanisms are primarily short-term financing options and include commercial paper, asset-backed commercial paper, money market mutual funds, repurchase agreements, credit commitments, and dollar funding of non-U.S. banks. They allow institutions to obtain debt and loan financing for funding requirements. A maturity mismatch typically exists between the short-term funding mechanism and the long-term assets that are funded, which creates rollover risk.
- When investor sentiment declines, investors are less inclined to continue lending, and the market for funding mechanisms declines. When the supply of short-term financing dries up,

governments may be forced to provide emergency liquidity and lending.

- Both CP and ABCP are forms of short-term debt obligations issued by corporations for working capital or receivables financing or to meet short-term obligations. CP is generally unsecured. ABCP is a category of CP that is secured by collateral and issued by conduits of corporations as a form of off-balance sheet financing. The primary risk of CP and ABCP is rollover risk, and disruptions in these markets can increase rollover risk leading to higher funding costs and forced asset sales. The policy response to the crisis in the CP market included the creation of the Commercial Paper Funding Facility (CPFF) by the U.S. Federal Reserve to provide a liquidity back stop as temporary support to troubled CP issuers. The policy response to the crisis in the ABCP market initially included providing liquidity support to struggling banks and the creation of various liquidity facilities. In 2010, these initiatives ended with the change in U.S. accounting rules that require consolidation of most ABCP conduits on the sponsor's balance sheet.
- Money market mutual funds (MMFs) provide short-term funding to financial institutions and are important sources of liquidity in the wholesale lending markets. Policy responses to MMF troubles during the financial crisis included both short-term, emergency measures, and long-term solutions, including: (1) the Temporary Guarantee Program guaranteeing investors against any principal losses in participating MMFs, (2) providing nonrecourse loans to purchase eligible ABCPs from MMFs; and (3) the SEC easing the requirements by boards to close troubled funds, and to limit the liquidity, market and credit risks of MMFs.
- Repurchase agreements (repos) are short-term loans collateralized by securities, whereby a security is sold by a borrower with the promise to buy it back in the future at a higher price. Repos tend to be over collateralized; that is, the value of assets as collateral typically exceeds the repurchased security's price. Risks in the repo market relate to the term of the security (short maturities create greater rollover risk as maturing contracts must be renewed), quality of the collateral (investors prefer higher quality collateral), and counterparty credit strength (investors prefer more creditworthy borrowers). Policy responses to troubles in the repo market during the financial crisis included establishing funding programs to provide emergency liquidity to dealers, strengthening investor confidence, and backstopping the tri-party repo market.
- Credit commitments refer to banks' promises to provide liquidity insurance to corporations by extending them lines of credit and loan commitments. During stressed times, depositors who are worried about the financial condition of the bank withdraw deposits at the same time as borrowers draw down credit lines, which puts liquidity pressure on the bank. Policy responses to distresses during the financial crisis included federal government actions that included increasing the deposit insurance coverage from $100,000 to $250,000 (initially temporarily, then permanently) and providing a full guarantee for non-interest bearing transaction accounts. Alternative measures included instituting the Temporary Guarantee Program for MMFs and adjusting the discount

window.

- Non-U.S. banks met their dollar liability funding requirements primarily through issuing dollar wholesale debt, including commercial paper and certificates of deposits, primarily to MMFs. As MMFs reduced their wholesale lending during the financial crisis, non-U.S. banks needed to find alternative funding arrangements. These included reducing their dollar assets and dollar requirements (deleveraging), intrafirm dollar transfers, using foreign exchange swaps, and borrowing dollars from central bank dollar liquidity facilities. Policy responses to the financial crisis included the use of the discount window and the TAF by the Fed, and the use of foreign exchange swaps through central bank liquidity swaps.

5. Which of the following descriptions is least applicable to financial commercial paper?
   A. Rollover risk, or the risk of renewing maturing instruments.
   B. Off-balance sheet financing.
   C. Short-term debt instrument.
   D. Primary issuers are U.S. subsidiaries of foreign banks or financial entities.

Answer: B

Financial commercial paper is a short-term, unsecured debt obligation issued by financial institutions as a short-term financing tool. Primary issuers in the financial CP market are U.S. subsidiaries of foreign banks or financial entities. Rollover risk is a concern for all CPs given that investors must roll over the maturing CP into a new instrument. Asset-backed commercial paper, not financial commercial paper, is considered an off-balance sheet obligation.

6. During a mutual fund industry conference, two participants are discussing the role of money market mutual funds (MMFs) during the recent financial crisis. The participants make the following observations:
   - Participant 1: When stress events cause shareholders to redeem their shares, MMFs respond by first selling their less liquid securities to satisfy redemptions.
   - Participant 2: The good news for redeeming shareholders is that if a fond incurs a loss of 0.3%, the shareholder may still receive $1 per share.

   Which participant's statement is accurate?
   A. Participant 1 only.
   B. Participant 2 only.
   C. Both participants.
   D. Neither participant.

Answer: B

Participant 2 is correct. Because MMFs round their share price to the nearest cent, shareholders

may still receive $1 per share if the fund incurs a loss of less than 0.5%.

Participant 1 is incorrect. When shareholders redeem their shares, MMFs initially respond by selling their highly liquid assets to quickly meet redemptions without incurring material losses. This leaves the less liquid securities for nonredeeming shareholders.

7. A borrower in the repo market sells a security for $99.80 today, and promises to buy it back in one week for $100.00. The borrower posts collateral worth $ 101.00 for the transaction. The difference between the $99.80 sale price and $100.00 repurchase price is referred to as the:

   A. Discount.

   B. Haircut.

   C. Repo rate.

   D. Overcollateralization.

Answer: C

The repo rate represents the difference between the sale price of a security and the repurchase of the security at a higher price in the future. The repo rate represents implied interest on the transaction.

Haircut and overcollateralization relate to a discount from the value of the collateral, where the collateral pledged is in excess of the value of the security sold. Discount is not a term used in reference to repos.

Key Point: Why do We Need Both Liquidity Regulations and a Lender of Last Resort?

- There are advantages associated with Federal Reserve lender of last resort (LOLR) lending including the creation of liquidity to aid society as a whole and the promotion of optimal levels of liquidity and maturity transformation. LOLR can help stem a liquidity crisis before it worsens, especially if it is the result of market wide "pure liquidity" factors. Advantages of liquidity regulations to manage liquidity shocks include the mitigation of the costs of moral hazard, the tax on liquidity risk, which gives institutions an incentive to minimize liquidity risk and thus minimizes liquidity crises and the cushion that allows the central bank more time to discern whether the liquidity problem is market wide or institution specific. Bank specific liquidity shocks that result from solvency issues increase credit risk for the Fed if they solve the problem with LOLR lending and create moral hazard. As such, these situations are best solved by liquidity regulations. Even if the bank ultimately fails, higher liquidity requirements initially give the Fed more time to figure out the type of problem and the best solution for resolution and/ or an orderly default.
- Moral hazard occurs when one party acts risky because it knows the risk will be borne by

someone else. When a bank or other institution believes that the central bank will provide liquidity when needed, regardless of the reason the funds are required, the institution has an incentive to manage liquidity imprudently.

- The Federal Reserve has two basic challenges related to LOLR lending in the event of a liquidity crisis. First, it takes time to figure out if the problem is a market wide pure liquidity event. The Fed should lend quickly and aggressively if it is a systemic problem, but should wait until liquidity buffers are run down before lending if it is a firm specific, related to solvency, event. Second, if the central bank takes too much collateral, in other words, enough collateral to protect it from unknown risks, that, in and of itself, can cause a run on a financial institution in times of stress. Remaining investors will pull their funds out of fear, worsening a crisis.
- The Federal Reserve took two approaches to lending during the 2007-2009 financial crisis. First, they tapped existing and newly created sources that were meant to provide liquidity to the overall market. These sources include the following: (1) the Fed's core discount window lending program called the primary credit facility (PCF); (2) the term auction facility (TAF), which was created during the crisis and did not appear to have a stigma associated with it; (3) the primary dealer credit facility (PDCF), which provided overnight loans to primary dealers; and (4) the asset-backed commercial paper money market mutual fund liquidity facility (AMLF), which was created to help money market mutual funds(MMMFs) avoid fire sales to meet the rising tide of redemptions during the crisis. The second approach involved bailing out individual firms like Bear Stearns and AIG, because the central bank and other government officials were concerned about systemic risk.
- It appears, based on all of the evidence and arguments, that the optimal policy regarding liquidity risk management is a combination of liquidity regulations to mitigate moral hazard in the market and lender of last resort (LOLR) solutions for solvent institutions.

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8. It is best to run down liquidity buffers before providing lender of last resort funding:
   A. Never.
   B. Always.
   C. If the liquidity crisis is idiosyncratic.
   D. If the liquidity crisis is a market-wide pure liquidity event.

Answer: C

In general, if the liquidity problem is firm specific and idiosyncratic, liquidity buffers should be run down and supervisors intervene only when needed. If the problem is a market-wide pure liquidity event, then the central bank should immediately and aggressively lend, before liquidity buffers are shrunk or exhausted.

9. Which of the following statements is least likely accurate regarding the Federal Reserve's decision to lend or not lend to Lehman Brothers to prevent the firm's failure in 2008?
   A. The Federal Reserve was concerned about moral hazard.
   B. Lehman Brothers did not have sufficient collateral to back a loan from the Federal Reserve.
   C. The Federal Reserve did not have authority to lend to any single institution, regardless of the reason.
   D. The Federal Reserve did not have authority to provide an unsecured loan to an individual institution.

Answer: C

The Federal Reserve made loans to Bear Stearns and to American International Group (AIG), but not Lehman Brothers, during the financial crisis. The Fed knew that the failure of Lehman would impact the market as a whole, but was afraid that the bailout of another large, nonbank financial institution would create greater moral hazard problems. The Fed could provide short-term funding for liquidity purposes with adequate collateral from the borrower, but Lehman did not have adequate collateral. Lehman needed capital and the Fed was not authorized to provide capital or an unsecured loan, thus there was no path available to bail out Lehman Brothers.

10. The primary credit facility (PCF):
   A. Is the core discount window lending facility of the Federal Reserve.
   B. Was created to lend longer term funds to nonbank institutions during the financial crisis.
   C. Was never used during the financial crisis because there was stigma associated with borrowing through this mechanism.
   D. Was created to provide overnight loans to primary dealers during the financial crisis.

Answer: A

The Federal Reserve first stepped in with its core discount window lending program called the primary credit facility (PCF). The Fed later introduced the term auction facility (TAF) in December 2007. There were fewer stigmas associated with TAF than with the PCF, perhaps because the institution was required to wait for a short period before receiving funds from TAF, signaling to the market the firm was not in a dire liquidity situation.

11. Which of the following statements is least likely a goal of lender of last resort funding by the Federal Reserve?
   A. To make institutions less likely to have to engage in fire sales of assets.
   B. To protect the broader economy from potentially disastrous liquidity shocks.
   C. To make banks less vulnerable to runs on deposits and short-term wholesale funding

sources.

D. To supplement the federal funds market so that banks are not forced to borrow in non-regulated wholesale funding markets such as the commercial paper and repurchase agreement markets.

Answer: D

In general, some of the goals of liquidity regulations and LOLR solutions are to make institutions less vulnerable to runs, less in need of liquidity support, and less likely to engage in fire sales. Also, LOLR, as noted by Ben Bernanke, former Chairman of the Federal Reserve, is to provide a source of liquidity and stability in financial markets. LOLR is not meant to supplement the Federal funds market and is not meant for routine borrowing by banks.

Key Point: Global Financial Markets Liquidity Study

- Liquidity can be best described as the ability to execute large trades with limited price impact. Dimensions of liquidity include immediacy, depth and resilience, breadth, tightness, and multi-dimensional aspects. Benefits of liquidity include facilitating global capital flows, allocating risks to those willing and able to bear them, effectively disseminating issuer information, and improving the effectiveness of monetary policy, and improving financial stability and market resiliency.
- The provision of liquidity in financial markets depends on whether the market is order driven (exchanges, standardized), quote driven (market makers), or request for quote (market makers).
- Liquidity differences across financial assets and markets are driven by issuer-specific characteristics (financial performance, creditworthiness, issuance frequency and volume, microeconomic factors) and instrument-specific factors (size, maturity, and coupon). Increased international trading and lending can create liquidity contagion effects.
- The four broad market factors impacting global liquidity conditions include stable global monetary conditions, greater electronification and digitalization of financial markets, increased size of financial markets, and weak growth and profitability in the banking sector.
- Sovereign bond markets have demonstrated overall reductions in liquidity over time with lower turnover and higher price impact costs. The amount of repo financing has decreased in all markets globally. In addition, interbank daily trading volumes and nominal values of general collateral financing repos submitted for clearing have been declining. Interest rate derivatives have seen some changes in the breadth of liquidity as demonstrated through bifurcation through various currencies and between cleared and non-cleared derivatives. Post-crisis, corporate bond markets have seen significantly increased issuance volumes but not the same increase in trading volumes, which suggests an overall decrease in liquidity. Credit default swaps (CDSs) have seen an overall reduction in liquidity most often in the form of reduced trading volume, reduced transactions, and

reduced number of market participants providing CDSs. Securitized products have seen dramatic drops in issuance levels since the crisis. Secondary markets for securitized products have seen stable or reducing trading volumes since the crisis. Overall, liquidity has declined further since the crisis, although there are hopes of liquidity improvements after some key regulatory changes. Foreign exchange markets have seen decreased liquidity in longer-term forward contracts versus shorter-term contracts. Equity markets have seen reduced trading volumes and transaction amounts over the years, which suggests reductions in depth and liquidity. Emerging markets have seen increasing trading volumes that have not kept pace with issuance volumes, thereby resulting in lower turnover ratios and lower liquidity over the last several years.

12. Which of the following dimensions of liquidity is best described as the cost of completing a transaction?

A. Breadth.

B. Depth and resilience.

C. Immediacy.

D. Tightness.

Answer: D

Tightness is described as the cost of completing a transaction. Response A is not correct because breadth is described as the consistency in distributing liquidity within assets and across markets. Response B is not correct because depth and resilience is described as the frequency of large trades and level of willingness and interest to transact. Response C is not correct because immediacy is described as the time to complete a transaction.

13. Brendan Fehr is an economist at a policy think tank. In his latest research report, Fehr notes that excess money supply may contribute to inflation and asset price bubbles. He further notes that in order to moderate excess money supply, newly created monetary policy tools are needed. With regard to these statements, is Fehr correct or incorrect?

	Effects of excess money supply	Moderating excess money supply
A.	Correct	Incorrect
B.	Incorrect	Correct
C.	Correct	Correct
D.	Incorrect	Incorrect

Answer: A

Fehr's first statement on the effects of excess money supply is correct. His second statement on moderating excess money supply is incorrect, because excess money supply can be moderated through the use of existing monetary policy tools and prudential regulation.

14. Which of the following statements regarding trends in the volume and liquidity of corporate bond markets is correct?
    A. The average transaction size for corporate bonds is greater than that of government bonds.
    B. Lower bid-ask spreads within the U.S. corporate bond market should be interpreted as a sign of an increase in overall liquidity.
    C. Within the U.S. corporate bond market, the relative proportion of investment grade and high yield bonds has remained stable over time.
    D. The U.S. corporate bond market has seen higher trading volumes compared to issuance volumes, thereby resulting in lower turnover ratios and liquidity.

Answer: C

Within the U.S. corporate bond market, the relative proportion of investment-grade and high-yield bonds has remained stable over time. Response A is not correct because the average transaction size for corporate bonds is smaller than that of government bonds. In fact, the average transaction size for government bonds is about 20 times that of corporate bonds. Response B is not correct because lower bid-ask spreads within the U.S. corporate bond market should not be interpreted as a sign of an increase in overall liquidity. The spreads are very specific for a given trade size at a given time. In addition, changes in business practices that result in increasing trading volumes may be contributing to the lower spreads. Response D is not correct because the U.S. corporate bond market has seen lower trading volumes compared to issuance volumes, thereby resulting in lower turnover ratios and liquidity.

15. John Bennett is discussing the primary benefits of market liquidity to a client, and he highlights the dimensions by which liquidity can be measured. He states that liquidity is critical for financial markets to allow for the efficient allocation of resources. Regarding the various dimensions of liquidity, which of the following accurately describes market breadth?
    A. The cost of completing a transaction.
    B. The time it takes to complete a transaction.
    C. The consistency in distributing liquidity within assets and across markets.
    D. The frequency of large trades and the level of willingness and interest to transact.

Answer: C

Dimensions of liquidity include immediacy, depth and resilience, breadth, tightness, and multi-dimensional aspects. Breadth refers to the consistency in distributing liquidity within assets and across markets. It is impacted by the number of market participants and by segmenting liquidity.

Key Point: Reforming LIBOR and Other Financial Market Benchmarks

- There are two main recommendations for making interest rate benchmarks such as LIBOR less susceptible to manipulation. They are:

✧ Base benchmark rates on transactions rather than on submissions by banks regarding their borrowing rates or their expected borrowing rates. This is difficult to implement.

✧ Another option is to consider alternative benchmark rates such as Treasury bills or the overnight indexed swap rate. Policymakers highly recommend that alternative benchmarks be used in place of, or in addition to, LIBOR.

- Advantages when traders and other market participants use benchmark interest rates such as LIBOR:

✧ Reduce information asymmetries,

✧ Reduce search costs

✧ Create better trade executions

✧ Mitigate the costs of adverse selection.

- Agglomeration means that the establishment of a benchmark results in the attraction of related trades to the benchmark. There are two primary forces that drive the agglomeration effect. They are:

✧ Information-related benefits such as reduced search costs and reduced information asymmetries.

✧ Reducing trading costs associated with illiquidity including lower bid-ask spreads and faster executions that are generally associated with high volume trading.

- LIBOR is easily manipulated. There are two primary motives for manipulating LIBOR.

✧ Banks do not want to appear less creditworthy than their competitors and thus have an incentive to "low ball" their estimated borrowing rates.

✧ Profits on trillions of dollars of derivatives contracts are linked to LIBOR. Because the size of positions is so large, even tiny moves in the rate one way or the other can result in significant profits (or losses). As such, traders have an incentive to encourage banks to under- or overestimate their borrowing costs when submitting reports.

- It appears that there are two distinct costs associated with the agglomeration around LIBOR as a benchmark for loans, for which LIBOR is suited, and for interest rate derivatives, for which LIBOR is less suited. They are:

✧ LIBOR is not ideal for most derivatives contracts because LIBOR has a bank credit risk component. Despite this mismatch, it will be difficult to move the market to an alternative benchmark such as Treasury bills because the market is "set" on LIBOR.

- Derivatives trading activity dwarfs the primary market. Traders who have accumulated large derivatives positions linked to LIBOR profit heavily from even miniscule differences in the rates.

This also provides the motive for manipulating LIBOR.

- The two-rate approach is one possibility for reforming LIBOR. In it, there would still be a LIBOR-like benchmark, but based on transactions rather than bank submissions. This benchmark would capture movements in overall interest rates and bank credit risk. The second benchmark, also based on transactions, would be better suited to many interest rate derivatives contracts in the sense that it would not include a bank credit risk component. It would be based on riskless securities, like Treasury bills, and would have a wide-ranging, deep market.
- There are four suggested possibilities for a riskless rate that could be used as the second benchmark. They are: (1) a rate set by the central bank such as the rate the Federal Reserve pays banks on excess reserves or the overnight reverse repo rate, the rate the Fed pays market participants to borrow against its holdings of government securities; (2) Treasury bill rates; (3) general collateral repurchase agreement (repo) rates which are the rates on repos that are backed by the general class of Treasury and related securities; or (4) the overnight indexed swap (OIS) rate.

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16. Barry English, a New York based interest rate swap trader, has developed a relationship with a LIBOR "submitter" while attending industry conferences over the last several years. He has, on a few occasions, asked the banker to "make the 3-month rate as low as possible at this fixing." English's likely motive for trying to manipulate LIBOR is to:
    A. Make his firm's borrowing costs look as low as possible.
    B. Profit on a swap from the lower LIBOR rate.
    C. Reference LIBOR in more contracts if he determines he can control the rate to some extent.
    D. Push LIBOR in the direction of the 3-month Treasury bill rate in order to profit from the convergence of the two rates.

Answer: B

One of the primary motives for manipulating LIBOR is to profit on derivatives contracts linked to LIBOR. If a bank has an interest rate swap (or some other derivatives contract) linked to LIBOR, it will have an incentive to see LIBOR higher or lower, depending on the obligation of the contract. Because of the scale of derivatives positions relative to the primary market that sets LIBOR, small manipulations can mean very large profits for derivatives traders.

17. What is a disadvantage of using the overnight indexed swap (OIS) rate as a riskless benchmark rate if a two-rate regime is adopted?
    A. There is significantly more risk embedded in the OIS rate relative to other alternatives such as Treasury bills.

B. The rate is easily manipulated.

C. There is no bank credit spread component of the OIS, making it unacceptable to use in Interest rate swap contracts.

D. Trading is thin, making it similar to LIBOR in terms of the scale of transactions in the potential benchmark versus the scale of derivatives positions.

Answer: D

The overnight indexed swap (OIS) rate has been proposed as a possible riskless rate if a two rate regime is adopted. The OIS rate pays a predetermined fixed rate in exchange for the compounded daily federal funds rate over the three-month terms of the contract. However, one disadvantage is that the market is thin-approximately $30 billion per day in notional volume, and approximately 31 U.S. dollar transactions per day, based on a study using data from June to August, 2010. Thus, it has one of the key disadvantages of LIBOR, the benchmark it is meant to replace.

Key Point: Central Counterparties Addressing Their Too Important to Fail Nature

- Benefits of CCP multilateral netting include:
  - ✧ Reduction in credit exposures
  - ✧ Firewall of protection
  - ✧ Operational efficiency
  - ✧ Trading efficiency
  - ✧ Transparency.
- Costs of a CCP structure include:
  - ✧ Increased systemic risk due to risk concentration if a CCP fails
  - ✧ Increased participation costs.
- Increased margin calls and collateral requirements during a financial crisis will create liquidity stress for CCP clearing members.
- The loss/risk waterfall process describes the process of loss sharing with other CCP members.
- Interconnections with other CCPs and G-SIBs increases systemic risk due primarily to lack of liquidity in a crisis and increased market volatility with simultaneous collateral sales for multiple CCPs. Failure of a G-SIB could lead to global market disruptions due to contagion loss effects for interconnected CCPs.
- The interconnected links of a CCP to other CCPs, financial institutions, and CCP members can provide channels to contagion.
- The following measures are proposed to decrease the probability and/or impact of a CCP failure: increased regulation and standards for CCPs, recovery planning, emergency liquidity available through the central bank, bank capital requirements to cover CCP exposures, and

resolution planning.

- Four measures to reduce the interconnections of CCPs and mitigate systemic risk are: strengthen international standards, strengthen regulation and supervision, create a common global central bank approach, and establish direct relationships between central securities depositories and CCPs.

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18. The multilateral netting framework of a central counterparty (CCP) creates benefits and costs for market participants. Which of the following statements is not a benefit created by the CCP?
    A. The loss waterfall structure provides protection in the event a CCP defaults.
    B. Transparency is increased by central clearing of private information.
    C. The CCP structure provides firewall protection in the event of a financial crisis.
    D. Multilateral netting creates operational efficiencies through improved settlement processes.

Answer: A

The biggest concern of the CCP framework is the risk of default of a CCP. The failure of a CCP could lead to even greater systemic risk with no market liquidity or settlement process. The loss waterfall process does not provide a solution for the failure of a CCP, only the failure of a CCP member.

19. The default of which of the following entities would most likely lead to the largest decrease in collateral prices for the collateral market where CCPs are interconnected?
    A. CCP member.
    B. CCP connected with other CCPs all in the same region or country.
    C. Global systemically important bank (G-SIB).
    D. Federal Reserve Bank (FRB).

Answer: C

The default of a G-SIB would impact multiple CCPs that clear through it creating liquidity problems for multiple CCPs and increasing market volatility from simultaneous collateral sales.

20. Providing a direct link between CCPs and a central security depository is one measure that is proposed to help mitigate systemic risk. Which of the following statements most accurately describes the major benefit of a direct link to a central security depository?
    A. Reduces CCPs' reliance of global systemically important banks (G-SIBs).
    B. Reduces the amount of collateral required for CCPs.
    C. Standardizes loss waterfall structures internationally.

D. Standardizes capital, collateral, and margin requirements to make them consistent across national jurisdictions.

Answer: A

The direct account with a central securities depository for custody functions would facilitate CCP transaction settlements and provide intraday liquidity backed by collateral without the reliance of G-SIBs.

21. Proprietary Traders, Inc., is analyzing policy measures that are designed to reduce the probability and impact of a potential central counterparty (CCP) failure. Which of the following policy measures would most likely be intended to measure both the probability and impact of a CCP failure?

A. Increased regulation and standards for CCPs.

B. Bank capital requirements to cover CCP exposures.

C. Recovery planning as a last line of defense in a crisis.

D. Emergency liquidity available through a central bank.

Answer: B

Policy measures designed to decrease the probability of a CCP failure are:

✧ Increased regulation and standards for CCPs.

✧ Recovery planning as last line of defense in a crisis.

✧ Emergency liquidity available through a central bank.

✧ Bank capital requirements to cover CCP exposures.

Policy measures designed to reduce the impact of a CCP failure are:

✧ Resolution planning.

✧ Bank capital requirements to cover CCP exposures.

Key Point: Stress Testing Convergence

- The regulatory environment for bank capital management has evolved from the dual scenario test of SCAP to the CCAR system where banks must annually submit a report to the Federal Reserve covering four key elements.
- There are several different types of bank holding companies (BHCs), each with different ways of managing capital that needs to be monitored using the CCAR system. They include investment banks, universal banks, custodian banks, regional banks, and card monolines.
- There are two key factors that are encouraging BHCs to manage capital with narrower buffers. The first is that equity markets are directly rewarding companies that pursue profits above conservative capital management. The second factor is the stability of CCAR results themselves.
- Bank stress testing results hinge on the Fed's standards. This single focus has the potential to

expand systemic risk because all testing is reliant on the same set of variables and the same levels of those variables. Model risk is therefore a concern.

22. Which significant enhancement was added to the 2015 CCAR that was an improvement on the 2009 SCAP testing?
    A. Testing a baseline scenario and a stressed scenario.
    B. Annual testing that must be approved by the Federal Reserve.
    C. Testing capital ratios for minimum compliance.
    D. Testing an alternate scenario that is more conservative than the baseline scenario.

Answer: B

The 2009 SCAP was a one-time dual-stage test that was replaced by the annual CCAR approval process.

23. Which of the following trends is most likely to be observed in the equity markets relative to CCAR testing results?
    A. Companies that pass stress testing on the first attempt are the most highly rewarded in the equity markets.
    B. Company share prices are not negatively impacted by a failure in CCAR testing.
    C. Companies that operate close to regulatory minimums and need to resubmit capital plans are rewarded the most highly in the equity markets.
    D. The equity markets are indifferent to the results of CCAR testing.

Answer: C

Companies that declare a mulligan (i.e., must resubmit capital plans) are the most highly rewarded in terms of stock price increases.

24. Which of the following trends have been observed regarding stabilization of stress testing results?
    I. The BHCs with the most stable results are the investment banks, the universal banks, and the card monolines.
    II. The forecasts of regional banks and custodian banks are converging with Fed forecasts.
    A. I only.
    B. II only.
    C. Both I and II.
    D. Neither I nor II.

Answer: B

The BHCs that have the most stable capital buffers are the universal banks, regional banks, and

card monolines. The forecasts of regional banks and custodian banks are converging with the estimates used by the Fed itself.

25. Which of the following concerns have not emerged from the observed trends in CCAR testing?

A. Fed projections have become more restrictive than internal bank estimates.

B. Stress testing has become increasingly reliant on Fed-mandated variables.

C. Some banks have a narrower capital buffer than others.

D. Modeling risk has become apparent.

Answer: A

Stress testing results have become increasingly reliant on Fed-mandated variables. This has greatly increased the possibility of modeling risk. The risk is amplified because many banks are operating with increasingly narrow buffers.

Key Point: Cybersecurity 101: A Resource Guide for Bank Executives

- Five core functions of the NIST's Cybersecurity Framework are as follows:
  - ✧ Identify.
  - ✧ Protect.
  - ✧ Detect.
  - ✧ Respond.
  - ✧ Recover.
- Four facets of the risk assessment process are as follows:
  - ✧ Classifying information.
  - ✧ Identifying threats and vulnerabilities.
  - ✧ Measuring risk.
  - ✧ Communicating risk.
- In measuring risk for each information asset, there are three dimensions to be considered: value, level of risk, and firm actions in response to the risk.
- A system within the firm needs to be developed to communicate with top-level management and the board of directors regarding the cyber risks faced by the bank, how those risks are currently handled, how to mitigate those risks, and who is responsible for doing so.
- Five primary protection measures to consider:
  - ✧ Customer authentication.
  - ✧ Access controls.
  - ✧ Data security.
  - ✧ Secure configuration.

- ✧ Firewalls.
- Five general categories of detection tools include:
- ✧ Intrusion detection systems.
- ✧ Network behavior anomaly detection (NBAD).
- ✧ Security information and event management (SIEM) systems.
- ✧ Configuration management tools.
- ✧ Integrity monitoring tools.
- An incident response team needs to be established in order to develop an incident response plan. The overall objective is to discover the breach as soon as possible, limit the damage, repair the damage caused by the breach, and return the IT system back to normal as soon as possible.
- A recovery plan consists of both a restoration component and a review component.
- Key elements involved in restoration include reconstructing any damaged IT assets based on the firm's most up-to-date IT infrastructure images/layouts, restoring deleted or altered data from prior backups made, and reconnecting service with little or no disruption. The review component should include auditing and testing the incident response plan as well as reviewing third-party vendors.

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26. In categorizing threats to information security, intruders would most likely be classified as a(n):
    A. Internal threat.
    B. Internet threat.
    C. Natural disaster.
    D. Physical threat.

Answer: D

An example of a physical threat would be an intruder. An intruder is an external threat, not an internal threat.

27. Which of the following detection methods is focused on abnormal deviations between current values and baseline values of specific items?
    A. Intrusion detection system.
    B. Configuration management tool.
    C. Integrity monitoring tool.
    D. Security information and event management (SIEM) systems.

Answer: C

Integrity monitoring tools detect abnormal deviations between current values and baseline values of specific items. Intrusion detection systems find and process information from all parts of the

network in order to detect potential internal and external intrusions. Configuration management tools provide a full listing of the firm's hardware and its locations and network addresses as well as the firm's software and all of the versions installed and updates applied. SIEM systems allow for the consolidation of monitored data from multiple sources to help avoid missing critical events.

28. Which of the following protective measures is considered a secondary line of defense against cyber-attacks?
    A. Access controls.
    B. Data encryption.
    C. Firewall.
    D. Intrusion detection system.

Answer: D

An intrusion detection system is a detection tool that finds and processes information from all parts of the network in order to detect potential internal and external intrusions.

Detection tools are considered a secondary or reinforcing line of defense.

Access controls, data encryption, and firewalls are all examples of primary protection measures.

29. Which of the following statements regarding incident response teams and plans is correct?
    A. The incident response team must include the CFO of the firm.
    B. Only the IT director of the firm should be authorized to formally declare an incident.
    C. In order to ensure that the incident response plan remains relevant, annual audits should be performed.
    D. In order to ensure that the incident response plan remains relevant, testing should be done on an annual basis.

Answer: D

Testing the incident response plan should be done on an annual basis. Testing methods include tabletop exercises and functional exercises.

The incident response team should include the CEO, the IT director, the communications director, and relevant personnel from the legal and human resources departments. Members of senior management (besides the IT director) may be authorized to formally declare an incident. Quarterly (not annual) audits should be performed on most elements of the incident response plan.

30. Which of the following statements is correct with respect to the five core functions within the National Institute of Standards and Technology (NIST) Cybersecurity Framework?
    A. The core functions include identify, detect, and recover.

B. The core functions include prevent, respond, and monitor.

C. A risk assessment process allows a firm to recover from a cyber-attack.

D. Developing an incident response plan allows a firm to identify threats to information.

Answer: A

The five core functions are identify, protect, detect, respond, and recover. A risk assessment allows a firm to identify threats to information. Developing an incident response plan allows a firm to respond to any potential cybersecurity threat.