

CFA L2 Candidates

We've been receiving huge number of requests for help in understanding some challenging Case Studies of CFA Institute core.

Here, we are providing some support (in the form of audio explanation) to help all L2 candidates understand the same. The Case Studies all belong to the CFA Institute—we are just providing some support to help understand the concepts involved.

Hope it helps!

CFA Level II

Fixed Income

Valuation and Analysis : Bonds with Embedded Options

John Smith, an investment adviser, meets with Lydia Carter to discuss her pending retirement and potential changes to her investment portfolio. Domestic economic activity has been weakening recently, and Smith's outlook is that equity market values will be lower during the next year. He would like Carter to consider reducing her equity exposure in favor of adding more fixed-income securities to the portfolio.

Government yields have remained low for an extended period, and Smith suggests considering investment-grade corporate bonds to provide additional yield above government debt issues. In light of recent poor employment figures and two consecutive quarters of negative GDP growth, the consensus forecast among economists is that the central bank, at its next meeting this month, will take actions that will lead to lower interest rates.

Smith and Carter review par, spot, and one-year forward rates (Exhibit 1) and four fixed-rate investment-grade bonds issued by Alpha Corporation which are being considered for investment (Exhibit 2).

Exhibit 1 Par, Spot, and One-Year Forward Rates (annual coupon payments)

Maturity (Years)	Par Rate (%)	Spot Rate (%)	One-Year Forward (%)
1	1.0000	1.0000	1.0000
2	1.2000	1.2012	1.4028
3	1.2500	1.2515	1.3522

Exhibit 2 Selected Fixed-Rate Bonds of Alpha Corporation

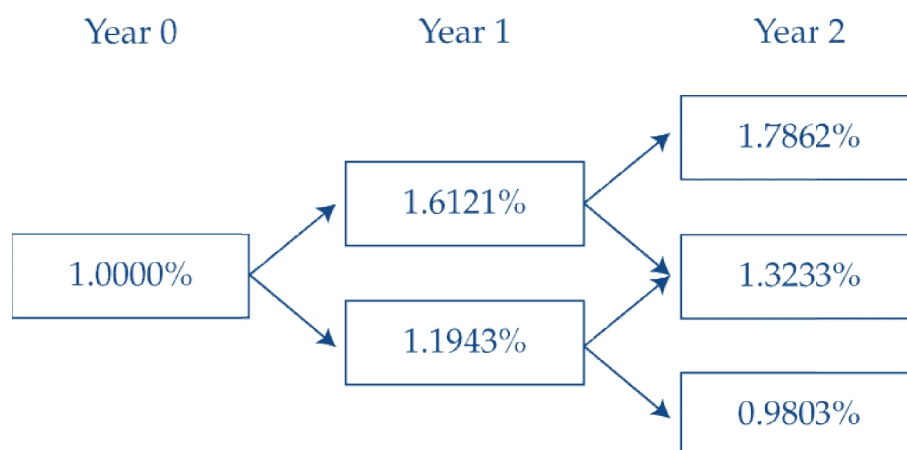
Bond	Annual Coupon	Type of Bond
Bond 1	1.5500%	Straight bond
Bond 2	1.5500%	Convertible bond: currently trading out of the money
Bond 3	1.5500%	Putable bond: putable at par one year and two years from now
Bond 4	1.5500%	Callable bond: callable at par without any lockout periods

Note: All bonds in Exhibit 2 have remaining maturities of exactly three years.

Carter tells Smith that the local news media have been reporting that housing starts, exports, and demand for consumer credit are all relatively strong, even in light of other poor macroeconomic indicators. Smith explains that the divergence in economic data leads him to believe that volatility in interest rates will increase. Smith also states that he recently read a report issued by Brown and Company forecasting that the yield curve could invert within the next six months.

Smith develops a binomial interest rate tree with a 15% interest rate volatility assumption to assess the value of Alpha Corporation's bonds. Exhibit 3 presents the interest rate tree.

Exhibit 3 Binomial Interest Rate Tree for Alpha Corporation 15% Interest Rate Volatility



Carter asks Smith about the possibility of analyzing bonds that have lower credit ratings than the investment-grade Alpha bonds. Smith discusses four other corporate bonds with Carter. Exhibit 4 presents selected data on the four bonds.

Exhibit 4 Selected Information on Fixed-Rate Bonds for Beta, Gamma, Delta, and Rho Corporations

Bond	Issuer	Bond Features	Credit Rating
Bond 5	Beta Corporation	Coupon 1.70% Callable in Year 2 OAS of 45 bps	B
Bond 6	Gamma Corporation	Coupon 1.70% Callable in Year 2 OAS of 65 bps	B
Bond 7	Delta Corporation	Coupon 1.70% Callable in Year 2 OAS of 85 bps	B
Bond 8	Rho Corporation	Coupon 1.70% Callable in Year 2 OAS of 105 bps	CCC

Notes: All bonds have remaining maturities of three years. OAS stands for option-adjusted spread.

Question 80.

Based on Exhibit 2, and assuming that the forecast for interest rates and Smith's outlook for equity returns are validated, which bond's option is *most likely* to be exercised?

- A. Bond 2
- B. Bond 3
- C. Bond 4

Solution

C is correct.

If the central bank takes actions that lead to lower interest rates, the yields on Alpha's bonds are likely to decrease. If the yield to maturity on Bond 4 (callable) falls below the 1.55% coupon rate, the call option will become valuable and Alpha may call the bond because it is in the money.

A is incorrect because if the equity market declines, the market value of Alpha stock will also likely decrease. Therefore, Bond 2 (convertible) would have a lower conversion value, and hence, the conversion option likely would not be exercised. Because Bond 2 is currently trading out of the money, it will likely trade further out of the money once the price of Alpha stock decreases.

B is incorrect because Bond 3 (putable) is more likely to be exercised in an increasing rather than a decreasing interest rate environment.

Question 81.

Based on Exhibit 2, the current price of Bond 1 is *most likely* greater than the current price of:

- A. Bond 2.
- B. Bond 3.
- C. Bond 4.

Solution

C is correct.

All four bonds in Exhibit 2 issued by Alpha Corporation offer the same coupon rate and have the same remaining term to maturity. Bond 4 (callable) most likely has a current price that is less than Bond 1 (straight or option free) because investors are short the call option and must be compensated for bearing call risk. Bond 2 (convertible) most likely has a current price that is greater than Bond 1 because investors are paying for the conversion option embedded in Bond 2 and the option has time value associated with it, even though the option is trading out of the money. Similarly, Bond 3 (puttable) most likely has a current price that is greater than Bond 1 because investors are paying for the put option.

Question 82.

Assuming the forecast for interest rates is proven accurate, which bond in Exhibit 2 will likely experience the smallest price increase?

- A. Bond 1
- B. Bond 3
- C. Bond 4

Solution

C is correct.

The consensus economic forecast is for interest rates to decrease. In an environment of decreasing interest rates, all bond prices should rise ignoring any price impact resulting from any embedded options. When interest rates fall, the value of the embedded call option in Bond 4 (callable) increases, causing an opposing effect on price. The put option of puttable bonds, by contrast, increases in value when interest rates rise rather than decline.

Question 83.

Based on the information in Exhibit 1 and Exhibit 2, the value of the embedded option in Bond 4 is *closest* to:

- A. nil.
- B. 0.1906.
- C. 0.3343.

Solution

C is correct.

Bond 4 is a callable bond. Value of an issuer call option = Value of straight bond – Value of callable bond. The value of the straight bond may be calculated using the spot rates or the one-year forward rates.

Value of an option-free (straight) bond with a 1.55% coupon using spot rates: $1.55/(1.0100)^1 + 1.55/(1.012012)^2 + 101.55/(1.012515)^3 = 100.8789$.

The value of a callable bond (at par) with no lockout period and a 1.55% coupon rate is 100.5446, as shown in the following table:

	Today	Year 1	Year 2	Year 3
Cash flow		1.55	1.55	100 + 1.55
One-year forward		1.0000%	1.4028%	1.3522%
Value of bond	$101.55/1.010000$ = 100.5446	$101.55/1.014028$ = 100.1452 Called at 100	$101.55/1.013522$ = 100.1952 Called at 100	

The value of the call option = $100.8789 - 100.5446 = 0.3343$.

Question 84.

If Smith's interest rate volatility forecast turns out to be true, which bond in Exhibit 2 is likely to experience the greatest price increase?

- A. Bond 2
- B. Bond 3
- C. Bond 4

Solution

B is correct.

An increase in interest rate volatility will cause the value of the put and call options embedded in Bond 3 and Bond 4 to increase. Bond 3 (puttable) would experience an increase in price because the increased value of the put option increases the bond's value. In contrast, Bond 4 (callable) will experience a price decrease because the increased value of the call option reduces the callable bond's value. Bond 2, an out-of-the-money convertible, will resemble the risk–return characteristics of a straight bond and will thus be unaffected by interest rate volatility.

Question 85.

If the Brown and Company forecast comes true, which of the following is *most* likely to occur? The value of the embedded option in:

- A. Bond 3 decreases.
- B. Bond 4 decreases.
- C. both Bond 3 and Bond 4 increases.

Solution

A is correct.

All else being equal, the value of a put option decreases as the yield curve moves from being upward sloping to flat to downward sloping (inverted). Alternatively, a call option's value increases as the yield curve flattens and increases further if the yield curve inverts. Therefore, if the yield curve became inverted, the value of the embedded option in Bond 3 (puttable) would decrease and the value of the embedded option in Bond 4 (Callable) would increase.

Question 86.

Based on Exhibit 2 and Exhibit 3, the market price of Bond 4 is *closest* to:

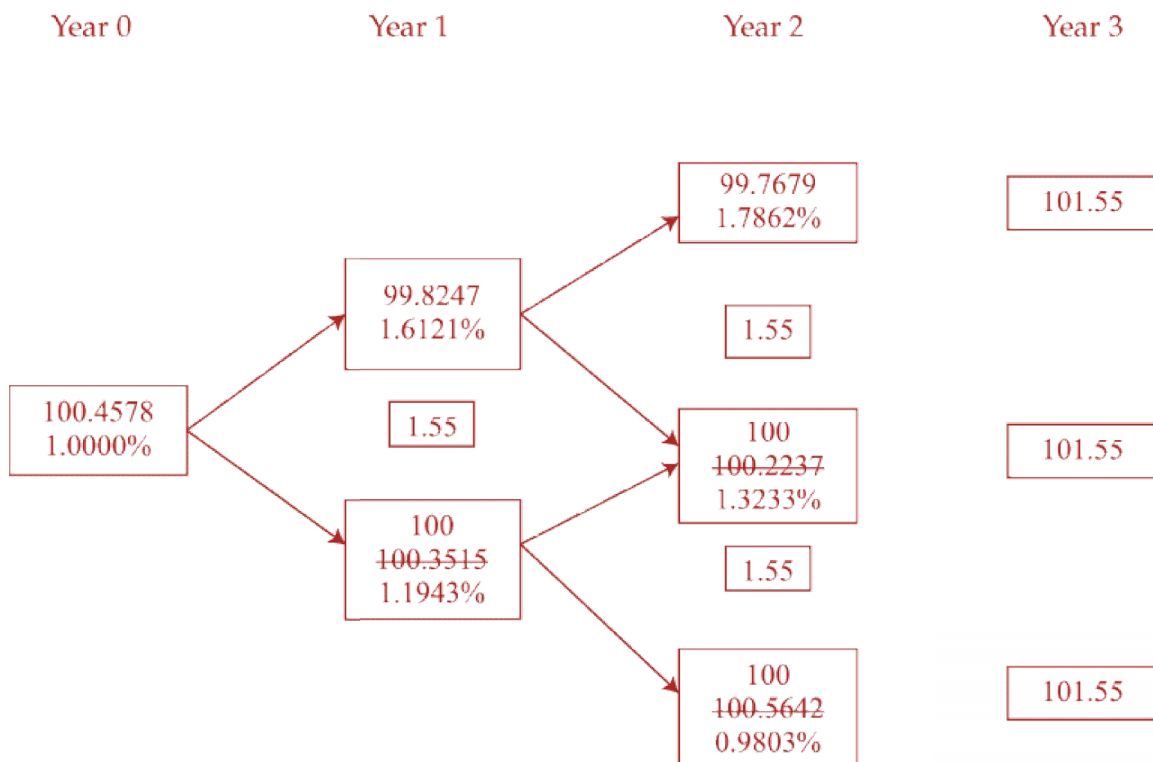
- A. 100.4578.
- B. 100.5123.
- C. 100.8790.

Solution

A is correct.

The market price of Bond 4 using the binomial interest rate tree is 100.4578.

The valuation of Bond 4 (Callable) with a 1.55% coupon, no lockout periods, and 15% volatility is shown in the following table.



Question 87.

Which of the following conclusions regarding the bonds in Exhibit 4 is correct?

- A. Bond 5 is relatively cheaper than Bond 6.
- B. Bond 7 is relatively cheaper than Bond 6.
- C. Bond 8 is relatively cheaper than Bond 7.

Solution

B is correct.

A bond with a larger option-adjusted spread (OAS) than that of a bond with similar characteristics and credit quality means that the bond is likely underpriced (cheap). Bond 7 (OAS 85 bps) is relatively cheaper than Bond 6 (OAS 65 bps).

C is incorrect because Bond 8 (CCC) has a lower credit rating than Bond 7 (B) and the OAS alone cannot be used for the relative value comparison. The larger OAS (105 bps) incorporates compensation for the difference between the B and CCC bond credit ratings. Therefore, there is not enough information to draw a conclusion about relative value.