2020 FRM Part I

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债券与基础衍生品

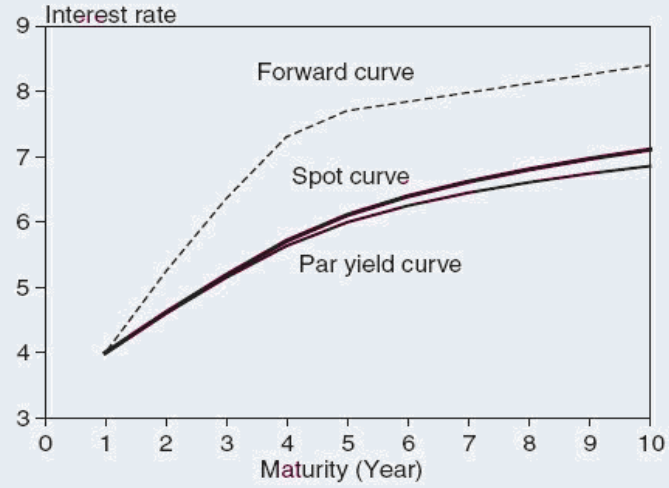
2020 年 5 月

3. Bonds and Basic Derivatives

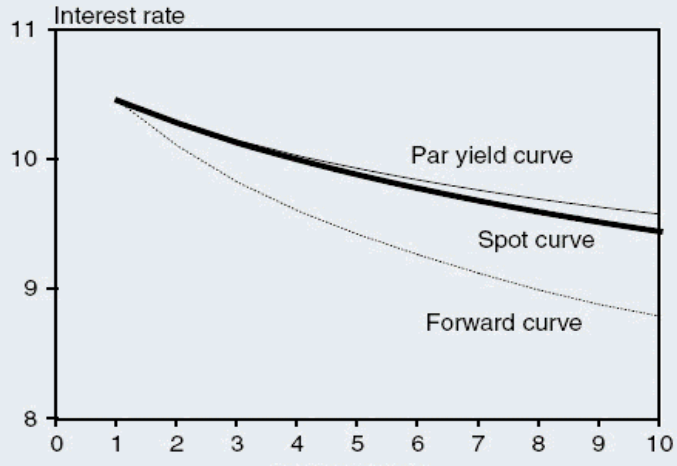
3.1. Spot Rate and Forward Rate

3.1.1. 重要知识点

3.1.1.1. Spot Rate and Forward Rate



Upward-Sloping Term Structure



Downward-Sloping Term Structure

- Forward rates are interest rates implied by the spot curve for a specified future period. The forward rate between T1 and T2 can be calculated as:

$$(1+Z_1)^{T_1}\left(1+F_{1,2}\right)^{(T_2-T_1)}=(1+Z_2)^{T_2}$$

$$e^{Z_1T_1}\times e^{F_{1,2}(T_2-T_1)}=e^{Z_2T_2}\Rightarrow F_{1,2}=\frac{Z_2T_2-Z_1T_1}{T_2-T_1}$$

3.1.2. 基础题

Q-1. The zero rate of three years is 4.6%, the zero rate of four years is 5.0%. Please calculate the 1-year forward rate three years from today (continuously compounding).

A. 6.2%

B. 6.0%

C. 5.5%

D. 4.8%

Q-2. Suppose that the yield curve is upward sloping. Which of the following statements is TRUE?

A. The forward rate yield curve is above the zero-coupon yield curve, which is above the coupon-bearing bond yield curve.

B. The forward rate yield curve is above the coupon-bearing bond yield curve, which is above the zero-coupon yield curve.

C. The coupon-bearing bond yield curve is above the zero-coupon yield curve, which is above the forward rate yield curve.

D. The coupon-bearing bond yield curve is above the forward rate yield curve, which is above the zero-coupon yield curve.

Q-3. The price of a three-year zero coupon government bond is 85.16. The price of a similar four-year bond is 79.81. What is the one-year implied forward rate form year 3 to year 4?

A. 5.4%

B. 5.5%

C. 5.8%

D. 6.7%

Q-4. The interest rate for a 1-year period is 5% and the rate for a 2-year period is 6%. Assuming continuous compounding, what is the forward rate for the period from the end of the first year to the second year?

A. 6.9991%

B. 7.0000%

C. 7.0009%

D. 8.0000%

Q-5. Given the following bonds and forward rates:

Maturity	YTM	Coupon	Price
1 year	4.5%	0%	95.694
2 years	7%	0%	87.344
3 years	9%	0%	77.218

- 1-year forward rate one year from today = 9.56%
- 1-year forward rate two years from today = 10.77%

- 2-year forward rate one year from today = 11.32%

Which of the following statements about the forward rates, based on the bond prices, is true?

A. The 1-year forward rate one year from today is too low.

B. The 2-year forward rate one year from today is too high.

C. The 1-year forward rate two years from today is too low.

D. The forward rates and bond prices provide no opportunities for arbitrage.

Q-6. Below is a table of term structure of swap rates:

Maturity in Years	Swap Rate
1	2.50%
2	3.00%
3	3.50%
4	4.00%
5	4.50%

The 2-year forward swap rate starting in three years is closest to:

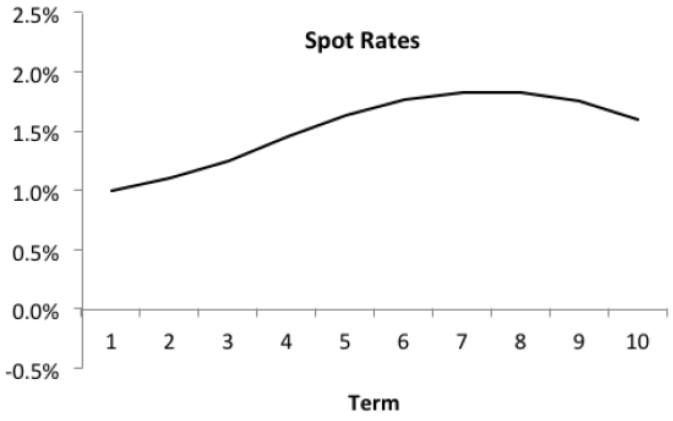
A. 3.50%

B. 4,50%

C. 5.51%

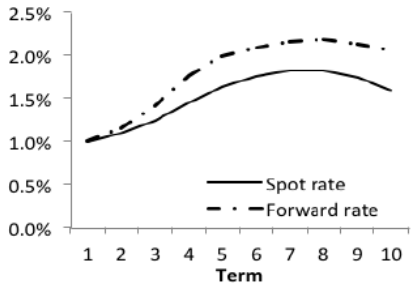
D. 6.02%

Q-7. Below is a chart showing the term structure of risk-free spot rates:



Which of the following charts presents the correct derived forward rate curve?

a.



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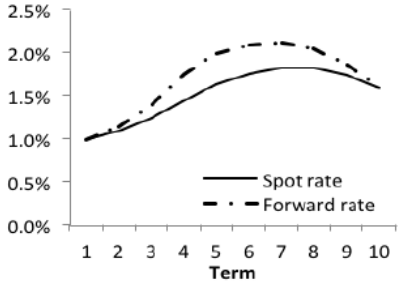

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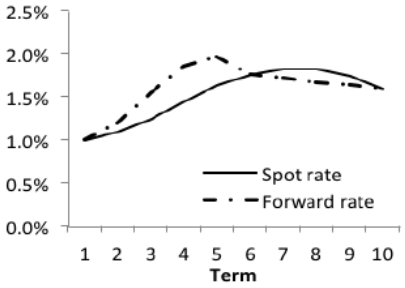

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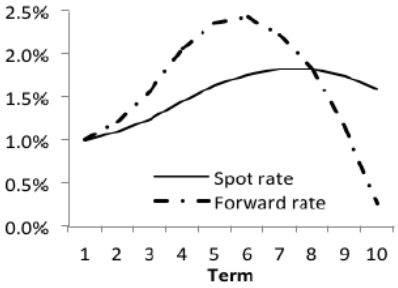


Q-8. An asset manager at an insurance company is considering making a fixed income investment and holding it for 2 years. The manager is comparing two bond issues that have equal yield to maturity at origination. One is a semi-annual coupon bond paying 7%, maturing in 2 years, and priced at USD 101.86. The other is a zero- coupon bond, also maturing in 2 years, and priced at USD 88.85. The manager is uncertain about the outlook for interest rates over the next two years but will incorporate the forecast of the company's economist when making the investment decision. Assuming no default risk, tax implications, or liquidity constraints, which of the following statements is correct?

A. The manager should be indifferent between the bonds if the interest rate is expected to rise since both bonds have the same yield and cash flows.

B. The manager should prefer the zero-coupon bond if the interest rate is expected to rise in the future.

C. The manager should prefer the zero-coupon bond if the expected average interest rate over the next 2 years is less than 6%.

D. The manager should prefer the coupon bond if the expected average interest rate over the next 2 years is less than 6%.

Q-9. The table below gives coupon rates and mid-market price for three U.S. Treasury bonds for settlement on (as of) May 31, 2013

Coupon	Maturity	Price
2 7/8	11/30/2013	$100.62600
2 1/2	5/31/2014	$99.45250

4 3/4	11/30/2014	$100.38000

Which of the following is nearest to the implied discount function (set of discount factors) assuming semi-annual compounding?

A. d(0.5) = 0.9370, d(1.0) = 0.8667, d(1.5) = 0.9210

B. d(0.5) = 0.9920, d(1.0) = 0.9700, d(1.5) = 0.9350

C. d(0.5) = 0.9999, d(1.0) = 0.7455, d(1.5) = 0.8018

D. d(0.5) = 1.0350, d(1.0) = 1.1175, d(1.5) = 0.6487

3.2. Corporate Bonds

3.2.1. 重要知识点

3.2.1.1. Corporate Trustee

- The corporate trustee is a third party to the contract. The trustee acts in a fiduciary (legal) capacity on behalf of the investors. Acting on behalf of the bondholders, the trustee must ensure that the bond issuer is in compliance with the covenants of the indenture at all times.

3.2.2. 基础题

Q-10. As it relates to the bond indenture, the corporate trustee acts in a fiduciary capacity for:

I. bond investors

II. bond issuers

III. bond underwriters

IV. regulators

A. I only

B. II only

C. I and IV

D. II and III

Q-11. TRSC, a trust company specializing in corporate investments, is brought in as a corporate trustee for a recent bond issue made by Banko, a small investment bank. Which of the following statements about TRSC and its role as a third party to the indenture is correct?

A. TRSC must monitor Banko's financial situation to foresee any covenant breaches.

B. When deemed necessary, TRSC should take action beyond the terms of the indenture in order to protect bondholders.

C. TRSC must take action according to the terms of the indenture whenever it is requested by bondholders.

D. TRSC is paid by Banko to represent the interests of the bondholders.

Q-12. Relative to coupon-bearing bonds of same maturity, zero-coupon bonds are NOT subject to which type of risk?

A. Interest rate risk
B. Credit risk
C. Reinvestment risk
D. Liquidity risk

Q-13. Which of the following statements regarding the trustee named in a corporate bond indenture is correct?

A. The trustee has the authority to declare a default if the issuer misses a payment.
B. The trustee may take action beyond the indenture to protect bondholders.
C. The trustee must act at the request of a sufficient number of bondholders.
D. The trustee is paid by the bondholders or their representatives.

3.3. Bond Pricing

3.3.1. 重要知识点

3.3.1.1. Bond Pricing

$$P=\frac{C_1}{1+y}+\frac{C_2}{(1+y)^2}+\cdots+\frac{C_T}{(1+y)^T}=\sum_{t=1}^{T}\frac{C_t}{(1+y)^t}$$

3.3.1.2. Perpetual Bond

$$P=\frac{CF}{1+y}+\frac{CF}{(1+y)^2}+\cdots=\sum_{t=1}^{+\infty}\frac{CF}{(1+y)^t}=\frac{CF}{y}$$

3.3.1.3. Clean Price & Dirty Price

Dirty price = clean price + accrued price

3.3.2. 基础题

Q-14. Given a one-year and a three-year zero coupon bonds price of 95.18 and 83.75 respectively, what should be the price of a two year zero coupon bond using linear interpolation on zero rates (semiannual compounding)?

A. 95.18
B. 89.47
C. 89.72
D. 83.75

Q-15. A two-year zero-coupon bond issued by corporate XYZ is currently rated A. One year from now XYZ is expected to remain at A with 85% probability, upgraded to AA with 5% probability, and downgraded to BBB with 10% probability. The risk free rate is flat at 4%. The credit spreads are flat at 40, 80, and 150 basis points for AA, A, and BBB rated issuers, respectively. All rates are compounded annually. Estimate the expected value of the zero-coupon bond one year from now (for USD 100 face amount).

A. USD 92.59

B. USD 95.33

C. USD 95.37

D. USD 95.42

Q-16. A $1,000 par corporate bond carries a coupon rate of 6%, pays coupons semiannually, and has ten coupon payments remaining to maturity. Market rates are currently 5%. There are 90 days between settlement and the next coupon payment. The dirty and clean prices of the bond, respectively, are closest to:

A. $1,043.76, $1,013.76

B. $1,043.76, $1,028.76

C. $1,056.73, $1,041.73

D. $1,069.70, $1,054.70

Q-17. An investor buys $10,000 face amount of the U.S. Treasury 6 1/2 (coupon rate = 6.50%) of August 15, 2017, for settlement on July 1st, 2014. The last coupon paid on February 15, 2014 and the next coupon pays on August 15, 2014. The bond's yield to maturity happens to be 4.00%. What is nearest to the bond's quoted price at settlement?

A. $9,338.48

B. $9,904.15

C. $10,095.07

D. $10,726.83

Q-18. Assume the following theoretical continuously compounded spot rates: 2.0% at 0.5 years; 3.0% at 1.0 year; 4.0% at 1.5 years; and 5.0% at 2.0 years. What is the two-year PAR YIELD with continuous compounding?

A. 4.88%

B. 4.94%

C. 5.00%

D. 5.04%

3.4. Duration and DV01

3.4.1. 重要知识点

3.4.1.1. Duration

- Macaulay Duration → Modified Duration

3.4.1.2. DV01 & DD

- DV01~1bps
- $\mathrm{DV01} = \mathrm{DD} \times 0.0001$

3.4.1.3. Portfolio Duration

- $\mathrm{D}_{\mathrm{portfolio}} = \sum_{i=1}^{k} w_j \times D_j$

3.4.2. 基础题

Q-19. A trading portfolio consists of two bonds, A and B. Both have modified duration of 3 years and face value of USD 1000, but A is a zero-coupon bond and its current price is USD 900, and bond B pays annual coupons and is priced at par. What do you expect will happen to the market prices of A and B if the risk-free yield curve moves up by 1 basis point?

A. Both bond prices will move up by roughly the same amount.
B. Both bond prices will move up, but bond B will gain more than bond A.
C. Both bond prices will move down by roughly equal amounts.
D. Both bond prices will move down, but bond B will lose more than bond A.

Q-20. A hedge fund manager wants to change her interest rate exposure by investing in fixed-income securities with negative duration. Which of the following securities should she buy?

A. Short maturity calls on zero-coupon bonds with long maturity.
B. Short maturity puts on interest-only strips from long maturity conforming mortgages.
C. Short maturity puts on zero-coupon bonds with long maturity.
D. Short maturity calls on principal-only strips from long maturity conforming mortgages.

Q-21. Which of the following assumptions are made when using DV01 as a measure of interest rate risk?

I. Changes in the interest rates are small.
II. The yield curve is flat.
III. Changes to the yield curve are parallel.
IV. The yield curve is downward sloping.

A. I and III

B. I and II

C. I and IV

D. II and III

Q-22. Calculate the impact of a 10 basis point increase in yield on the following bond portfolio.

Bond	Value (USD)	Modified Duration
1	4,000,000	7.5
2	2,000,000	1.6
3	3,000,000	6.0
4	1,000,000	1.3

A. USD -41,000

B. USD -52,500

C. USD -410,000

D. USD -525,000

3.5. Effective Duration& Effective Convexity

3.5.1. 重要知识点

3.5.1.1. Effective Duration

- $\text{Effective Duration} = \frac{P_- - P_+}{2 \times P_0 \times \Delta y}$

3.5.1.2. Effective Convexity

- $\text{Effective Convexity} = \frac{P_- + P_+ - 2 \times P_0}{P_0 \times \Delta y^2}$

3.5.2. 基础题

Q-23. An 8-year 5% coupon bond with at par value of 100 is currently trading at a price of 94.65. The price of this bond rises to 96.35 when interest rates fall by 30 basis points and falls to 92.75 when interest rates rise by 30. The effective duration of this bond is closest to:

A. 5.99

B. 6.34

C. 6.69

D. 7.04

Q-24. A portfolio manager uses her valuation model to estimate the value of a bond portfolio at USD 125.482 million. The term structure is flat. Using the same model, she estimates that the value of the portfolio would increase to USD 127.723 million if all interest rates

fell by 30 basis points and would decrease to USD 122.164 million if all interest rates rose by 30 basis points. Using these estimates, the effective duration of the bond portfolio is closest to:

A. 7.38

B. 8.38

C. 14.77

D. 16.76

Q-25. A risk manager is evaluating the price sensitivity of an investment-grade callable bond using the firm's valuation system. The table below presents information on the bond as well as on the embedded option. The current interest rate environment is flat at 5%.

Value in USD per USD 100 face value		
Interest Rate Level	Callable Bond	Call Option
4.98%	102.07848	2.0871
5.00%	101.61158	2.0501
5.02%	100.92189	2.0131

The DV01 of a comparable bond with no embedded options having the same maturity and coupon rate is closest to:

A. 0.0185

B. 0.2706

C. 0.2891

D. 0.3077

Q-26. A risk manager is evaluating the price sensitivity of an investment-grade callable bond using the firm's valuation system. The table below presents information on the bond as well as on the embedded option. The current interest rate environment is flat at 5%.

Value in USD per USD 100 face value		
Interest Rate Level	Callable Bond	Call Option
4.98%	102.07848	2.0871
5.00%	101.61158	2.0501
5.02%	100.92189	2.0131

The convexity of the callable bond can be estimated as:

A. -55,698

B. -54,814

C. -5.5698

D. -5.4814

3.6. Bullet versus Barbell Portfolio

3.6.1. 重要知识点

3.6.1.1. Barbell benefits more from interest rate volatility than does the bullet portfolio.

3.6.1.2. The barbell has greater convexity than the bullet because duration increases linearly with maturity while convexity increases with the square of maturity.

3.6.2. 基础题

Q-27. A fixed-income portfolio manager currently holds a bullet 7-year US Treasury position with USD 60 million face value. The manager would like to create a cost matching barbell portfolio by purchasing a combination of a 2-year Treasury and a 15-year Treasury that would have the same duration as the 7-year US Treasury position. The data for the three US Treasuries are listed below:

Maturity	Price	Duration
2 Years	100.972	1.938
7 Years	106.443	6.272
15 Years	122.175	11.687

Which of the following combinations correctly describes the weights of the two bonds that the manager will use to construct the barbell portfolio?

	Weight of 2-Year Treasury	Weight of 15-Year Treasury
A.	14.22%	85.78%
B.	44.46%	55.54%
C.	55.54%	44.46%
D.	85.78%	14.22%

3.7. Price Approximation, Effect of Convexity

3.7.1. 重要知识点

3.7.1.1. The actual, exact price

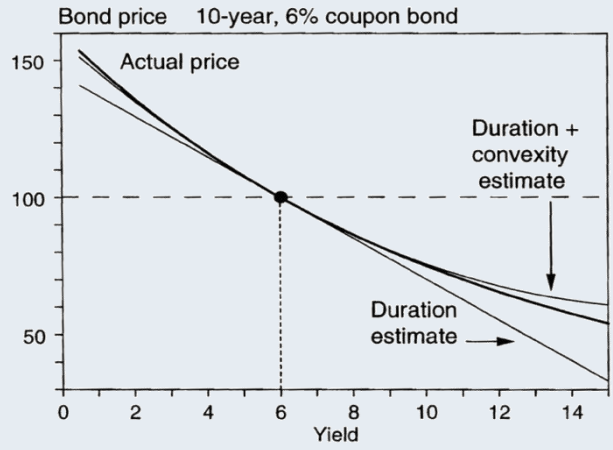
- $P = f(y_0 + \Delta y)$

3.7.1.2. The duration estimate:

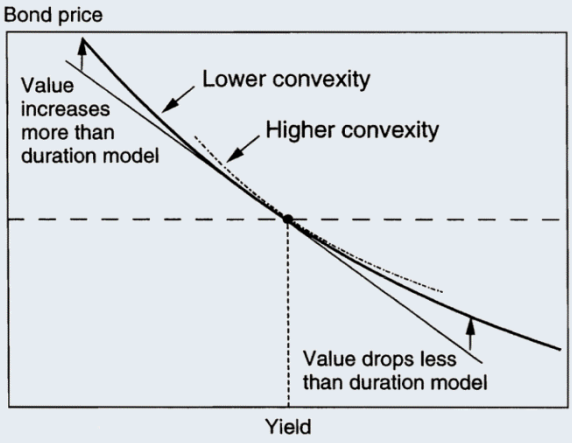
- $P = P_0 - DP_0\Delta y$

3.7.1.3. The duration and convexity estimate:

- $P = P_0 - DP_0\Delta y + \frac{1}{2}CP_0(\Delta y)^2$



Price Approximation



Effect of Convexity

3.7.2. 基础题

Q-28. For an option-free bond, which of the following are the effects of the convexity adjustment on the magnitude (absolute value) of the approximate bond price change in response to an increase in yield and in response to a decrease in yield, respectively?

	Decrease in Yield	Increase in Yield
A.	Increase in magnitude	Decrease in magnitude
B.	Increase in magnitude	Increase in magnitude
C.	Decrease in magnitude	Decrease in magnitude
D.	Decrease in magnitude	Increase in magnitude

Q-29. Which of the following is TRUE?

A. If a consol (perpetual) bond with a $100 face value pays a 3.0% coupon in perpetuity and the yield is 5.0%, the consol's price is $60 and its modified duration is 20 years.

B. Since a BARBELL bond portfolio has greater convexity than a BULLET, the barbell always outperforms

C. Duration, convexity and DV01 are all (each) increasing with maturity

D. Portfolio duration is weighted average of individual (component) durations but portfolio convexity is not a weighted average of individual convexities

3.8. Bond Replication

3.8.1. 重要知识点

3.8.1.1. Law of one price: absent confounding factors (e.g., liquidity, financing, taxes, credit risk), identical sets of cash flows should sell for the same price.

3.8.1.2. While the law of one price is intuitively reasonable, its justification rests on a stronger foundation. It turns out that a deviation from the law of one price implies the existence of an arbitrage opportunity, that is, a trade that generates profits without any chance of losing money.

3.8.2. 基础题

Q-30. You have been asked to check for arbitrage opportunities in the Treasury bond market by comparing the cash flows of selected bonds with the cash flows of combinations of other bonds. If a 1-year zero-coupon bond is priced at USD 96.12 and a 1-year bond paying a 10% coupon semi-annually is priced at USD 106.20, what should be the price of a 1-year Treasury bond that pays a coupon of 8% semiannually?

A. USD 98.10

B. USD 101.23

C. USD 103.35

D. USD 104.18

Q-31. The following table gives the prices of two out of three US Treasury notes for settlement on August 30, 2008. All three notes will mature exactly one year later on August 30, 2009. Assume semi-annual coupon payments and that all three bonds have the same coupon payment date.

Coupon	Price
2 7/8	94.40
4 1/2	?
6 1/4	101.30

Approximately what would be the price of the 4 1/2 US Treasury note?

A. 99.20

B. 99.40

C. 97.71

D. 100.20

3.9. Key Rate

3.9.1. 重要知识点

3.9.1.1. The key rate shift technique is an approach to nonparallel shifts in the yield curve, which is allows for changes in all rates to be determined by changes from selected key rates.

3.9.1.2. The rate of a given maturity is affected solely by its closest key-rate.

3.9.1.3. Shifts in the key-rates are decline linearly.

3.9.2. 基础题

Q-32. The main problem associated with using single-factor approaches to hedge interest rate risk is:

A. No method can hedge interest rate risk.

B. Single-factor models assume mean-reversion between one short-term and one long-term rate.

C. Single-factor models assume effects across the entire curve dictated by one rate.

D. Single-factor models assume risk-free securities have credit exposure.

Q-33. You are using key rate shifts to analyze the effect of yield changes on bond prices. Suppose the 10-year yield has increased by 10 basis points and this shock decreases linearly to zero for the 20-year yield. What is the effect of this shock on the 14-year yield?

A. Increase of 0 basis points

B. Increase of 4 basis points

C. Increase of 6 basis points

D. Increase of 10 basis points

Q-34. Using key rates of 2-year, 5-year, 7-year, and 20-year exposures assumes all of the following except that the:

A. 2-year rate will affect the 5-year rate

B. 7-year rate will affect the 20-year rate

C. 5-year rate will affect the 7-year rate

D. 2-year rate will affect the 20-year rate

Use the following information to answer the following two questions:

The following table provides the initial price of a C-strip and its present value after application of a one basis shift in four key rates.

Value	
Initial value	25.11584
2-year shift	25.11681
5-year shift	25.11984
10-year shift	25.13984
30-year shift	25.01254

Q-35. What is the key rate '01 for a 30-year shift?

A. -0.058

B. 0.024

C. 0.103

D. 0.158

Q-36. What is the key-rate duration for a 30-year shift?

A. -4.57

B. 15.80

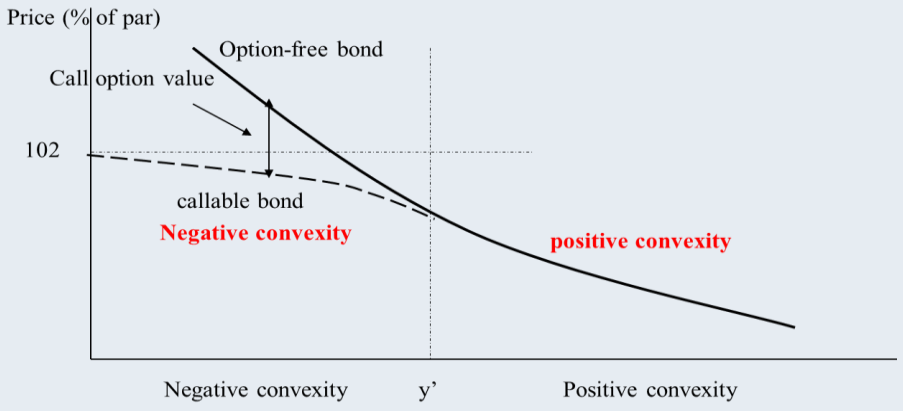
C. 38.60

D. 41.13

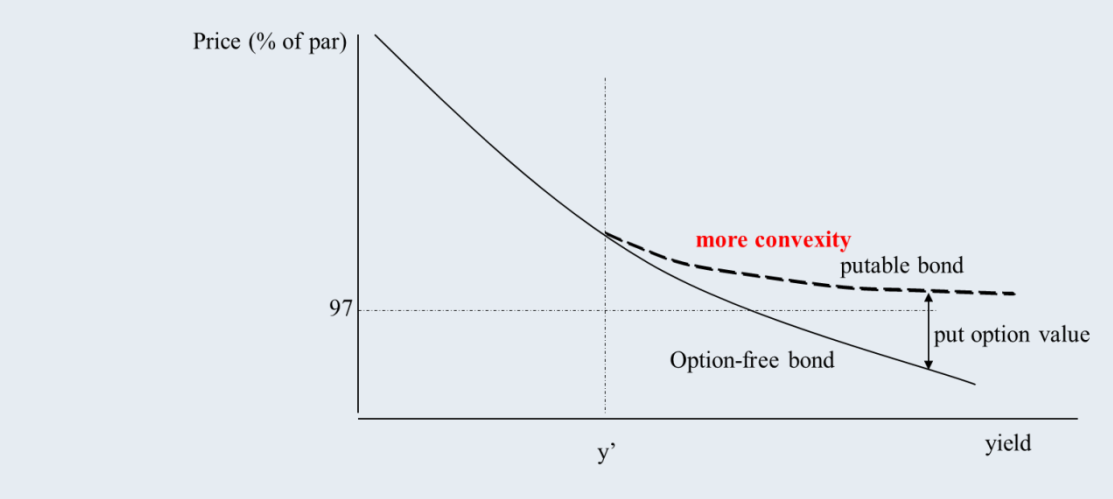
3.10. Callable, Putable Bond

3.10.1. 重要知识点

3.10.1.1. Callable bond：Issuer has the right to buy back the bond in the future at a set price; as yields fall, bond is likely to be called; prices will rise at a decreasing rate-negative convexity.



3.10.1.2. Putable bond: Bondholder has the right to sell bond back to the issuer at a set price.



3.10.2. 基础题

Q-37. An investment in a callable bond can be analytically decomposed into a:

A. Long position in a non-callable bond and a short position in a put option
B. Short position in a non-callable bond and a long position in a call option
C. Long position in a non-callable bond and a long position in a call option
D. Long position in a non-callable bond and a short position in a call option

Q-38. Which of the following statements about a putable bond and a callable bond is correct?

A. The put option of a putable bond is more expensive than the call option of the callable bond.
B. A putable bond will have a lower yield than a comparable callable bond.
C. The value of a callable bond increases when interest rate volatility increases.
D. Long position in a putable bond has more interest rate risk than a long position in a callable bond.

Q-39. Bonds issued by the XYZ Corp. are currently callable at par value and trade close to par. The bonds mature in 8 years and have a coupon of 8%. The yield on the XYZ bonds is 175 basis points over 8-year US Treasury securities, and the Treasury spot yield curve has a normal, rising shape. If the yield on bonds comparable to the XYZ bond decreases sharply, the XYZ bonds will most likely exhibit:

A. Negative convexity
B. Increasing modified duration
C. Increasing effective duration
D. Positive convexity

Q-40. Which of the following statements are TRUE?

I. The convexity of a 10-year zero coupon bond is higher than the convexity of a 10-year, 6% bond.

II. The convexity of a 10-year zero coupon bond is higher than the convexity of a 6% bond with a duration of 10 years.

III. Convexity grows proportionately with the maturity of the bond.

IV. Convexity is always positive for all types of bonds.

V. Convexity is always positive for "straight" bonds.

A. I only

B. I and II only

C. I and V only

D. II, III, and V only

3.11. Exchange VS. Over the Counter Market

3.11.1. 重要知识点

Over-the-Counter	Exchange-Traded
Customized	Standardized
Trade with counterparty (Default Risk)	Backed by a clearing house
Not trade in a central location	Trade in a physical exchange
Unregulated	Regulated
Trading volume: large	Trading volume: small

3.11.2. 基础题

Q-41. Which of the following statements is an advantage of an exchange trading system? On an exchange system:

A. Terms are not specified.

B. Trades are made in such a way as to reduce credit risk.

C. Participants have flexibility to negotiate.

D. In the event of a misunderstanding, calls are recorded between parties.

3.12. CCPs

3.12.1. 重要知识点

3.12.1.1. Central Counterparties (CCPs):

- When trades are centrally cleared, a CCP becomes the seller to a buyer and the buyer to a seller.

3.12.1.2. Advantages of CCPs:

- Transparency, offsetting, loss mutualization, legal and operational efficiency, liquidity, and default management.

3.12.1.3. Disadvantages of CCPs:

- Moral hazard, adverse selection, separation of cleared and non-cleared products, and margin procyclicality.

3.12.1.4. Risks faced by CCPs:

- Default risk, model risk, liquidity risk, operational risk, and legal risk.
- Default of a clearing member and its flow through effects is the most significant risk for a CCP

3.12.2. 基础题

Q-42. Which of the following statements least likely describe a problem with bilaterally cleared over-the-counter (OTC) derivatives trades?

A. The defaults of individual counterparties could lead to systemic problems.
B. Bilateral OTC derivatives are often non-standard with exotic features.
C. Closing out trades may be difficult.
D. Loss mutualization may not spread all the losses among participants.

Q-43. Which of the following functions is least likely performed by an exchange?

A. Derivatives contract design and specifying contract terms.
B. Price negotiation through a bilateral process.
C. Limiting access to approved firms and individuals.
D. Reporting transaction prices to trading participants and data vendors.

Q-44. Alex Dell, a derivatives trader, has some reservations about the central clearing of OTC derivatives with a central counterparty (CCP). Specifically, he is worried that clearing members' willingness to monitor credit risk may decline since the CCP assumes most of the risks, and that CCPs may increase margin requirements during a period of market stress. Which of the following concepts best describe Dell's reservations?

	Decline in Willingness	Higher Margin Requirements
A.	Moral hazard	Procyclicality
B.	Adverse selection	Offsetting
C.	Moral hazard	Offsetting
D.	Adverse selection	Procyclicality

Q-45. XYZ, a clearinghouse member, has recently contributed funds with its clearinghouse. The

funds are designed to give the clearinghouse the ability to meet the financial obligations of any defaulting members. The funds may not be withdrawn by XYZ as long as it remains a member of the clearinghouse. Which of the following amounts best describe XYZ's contribution?

A. Variation margin
B. Original margin
C. Membership dues
D. Guaranty deposit

Q-46. Jack Johnson is going to receive a physical commodity from a settling long futures trade. Which of the following statements best describe the role of Johnson and the clearinghouse in this process?

A. The clearinghouse will coordinate Johnson's settlement with any eligible settling shorts.
B. Johnson will have to contact the clearinghouse to coordinate with any eligible settling short.
C. Johnson will have to close his position with the original counterparty.
D. The clearinghouse will coordinate Johnson's settlement with the original counterparty only.

3.13. Forward Rate Agreement (FRA)

3.13.1. 重要知识点

- A long FRA position benefits from an increase in rates. A short FRA positions similar to a long position in a bond.

3.13.2. 基础题

Q-47. A long position in a FRA 2 × 5 is equivalent to the following positions in the spot market:

A. Borrowing in two months to finance a five-month investment.
B. Borrowing in five months to finance a two-month investment.
C. Borrowing half a loan amount at two months and the remainder at five months.
D. Borrowing in two months to finance a three-month investment.

Q-48. A company wants to borrow $10 million for 90 days starting in one year. To hedge the interest rate risk of the future borrowing, the company enters into a forward rate agreement (FRA) where the company will pay a fixed rate, R(k), of 5.0%. The FRA cash settles in one year; i.e., in advance (T=1.0) not in arrears (T=1.25). All rates are expressed with quarterly compounding. If the actual 90-day LIBOR observed one year forward turns out to be 6.0%, what is the cash flow payment/receipt by the company under the FRA?

A. Company pays $24,631
B. Company pays $25,000
C. Company receives $24,631
D. Company receives $25,000

3.14. Margin

3.14.1. 重要知识点

3.14.1.1. Initial Margin

- Must be deposited when contract is initiated

3.14.1.2. Marking to Market

- At the end of each trading day, margin account is adjusted to reflect gains or losses.

3.14.1.3. Maintenance Margin

- Investor can withdraw funds in the margin account in excess of the initial margin. A maintenance margin guarantees that the balance in the margin account never gets negative (the maintenance margin is lower than the initial margin).

3.14.1.4. Margin Call

- When the balance in the margin account falls below the maintenance margin, broker executes a margin call. The next day, the investor needs to "top up" the margin account back to the initial margin level.

3.14.1.5. Variation margin

- Extra funds deposited by the investor after receiving a margin call.
- Variation margin = initial margin – margin account balance

3.14.2. 基础题

Q-49. To utilize the cash position of assets under management, a portfolio manager enters into a long futures position on the S&P 500 index with a multiplier of 250. The cash position is $15 million with the current futures value of 1000, which requires the manager to long 60 contracts. If the current initial margin is $12500 per contract, and the current maintenance margin is $10000 per contract, what variation margin does the portfolio manager have to advance if the futures contract value falls to 995 at the end of the first day of the position being placed?

A. $30,000
B. $0
C. $300,000
D. $75,000

Q-50. In late June, John purchased two December gold futures contracts. Each contract size is 5,000 ounces of silver and the futures price on the date of purchase was USD 18.62 per ounce. The required initial margin is USD 6,000 and a maintenance margin of USD 4,500. You are given the following price history for the December silver futures:

Day	Futures Price	Daily Gain
June 29	18.62	0
June 30	18.69	700
July 1	18.03	-6600
July 2	17.72	-3100
July 6	18.00	2800
July 7	17.70	-3000
July 8	17.60	-1000

On which days did John receive a margin call?

A. July 1 only

B. July 1 and July 2 only

C. July 1, July 2 and July 7 only

D. July 1, July 2 and July 8 only

Q-51. Assume you enter into 5 long futures contracts to buy July gold for $1,400 per ounce. A gold futures contract size is 100 troy ounces. The initial margin is $14,000 per contract and the maintenance margin is 75% of the initial margin. What change in the futures price of gold will lead to a margin call?

A. $35 drop

B. $70 drop

C. $175 drop

D. $350 drop

3.15. Order Terms

3.15.1. 重要知识点

3.15.1.1. Market Order

- The market order is a simple (the simplest) request to execute the trade immediately at the best available price.

3.15.1.2. Limit Order

- A limit order specifies a particular price. The order can be executed only at this price or at one more favorable to the investor.

3.15.1.3. Stop Loss

- The order is executed at the best available price once a bid or offer is made at that particular price or a less-favorable price.

3.15.1.4. Stop-Limit

- The order becomes a limit order as soon as a bid or offer is made at a price equal to or less favorable than the stop price.

3.15.1.5. Market-if-Touched

- A market-if-touched (MIT) order is executed at the best available price after a trade occurs at a specified price or at a price more favorable than the specified price.

3.15.1.6. Discretionary

- A market order except that execution may be delayed at the broker's discretion in an attempt to get a better price.

3.15.2. 基础题

Q-52. Assume you have a long position in a stock with a current market price of $35. You have two goals. First, to retain ownership as long as the stock continues to go up. Second, to exit the position completely if the stock drops below $30. Which order best meets your dual objectives?

A. Sell market order
B. Sell limit order at $37
C. Stop-loss sell order at $30
D. Stop-and-limit sell order at $30

Q-53. An investor with a long position in a futures contract wants to issue instructions to close out the position. A market-if-touched order would be used if the investor wants to:

A. Execute at the best available price once a trade occurs at the specified or better price.
B. Execute at the best available price once a bid/offer occurs at the specified or worse price.
C. Allow a broker to delay execution of the order to get a better price.
D. Execute the order immediately or not at all.

3.16. T-bond futures, CTD bond

3.16.1. 重要知识点

- In a T-bond futures contract, any government bond with more than 15 years to maturity on the first of the delivery month (and not callable within 15 years) is deliverable on the contract.

- The procedure to determine which bond is the cheapest-to-deliver (CTD) is as follows:

  Cash received by the short = (QFP × CF) + AI

  Cost to purchase bond = QBP + AI

  Where:

  QFP = quoted futures price

  CF = conversion factor

  QBP = quoted bond price
- The CTD is the bond that minimizes the following: QBP – (QFP × CF). This formula calculates the cost of delivering the bond.

3.16.2. 基础题

Q-54. The yield curve is upward sloping. You have a short T-bond futures position. The following bonds are eligible for delivery:

Bond	A	B	C
Spot price	102-14/32	106-19/32	98-12/32
Coupon	4%	5%	3%
Conversion factor	0.98	1.03	0.952

The futures price is 103-17/32 and the maturity date of the contract is September 1. The bonds pay their coupon semiannually on June 30 and December 31. The cheapest to deliver bond is:

A. Bond A

B. Bond B

C. Bond C

D. Insufficient information

Q-55. A German housing corporation needs to hedge against rising interest rates. It has chosen to use futures on 10-year German government bonds. Which position in the futures should the corporation take, and why?

A. Take a long position in the futures because rising interest rates lead to rising futures prices.

B. Take a short position in the futures because rising interest rates lead to rising futures prices.

C. Take a short position in the futures because rising interest rates lead to declining futures prices.

D. Take a long position in the futures because rising interest rates lead to declining futures

prices.

3.17. Eurodollar Futures

3.17.1. 重要知识点

- This contract settles in cash and the minimum price change is one "tick", which is a price change of one basis point, or $25 per $1 million contract.
- The interest rate underlying this contract is essentially the 3-month (90-day) forward LIBOR. If Z is the quoted price for a Eurodollar futures contract, the contract price is:

  Eurodollar futures price = $10,000×[100–(0.25)×(100 – Z)] = 10,000×[100–0.25F_t]
- Convexity adjustment: The daily marking to market aspect of the futures contract can result in differences between actual forward rates and those implied by futures contracts.

  Forward rate = Futures rate – $0.5 \times \sigma^2 \times T \times (T+0.25)$

3.17.2. 基础题

Q-56. Consider an FRA (forward rate agreement) with the same maturity and compounding frequency as a Eurodollar futures contract. The FRA has labor underlying. Which of the following statements are true about the relationship between the forward rate and the futures rate?

A. The forward rate is normally higher than the futures rate.
B. They have no fixed relationship.
C. The forward rate is normally lower than the futures rate.
D. They should be exactly the same.

Q-57. The four-year Eurodollar futures quote is 97.00. The volatility of the short-term interest rate (LIBOR) is 1.0%, expressed with continuous compounding. What is the equivalent forward rate, adjusted for convexity, given in ACT/360 day count with continuous compounding (i.e., the Eurodollar futures contract gives LIBOR in quarterly compounding ACT/360, so convert to continuous but a day count conversion is not needed)?

A. 2.90%
B. 2.95%
C. 2.99%
D. 3.00%

3.18. Forward and Futures Price

3.18.1. 重要知识点

3.18.1.1. Forward and Futures Price

- Forward Price for a Financial Asset that Provides no Income: $F = S(1+R)^T$
- Forward Price for a Financial Asset that Paying a Known Cash Income: $F = (S-I)(1+R)^T$
- Forward Price for a Financial Asset that Provides a Known Yield: $F = S\left(\frac{1+R}{1+Q}\right)^T$
- Forward Price for a Commodity Asset with a Lease Rate: $F = S\left(\frac{1+R}{1+I}\right)^T$
- Forward Price for a Commodity with Storage Cost & Convenience Yield: $F = (S+U)\left(\frac{1+R}{1+Y}\right)^T$

3.18.1.2. Arbitrage

- If $F > S(1+R)^T$, borrow, buy spot, sell forward today; deliver asset, repay loan at end.
- If $F < S(1+R)^T$, short spot, invest, buy forward today; collect loan, buy asset under futures contract, deliver to cover short sale.

3.18.1.3. Interest Rate Parity

$$F = S\left(\frac{1+R_A}{1+R_B}\right)^T$$

3.18.2. 基础题

Q-58. A stock index is valued at USD 750 and pays a continuous dividend at the rate of 2% per annum. The 6-month futures contract on that index is trading at USD 757. The risk free rate is 3.50% continuously compounded. There are no transaction costs or taxes. Is the futures contract priced so that there is an arbitrage opportunity? If yes, which of the following numbers comes closest to the arbitrage profit you could realize by taking a position in one futures contract?

A. 4.18
B. 1.35
C. 12.60
D. There is no arbitrage opportunity.

Q-59. A trader in the arbitrage unit of a multinational bank finds that an asset is trading at USD 1,000, the price of a 1-year futures contract on that asset is USD 1,010, and the price of a 2-year futures contract is USD 1,025. Assume that there are no cash flows from the asset for 2 years. If the term structure of interest rates is flat at 1% per year (continuously compounded), which of the following is an appropriate arbitrage strategy?

A. Short 2-year futures and long 1-year futures
B. Short 1-year futures and long 2-year futures
C. Short 2-year futures and long the underlying asset funded by borrowing for 2 years
D. Short 1-year futures and long the underlying asset funded by borrowing for 1 year

Q-60. A risk manager is deciding between buying a futures contract on an exchange and buying a forward contract directly from a counterparty on the same underlying asset. Both contracts would have the same maturity and delivery specifications. The manager finds that the futures price is less than the forward price. Assuming no arbitrage opportunity exists, what single factor acting alone would be a realistic explanation for this price difference?

A. The futures contract is more liquid and easier to trade.
B. The forward contract counterparty is more likely to default.
C. The asset is strongly negatively correlated with interest rates.
D. The transaction costs on the futures contract are less than on the forward contract.

Q-61. A 15-month futures contract on an equity index is currently trading at USD 3,767.52. The underlying index is currently valued at USD 3,625 and has a continuously compounded dividend yield of 2% per year. The continuously compounded risk-free rate is 5% per year. Assuming no transactions costs, what is the potential arbitrage profit per contract and the appropriate strategy?

A. USD 189, buy the futures contract and sell the underlying.
B. USD 4, buy the futures contract and sell the underlying.
C. USD 189, sell the futures contract and buy the underlying.
D. USD 4, sell the futures contract and buy the underlying.

Q-62. A risk analyst at a commodities trading firm is examining the supply and demand conditions for various commodities and is concerned about the volatility of the forward prices for silver in the medium term. Currently, silver is trading at a spot price of USD 20.35 per troy ounce and the six-month forward price is quoted at USD 20.50 per troy ounce. Assuming that after six months the lease rate rises above the continuously compounded interest rate, which of the following statements is correct about the shape of the silver forward curve after six months?

A. The forward curve will be downward sloping.
B. The forward curve will be upward sloping.
C. The forward curve will be flat.

D. The forward curve will be humped.

Q-63. Current spot USD/CHFate: 1.3680 (1.3680CHF = 1USD)

3-month USD interest rates: 1.05%

3-month Swiss interest rates: 0.35%

(Assume continuous compounding)

A currency trader notices that the 3-month future price is USD 0.7350. In order to arbitrage, the trader should investment:

A. Borrow CHF, buy USD spot, go long CHF futures

B. Borrow CHF, sell CHF spot, go short CHF futures

C. Borrow USD, buy CHF spot, go short CHF futures

D. Borrow USD, sell USD spot, go long CHF futures

Q-64. You are examining the exchange rate between the U.S. dollar and the Euro and have the following information:

- Current exchange rate is 1.25 USD per EUR.
- Current USD-denominated 1-year risk-free interest rate is 4% per year (continuously compounded).
- Current EUR-denominated 1-year risk-free interest rate is 7% per year (continuously compounded).

According to the interest rate parity theorem, what is the 1-year forward exchange rate?

A. 0.78

B. 0.82

C. 1.21

D. 1.29

3.19. Contango and Backwardation

3.19.1. 重要知识点

3.19.1.1. Backwardation

- Refers to a situation where the futures price is below the spot price. For this to occur, there must be a significant benefit to holding the asset.

3.19.1.2. Contango

- Refers to a situation where the futures price is above the spot price. If there are no benefits to holding the asset (e.g., dividends, coupons, or convenience yield), contango will occur because the futures price will be greater than the spot price.

3.19.2. 基础题

Q-65. The current price of Commodity X in the spot market is $42.47. Forward contracts for delivery of Commodity X in one year are trading at a price of $43.11. If the current continuously compounded annual risk-free interest rate is 7.0%, calculate the implicit lease rate for Commodity X. Holding the calculated implicit lease rate constant, would the forward market for Commodity X be in backwardation or contango if the continuously compounded annual risk-free rate immediately fell to 5.0%?

A. The implicit lease rate is 1.49%. Holding this rate constant, the forward market would be in contango if the continuously compounded annual risk-free rate immediately fell to 5.0%.

B. The implicit lease rate is 5.50%. Holding this rate constant, the forward market would be in backwardation if the continuously compounded annual risk-free rate immediately fell to 5.0%.

C. The implicit lease rate is 1.49%. Holding this rate constant, the forward market would be in backwardation if the continuously compounded annual risk-free rate immediately fell to 5.0%.

D. The implicit lease rate is 5.50%. Holding this rate constant, the forward market would be in contango if the continuously compounded annual risk-free rate immediately fell to 5.0%.

Q-66. In commodity markets, the complex relationships between spot and forward prices are embodied in the commodity price curve. Which of the following statements is true?

A. In a backwardation market, the discount in forward prices relative to the spot price represents a positive yield for the commodity supplier.

B. In a backwardation market, the discount in forward prices relative to the spot price represents a positive yield for the commodity consumer.

C. In a contango market, the discount in forward prices relative to the spot price represents a positive yield for the commodity supplier.

D. In a contango market, the discount in forward prices relative to the spot price represents a positive yield for the commodity consumer.

Q-67. A commodities trader observes quotes for futures contracts as follow:

Spot Price	321
July, 2014	312
October, 2014	310
December, 2014	309

This commodity is trading:

A. As a normal futures market since the futures prices are consistent with the commodity's seasonality.

B. As an inverted futures market since more distant delivery contracts are trading at lower prices than nearer-term ones.

C. As a normal futures market because it is typical for more distant delivery contracts to trade lower than nearer-term delivery contracts.

D. Consistently with convergence as futures prices will rise when the delivery period nears.

3.20. Forward Contract Value

3.20.1. 基础题

Q-68. Three months ago a company entered in a one-year forward contract to buy 100 ounces of gold. At the time, the one-year forward price was USD 1,000 per ounce. The nine-month forward price of gold is now USD 1,050 per ounce. The continuously-compounded risk-free rate is 4% per year for all maturities and there are no storage costs. Which of the following is closest to the value of the contract?

A. USD5,000

B. USD 4,852

C. USD 7,955

D. USD1,897

Q-69. A French bank enters into a 6-month forward contract with an importer to sell GBP 40 million in 6 months at a rate of EUR 0.80 per GBP. If in 6 months the exchange rate is EUR 0.85 per GBP, what is the payoff for the bank from the forward contract?

A. EUR -2,941,176

B. EUR -2,000,000

C. EUR 2,000,000

D. EUR 2,941,176

Q-70. Company XYZ operates in the U.S. On April 1, 2009, it has a net trade receivable of EUR 5,000,000 from an export contract to Germany. The company expects to receive this amount on Oct. 1, 2009. The CFO of XYZ wants to protect the value of this receivable. On April 1, 2009, the EUR spot rate is 1.34, and the 6-month EUR forward rate is 1.33. The CFO can lock in an exchange rate by taking a position in the forward contract. Alternatively, he can sell a 6-month EUR 5,000,000 call option with strike price of 1.34. The CFO thinks that selling an option is better than taking a forward position because if

the EUR goes up, XYZ can take delivery of the USD at 1.34, which is better than the outright forward rate of 1.33. If the EUR goes down, the contract will not be exercised. So, XYZ will pocket the premium obtained from selling the call option.

What can be concluded about the CFO's analysis?

A. CFO's analysis is correct. The company is better off whichever way the EUR rate goes.

B. CFO's analysis is not correct. The company will suffer if the EUR goes up sharply.

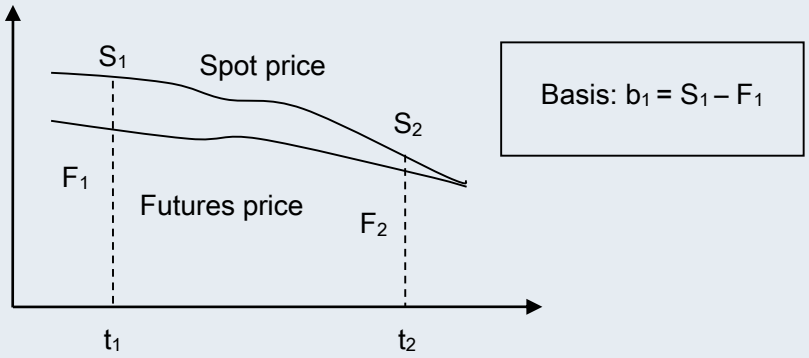
C. CFO's analysis is not correct. The company will suffer if the EUR moves within a narrow range.

D. CFO's analysis is not correct. The company will suffer if the EUR goes down sharply.

3.21. Basis and Basis Risk

3.21.1. 重要知识点

- Define the basis and the various sources of basis risk, and explain how basis risks arise when hedging with futures.



- The profit on the futures position is $F_1 - F_2$.
- The effective price that is obtained for the asset with hedging is therefore: $S_2 + F_1 - F_2 = F_1 + b_2$; The value of F_1 is known at time t_1. If b_2 were also known at this time, a perfect hedge would result. The hedging risk is the uncertainty associated with b_2 and is known as basis risk.

3.21.2. 基础题

Q-71. Which of the following statements are true with respect to basis risk?

I. Basis risk arises in cross-hedging strategies but there is no basis risk when the underlying asset and hedge asset are identical.

II. Short hedge position benefits from unexpected strengthening of basis.

III. Long hedge position benefits from unexpected strengthening of basis.

A. I and II

B. I and III

C. II only

D. III only

Q-72. The May 2011 spot price (S1) of wheat is $7.00 per bushel and the December 2011 futures price (F1) is $9.00. Going forward three months to August, assume the spot price (S2) of wheat increases to $7.30 and the December 2011 futures price (F2) increased to $9.10. What happens to the basis between May and August?

A. Basis strengthens by +$0.10

B. Basis weakens by +$0.10

C. Basis strengthens by +$0.20

D. Basis weakens by -$0.20

Q-73. A buffalo farmer is concerned that the price he can get for his buffalo herd will be less than he has forecasted. To protect himself from price declines in the herd, the farmer has decided to hedge with live cattle futures. Specifically, he has entered into the appropriate number of cattle future position for September delivery that he believes will help offset any buffalo price declines during the winter slaughter season. The appropriate position and the likely sources of basis risk in the hedge are, respectively:

A. Short; choice of futures delivery date.

B. Short; choice of futures asset.

C. Short; choice of futures delivery date and asset.

D. Long; choice of futures delivery date and asset.

Q-74. You wish to hedge an investment in Zirconium using futures. Unfortunately, there are no futures that are based on this asset. To determine the best futures contract for you to hedge with, you run a regression of daily changes in the price of Zirconium against daily changes in the prices of similar assets which do have futures contracts associated with them. Based on your results, futures tied to which asset would likely introduce the least basis risk into your hedging position?

Change in price of Zirconium = α+ β (Change in price of Asset)			
Asset	**α**	**β**	**R^2**
A	1.25	1.03	0.62
B	0.67	1.57	0.81
C	0.01	0.86	0.35
D	4.56	2.30	0.45

A. Asset A

B. Asset B

C. Asset C

D. Asset D

Q-75. Imagine a stack-and-roll hedge of monthly commodity deliveries that you continue for the next five years. Assume the hedge ratio is adjusted to take into effect the mistiming of cash flows but is not adjusted for the basis risk of the hedge. In which of the following situations is your calendar basis risk likely to be greatest?

A. Stack and roll in the front month in oil futures.

B. Stack and roll in the 12-month contract in natural gas futures.

C. Stack and roll in the 3-year contract in gold futures.

D. All four situations will have the same basis risk.

Q-76. Pear, Inc. is a manufacturer that is heavily dependent on plastic parts shipped from Malaysia. Pear wants to hedge its exposure to plastic price shocks over the next 7 ½ months. Futures contracts, however, are not readily available for plastic. After some research, Pear identifies futures contracts on other commodities whose prices are closely correlated to plastic prices. Futures on Commodity A have a correlation of 0.85 with the price of plastic, and futures on Commodity B have a correlation of 0.92 with the price of plastic. Futures on both Commodity A and Commodity B are available with 6-month and 9-month expirations. Ignoring liquidity considerations, which contract would be the best to minimize basis risk?

A. Futures on Commodity A with 6 months to expiration

B. Futures on Commodity A with 9 months to expiration

C. Futures on Commodity B with 6 months to expiration

D. Futures on Commodity B with 9 months to expiration

3.22. Hedging Strategy

3.22.1. 重要知识点

3.22.1.1. Optimal Hedge Ratio

$$h^* = \rho_{S,F}\frac{\sigma_S}{\sigma_F}$$

3.22.1.2. Hedge Effectiveness

$$R^2 = h^{*2}\ \frac{\sigma_F^2}{\sigma_S^2}$$

3.22.1.3. Optimal Number of Futures Contracts

$$N^* = \frac{h^* Q_A}{Q_F}$$

3.22.1.4. Hedging with Stock Index Futures

$$N^* = \beta \times \frac{P}{A}$$

3.22.1.5. Adjusting Portfolio Beta

- $$\text{number of contracts} = (\beta^* - \beta) \times \frac{\text{portfolio value}}{\text{value of futures contract}}$$

3.22.1.6. Duration-Based Hedge Ratio

- $$N^* = \frac{PD_P}{FD_F} = \frac{DV01_P}{DV01_F}$$

3.22.2. 基础题

Q-77. The hedge ratio is the ratio of derivatives to a spot position (or vice versa that achieves an objective such as minimizing or eliminating risk. Suppose that the standard deviation of quarterly changes in the price of a commodity is 0.57, the standard deviation of quarterly changes in the price of a futures contract on the commodity is 0.85, and the correlation between the two changes is 0.3876. What is the optimal hedge ratio for a 3-month contract?

A. 0.1893

B. 0.2135

C. 0.2381

D. 0.2599

Q-78. On Nov 1, Jimmy Walton, a fund manager of a USD 60 million US medium-to-large cap equity portfolio, considers locking up the profit from the recent rally. The S&P 500 index and its futures with the multiplier of 250 are trading at 900 and 910, respectively. Instead of selling off his holdings, he would rather hedge two-thirds of his market exposure over the remaining 2 months. Given that the correlation between Jimmy's portfolio and the S&P 500 index futures is 0.89 and the volatilities of the equity fund and the futures are 0.51 and 0.48 per year respectively, what position should he take to achieve his objective?

A. Sell 250 futures contracts of S&P 500

B. Sell 169 futures contracts of S&P 500

C. Sell 167 futures contracts of S&P 500

D. Sell 148 futures contracts of S&P 500

Q-79. The current value of the S&P 500 index futures is 1457, and each S&P futures contract is

for delivery of 250 times the index. A long-only equity portfolio with market value of USD 300,100,000 has beta of 1.1. To reduce the portfolio beta to 0.75, how many S&P futures contract should you sell?

A. 288 contracts

B. 618 contracts

C. 906 contracts

D. 574 contracts

Q-80. A trader executes a $420 million 5-year pay fixed swap (duration 4.433) with one client and a $385 million 10 year receive fixed swap (duration 7.581) with another client shortly afterwards. Assuming that the 5-year rate is 4.15% and 10-year rate is 5.38% and that all contracts are transacted at par, how can the trader hedge his position?

A. Buy 4,227 Eurodollar contracts

B. Sell 4,227 Eurodollar contracts

C. Buy 7,185 Eurodollar contracts

D. Sell 7,185 Eurodollar contracts

Q-81. A bronze producer will sell 1,000 mt (metric tons) of bronze in three months at the prevailing market price at that time. The standard deviation of the change in the price of bronze over a 3-month period is 2.6%. The company decided to use 3-month futures on copper to hedge the exposure. The copper futures contract is for 25mt of copper. The standard deviation of the futures price is 3.2%. The correlation between 3-month changes in the futures price and the price of bronze is 0.77. To hedge its price exposure, how many futures contracts should the company buy/sell?

A. Sell 38 futures

B. Buy 25 futures

C. Buy 63 futures

D. Sell 25 futures

3.23. Strip Hedge and Stack Hedge

3.23.1. 基础题

Q-82. An oil producer has an obligation under an agreement to supply 75,000 barrels of oil every month for one year at a fixed price. He wishes to hedge his liability to address the event of an upward surge in oil prices. The producer has opted for a stack and roll hedge rather than a strip hedge. Which of the following two statements are correct?

I. A strip hedge increases transaction costs owing to active trading each month.

II. A strip hedge tends to have wider bid-ask spreads as compared to a stack & roll hedge.

A. I only

B. II only

C. I and II

D. Neither

Q-83. The spot price of oil is $106, the one-month futures price is $102 and the 12-month futures price is $98. If the spot price and the oil futures curve do not shift at all during the entire one-year period, while the oil producer employs the stack-and-roll hedge (e.g., at the end of the one year, the spot price is unchanged at $106), what will be the net performance of rolling the hedge forward without regard to the underlying future sale of spot oil (ignoring transaction costs)?

A. Losses due to the roll yield

B. Approximately breakeven (no gain or loss)

C. Gains due to the roll yield

D. Not enough information

3.24. Swaps

3.24.1. 重要知识点

3.24.1.1. Interest Rate Swap

- Plain vanilla interest rate swap: exchanges fixed for floating-rate payments over the life of the swap.
- At inception, the value of the swap is zero.
- After inception, the value of the swap is the difference between the present value of the remaining fixed-and floating-rate payments:

$V_{\text{swap to pay fixed}} = B_{\text{float}} - B_{\text{fix}}$

$V_{\text{swap to receive fixed}} = B_{\text{fix}} - B_{\text{float}}$

$B_{\text{fixed}} = (PMT_{\text{fixed},t_1} \times e^{-rt_1}) + (PMT_{\text{fixed},t_2} \times e^{-rt_2}) + \cdots + [(\text{notional} + PMT_{\text{fixed},t_n}) \times e^{-rt_n}]$

$B_{\text{floating}} = [\text{notional} + (\text{notional} \times r_{\text{float}})] \times e^{-rt_1}$

3.24.1.2. Currency Swaps

$V_{\text{swap}}(DC) = B_{DC} - (S_0 \times B_{FC})$

3.24.1.3. Swaptions

- OTC options that give the buyer the right to enter a swap at a fixed point in time at specified terms.

3.24.2. 基础题

Q-84. Consider a $1 million notional swap that pays a floating rate based on 6-month LIBOR and receives a 6% fixed rate semiannually. The swap has a remaining life of 15 months with pay dates at 3, 9 and 15 months. Spot LIBOR rates are as following: 3 months at 5.4%; 9 months at 5.6%; and 15 months at 5.8%. The LIBOR at the last payment date was 5.0%. Calculate the value of the swap to the fixed-rate receiver using the bond methodology.

A. $6,077

B. -$6,077

C. -$5,077

D. $5,077

Q-85. Two companies, C and D, have the borrowing rates shown in the following table.

Borrowing Rates for C and D		
Company	Fixed Borrowing	Floating Borrowing
C	10%	LIBOR+ 50bps
D	12%	LIBOR+ 100bps

According to the comparative advantage argument, what is the total potential savings for C and D if they enter into an interest rate swap?

A. 0.5%

B. 1.0%

C. 1.5%

D. 2.0%

Q-86. An oil driller recently issued USD 250 million of fixed-rate debt at 4.0% per annum to help fund a new project. It now wants to convert this debt to a floating-rate obligation using a swap. A swap desk analyst for a large investment bank that is a market maker in swaps has identified four firms interested in swapping their debt from floating-rate to fixed-rate. The following table quotes available loan rates for the oil driller and each firm:

Firm	**Fixed-rate (in %)**	**Floating-rate (in %)**
Oil driller	4.0	6-month LIBOR + 1.5
Firm A	3.5	6-month LIBOR + 1.0
Firm B	6.0	6-month LIBOR + 3.0
Firm C	5.5	6-month LIBOR + 2.0
Firm D	4.5	6-month LIBOR + 2.5

A swap between the oil driller and which firm offers the greatest possible combined benefit compared with the driller directly issues a floating debt and the counterparty financed with a

fixed rate?

A. Firm A

B. Firm B

C. Firm C

D. Firm D

Q-87. Savers Bancorp entered into a swap agreement over a 2-year period on August 9, 2008, with which it received a 4.00% fixed rate and paid LIBOR plus 1.20% on a notional amount of USD 6.5 million. Payments were to be made every 6 months. The table below displays the actual annual 6-month LIBOR rates over the 2-year period.

Date	6-month LIBOR
Aug 9,2008	3.11%
Feb 9,2009	1.76%
Aug 9,2009	0.84%
Feb 9,2010	0.39%
Aug 9,2010	0.58%

Assuming no default, how much did Savers Bancorp receive on August 9, 2010?

A. USD 72,150

B. USD 78,325

C. USD 117,325

D. USD 156,650

Q-88. Consider the following 3-year currency swap, which involves exchanging annual interest of 2.75% on 10 million US dollars for 3.75% on 15 million Canadian dollars. The spot rate is 1.52 CAD per USD . The term structure is flat in both countries. Calculate the value of the swap in USD if interest rates in Canada are 5% and in the United States are 4%. Assume continuous compounding. Round to the nearest dollar.

A. $152,000

B. $145,693

C. $131,968

D. $127,818

Q-89. As an asset manager, Sarah Peck wishes to reduce her exposure to fixed-income securities and increase her exposure to large-cap stocks. She enters into an equity swap with a dealer on the terms that she will pay the dealer a fixed rate of 5% and receive from him the return on the large-cap stock index. Assume that payments are made

annually and that the notional principal is EUR 50 million. If the large-cap stock index had a value of 10,320 at the beginning of the year and a value of 11,219 at the end of the year, what is the net payment made at the end of the year and which party makes the net payment?

	Net payment made	Party making net payment
A.	EUR 1.86 million	Asset manager
B.	EUR 2.50 million	Dealer
C.	EUR 1.86 million	Dealer
D.	EUR 2.50 million	Asset manager

Q-90. The yield curve is upward sloping and a portfolio manager has a long position in 10-year Treasury notes funded through overnight repurchase agreements. The risk manager is concerned with the risk that market rates may increase further and reduce the market value of the position. What hedge could be put on to reduce the position's exposure to rising rates?

A. Enter into a 10-year pay-fixed and receive-floating interest rate swap.
B. Enter into a 10-year receive-fixed and pay-floating interest rate swap.
C. Establish a long position in 10-year Treasury note futures.
D. Buy a call option on 10-year Treasury note futures.

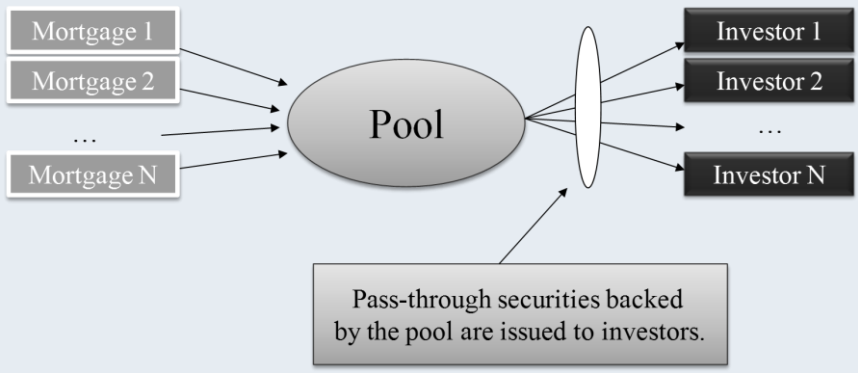
3.25. Mortgage and MBS

3.25.1. 重要知识点

3.25.1.1. Fixed Rate Mortgage Payments

$$X\sum_{n=1}^{12T}\frac{1}{\left(1+\frac{y}{12}\right)^{n}}=B(0)\ ;\ X\frac{12}{y}\left[1-\frac{1}{\left(1+\frac{y}{12}\right)^{12T}}\right]=B(0)$$

3.25.1.2. Mortgage Pass-through Securities



3.25.1.3. Prepayment of Mortgage Loans

$$\mathrm{CPR_n} = 1 - (1 - \mathrm{SMM_n})^{12}$$

3.25.1.4. Dollar Rolls

- Consider an investor who has just purchased a mortgage pool but wants to finance that purchase over the next month. One alternative is an MBS repo. The investor could sell the repo, i.e., sell the pool today while simultaneously agreeing to repurchase it after a month.
- An alternative for financing mortgages is the dollar roll. The buyer of the roll sells a TBA for one settlement month and buys the same TBA for the following settlement month. Two differences: 1) The buyer of the roll may not get back in the later month the same pool delivered in the earlier month. 2) The buyer of the roll does not receive any interest or principal payments from the pool over the roll.

3.25.2. 基础题

Q-91. If a pool of mortgage loans begins the month with a balance of $10,500,000, has a scheduled principal payment of $54,800, and ends the month with a balance of $9,800,000, what is the CPR for this mouth?

A. 6.18%

B. 42.24%

C. 53.47%

D. 66.67%

Q-92. How would you describe the typical price behavior of a low premium mortgage pass-through security?

A. It is similar to a U.S. Treasury bond.

B. It is similar to a plain-vanilla corporate bond.

C. When interest rates fall, its price increase would exceed that of a comparable duration U.S. Treasury bond.

D. When interest rates fall, its price increase would lag that of a comparable duration U.S. Treasury bond.

Q-93. Bennett Bank extends a 5% APR (annual percentage rate) USD 100,000 30-year mortgage requiring monthly payments. If the mortgage is structured so that it requires interest-only payments for the first 5 years, after which point it becomes a self-amortizing mortgage, what would be the portion of the monthly payment applied to the principal in the 61st month?

A. USD 167.92
B. USD 174.60
C. USD 584.59
D. USD 591.27

Q-94. A fixed-income portfolio manager purchases a seasoned 5.5% agency mortgage-Backed security with a weighted average loan age of 60 months. The current balance on the loans is USD 20 million, and the conditional prepayment rate is assumed to be constant at 0.4% per year. Which of the following is closest to the expected principal prepayment this month?

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

Q-95. Consider an investor who wants to finance the purchase of a mortgage pool over a one month period. One alternative is to sell an MBS repo, in which case the investor could sell the pool today while simultaneously agreeing to repurchase it after a month. This trade has the same economics as a secured loan: the investor effectively borrows cash today by posting the pool as collateral, and upon paying back the loan with interest after a month, retrieves the collateral. An alternative is the "dollar roll". In the dollar roll, the buyer of the roll sells a TBA for one settlement month (the "earlier month") and buys the same TBA for the following settlement month (the "later month").

For example, the investor who just purchased a 30-year 4% FNMA pool might sell the FNMA 30-year 4% January TBA and buy the FNMA 30-year 4% February TBA. Delivering the pool just purchased through the sale of the January TBA, which raises cash, and purchasing a pool through the February TBA, which returns cash, is very close to the economics of a secured loan.

But there are two important differences between dollar roll and repo financing:

I. The buyer of the roll may not get back in the later month the same pool delivered in the earlier month. The buyer of the roll delivers a particular pool, for example, in January but will have to accept whatever eligible pool is delivered in the next February. By contrast, an MBS repo seller is always returned the same pool that was originally posted as collateral.

II. The buyer of the roll does not receive any interest or principal payments from the pool over the roll. For example, the buyer of the Jan/Feb roll, who delivers the pool in January,

does not receive the January payments of interest and principal. By contrast, a repo seller receives any payments of interest and principal over the life of the repo. While the prices of TBA contracts reflect the timing of payments, so that the buyer of a roll does not, in any sense, lose a month of payments relative to a repo seller, the risks of the two transactions are different. The buyer of a roll does not have any exposure to prepayments over the month being higher or lower than what had been implied by TBA prices while the repo seller does.

Which of these two differences is (are) correct?

A. Neither is correct.
B. I is true but II is incorrect.
C. I is incorrect but II is true.
D. Both are correct.

Q-96. Mortgage-Backed securities (MBS) are a class of securities where the underlying is a pool of mortgages. Assume that the mortgages are insured, so that they do not have default risk. The mortgages have prepayment risk because the borrower has the option to repay the loan early (at any time) usually due to favorable interest rate changes. From an investor's point of view, a mortgage-backed security is equivalent to holding a long position in a non-prepayable mortgage pool and which of the following?

A. A long American call option on the underlying pool of mortgages.
B. A short American call option on the underlying pool of mortgages.
C. A short European put option on the underlying pool of mortgages.
D. A long American put option on the underlying pool of mortgages.

Q-97. Jack recently completed a Monte Carlo simulation analysis of a CMO tranche. Jack's analysis includes six equally weighted paths, with the present value of each calculated using four different discount rates, which are shown in the following table. If the actual market price of the CMO tranche being valued is 70.17, what is the tranche's option-adjusted spared (OAS)?

Representative Path	PV if Spread is 50 bps	PV if Spread is 60 bps	PV if Spread is 70 bps	PV if Spread is 75 bps
1	70	68	66	65
2	73	70	68	66
3	68	66	64	63
4	71	69	68	67
5	77	75	73	71

6	75	73	71	70

A. 50 basis points

B. 60 basis points

C. 70 basis points

D. 75 basis points

Q-98. In regard to the prepayment option embedded in a mortgage, the borrower (the homeowner) is most similar to:

A. Corporate issuer of a bond with a put option

B. Corporate issuer of a bond with a call option

C. Corporate issuer of a bond with an interest rate cap

D. Corporate issuer of a bond with an interest rate floor

Q-99. A homeowner has a 30-year, 5% fixed-rate mortgage with a current balance of USD 250,000. Mortgage rates have been decreasing. If the existing mortgage was refinanced into a new 30-years, 4% fixed rate mortgage, which of the following is closest to the amount that the homeowner would save in monthly mortgage payments?

A. USD 145

B. USD 150

C. USD 155

D. USD 160

3. Bonds and Basic Derivatives

Q-1. Solution: A

$$R_{forward} = \frac{R_2 T_2 - R_1 T_1}{T_2 - T_1} = \frac{5.0\% \times 4 - 4.6\% \times 3}{4 - 3} = 6.2\%$$

Q-2. Solution: A

With an upward sloping curve, the coupon curve is the lowest, the zero-coupon curve is above the coupon curve and the forward curve is above the zero-coupon curve. The order is reversed if the curve is downward sloping.

Q-3. Solution: D

The forward rate can be inferred from $(1 + R_4)^4 = (1 + R_3)^3(1 + F_{3,4})$. Solving, this gives $F_{3,4} = (85.16/79.81) – 1 = 0.067$.

Q-4. Solution: B

$$e^{5\%} \times e^{F_{1,2}} = e^{6\% \times 2}$$

$$5\% + F_{1,2} = 6\% \times 2 \text{ , } F_{1,2} = 7\%$$

Q-5. Solution: C

1-year forward rate one year from today = $1.07^2/1.045 – 1 = 9.56\%$

1-year forward rate two years from today = $1.09^3/1.07^2 – 1 = 13.11\%$

2-year forward rate one year from today = $(1.09^3/1.045)^{0.5} – 1 = 11.32\%$

Q-6. Solution: D

Computing the 2-year forward swap rate starting in three years:

$$(1+4.50\%)^5 = (1+3.50\%)^3 \times (1+r)^2$$

r = 6.02%

Q-7. Solution: D

The forward curve will be above the spot curve when the spot curve is rising. The forward curve will also cross the spot curve when the spot curve reaches its maximum (or extreme) value. The forward curve will be below the spot curve when the spot curve is declining. The only chart that reflects these three conditions is choice D.

Q-8. Solution: C

C is correct. The current annual yield on both the coupon and zero-coupon bonds are the same at 6% if rates are higher than 6% then the coupon bond would be preferred due to higher reinvestment income.

A is incorrect. If the interest rate are expected to rise, coupon bonds would be more attractive

because investors can reinvest the coupon at higher interest rates.

B is incorrect. If the interest rate are expected to rise, coupon bonds would be more attractive because investors can reinvest the coupon at higher interest rates.

D is incorrect. Falling interest rates below the yield to maturity would mean lower reinvestment income for the coupon bond, which makes the coupon bond less attractive.

Q-9. Solution: B

The future value of $1 invested for time t is 1/d(t).

$$\mathrm{d}(0.5) = \frac{100.6260}{(100 + 2.875/2)} = 0.9920$$

$$\mathrm{d}(1.0) = \frac{99.4525 - 1.25\mathrm{d}(0.5)}{(100 + 2.5/2)} = 0.9700$$

$$\mathrm{d}(1.5) = \frac{100.3800 - 2.375\mathrm{d}(0.5) - 2.375\mathrm{d}(1.0)}{(100 + 4.75/2)} = 0.9350$$

Q-10. Solution: A

The promises of corporate bond issuers and the rights of investors who buy them are set forth in great detail in contracts generally called indentures. The indenture is made out to the corporate trustee as a representative of the interests of bondholders; that is, the trustee acts in a fiduciary capacity for investors who own the bond issue.

Q-11. Solution: D

Trustees are not required to take actions to monitor indenture covenant compliance.Trustees can only perform the actions indicated in the indenture but are typically under no obligation to exercise the powers granted by the indenture even at the request of bondholders. It is true that the trustee is paid by the debt issuer, not by bond holders or their representatives.

Q-12. Solution: C

Since zero-coupon bonds have no coupons, there is nothing to reinvest. They are subject to all of the other risks listed, however.

Q-13. Solution: A

According to the Trust Indenture Act, if a corporate issuer fails to pay interest or principal, the trustee may declare a default and take such action as may be necessary to protect the rights of bondholders. Trustees can only perform the actions indicated in the indenture, but are typically under no obligation to exercise the powers granted by the indenture even at the request of bondholders. The trustee is paid by the debt issuer, not by bond holders or their representatives.

Q-14. Solution: C

Step 1: Compute semiannual zero rates for the 1-and 3-year bonds.

1-year bond: FV = 100; N = 2; PMT = 0, PV = -95.18, CPT: I/Y = 2.5008 × 2 = 5.0%

3-year bond: FV = 100; N = 6; PMT = 0, PV = -83.75, CPT: I/Y = 3 × 2 = 6%

Step 2: Use linear interpolation on zero rates for 2-year bond

(6% – 5%)/2 = 0.5%, zero rates for 2-year bonds = 5% + 0.5% = 5.5%

Step3: Compute 2-year bond price

FV = I00; N = 4; PMT = 0, I/Y = 2.75(5.5/2), CPT: PV = -89.72

Q-15. Solution: C

The expected value of the zero coupon bond one year from now is given by:

$$5\% \times \frac{100}{1+(4\%+0.004)} + 85\% \times \frac{100}{1+(4\%+0.008)} + 10\% \times \frac{100}{1+(4\%+0.015)} = 95.37$$

Q-16. Solution: C

The dirty price of the bond 90 days ago is calculated as N = 10, I/Y = 2.5, PMT = 30, FV = 1,000; CPT→PV = 1,043.76. Adjusting the PV for the fact that there are only 90 days until the receipt of the first coupon, then the dirty price now is $1{,}043.76 \times 1.025^{(90/180)} = 1056.73$. Clean price = dirty price – accrued interest = 1056.73 – 30 × (90/180) = 1041.73.

Q-17. Solution: D

We first need the invoice price. We can price the bond as of the last coupon date: PV (at 2/15/2014) = -PV(2.0%, 7, 325, 10000) = $10,809.00,

Then we can compound this forward to settlement date, with the given yield, such that: Invoice (aka, Full) Price = PV(at 7/1/2014) = $\$10{,}809.00 \times (1+4\%/2)^{136/181} = \$10{,}971.03$.

Finally, we extract the bond's quoted price:

As $\text{AI} = \$10{,}000 \times 6.5\%/2 \times 136/181 = \$244.20$,

Quoted Price = Invoice Price - AI = $\$10{,}971.03 - \$244.20 = \$10{,}726.83$.

Q-18. Solution: B

$\text{A} = \text{e}^{-0.02\times0.5} + \text{e}^{-0.03\times1.0} + \text{e}^{-0.04\times1.5} + \text{e}^{-0.05\times2.0} = 3.80710$.

$\text{Par yield} = [1 - 1 \times \text{e}^{-0.05\times2.0}] \times 2/3.80710 = 4.99922\%$; i.e., assumes semi-annual coupons and gives answer under semi-annual compounding.

The continuous par yield is therefore $= 2 \times \text{LN}(1 + 4.99922\%/2) = 4.94\%$

Q-19. Solution: D

Assuming parallel movements to the yield curve, the expected price change is:

$\Delta P = -P \times \Delta y \times D$

P is the current price or net present value.

Δy is the yield change.

D is duration

All else equal, a negative impact of yield curve move is stronger in absolute terms at the bond which is currently priced higher. Upward parallel curve movements makes bonds cheaper.

Q-20. Solution: C

In order to change her interest rate exposure by acquiring securities with negative duration, the manager will need to invest in securities that decrease in value as interest rates fall (and increase in value as interest rates rise).

Zero coupon bonds with long maturity will increase in value as interest rates fall, so calls on these bonds will increase in value as rates fall but puts on these bonds will decrease in value and this makes C the correct choice.

Interest-only strips from long maturity conforming mortgages will decrease in value as interest rates fall, so puts on them will increase in value, while principal strips on these same mortgages will increase in value, so calls on them will also increase in value.

Q-21. Solution: A

DV01 may not be a reliable measure when interest rates changes are not small. Also, when applying DV01 we assume that the yield curve shifts are parallel.

Q-22. Solution: B

(A)	(B)	(C)	(D)	(E)
Bond	**Value (USD)**	**Modified Duration**	**(B × C)**	**(D/B)**
1	4,000,000	7.5	30,000,000	
2	2,000,000	1.6	3,200,000	
3	3,000,000	6	18,000,000	
4	1,000,000	1.3	1,300,000	
SUM	10,000,000		52,500,000	5.25

The portfolio modified duration is 5.25. This is obtained by multiplying the value of each bond by the modified duration(s), then taking the sum of these products, and dividing it by the value of the total bond portfolio.

The change in the value of the portfolio will be -10,000,000 × 5.25 × 0.1% = -52,500

Q-23. Solution: B

D = $(P_- - P_+)/(2P_0 \triangle Y)$ = (96.35 – 92.75)/ (2 × 94.65 × 0.003) = 6.34

Q-24. Solution: A

$$D = \frac{V_- - V_+}{2 \times V_0 \times \Delta y} = \frac{127.723 - 122.164}{2 \times 125.482 \times 0.003} = 7.38$$

Q-25. Solution: D

The call option reduces the bond price, therefore the bond with no embedded options will be the sum of the callable bond price and the call option price.

Therefore the price of the bond with no embedded options at a rate of 4.98% would be 104.1657 and the price at a rate of 5.02% would be 102.9351.

DV01 is a measure of price sensitivity of a bond. To calculate the DV01, the following equation is used:

$$DV01 = -\frac{\Delta P}{10{,}000 \times \Delta y}$$

Where ΔP is the change in price and Δy is the change in yield. Therefore

$$DV01 = -\frac{102.9351 - 104.1657}{10{,}000 \times (5.02\% - 4.98\%)} = 0.3077$$

Q-26. Solution: B

Convexity is defined as the second derivative of the price-rate function divided by the price of the bond. To estimate convexity, one must first estimate the difference in bond price per difference in the rate for two separate rate environments, one a step higher than the current rate and one a step lower. One must then estimate the change across these two values per difference in rate. This is given by the formula:

$$C = \frac{1}{P_0} \times \frac{\frac{P_+ - P_0}{\Delta r} - \frac{P_0 - P_-}{\Delta r}}{\Delta r} = \frac{1}{P_0} \times \frac{P_+ - 2P_0 + P_-}{(\Delta r)^2}$$

Where Δr is the change in the rate in one step; in this case, 0.02%.

Therefore, the best estimate of convexity is:

$$C = \frac{1}{101.61158} \times \frac{(100.92189 - 2 \times 101.61158 + 102.07848)}{(0.02\%)^2} = -54{,}814$$

Q-27. Solution: C

To construct a barbell portfolio with the same cost and same duration as the bullet:

Cost of bullet = (106.443/100) ×USD 60,000,000 = USD 63,865,800

If V_2 and V_{15} are values (costs) of the 2-Year and 15-Year Treasuries, respectively, then,

$V_2 + V_{15}$ = USD 63,865,800 (1)

Therefore, to match duration:

Duration of bullet = weighted-average duration of 2-year and 15-year Treasuries

$6.272 = (V_2/63,865,800) \times 1.938 + (V_{15}/63,865,800) \times 11.687$ (2)

From Equation (1), $V_2 = 63,865,800 - V_{15}$. Then, Equation (2) becomes:

$6.272 = [(63,865,800 - V_{15})/63,865,800)] \times 1.938 + (V_{15}/63,865,800) \times 11.687$

$400,566,297.6 = 123,771,920.4 - 1.938V_{15} + 11.687V_{15}$

$276,794,377.2 = 9.749V_{15}$

And so, V_{15} = USD 28,392,078.90

And so, $V_2 = 63,865,800 - V_{15} = 63,865,800 - 28,392,078.90$ = USD 35,473,721.10

Giving weight of 2-Year Treasury = 35,473,721.10/63,865,800 = 55.54%

And weight of 15-year Treasury = 28,392,078.90/63,865,800 = 44.46%

A is incorrect. It incorrectly calculates the weights based on duration as: weight of 2-Year T = 1.938/(1.938 + 11.687) = 14.22%; and weight of 15-year T = 1 – 0.1422 = 85.78%.

B is incorrect. It switches the weights derived in C above.

D is incorrect. It switches the weights explained in A above.

Q-28. Solution: A

Option-free bonds have positive convexity and the effect of (positive) convexity is to increase the magnitude of the price increase when yield fall and to decrease the magnitude of the price decrease when yields rise.

Q-29. Solution: A

If a consol (perpetual) bond with a $100 face value pays a 3.0% coupon in perpetuity and the yield is 5.0%, the consol's price is $60 and its modified duration is 20 years. Each of the other three answers are FALSE (or not necessarily true):

In regard to (B), the barbell outperforms if rates move by a large amount, but the bullet outperforms if rates move by a small amount.

In regard to (C), duration and convexity are increasing with maturity, but DV01 is not necessarily increasing with maturity for (deeply) discounted bonds: DV01 = P*mod duration/10,000 such that with increasing maturity, mod duration in the numerator is increasing ("duration effect") but (think about "pull to par" in reverse), the (P) is decreasing with maturity (the "price effect").

In regard to (D), this is false as both portfolio duration and convexity are (simple) weighted averages.

Q-30. Solution: D

The solution is to replicate the 1 year 8% bond using the other two treasury bonds. In order to replicate the cash flows of the 8% bond, you could solve a system of equations to determine the weight factors, F_1 and F_2, which correspond to the proportion of the zero and the 10% bond to be held, respectively.

The two equations are as follows:

$(100 \times F_1) + (105 \times F_2) = 104$ (replicating the cash flow including principal and interest payments at the end of 1 year), and $(5 \times F_2) = 4$ (replicating the cash flow from the coupon payment in 6 months.)

Solving the two equations gives us $F_1 = 0.2$ and $F_2 = 0.8$. Thus the price of the 8% bond should be $0.2 \times 96.12 + 0.8 \times 106.2 = 104.18$.

Q-31. Solution: C

$$(2.875/2 + 100)X_1 + (6.25/2 + 100)(1 - X_1) = (4.5/2 + 100)$$
$$X_1 = 0.52$$
$$\text{Price} = 0.52 \times 94.40 + (1 - 0.52) \times 101.30 = 97.71$$

Q-32. Solution: C

Single-factor models assume that any change in any rate across the maturity spectrum can indicate changes across the maturity spectrum can indicate changes across any other portion of the curve.

Q-33. Solution: C

The 10 basis point shock to the 10-year yield is supposed to decline linearly to zero for the 20-year yield. Thus, the stock decrease by 1 basis point per year and will result in an increase of 6 basis points for the 14-year yield.

Q-34. Solution: D

Key rate exposures assume that key rates chosen adjacent to the rate of interest are affected, not across other key rates.

Q-35. Solution: C

Key rate'01 with respect to the 30-year shift is calculated as follows:

-1/10,000 (25.01254 − 25.11584) / (0.01%) = 0.103 or 25.01254-25.11584=0.103

This implies that the C-strip decreases in price by 0.103 per 100 face amount for a positive one basis point 30-year shift.

Q-36. Solution: D

Key rate duration for the 30-year shift is calculated as follows:

-1/25.11584 (25.01254 − 25.11584) / (0.01%) = 41.13

Q-37. Solution: D

A callable bond includes an embedded option for the issuer to call the bond at a stated redemption or call price. If the issuer is long the call option, then the holder of a callable bond is short the call option.

Q-38. Solution: B

Callable bond can be decomposed into a long position in a straight bond minus a call option on the bond price. Putable bond can be decomposed into a long position in a straight bond plus a put option on bond price.

Q-39. Solution: A

As yields in the market declines, the probability that the call option will get exercised increases. This causes the price to reduce relative to an otherwise comparable option free bond, which is also known as a negative convexity.

Q-40. Solution: C

All else equal, convexity increase for longer maturities, lower coupons, and lower yields.

Bonds with embedded options (e.g., callable bonds) exhibit negative convexity over certain ranges of yields while straight bonds with no embedded options exhibit positive convexity over the entire range of yields.

Q-41. Solution: B

Q-42. Solution: D

Loss mutualization is a feature of central clearing, whereby losses arising from a party's default are spread across all other members. Bilaterally cleared OTC derivatives do not have a loss mutualization feature.

Q-43. Solution: B

Exchanges set specific prices and standardize contracts. They do not negotiate prices bilaterally. Price negotiation through a bilateral process is a feature of the OTC derivatives market.

Q-44. Solution: A

Dell's reservations describe moral hazard and procyclicality, respectively. In central clearing, moral hazard is the risk that members have less incentive to monitor risk knowing that the CCP assumes

most of the risks of the transactions. Procyclicality describes a scenario where a CCP increases margin requirements (initial margin) in volatile markets or during a crisis, which may aggravate systemic risk. Offsetting describes the elimination of duplicate bilateral contracts by transacting through a CCP, which improves flexibility and reduces costs. Adverse selection is the risk that participants with a better understanding of product risks and pricing will trade more products whose risks the CCP underprices, and fewer products whose risks the CCP overprices.

Q-45. Solution: D

Clearinghouse members are required to provide not only original and variation margin to maintain their own and customer positions, but also must maintain a large guaranty deposit with the clearinghouse. The deposit, or reserve, must be maintained with the clearinghouse as long as the firm is a member of the clearinghouse. The deposit can be made with cash, securities, or letters of credit. The clearinghouse has access to the funds at all times to meet the financial needs of any defaulting member.

Q-46. Solution: A

Futures market physical delivery is made easier by having the clearinghouse as the counterparty on every trade. Direct deliveries can be made by a short to a long even though the two parties never actually trade with one another. The clearinghouse receives delivery notices from sellers (shorts) and assigns the notices to buyers (longs).

Q-47. Solution: B

An FRA defined as $t_1 \times t_2$ involves a forward rate starting at time t_1 and ending at time t_2. The buyer of this FRA locks in a borrowing rate for months 3 to 5.This is equivalent to borrowing for five months and reinvesting the funds for the first two months.

Q-48. Solution: C

The payoff to the company $= \$10\ \text{MM} \times (6.0\% - 5.0\%) \times 0.25 = \$25{,}000$; i.e., if LIBOR goes up, the companies borrowing cost will increase but the FRA will hedge by paying the company But the FRA settles at T = 1.0, such that payoff $= \$25{,}000 \,/\, (1 + 6.0\% \times 0.25) = \$24{,}631$

Q-49. Solution: B

Step 1: Initial margin \$12,500 × 60 = \$750,000; Maintenance margin\$10,000 × 60 = \$600,000

Step 2: The first day lose = (1,000 – 995) × 250 × 60 = \$75,000,

So the first day value = \$750,000 – \$75,000 = \$675,000>\$600,000

It will not require a variation margin to bring the position to the proper margin level.

Q-50. Solution: B

Q-51. Solution: A

The maintance margin = 75% × $14,000 = $10,500 per contract;the margin call occurs when the loss is $3,500 per contract or $35 per ounce.

That is, if gold drops from $1,400 to $1,365 then value of margin account,per contract,drop $3,500 ($35 × 100) which is 25% of the initial margin.

Q-52. Solution: C

In regard to (A), a market order sells immediately and does not meet the first objective.

In regard to (B), a sell limit will try to execute if the price rises to $37 and does not meet the first objective.

In regard to (C), the stop-loss becomes a market order once the stock drops to $30 and therefore best meets the second objective.

In regard to (D), the stop becomes a limit at $30 and risks not being filled so does not meet the second objective as well as the stop-loss.

Q-53. Solution: A

A market-if-touched order executes at the best available price once a trade occurs at the specified or better price. A stop order executes at the best available price once a bid/offer occurs at the specified or worse price. A discretionary order allows a broker to delay execution of the order to get a better price. A fill-or-kill order executes the order immediately or not at all.

Q-54. Solution: C

Cost of bond A: (102-14/32) – (103-17/32) × 0.98 = 0.9769

Cost of bond B: (106-19/32) – (103-17/32) × 1.03 = -0.0435

Cost of bond C: (98-12/32) – (103-17/32) × 0.952 = -0.1868

Q-55. Solution: C

Government bond futures decline in value when interest rates rise, so the housing corporation should short futures to hedge against rising interest rates.

Q-56. Solution: C

Futures rate exceeds the forward rate.

Q-57. Solution: A

$$\text{futures rate} = \text{forward rate} + \left(\frac{1}{2}\right)\sigma^2 t_1 t_2$$

$$\text{futures rate (annual)} = (100 - 97)\% = 3\%$$

$$\text{futures rate (quarterly)} = 3\% \times \frac{90}{360} = 0.75\%$$

$$\text{futures rate (continuous)} = \ln(1.0075) \times \frac{360}{90} = 2.99\%$$

$$\text{forward rate} = 2.99\% - (1/2)\,(1\%^{2})\,(4)\,(4.25) = 2.90\%$$

Q-58. Solution: B

The formula for computing the forward price on a financial asset is:

$F_{0,T} = S_0 \times e^{(r-\delta)\times T}$

Where S_0 is the spot price of the asset, r is the continuously compounded interest rate, and δ is the continuous dividend yield on the asset.

The no-arbitrage futures price is computed as follows:

$750 \times e^{(0.035 - 0.02)\times 0.5} = 755.65$

Since the market price of the futures contract is higher than this price, there is an arbitrage opportunity. The futures contract could be sold and the index purchased.

Q-59. Solution: C

The 1-year futures price should be $1{,}000 \times e^{0.01} = 1{,}010.05$

The 2-year futures price should be $1{,}000 \times e^{0.01\times 2} = 1{,}020.20$

The current 2-year futures price in the market is overvalued compared to the theoretical price. To lock in a profit, you would short the 2 year futures, borrow USD 1,000 at 1%, and buy the underlying asset. At the end of the 2nd years, you will sell the asset at USD 1,025 and return the borrowed money with interest, which would be $1{,}000 \times e^{0.01\times 2} = 1{,}020.20$, resulting in a USD 4.80 gain.

Q-60. Solution: C

When an asset is strongly negatively correlated with interest rates, futures prices will tend to be slightly lower than forward prices. When the underlying asset increases in price, the immediate gain arising from the daily futures settlement will tend to be invested at a lower than average rate of interest due to the negative correlation. In this case futures would sell for slightly less than forward contracts, which are not affected by interest rate movements in the same manner since forward contracts do not have a daily settlement feature.

The other three choices would all most likely result in the futures price being higher than the forward price.

Q-61. Solution: D

This is an example of index arbitrage. The no-arbitrage value of the futures contract can be calculated as the future value of the spot price: $S_0 \times e^{(\text{Risk free rate}-\text{Dividend yield})\times t}$,where S_0 equals the current spot price and t equals the time in years.

Future value of the spot price $= S_0 \times e^{(\text{Risk free rate - Dividend yield})\times t}$

$$= 3{,}625 \times e^{(5\%-2\%)\times 1.25} = 3{,}763.52$$

Since this value is different from the current futures contract price, a potential arbitrage situation exists.

Since the futures price is higher than the future value of the spot price in this case, one can short sell the higher priced futures contract, and buy the underlying stocks in the index at the current price. The arbitrage profit would equal 3,767.52 - 3,763.52 = USD 4.

Q-62. Solution: A

A is correct. The forward price is computed as: $F = Se^{(r+\lambda-c)\times T}$

And the commodity lease rate (δ) is computed as δ = c $^{-\lambda}$.*So,* the forward price can alternatively be expressed in terms of lease rate and risk-free rate as: $F = Se^{(r-\delta)\times T}$

Therefore, as the risk-free rate falls below the lease rate (r <δ= c –λ), we can see from the forward price formula above that F < S, and the forward curve will be in backwardation.

Q-63. Solution: C

Step 1. The spot is quoted in terms of Swiss Francs per USD, theoretical future price of USD = 1.368 × $e^{(0.35\% - 1.05\%) \times 3/12}$ = 1.368 × 0.99825 = 1.36561 CHF

Step 2. 3-month future price is USD 0.7350 → 1/0.7350 = 1.3054 CHF

Step 3. 1.36561 CHF > 1.3054 CHF → USD future contract is undervalued

Step 4. Arbitrage strategies: borrow USD (buy CHF) spot, buy USD (short CHF) future.

Q-64. Solution: C

The forward rate, F_t, is given by the interest rate parity equation:

$F_t = S_0 \times e^{(r - r_f) \times t}$

where S_0 is the spot exchange rate, r is the domestic (USD) risk-free rate, and r_f is the foreign (EUR) risk-free rate, t is the time to delivery.

Substituting the values in the equation:

$F_t = 1.25 \times e^{(0.04 - 0.07) \times 1} = 1.21$

Q-65. Solution: B

Step1: Calculate implicit lease rate = 0.07 – 0.0150 = 5.5%.

Step2: The forward price ($43.11) is higher than the spot price ($42.47), the market for Commodity X is currently in contango.

Step 3: If annual risk-free rate immediately fell to 5.0%, holding the lease rate constant, forward price 42.487($se^{(r-\delta)t} = 42.47e^{(0.05-0.055)}$) is lower than the spot price ($42.47) the market would be in backwardation.

Q-66. Solution: B

When forward prices are as a discount to spot prices, a backwardation market is said to exist. The relatively high spot price represents a convenience yield to the consumer that holds the commodity for immediate consumption.

Q-67. Solution: B

Q-68. Solution: B

The forward price is computed as follows:

$F_0 = 100 \times (F_0 - K)\, e^{-rT} = 100 \times (1050 - 1000)\, e^{-4\% \times 0.75} = 4{,}852$

Q-69. Solution: B

The value of the contract for the bank at expiration: 40,000,000 GBP × 0.80 EUR per GBP

The cost to close out the contract for the bank at expiration: 40,000,000 GBP × 0.85 EUR per GBP

Therefore, the final payoff in EUR to the bank can be calculated as: 40,000,000 × (0.80 – 0.85) = -2,000,000 EUR.

Q-70. Solution: D

The CFO's analysis is incorrect because there is unlimited downside risk. The option premium received is a fixed amount, and if the EUR declines sharply, the value of the underlying receivable goes down as well. If instead the EUR moves in a narrow range, that would be good, but there is no guarantee of course that this will occur.

Q-71. Solution: C

"II" is the only true statement. A short hedge position or a short forward contract benefits from any unexpected decline in future prices and subsequent strengthening of basis. An increase in basis is known as a strengthening of the basis. The payoff to the short hedge position is spot price at maturity (S_2) and the difference between futures price i.e., ($F_1 - F_2$). Thus, payoff = $S_2 + F_1 - F_2 = F_1 + b_2$, where b_2 is the basis.

Basis risk can also arise if underlying asset and hedge asset are identical. This can happen if the maturity of the hedge contract and the delivery date of asset do not match. A long hedge position benefits from weakening of basis.

Q-72. Solution: C

Basis T1 = $7.00 - $9.00 = -$2.00.

Basis T2 = $7.30 - $9.10 = -$1.80

Basis change = -1.80 - (-2.00) = +0.20

Q-73. Solution: C

The farmer needs to be short the futures contracts. The two sources of basis risk confronting the farmer will result from the fact that he is using a cattle contract to offset the price movement of his buffalo herd. Cattle prices and buffalo prices may not be perfectly positively correlated. As a result, the correlation between buffalo and cattle prices will have an impact on the basis of the cattle futures contract and spot buffalo meat. Also the delivery date is a problem in this situation, because the farmer's hedge horizon is winter, which probability will not commence until December or January. In order to maintain a hedge during this period, the farmer will have to enter into another futures, which will introduce an additional source of basis risk.

Q-74. Solution: B

Futures on an asset whose price changes are most closely correlated with the asset you are looking to hedge will have the least basis risk. This is determined by examining the R^2 of the regressions and choosing the highest one. R^2 is the most applicable statistic in the above chart to determine correlation with the price of Zirconium.

Q-75. Solution: A

The oil term structure is highly volatile at the short end, making a front-month stack-and-roll hedge heavily exposed to basis fluctuations. In gold, the term structure rarely moves much at all and won't begin to compare with oil and gas.

Q-76. Solution: D

In order to minimize basis risk, one should choose the futures contract with the highest correlation to price changes, and the one with the closest maturity, preferably expiring after the duration of the hedge.

Q-77. Solution: D

The optimal hedge ratio can be determined by the formula:

$$h = \rho_{s,f} \times \frac{\sigma_s}{\sigma_f} = 0.3876 \times \frac{0.57}{0.85} = 0.2599$$

Q-78. Solution: C

The optimal hedge ratio is the product of the coefficient of correlation between the change in the spot price and the change in futures price, and the ratio of the volatility of the equity fund and the futures.

Two-thirds of the equity fund is worth USD 40 million. The optimal hedge ratio computed:

h = 0.89 × (0.51 / 0.48) = 0.945

Computing the number of futures contracts:

N = 0.945 × 40,000,000 / (910 × 250) = 166.26 ≈ 167, round up to nearest integer.

Q-79. Solution: A

This is as in the previous question, but the hedge is partial, i.e. for a change of 1.10 to 0.75. So,

$$N=(\beta_{new} - \beta_{old}) \times \frac{\text{size of spot position}}{\text{size of one futures contract}} = (0.75 - 1.1) \times \frac{300,100,000}{250\times1,457} = -288$$

Q-80. Solution: B

Step1. First swap is equivalent to a short position in a bond with similar coupon characteristics and maturity offset by a long position in a floating-rate note.

Its DV01=420×4.433×0.0001=0.186.

Step2. Second swap is equivalent to a long position in a bond with similar coupon characteristics and maturity offset by a short position in a floating-rate note.

Its DV01=385×7.581×0.0001=0.291.

Step3. Net DV01 of portfolio = -0.186+ 0.291 = 0.105m = 105,683

Step4. The optimal number is N^*= -$DV01_S$/$DV01_F$= -105,683/25 = -4,227 (Note that the DVBP of the Eurodollar futures is about 25.)

Q-81. Solution: D

To hedge the exposure, the company should sell futures and not buy.

The number of contracts to sell is:

$$N = \text{hedge ratio} \times \frac{1,000}{25} = 0.77 \times \frac{2.6\%}{3.2\%} \times \frac{1,000}{25} = 25$$

Q-82. Solution: B

Statement II is correct. A strip hedge tends to have lower liquidity and wider bid-ask spreads owing to longer maturity contracts.

A strip hedge involves hedging a stream of obligations by offsetting each individual obligation with a futures contract matching the maturity and quantity of the obligation. Stacking futures contracts in the near-term contract and rolling over into the new near-term contracts is referred to as a stack and roll.

Statement I is incorrect. A strip hedge involves one time buying of futures contracts to match the maturity of liabilities.

Q-83. Solution: A

In backwardation, the roll yield generates losses for the short position; i.e., the short will generally enter each one month contract at $102 and exit near the spot (convergence!) at $106. The roll yield is profitable to the long position in backwardation.

Q-84. Solution: D

$$B_{fixed} = (PMT_{fixed,t_1} \times e^{-rt_1}) + (PMT_{fixed,t_2} \times e^{-rt_2}) + \cdots + [(notional + PMT_{fixed,t_n}) \times e^{-rt_n}]$$

$$= (\$30{,}000 \times e^{-0.054 \times 0.25}) + (\$30{,}000 \times e^{-0.056 \times 0.75}) + \cdots + [(\$1{,}000{,}000 + \$30{,}000) \times e^{-0.058 \times 1.25}]$$

$$= \$29{,}598 + \$28{,}766 + \$957{,}968 = \$1{,}016{,}332$$

$$B_{floating} = (notional + notional \times \frac{r_{floating}}{2}) \times e^{-rt_1}$$

$$= (\$1{,}000{,}000 + \$1{,}000{,}000 \times \frac{0.05}{2}) \times e^{-0.0054 \times 0.25} = \$1{,}011{,}255$$

$$V_{swap} = B_{fixed} - B_{floating} = \$1{,}016{,}332 - \$1{,}011{,}255 = \$5{,}077$$

Q-85. Solution: C

The difference of the differences is (12% – 10%) – [LIBOR + 1% – (LIBOR + 0.5%)] = 1.5%.

Q-86. Solution: C

Since the oil driller is swapping out of a fixed-rate and into a floating-rate, the larger the difference between the fixed spread and the floating spread the greater the combined benefit. See table below:

Firm	Fixed-rate	Floating-rate	Fixed-spread	Floating-spread	Possible Benefit
Oil driller	4.0	1.5			
Firm A	3.5	1.0	-0.5	-0.5	-0.0
Firm B	6.0	3.0	2.0	1.5	0.5
Firm C	5.5	2.0	1.5	0.5	1.0
Firm D	4.5	2.5	0.5	1.0	-0.5

Q-87. Solution: B

The proper interest rate to use is the 6-month LIBOR rate at February 9, 2010, since it is the 6-month LIBOR that will yield the payoff on August 9, 2010. Therefore the net settlement amount on August 9th, 2010 is as follows:

Savers receives: 6,500,000×4.00%×0.5 years, or USD 130,000

Savers pays 6,500,000×(0.39% + 1.20%)×0.5, or USD 51,675.

Therefore Savers would receive the difference, or 78,325.

Q-88. Solution: C

$V_{swap}(USD) = B_{USD}$ - (Spot rate × B_{CAD})

$B_{USD} = 275{,}000\ e^{-0.04\times1} + 275{,}000\ e^{-0.04\times2} + 10{,}275{,}000\ e^{-0.04\times3} = USD9{,}631{,}182$

$B_{CAD} = 562{,}500\ e^{-0.05\times1} + 562{,}500\ e^{-0.05\times2} + 15{,}562{,}500\ e^{-0.05\times3} = USD14{,}438{,}805$

$V_{swap}(USD) = 9{,}631{,}182$ - $14{,}438{,}805/1.52 = USD131{,}968$

Q-89. Solution: C

Cash Flows for Peck:

(Inflow at the return (%) on stock index – Outflow at 5%) × Notional principal

Return on stock index = (11219/10320) – 1 = 0.0871 or 8.71%

Net amount owed by the dealer to Peck = 50 M × (0.0871 – 0.05) = 50,000,000 × 0.0371 = EUR 1.86 million

Q-90. Solution: A

Q-91. Solution: C

We use the following formulas: SMM = (prepayment/beg. bal – scheduled principal payment) and $(1 – SMM)^{12} = (1 – CPR)$.

Prepayment = actual payment – scheduled payment = ($10,500,000 – $9,800,000) – $54,800 = $700,000 – $54,800 = $645,200

So: $645,200/($10,500,000 – $54,800) = 0.06177 and CPR = $1 – (1 – 0.06177)^{12} = 0.5347 = 53.47\%$

Q-92. Solution: D

MBSs are unlike regular bonds, Treasuries, or corporates, because of their negative convexity. When rates fall, homeowners prepay early, which means that the price appreciation is less than that of comparable duration regular bonds.

Q-93. Solution: A

N = (30 – 5) × 12, I/Y = 5 ÷12, PV = -100, 0000, FV =0, CPT PMT = -584.59

Interest in the 61st month = 100,000 × 5% / 12 = 416.67

Principal in the 61st month = 584.59 – 416.67 = 167.92

Q-94. Solution: B

SMM=1 – (1 – 0.004)^(1/12) = 0.0334%

N=60, I/Y=5.5/12, PV=-20,000,000, FV=0 CPT PMT=382,023.24

PRN=290,256.58

Expected principal prepayment = (20,000,000 -290,356.58)* 0.0334%=6583.02

Q-95. Solution: D

Both are correct.

Q-96. Solution: B

Prepayment risk is equivalent to an American call option because the borrower can repay at any time and the position is short because the option lies with the borrower.

Q-97. Solution: B

The problem tells us that the market price of the CMO tranche is 70.17. The OAS is the spread that is added to the interest rates along the interest rate path that makes the market and the theoretical value equal. The price of the CMO will be the weighted average of the values of each interest path. Because we are told in the problem that the paths are equally weighted, we simple find the arithmetic average for each path and choose the theoretical value that equals the market price. In this case, the average of the 60bp spread column is

$$\frac{68 + 70 + 66 + 69 + 75 + 73}{6} = \frac{421}{6} = 70.17$$

The OAS must be 60 bps.

Q-98. Solution: B

In a previous section it was noted that mortgage obligors generally have the ability to prepay their loans before they mature either by selling the property or by refinancing the loan to lower their interest rate or monthly payment. For the holder of the mortgage asset, the borrower's prepayment option creates a unique form of risk. In cases where the obligor refinances the loan in order to capitalize on a drop in market rates, the investor has a high-yielding asset payoff that can be replaced only with an asset carrying a lower yield. Prepayment risk is analogous to "call risk" for a corporate and municipal bond in terms of its impact on returns, and it also creates uncertainty with respect to the timing of investor cash flows.

Q-99. Solution: B

Calculate the mortgage payment factors for the 30-year, 5% and 4% fixed rate mortgages, then calculate the mortgage payment savings.

N=30×12, I/Y=5/12, PV=250,000, FV=0, CPT PMT=-1342

N=30×12, I/Y=4/12, PV=250,000, FV=0, CPT PMT=-1194

1342 – 1194 = 148