Valuation and Analysis: Bonds with Embedded Options

Test ID: 7441686

Question #1 of 88

Question ID: 472700

Sharon Rogner, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of her pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. Rogner computes the OAS of bond A to be 50bps using a binomial tree with an assumed interest rate volatility of 15%.

If Rogner revises her estimate of interest rate volatility to 10%, the computed OAS of Bond C would *most likely* be:

- ✓ **A) lower than 50bps.**
- ✗ **B)** higher than 50bps.
- ✗ **C)** equal to 50bps.

Explanation

The OAS of the three bonds should be same as they are given to be identical bonds except for the embedded options (OAS is after removing the option feature and hence would not be affected by embedded options). Hence the OAS of bond C would be 50 bps absent any changes in assumed level of volatility.

When the assumed level of volatility in the tree is decreased, the value of the embedded put option would decrease and the *computed* value of the putable bond would also decrease. The constant spread that is now needed to force the computed value to be equal to the market price is therefore lower than before. Hence a decrease in the volatility estimate reduces the computed OAS for a putable bond.

Question #2 of 88

Question ID: 463808

As the volatility of interest rates increases, the value of a callable bond will:

- ✗ **A) rise if the interest rate is below the coupon rate, and fall if the interest rate is above the coupon rate.**
- ✓ **B)** decline.
- ✗ **C)** rise.

Explanation

As volatility increases, so will the option value, which means the value of a callable bond will decline. Remember that with a callable bond, the investor is short the call option.

Question #3 of 88

Question ID: 472705

Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable at any time at par and bond C is putable at any time at par. Yield curve is currently flat at 3%.

The bond with the lowest one-sided down-duration is *most likely* to be:

✗ **A)** **Bond C.**

✗ **B)** Bond A.

✓ **C)** Bond B.

Explanation

When the underlying option is at (or near) money, callable bonds will have lower one-sided down-duration than one-sided up-duration; the price change of a callable when rates fall is smaller than the price change for an equal increase in rates. In this problem, the coupon rate is given to be equal to the current level of rates and hence the bond should be at par and the underlying option is at-the-money.

Question #4 of 88

Question ID: 472704

Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years.

If interest rates decrease, the duration of which bond is *most likely* to decrease?

✗ **A)** **Bond A.**

✗ **B)** Bond C.

✓ **C)** Bond B.

Explanation

Decrease in rates would increase the likelihood of the call option being exercised and reduce the expected life (and duration) of the callable bond the most.

Question #5 of 88

Question ID: 472708

If a bond has several key rate durations that are negative, it is most likely that the bond is a:

✗ **A)** **Putable bond**

✗ **B)** Callable bond

✓ **C)** Zero coupon bond.

Explanation

Bonds with low (or zero) coupons have negative key rate durations for horizons other than its maturity. This is true for all bonds regardless of whether the bond is callable/putable/straight.

Question #6 of 88

Question ID: 463843

Suppose the market price of a convertible security is $1,050 and the conversion ratio is 26.64. What is the market conversion price?

✗ **A)** **$1,050.00.**

✓ **B)** $39.41.

✗ **C)** $26.64.

Explanation

The market conversion price is computed as follows:

Market conversion price = market price of convertible security/conversion ratio = $1,050/26.64 = $39.41

Question #7 of 88

Question ID: 463796

How does the value of a callable bond compare to a noncallable bond? The bond value is:

✓ **A)** **lower.**

✗ **B)** higher.

✗ **C)** lower or higher.

Explanation

Since the issuer has the option to call the bonds before maturity, he is able to call the bonds when their coupon rate is high relative to the market interest rate and obtain cheaper financing through a new bond issue. This, however, is not in the interest of the bond holders who would like to continue receiving the high coupon rates. Therefore, they will only pay a lower price for callable bonds.

Question #8 of 88

Question ID: 472709

Which bonds would have its maturity-matched rate as its most critical rate?

✗ **A)** **High coupon callable bonds.**

✓ **B)** Low coupon callable bonds.

✗ **C)** Low coupon putable bonds.

Explanation

Callable bonds with low coupon rate are unlikely to be called; hence, their maturity-matched rate is their most critical rate (i.e., the highest key rate duration corresponds to the bond's maturity). Similarly, putable bonds with *high* coupon rates are unlikely to be put and are most sensitive to their maturity-matched rates.

Question #9 of 88

Question ID: 463811

Using the following tree of semiannual interest rates what is the value of a putable bond that has one year remaining to maturity, a put price of 99, coupons paid semiannually with payments based on a 5% annual rate of interest?

7.59%

6.35%

5.33%

✓ **A) 99.00.**

✗ **B)** 98.75.

✗ **C)** 97.92.

Explanation

The putable bond price tree is as follows:

100.00

A → 99.00

99.00 100.00

99.84

100.00

As an example, the price at node A is obtained as follows:

$Price_A$ = max[(prob × (P_{up} + coupon / 2) + prob × (P_{down} + (coupon / 2)) / (1 + (rate / 2)), put price] = max[(0.5 × (100 + 2.5) + 0.5 × (100 + 2.5)) / (1 + (0.0759 / 2)) ,99] = 99.00. The bond values at the other nodes are obtained in the same way.

The calculated price at node 0 =

[0.5(99.00 + 2.5) + 0.5(99.84 + 2.5)] / (1 + (0.0635 / 2)) = $98.78 but since the put price is $99 the price of the bond will not go below $99.

Question #10 of 88

Question ID: 463817

Which kind of risk remains if the option-adjusted spread is deducted from the nominal spread?

✗ **A) credit risk.**

✗ **B)** liquidity risk.

✓ **C)** option risk.

Explanation

The OAS captures the amount of credit risk and liquidity risk.

Question #11 of 88

Question ID: 472702

Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years.

The bond with the lowest duration is *least likely* to be:

✓ **A) Bond A.**

✗ **B)** Bond B.

✗ **C)** Bond C.

Explanation

Bond A is option-free and would have a duration that is equal to or greater than the duration of bonds B and C.

Question #12 of 88

Question ID: 463788

A callable bond, a putable bond, and an option-free bond have the same coupon, maturity and rating. The call price and put price are 98 and 102 respectively. The option-free bond trades at par. Which of the following lists *correctly* orders the values of the three bonds from lowest to highest?

✗ **A) Option-free bond, putable bond, callable bond.**

✗ **B)** Putable bond, option-free bond, callable bond.

✓ **C)** Callable bond, option-free bond, putable bond.

Explanation

The put feature increases the value of a bond and the call feature lowers the value of a bond, when all other things are equal. Thus, the putable bond generally trades higher than a corresponding option-free bond, and the callable bond trades at a lower price.

Question #13 of 88

Question ID: 463846

Which of the following statements is *most* accurate concerning a convertible bond? A convertible bond's value depends:

✓ **A) on both interest rate changes and changes in the market price of the stock.**

✗ **B)** only on changes in the market price of the stock.

✗ **C)** only on interest rate changes.

Explanation

The value of convertible bond includes the value of a straight bond plus an option giving the bondholder the right to buy the common stock of the issuer. Hence, interest rates affect the bond value and the underlying stock price affects the option value.

Question #14 of 88

Question ID: 463787

The value of a callable bond is equal to the:

✗ **A) callable bond plus the value of the embedded call option.**

✓ **B)** option-free bond value minus the value of the call option.

✗ **C)** callable bond value minus the value of the put option minus the value of the call option.

Explanation

The value of a bond with an embedded call option is simply the value of a noncallable ($V_{noncallable}$) bond minus the value of the option (V_{call}). That is: $V_{callable} = V_{noncallable} - V_{call}$.

Question #15 of 88

Question ID: 472710

Steve Jacobs, CFA, is analyzing the price volatility of Bond Q. Q's effective duration is 7.3, and its effective convexity is 91.2. What is the estimated price change for Bond Q if interest rates fall/rise by 125 basis points?

	Fall	Rise
✗ **A)**	**+13.38%**	**−6.70%**
✗ **B)**	+10.20%	−8.06%
✓ **C)**	+10.55%	−7.7%

Explanation

Estimated return impact if rates fall by 125 basis points:

$\approx -(\text{Duration} \times \Delta\text{Spread}) + \text{Convexity} \times (\Delta\text{Spread})^2$
$\approx -(7.3 \times -0.0125) + (91.2)(0.0125)^2$
$\approx +0.09125 + 0.01425$
$\approx +0.1055$
$\approx +10.55\%$

Estimated return impact if rates rise by 125 basis points:

$\approx -(\text{Duration} \times \Delta\text{Spread}) + \text{Convexity} \times (\Delta\text{Spread})^2$
$\approx -(7.3 \times +0.0125) + (91.2)(0.0125)^2$
$\approx -0.09125 + 0.01425$
≈ -0.077
$\approx -7.7\%$

Questions #16-21 of 88

The Calgary Institute Pension Fund includes a $65 million fixed-income portfolio managed by Cara Karstein, CFA, of Noble Investors. Karstein is asked by Calgary to provide an analysis of the interest rate risk of the bond portfolio. Karstein uses a binomial interest rate model to determine the effect on the portfolio of a 100 basis point (bp) increase and a 100 basis point decrease in yields. The results of her analysis are shown in the following figure.

Par Value	*Security*	*Market Value*	*Current Price*	*Price If Yield Change*	
				Down 100 bp	*Up 100 bp*

$25,000,000	4.75% due 2010	$25,857,300	$105.96	$110.65	$101.11
$40,000,000	5.85% due 2025	$39,450,000	$98.38	$102.76	$93.53
$65,000,000	Bond portfolio	$65,307,300			

At a subsequent meeting with the trustees of the fund, Karstein is asked to explain what a binomial interest rate model is, and how it was used to estimate effective duration and effective convexity. Karstein is uncertain of the exact methodology because the actual calculations were done by a junior analyst, but she tries to provide the trustees with a reasonably accurate step-by-step description of the process:

> *Step 1:* Given the bond's current market price, the Treasury yield curve, and an assumption about rate volatility, create a binomial interest rate tree and calculate the bond's option-adjusted spread (OAS) using the model.
>
> *Step 2:* Impose a parallel upward shift in the on-the-run Treasury yield curve of 100 basis points.
>
> *Step 3:* Build a new binomial interest rate tree using the new Treasury yield curve and the original rate volatility assumption.
>
> *Step 4:* Add the OAS from Step 1 to each of the 1-year rates on the tree to derive a "modified" tree.
>
> *Step 5:* Compute the price of the bond using this new tree.
>
> *Step 6:* Repeat Steps 1 through 5 to determine the bond price that results from a 100 basis point decrease in rates.
>
> *Step 7:* Use these two price estimates, along with the original market price, to calculate effective duration and effective convexity.

Julio Corona, a trustee and university finance professor, immediately speaks up to disagree with Karstein. He claims that a more accurate description of the process is as follows:

> *Step 1:* Given the bond's current market price, the on-the-run Treasury yield curve, and an assumption about rate volatility, create a binomial interest rate tree.
>
> *Step 2:* Add 100 basis points to each of the 1-year rates in the interest rate tree to derive a "modified" tree.
>
> *Step 3:* Compute the price of the bond if yield increases by 100 basis points using this new tree.
>
> *Step 4:* Repeat Steps 1 through 3 to determine the bond price that results from a 100 basis point decrease in rates.
>
> *Step 5:* Use these two price estimates, along with the original market price, to calculate effective duration and effective convexity.

Corona is also concerned about the assumption of a 100 basis point change in yield for estimating effective duration and effective convexity. He asks Karstein the following question: "If we were to use a 50 basis point change in yield instead of a 100 basis point change, how would the duration and convexity estimates change for each of the two bonds?"

Karstein responds by saying, "Estimates of effective duration and effective convexity derived from binomial models are very robust to the size of the rate shock, so I would not expect the estimates to change significantly."

Question #16 of 88

Question ID: 463832

Which of the following statements is *most* accurate?

✗ **A)** **The two methodologies will result in the same effective duration and convexity estimates only if the same rate volatility assumption is used in each and the bond's OAS is equal to zero.**

✗ **B)** Corona's description is a more accurate depiction of the appropriate methodology than Karstein's.

✓ **C)** Karstein's description is a more accurate depiction of the appropriate methodology than Corona's.

Explanation

Karstein correctly outlined the appropriate methodology for using a binomial model to estimate effective duration and effective convexity. Corona fails to adjust for the OAS and, instead, simply adds 100 basis points to every rate on the tree rather than shifting the yield curve upward and then recreating the entire tree using the same rate volatility assumption from the first step. Even if both use the same rate volatility assumption, and the OAS is equal to zero, the two methodologies will generate significantly different duration and convexity estimates. (Study Session 14, LOS 47.h)

Question #17 of 88

Question ID: 463833

Assume that the effective convexity of the 4.75% 2010 bond is 3.45. The effective duration of the 4.75% 2010 bond and the percentage change in the price of the bond for an 80 basis point decrease in the yield are *closest* to:

	Effective Duration	% Change in Bond Price
✗ **A)**	**4.58**	**+1.79%**
✓ **B)**	4.50	+3.62%
✗ **C)**	4.21	+2.09%

Explanation

$$ED = \frac{110.65 - 101.11}{2 \times 105.96 \times 0.01} = 4.50$$

$$\%\Delta BV \approx (-4.50 \times -0.008 \times 100) + (3.45 \times -0.008^2 \times 100) = 3.62\%$$

(Study Session 14, LOS 47.h)

Question #18 of 88

Question ID: 463834

The convexity of the 5.85% 2025 bond for a 100 basis point change in rates is *closest* to:

✗ **A)** **3.57.**

✗ **B)** −12.18.

✓ **C)** &£8722;23.88.

Explanation

$$EC = \frac{102.76 + 93.53 - (2 \times 98.38)}{(2 \times 98.38 \times 0.01^2)} = -23.88$$

(Study Session 14, LOS 47.h)

Question #19 of 88

Question ID: 463835

Assume that the duration of the 5.85% 2025 bond is 2.88. The duration of the portfolio is *closest* to:

✓ **A) 3.52.**

✗ **B)** 3.12.

✗ **C)** 3.01.

Explanation

$$D_{portfolio} = 4.50\left(\frac{25,857,300}{65,307,300}\right) + 2.88\left(\frac{39,450,000}{65,307,300}\right)$$
$$= 4.50(0.3959) + 2.88(0.6041)$$
$$= 3.52$$

(Study Session 14, LOS 47.h)

Question #20 of 88

Question ID: 463836

In regard to the effect of a change in the size of the rate shock on the duration and convexity estimates, Karstein is:

✗ **A) incorrect in her analysis of the effect on both bonds.**

✗ **B)** correct in her analysis of the effect on both bonds.

✓ **C)** correct only in her analysis of the effect on the 4.75% 2010 bond.

Explanation

Duration and convexity estimates for bonds without embedded options will not be significantly affected by changing the size of the rate shock from 100 basis points to 50 basis points. However, for bonds with embedded options, the size of the rate shock can have a significant effect on the estimates.

We know from Part 3 that the 2025, 5.85% bond exhibits significant negative convexity, which is consistent with a callable bond. The 2010, 4.75% bond has positive convexity, even when yields are significantly below the coupon rate and the bond is trading at a substantial premium. That suggests the 2010, 4.75% bond has no embedded options.

We would expect that changing the size of the rate shock would have a significant effect on the 2025, 5.85% callable bond, but not on the 4.75% 2010 bond. Therefore, Karstein is correct in her analysis of the 4.75% bond, but not the 5.85% bond. (Study Session 14, LOS 47.g)

Question #21 of 88

Question ID: 463837

The portfolio convexity adjustment, assuming a 100 basis point decrease in yield, is *closest* to:

✓ **A) +1.77%.**

✗ **B)** −2.93%.

✗ **C)** −1.77%.

Explanation

$$\text{duration effect} = -3.52 \times -0.01 \times 100 = 3.52\%$$
$$\text{value of } 4.75\% \text{ bond} = \$25{,}000{,}000 \times 110.65\% = \$27{,}662{,}500$$
$$\text{value of } 5.85\% \text{ bond} = \$40{,}000{,}000 \times 102.76\% = \$41{,}104{,}000$$
$$\text{portfolio value} = \$27{,}662{,}500 + \$41{,}104{,}000 = \$68{,}766{,}500$$
$$\text{total effect} = \frac{\$68{,}766{,}500}{\$65{,}307{,}300} - 1 = 5.30\%$$
$$\text{convexity adjustment} \approx 5.30\% - 3.52\% = +1.77\%$$

(Study Session 14, LOS 47.h)

Question #22 of 88

Question ID: 463823

When is it *best* for an asset-backed security (ABS) to be valued using the zero-volatility spread approach?

✗ **A) For agency ABS.**

✗ **B)** To value ABS that have a prepayment option.

✓ **C)** To value ABS that do not have a prepayment option.

Explanation

With the zero-spread method, the value of an ABS is the present value of its cash flows discounted at the spot rates plus the zero-volatility spread. The Z-spread technique does not incorporate prepayments. Thus, it should only be used for ABSs for which the borrower either has no option to prepay, or is unlikely to.

Question #23 of 88

Question ID: 472712

Alnoor Hudda, CFA is valuing two floaters issued by Mateo Bank. Both floaters have a par value of $100, three year life and pay based on annual LIBOR. Hudda has generated the following binomial tree for libor.

1-year forward rates starting in year:

0	1	2
2%	5.7798%	6.0512%
	3.8743%	4.0562%
		2.7190%

Value of the cap in a capped floater with a cap of 4% is closest to:

✗ **A) $4.41**

✓ **B)** $2.18

✗ **C)** $1.23

Explanation

value of the cap = $100 - $97.82 = $2.18

Question #24 of 88

Question ID: 463818

The spread (k) that must be added to all of the spot rates along each interest rate path that will force equality between the average present value of the path's cash flows and the market price (plus accrued interest) for the mortgage-backed security (MBS) being evaluated is called the:

✗ **A) PAC spread.**

✓ **B)** option-adjusted spread (OAS).

✗ **C)** k-spread.

Explanation

The spread (k) that must be added to all of the spot rates along each interest rate path that will force equality between the average present value of the path's cash flows and the market price (plus accrued interest) for the MBS being evaluated is called the OAS.

Question #25 of 88

Question ID: 479055

Alnoor Hudda, CFA is valuing two floaters issued by Mateo Bank. Both floaters have a par value of $100, three year life and pay based on annual LIBOR. Hudda has generated the following binomial tree for libor.

1-year forward rates starting in year:

0	1	2
2%	5.7798%	6.0512%
	3.8743%	4.0562%
		2.7190%

Value of a capped floater with a cap of 4% is closest to:

✓ **A) $98.70**

✗ **B)** $97.38

✗ **C)** $96.71

Explanation

The cap will be in the money for nodes 2,UU; 2,UL; and 1,U.

$V_{2,UU}$ = 104/1.060512 = 98.07

$V_{2,UL}$ = 104/1.040562 = 99.95

$V_{2,UL}$ = 102.7190/1.027190 = 100

$$V_{1,U} = \frac{\left(\frac{98.07 + 99.95}{2} + 4\right)}{1.057798} = 97.38$$

$$V_{1,L} = \frac{\left(\frac{100 + 99.95}{2} + 3.8743\right)}{1.038743} = 99.97$$

$$V_0 = \frac{\left(\frac{97.38 + 99.97}{2} + 2\right)}{1.02} = 98.70$$

Question #26 of 88

Question ID: 472698

Generally speaking, an analyst would like the option adjusted spread (OAS) to be big controlling for:

✓ **A)** **Credit and liquidity risk.**

✗ **B)** Option risk.

✗ **C)** Credit, liquidity and option risk.

Explanation

OAS is compensation for taking credit and liquidity risk. Analysts would prefer higher OAS after controlling for credit and liquidity risk.

Question #27 of 88

Question ID: 463816

If the simulated interest rates are based on the Treasury curve, then how is the option-adjusted spread obtained (OAS) using the Monte Carlo simulation model interpreted? The OAS is the:

✓ **A)** **average spread over the Treasury spot rate curve.**

✗ **B)** average spread over the Treasury yield.

✗ **C)** spread over the Treasury spot rate corresponding to the maturity of the mortgage-backed security.

Explanation

The monthly rates along the paths generated with the Monte Carlo simulation model using the Treasury yield curve as a benchmark are Treasury spot rates that have been adjusted to be arbitrage-free. As such, the OAS measures the average spread over Treasury spot rates, *not* the Treasury yield.

Question #28 of 88

Question ID: 463804

When should an asset-backed security (ABS) be valued using the option-adjusted spread (OAS) approach?

✗ **A)** **For agency ABS.**

✗ **B)** To value ABS that do not have a prepayment option.

✓ **C)** To value ABS that have a prepayment option.

Explanation

The OAS method recognizes that cash flow changes accompany interest rate changes. Thus, it is suitable to use OAS analysis with ABSs that have a prepayment option that is frequently exercised, e.g., high quality home equity loans.

Question #29 of 88

Question ID: 472695

Bill Moxley, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of his pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. The yield curve is currently flat.

If the yield curve is expected to have a parallel downward shift, the bond with the highest price appreciation is *least likely* to be:

✗ **A) Bond C**

✓ **B)** Bond B

✗ **C)** Bond A

Explanation

Bond B has an embedded call option which limits its upside resulting in negative convexity. Bonds A and C do not have such limits.

Question #30 of 88

Question ID: 463827

Which of the following *correctly* explains how the effective duration is computed using the binomial model. In order to compute the effective duration the:

✓ **A) yield curve has to be shifted upward and downward in a parallel manner and the binomial tree recalculated each time.**

✗ **B)** binomial tree has to be shifted upward and downward by the same amount for all nodes.

✗ **C)** the nodal probabilities are shifted upward and downward and the binomial tree recalculated each time.

Explanation

Apply parallel shifts to the yield curve and use these curves to compute new forward rates in the interest rate tree. The resulting bond values are then used to compute the effective duration.

Question #31 of 88

Question ID: 463815

An analyst has constructed an interest rate tree for an on-the-run Treasury security. Given equal maturity and coupon, which of the following would have the *highest* option-adjusted spread?

✗ **A) A putable corporate bond with a Aaa rating.**

✗ **B)** A putable corporate bond with a AAA rating.

✓ **C)** A callable corporate bond with a Baa rating.

Explanation

The bond with the lowest price will have the highest option-adjusted spread. All other things equal, the callable bond with the lowest rating will have the lowest price.

Question #32 of 88

Question ID: 463840

What is the market conversion price of a convertible security?

✓ **A) The price that an investor pays for the common stock if the convertible bond is purchased and then converted into the stock.**

✗ **B)** The price that an investor pays for the common stock in the market.

✗ **C)** The value of the security if it is converted immediately.

Explanation

The market conversion price, or conversion parity price, is the price that the convertible bondholder would effectively pay for the stock if she bought the bond and immediately converted it.

market conversion price = market price of convertible bond ÷ conversion ratio.

Question #33 of 88

Question ID: 463822

Wanda Brunner, CFA, is evaluating two tranches of a sequential-pay CMO structure.

Tranche	*OAS (bps)*	*Z-spread (bps)*	*Effective duration*
I	95	100	4.25
II	90	100	4.25

How should Brunner trade these CMO tranches?

✗ **A) Cannot be determined.**

✗ **B)** Buy Tranche II and sell Tranche I.

✓ **C)** Buy Tranche I and sell Tranche II.

Explanation

Tranche I option cost = 100 - 95 = 5 basis points

Tranche II option cost = 100 - 90 = 10 basis points

Tranche I has a higher OAS and lower option cost than Tranche II, and the effective durations of the two tranches are equal. Therefore:

- Tranche I is undervalued on a relative basis ("cheap"), and she should buy it.
- Tranche II is overvalued on a relative basis ("rich"), and she should sell it.

Question #34 of 88

Question ID: 463806

On a given day, a bond with a call provision rose in value by 1%. What can be said about the level and volatility of interest rates?

✗ **A) A possibility is that the level of interest rates remained constant, but the volatility of interest rates rose.**

✗ **B)** The only possible explanation is that level of interest rates fell.

✓ **C)** A possibility is that the level of interest rates remained constant, but the volatility of interest rates fell.

Explanation

As volatility declines, so will the option value, which means the value of a callable bond will rise.

Question #35 of 88

Question ID: 463819

Which of the following is NOT a major reason why the effective durations reported by dealers and vendors can be very different?

✓ **A) Differences in the assumption how yield volatility changes for shocks to the yield curve.**

✗ **B)** Differences in the relationship between short-term interest rates and refinancing rates.

✗ **C)** Different option-adjusted spreads.

Explanation

The major differences in the effective duration among analytical systems providers are attributable to differences in the following: the incremental change in interest rate, the prepayment model, the OAS, and the interest rate/refinancing rate spread assumption.

Question #36 of 88

Question ID: 463809

Using the following tree of semiannual interest rates what is the value of a callable bond that has one year remaining to maturity, a call price of 99 and a 5% coupon rate that pays semiannually?

> 7.59%
>
> 6.35%
>
> 5.33%

✗ **A) 98.65.**

✓ **B)** 98.26.

✗ **C)** 99.21.

Explanation

The callable bond price tree is as follows:

		100.00
	98.75	
98.26		100.00
	99.00	
		100.00

The formula for the price at each node is:

Price = min{(prob × (P_{up} + coupon/2) + prob × (P_{down} + coupon/2)) / (1 + rate/2), call price}.

Up Node at t = 0.5: min{(0.5 × (100 + 2.5) + 0.5 × (100 + 2.5)) / (1 + 0.0759/2), 99} = 98.75.

Down Node at t = 0.5: min{(0.5 × (100 + 2.5) + 0.5 × (100 + 2.5)) / (1 + 0.0533/2), 99} = 99.00.

Node at t = 0.0: min{(0.5 × (98.75 + 2.5) + 0.5 × (99 + 2.5)) / (1 + 0.0635/2), 99} = 98.26.

Question #37 of 88

Question ID: 463858

Suppose that the stock price of a common stock increases by 10%. Which of the following is *most* accurate for the price of the recently issued convertible bond? The value of the convertible bond will:

✓ **A) increase by less than 10%.**

✗ **B)** remain unchanged.

✗ **C)** increase by 10%.

Explanation

When the underlying stock price rises, the convertible bond will underperform because of the conversion premium. However, buying convertible bonds in lieu of stocks limits downside risk. The price floor set by the straight bond value causes this downside protection.

Question #38 of 88

Question ID: 463810

Patrick Wall is a new associate at a large international financial institution. His boss, C.D. Johnson, is responsible for familiarizing Wall with the basics of fixed income investing. Johnson asks Wall to evaluate the two otherwise identical bonds shown in Table 1. The callable bond is callable at 100 and exercisable on the coupon dates only.

Wall is told to evaluate the bonds with respect to duration and convexity when interest rates decline by 50 basis points at all maturities over the next six months.

Johnson supplies Wall with the requisite interest rate tree shown in Figure 1. Johnson explains to Wall that the prices of the bonds in Table 1 were computed using the interest rate lattice. Johnson instructs Wall to try and replicate the information in Table 1 and use his analysis to derive an investment decision for his portfolio.

Table 1

Bond Descriptions

	Non-callable Bond	*Callable Bond*
Price	$100.83	$98.79
Time to Maturity (years)	5	5
Time to First Call Date	--	0
Annual Coupon	$6.25	$6.25
Interest Payment	Semi-annual	Semi-annual
Yield to Maturity	6.0547%	6.5366%
Price Value per Basis Point	428.0360	--

Figure 1

15.44%

14.10%

12.69% 12.46%

						11.85%		11.38%	
					9.75%		10.25%		10.05%
				8.95%		9.57%		9.19%	
			7.91%		7.88%		8.28%		8.11%
		7.35%		7.23%		7.74%		7.42%	
	6.62%		6.40%		6.37%		6.69%		6.54%
6.05%		5.95%		5.85%		6.25%		5.99%	
	5.36%		5.17%		5.15%		5.40%		5.28%
		4.81%		4.73%		5.05%		4.83%	
			4.18%		4.16%		4.36%		4.26%
				3.82%		4.08%		3.90%	
					3.37%		3.52%		3.44%
						3.30%		3.15%	
							2.84%		2.77%
								2.54%	
									2.24%
Years	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5

Given the following relevant part of the interest rate tree, the value of the callable bond at node A is *closest* to:

	3.44%
3.15%	
	2.77%

✗ **A) $101.53.**

✗ **B)** $103.56

✓ **C)** $100.00.

Explanation

The value of the callable bond at node A is obtained as follows:

Bond Value = the lesser of the Call Price or {0.5 × [Bond Value$_{up}$ + Coupon/2] + 0.5 × [Bond Value$_{down}$ + Coupon/2]}/(1+ Interest Rate/2)]

So we have

Bond Value at node A = the lesser of either $100 or {0.5 × [$100.00 + $6.25/2] + 0.5 × [$100.00+ $6.25/2]}/(1+ 3.15%/2) = $101.52. Since the call price of $100 is less than the computed value of $101.52 the bond price would be $100 because once the price of the bond reached this value it would be called.

Question #39 of 88

Question ID: 463857

How do the risk-return characteristics of a newly issued convertible bond compare with the risk-return characteristics of ownership of the underlying common stock? The convertible bond has:

✗ **A) higher risk and higher return potential.**

✓ **B)** lower risk and lower return potential.

✗ **C)** lower risk and higher return potential.

Explanation

Buying convertible bonds in lieu of direct stock investing limits downside risk due to the price floor set by the straight bond value. The cost of the risk protection is the reduced upside potential due to the conversion premium.

Question #40 of 88

Question ID: 463829

Which of the following *most accurately* explains how the effective convexity is computed using the binomial model. In order to compute the effective convexity the:

✓ **A)** **yield curve has to be shifted upward and downward in a parallel manner and the binomial tree recalculated each time.**

✗ **B)** binomial tree has to be shifted upward and downward by the same amount for all nodes.

✗ **C)** volatility has to be shifted upward and downward and the binomial tree recalculated each time.

Explanation

Apply parallel shifts to the yield curve and use these curves to compute new forward rates in the interest rate tree. The resulting bond values are then used to compute the effective convexity.

Question #41 of 88

Question ID: 472696

Bill Moxley, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of his pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. The yield curve is currently flat.

If the yield curve becomes upward sloping, the bond *least likely* to have the highest price impact would be:

✗ **A)** **Bond B**

✗ **B)** Bond A

✓ **C)** Bond C

Explanation

Bond C is putable and hence has limited downside potential when rates rise. The other two bonds do not have any such protection.

Question #42 of 88

Question ID: 463801

For a bond with an embedded option where the cash flows are not interest rate path dependent, which of the following valuation approaches should be used?

✗ **A) The option-adjusted spread approach with the Monte Carlo simulation model.**

✗ **B)** The zero-volatility spread approach with the binomial model.

✓ **C)** The option-adjusted spread approach with the binomial model.

Explanation

The OAS method recognizes that cash flow changes accompany interest rate changes. Thus, it is suitable to use OAS analysis with ABSs that have a prepayment option that is frequently exercised, and if the cash flows are independent of the interest rate path, OAS should be computed with the binomial model.

Question #43 of 88

Question ID: 463824

Which part of the nominal spread does the option-adjusted spread (OAS) capture?

✗ **A) interest rate and volatility risk.**

✗ **B)** option risk.

✓ **C)** credit and liquidity risk.

Explanation

The OAS removes the amount that is due to option risk from the nominal spread leaving just the credit and liquidity risk.

Question #44 of 88

Question ID: 463799

Which of the following is equal to the value of the putable bond? The putable bond value is equal to the:

✗ **A) callable bond plus the value of the put option.**

✓ **B)** option-free bond value plus the value of the put option.

✗ **C)** option-free bond value minus the value of the put option.

Explanation

The value of a putable bond can be expressed as $V_{putable} = V_{nonputable} + V_{put}$.

Question #45 of 88

Question ID: 472706

Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable at any time at par and bond C is putable at any time at par. Yield curve is currently flat at 3%.

The bond *least likely* to have the highest one-sided down-duration is:

✓ **A) Bond B.**

✗ **B)** Bond A.

✗ **C)** Bond C.

Explanation

When the underlying option is at (or near) money, callable bonds will have lower one-sided down-duration than one-sided up-duration; the price change of a callable when rates fall is smaller than the price change for an equal increase in rates. In this problem, the coupon rate is given to be equal to the current level of rates and hence the bond should be at par and the underlying option is at-the-money.

Question #46 of 88

Question ID: 463830

Given the following information, which bond has the *greater* interest rate risk and what is the change in price if rates increase by 50 basis points?

	Duration	*Convexity*
Bond A	4.5	45.8
Bond B	7.8	125.0

✗ **A) Bond A, change in price = −2.14%.**

✗ **B)** Bond B, change in price = −27.4%.

✓ **C)** Bond B, change in price = −3.59%.

Explanation

Bond B has the greater interest rate risk since the change in price is larger than bond A.
Change in price = $(-D \times \text{change in bp} \times 100) + (C \times \text{change in bp}^2 \times 100)$
Bond A = $(-4.5 \times 0.005 \times 100) + (45.8 \times 0.005^2 \times 100) = -2.25 + 0.1145 = -2.14\%$
Bond B = $(-7.8 \times 0.005 \times 100) + (125 \times 0.005^2 \times 100) = -3.9 + 0.3125 = -3.59\%$

Question #47 of 88

Question ID: 463786

How is the value of the embedded call option of a callable bond determined? The value of the embedded call option is:

✓ **A) the difference between the value of the option-free bond and the callable bond.**

✗ **B)** equal to the amount by which the callable bond value exceeds the option-free bond value.

✗ **C)** determined using the standard Black-Scholes model.

Explanation

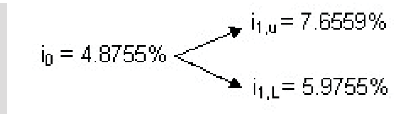
The callable bond is equivalent to the option-free bond except that the issuer has the option to call the bond at the call price before maturity. Therefore, for the holder of the bond, the bond is worth the same as the option-free bond reduced by the value of the option.

Questions #48-53 of 88

Eric Rome works in the back office at Finance Solutions, a limited liability firm that specializes in designing basic and sophisticated financial securities. Most of their clients are commercial and investment banks, and the detection, and control of interest rate risk is Financial Solution's competitive advantage.

One of their clients is looking to design a fairly straightforward security: a callable bond. The bond pays interest annually over a two-year life, has a 7% coupon payment, and has a par value of $100. The bond is callable in one year at par ($100).

Rome uses a binomial tree approach to value the callable bond. He's already determined, using a similar approach, that the value of the option-free counterpart is $102.196. This price came from discounting cash flows at on-the-run rates for the issuer. Those discount rates are given below:



Rome is also interested in the 2027 6% convertible bond of Stellar Inc. The bond can be converted into 25 shares of common stock and is trading at $1024. Stellar's current stock price is $32. Comparable nonconvertible bonds currently yield 6%.

Question #48 of 88

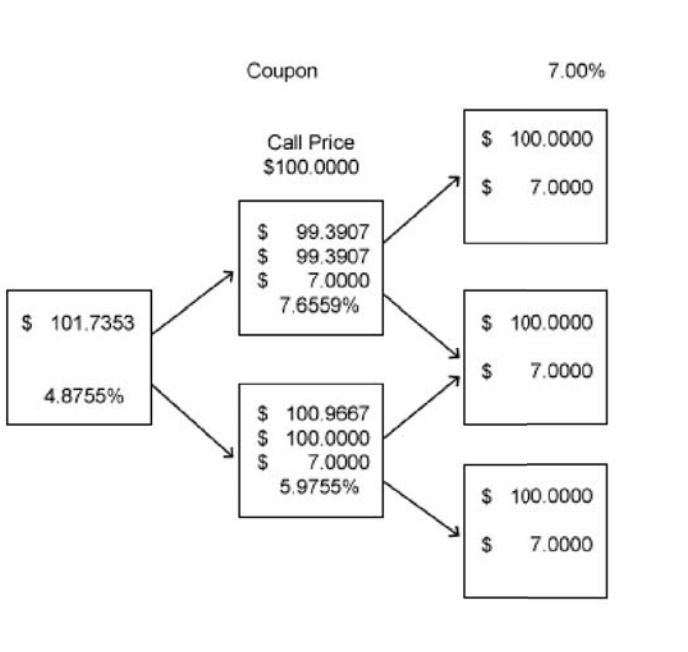
Question ID: 463849

Using the binomial tree model, what is the value of the callable bond?

- ✗ **A) $102.196.**
- ✗ **B)** $95.521.
- ✓ **C)** $101.735.

Explanation

The value of this bond at node 0 is V_0 = ½ × [($99.391 + $7) ÷ 1.048755 + ($100.000 + $7) ÷ 1.048755] = $101.735, so the price of the callable bond is $101.735. (LOS 47.d)



Question #49 of 88

Question ID: 463850

What is the value of the call option embedded in this bond?

✗ **A) $12.924.**

✓ **B)** $0.461.

✗ **C)** $6.675.

Explanation

Given in the problem is the value of the bond's option-free counterpart: $102.196. From Part A we've determined the price of the callable bond to be $101.735. From the relationship:

$V_{call} = V_{option\text{-}free} - V_{callable}$

We can determine that the value of the call option is $102.196 - $101.735 = $0.461. (LOS 47.d)

Question #50 of 88

Question ID: 463851

If the bond is putable in one year at par, the value of the put is *closest* to:

✓ **A) $0.291.**

✗ **B)** $12.487.

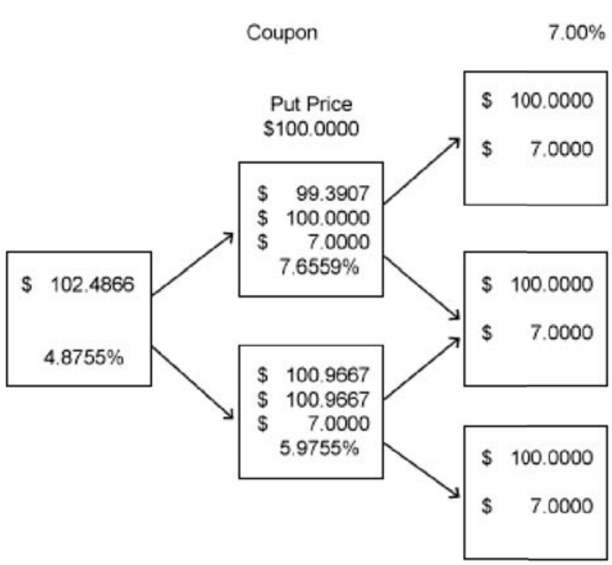
✗ **C)** $0.461.

Explanation

The value of the bond's option-free counterpart is $102.196 (given). We can calculate the price of the putable bond to be $102.487. From the relationship:

$V_{put} = V_{putable} - V_{option\text{-}free}$

We can determine that the value of the call option is $102.487 - $102.196 = $0.291.



Question #51 of 88

Question ID: 463852

Which of the following steps that Rome might go through in calculating the effective duration of this callable bond is *least accurate*?

✗ **A) Given the assumptions about benchmark interest rates, interest rate volatility, and a call and/or put rule, calculate the OAS for the issue, using the binomial model.**

✗ **B)** Impose a small parallel shift to the interest rates used in the problem by an amount equal to +Δ.

✓ **C)** Add the zero-volatility spread to each of the 1-year forward rates in the interest rate tree to get a "modified" tree.

Explanation

Calculating effective duration for bonds with embedded options is a complicated undertaking because you must calculate values of V_+ and V_-. Given the information in the problem, this requires following seven steps:

Step 1: Given the assumptions about benchmark interest rates, interest rate volatility, and a call and/or put rule, calculate the OAS for the issue, using the binomial model.

Step 2: Impose a small parallel shift to the interest rates used in the problem by an amount equal to $+D_i$.

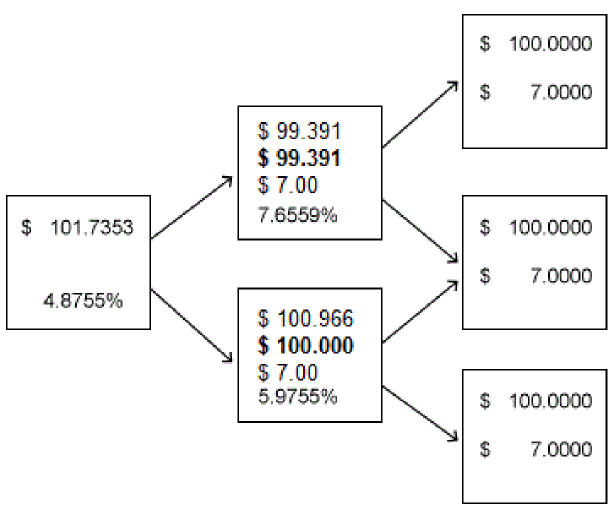
Step 3: Build a new binomial tree using the new yield curve.

Step 4: Add the OAS to each of the 1-year **forward** rates in the interest rate tree to get a "modified" tree. (We assume that the OAS does not change when the interest rates change.)

Step 5: Compute the new value for V_+ using this modified interest rate tree.

Step 6: Repeat steps 2 through 5 using a parallel shift of $-D_l$ to obtain the value for V_-.

Step 7: Use the formula duration = $(V_- + V_+) / 2V_0(DI)$.



Question #52 of 88

Question ID: 463853

If Rome revises his estimate of interest rate volatility used in generation of the interest rate tree upwards, the price of callable bond would *most likely*:

✓ **A) Fall.**

✗ **B)** Increase.

✗ **C)** Remain unchanged.

Explanation

An increase in interest rate volatility would increase the value of the call option leaving the value of option-free bond unchanged. This would lead to a decrease in the price of the callable bond. (LOS 47.f)

Question #53 of 88

Question ID: 463854

The market conversion premium ratio for Stellar's convertible bond is *closest to*:

✗ **A) 2.4%**

✓ **B)** 28%.

✗ **C)** 20.6%.

Explanation

An investor who purchases the convertible bond rather than the underlying stock will pay a premium over the current market price of the stock. This market conversion premium per share is equal to the difference between the market conversion price and the current market price of the stock.

Market conversion price = market price of CB ÷ conversion ratio = 1024 / 25 = 40.96

Market conversion premium = conversion price − market price = 40.96 − 32 = 8.96

$$\text{Market conversion premium ratio} = \frac{\text{market conversion premium per share}}{\text{market price of common stock}} = \frac{8.96}{32} = 28\%$$

(LOS 47.j)

Question #54 of 88

Question ID: 463805

For a bond with an embedded option where the cash flow is interest rate path dependent, which of the following valuation approaches should be used?

✗ **A) The option-adjusted spread approach with the binomial model.**

✓ **B)** The option-adjusted spread approach with the Monte Carlo simulation model.

✗ **C)** The nominal spread approach with the Monte Carlo simulation model.

Explanation

The OAS method recognizes that cash flow changes accompany interest rate changes. Thus, it is suitable to use OAS analysis with ABSs that have a prepayment option that is frequently exercised, and, if the cash flows are dependent upon the interest rate path, OAS should be computed with the Monte Carlo simulation model.

Question #55 of 88

Question ID: 463847

Which of the following is equal to the value of a noncallable / nonputable convertible bond? The value of the corresponding:

✓ **A) straight bond plus the value of the call option on the stock.**

✗ **B)** callable bond plus the value of the call option on the stock.

✗ **C)** straight bond.

Explanation

The value of a noncallable/nonputable convertible bond can be expressed as:

Option-free convertible bond value = straight value + value of the call option on the stock.

Question #56 of 88

Question ID: 463855

Which of the following scenarios will lead to a convertible bond underperforming the underlying stock? The:

✓ **A) stock price rises.**

✗ **B)** stock price is stable.

✗ **C)** stock price falls.

Explanation

A convertible bond underperforms the underlying common stock when that stock increases in value. This is because of the conversion premium which means that the bond will increase less than the increase in stock price. If the stock price falls, the convertible bond should outperform the stock because of the floor created by the straight-value. If the stock is stable, the bond is likely to outperform the stock because of the higher current yield of the bond. If the bond is upgraded, the bond should increase in value. There is no reason that upgrading the bond should lead to the bond underperforming the stock.

Question #57 of 88

Question ID: 463798

Suppose that the value of an option-free bond is equal to 100.16, the value of the corresponding callable bond is equal to 99.42, and the value of the corresponding putable bond is 101.72. What is the value of the call option?

✗ **A) 0.64.**

✓ **B)** 0.74.

✗ **C)** 0.21.

Explanation

The call option value is just the difference between the value of the option-free bond and the value of the callable bond. Therefore, we have:

Call option value = 100.16 - 99.42 = 0.74.

Question #58 of 88

Question ID: 472701

Sharon Rogner, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of her pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. Rogner computes the OAS of bond A to be 50bps using a binomial tree with an assumed interest rate volatility of 15%.

If Rogner revises her estimate of interest rate volatility to 10%, the computed OAS of Bond B would *most likely* be:

- ✗ **A) lower than 50bps.**
- ✓ **B)** higher than 50bps.
- ✗ **C)** equal to 50bps.

Explanation

The OAS of the three bonds should be same as they are given to be identical bonds except for the embedded options (OAS is after removing the option feature and hence would not be affected by embedded options). Hence the OAS of bond B would be 50 bps absent any changes in assumed level of volatility.

When the assumed level of volatility in the tree is decreased, the value of the call option would decrease and the *computed* value of the callable bond would increase. The constant spread now needed to force the computed value to be equal to the market price is therefore higher than before. Hence a decrease in the volatility estimate increases the computed OAS for a callable bond.

Question #59 of 88

Question ID: 463802

For a bond with an embedded option, if cash flows are independent of past interest rates, or not path dependent the:

- ✗ **A) Z-spread should be used with the binomial model.**
- ✓ **B)** option adjusted spread (OAS) should be used with the binomial model.
- ✗ **C)** option adjusted spread (OAS) should be used with the Monte Carlo simulation model.

Explanation

If cash flows are independent of past interest rates, or not path dependent, the OAS should be used with the binomial model.

Question #60 of 88

Question ID: 463838

For a convertible bond without any other options, the call feature implied by the convertibility feature will do all of the following EXCEPT:

- ✓ **A) cause negative convexity.**
- ✗ **B)** place a lower limit on the possible values of the bond.
- ✗ **C)** increase the value of the bond over that of a comparable option-free bond.

Explanation

Negative convexity is caused by the bond being callable where the issuer has the embedded call option. Negative convexity does not apply to convertible bonds. The convertibility feature gives the bondholder a call option on the shares of common stock of the issuer. This increases the price of the bond and places a lower limit on the possible values of the bond. However, that lower limit will change with the price of the common stock.

Question #61 of 88

Question ID: 463844

Which of the following factors must be included in an option-based valuation approach to price a callable convertible bond?

✓ **A)** **Interest rates, stock prices and their correlation.**

✗ **B)** Interest rates and stock prices only.

✗ **C)** Stock prices only.

Explanation

The valuation of convertible bonds with embedded call and/or put options requires a model that links the movement of interest rates and stock prices.

Question #62 of 88

Question ID: 463820

A collateralized mortgage obligation (CMO) bond structure includes three tranches, A, B, and C, with the following characteristics:

Tranche	*OAS (in BP)*	*Option Cost (in BP)*
A	54	73
B	55	94
C	68	71

Using this information, which of the tranches appears to be cheap?

✗ **A)** **A.**

✓ **B)** C.

✗ **C)** B.

Explanation

A large OAS indicates a wider risk-adjusted spread and lower relative price. Option cost measures prepayment risk. In general, the highest OAS and lowest option cost is most attractive. Tranche C has the highest OAS and the lowest option cost at the same time.

Question #63 of 88

Question ID: 472707

For an option-free bond trading at par, it is *least likely* that:

✗ **A)** **Its maturity key rate duration is the same as its effective duration.**

✓ **B)** The spot rate for the maturity of the bond is least important rate affecting the value of the bond.

✗ **C)** The rate durations for all the rates other than the maturity-matched rate are zero.

Explanation

If an option-free bond is trading at par, the bond's maturity- matched rate (or the spot rate applicable to its maturity) is the only rate that affects the bond's value. Its maturity key rate duration is the same as its effective duration, and all other key rate durations are zero.

Question #64 of 88

Question ID: 463825

A CFA charter holder observes a 12-year 7 ¾ percent semiannual coupon bond trading at 102.9525. If interest rates *rise* immediately by 50 basis points the bond will sell for 99.0409. If interest rates *fall* immediately by 50 basis points the bond will sell for 107.0719. What are the bond's effective duration (ED) and effective convexity (EC).

✓ **A) ED = 7.801, EC = 40.368.**

✗ **B)** ED = 8.031, EC = 2445.120.

✗ **C)** ED = 40.368, EC = 7.801.

Explanation

$ED = (V_- - V_+) / (2V_0(\Delta y))$

$= (107.0719 - 99.0409) / (2 \times 102.9525 \times 0.005) = 7.801$

$EC = (V_- + V_+ - 2V_0) / (2V_0(\Delta y)^2)$

$= (107.0719 + 99.0409 - (2 \times 102.9525)) / [(2 \times 102.9525 \times (0.005)^2)] = 40.368$

Question #65 of 88

Question ID: 472697

Bill Moxley, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of his pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. The yield curve is currently flat.

If the yield curve becomes downward sloping, the bond with the highest price impact is *least likely* to be:

✓ **A) Bond B**

✗ **B)** Bond A

✗ **C)** Bond C

Explanation

Due to the embedded call option, the upside potential of callable bond B is limited.

Question #66 of 88

Question ID: 463807

As the volatility of interest rates increases, the value of a putable bond will:

✓ **A) rise.**

✗ **B)** rise if the interest rate is below the coupon rate, and fall if the interest rate is above the coupon rate.

✗ **C)** decline.

Explanation

As volatility increases, so will the option value, which means the value of a putable bond will rise. Remember that with a putable bond, the investor is long the put option.

Question #67 of 88

Question ID: 463814

Using the following tree of semiannual interest rates what is the value of a putable semiannual bond that has one year remaining to maturity, a put price of 98 and a 4% coupon rate? The bond is putable today.

> 7.59%
> 6.35%
> 5.33%

✗ **A)** **97.92.**

✗ **B)** 98.75.

✓ **C)** 98.00.

Explanation

The putable bond price tree is as follows:

100.00

A ==> 98.27

98.00 100.00

99.35

100.00

As an example, the price at node A is obtained as follows:

$Price_A$ = max{(prob × (P_{up} + coupon/2) + prob × (P_{down} + coupon/2))/(1 + rate/2), putl price} = max{(0.5 × (100 + 2) + 0.5 × (100 + 2))/(1 + 0.0759/2),98} = 98.27. The bond values at the other nodes are obtained in the same way.

The price at node 0 = [0.5 × (98.27+2) + 0.5 × (99.35+2)]/ (1 + 0.0635/2) = $97.71 but since this is less than the put price of $98 the bond price will be $98.

Question #68 of 88

Question ID: 463812

Which of the following is the appropriate "nodal decision" within the backward induction methodology of the interest tree framework for a callable bond?

✓ **A)** **Min(call price, discounted value).**

✗ **B)** Max(call price, discounted value).

✗ **C)** Min(par value, discounted value).

Explanation

When valuing a callable bond using the backward induction methodology, the relevant cash flow to use at each nodal period is the coupon to be received during that nodal period plus the computed value or the call price, whichever is less.

Questions #69-74 of 88

Patrick Wall is a new associate at a large international financial institution. Wall has recently completed graduate school with a Master's degree in finance, and is also currently a CFA Level I candidate. His previous work experience includes three years as a credit analyst at a small retail bank. Wall's new position is as the assistant to the firm's fixed income portfolio manager. His boss, Charles Johnson, is responsible for getting Wall familiar with the basics of fixed income investing. Johnson asks Wall to evaluate the bonds shown in Table 1. The bonds are otherwise identical except for the call feature present in one of the bonds. The callable bond is callable at par and exercisable on the coupon dates only.

Table 1 *Bond Descriptions*		
	Non-Callable	*Callable Bond*
Price	$100.83	$98.79
Time to Maturity (years)	5	5
Time to First Call Date	--	0
Annual Coupon	$6.25	$6.25
Interest Payment	Semi-annual	Semi-annual
Yield to Maturity	6.0547%	6.5366%
Price Value per Basis Point	428.0360	--

Wall is told to evaluate the bonds with respect to duration and convexity when interest rates declined by 50 basis at all maturities over the next six months.

Johnson supplies Wall with the requisite interest rate tree shown in Figure 1. Johnson explains to Wall that the prices of the bonds in Table 1 were computed using this interest rate lattice. Johnson instructs Wall to try and replicate the information in Table 1 and use his analysis to derive an investment decision for his portfolio.

									15.44%
								14.10%	
							12.69%		12.46%
						11.85%		11.38%	
					9.75%		10.25%		10.05%
				8.95%		9.57%		9.19%	
			7.91%		7.88%		8.28%		8.11%
		7.35%		7.23%		7.74%		7.42%	
	6.62%		6.40%		6.37%		6.69%		6.54%
6.05%		5.95%		5.85%		6.25%		5.99%	

	5.36%		5.17%		5.15%		5.40%		5.28%
		4.81%		4.73%		5.05%		4.83%	
			4.18%		4.16%		4.36%		4.26%
				3.82%		4.08%		3.90%	
					3.37%		3.52%		3.44%
						3.30%		3.15%	
							2.84%		2.77%
								2.54%	
									2.24%
Years	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5

Question #69 of 88

Question ID: 463790

Wall is having a few problems computing the bond prices using the interest rate tree. He would like to compute the value of the non-callable bond at node A given the relevant part of the tree. Using the referenced portions of the tree, what is the value of the non-callable bond at node A?

Relevant part of interest rate tree:

	8.95%
7.91%	
	7.23%

Corresponding part of non-callable bond tree:

		$92.38
A →	–	
		$96.83

The value of the bond at node A is *closest* to:

- ✗ **A) $90.56.**
- ✓ **B)** $94.01.
- ✗ **C)** $97.02.

Explanation

This value of the non-callable bond at node A is computed as follows:

Bond Value = {0.5 × [Bond Value$_{up}$ + (Coupon / 2)]} + {0.5 × [Bond Value$_{down}$ + (Coupon / 2)]} / (1 + Interest Rate / 2)

Bond Value at node A = {0.5 × [$92.38 + ($6.25 / 2)]} + {0.5 × [$96.83 + ($6.25 / 2)]} / [1 + (7.91% / 2)] = $94.01 (Study Session 14, LOS 47.d)

Question #70 of 88

Question ID: 463791

Johnson asks Wall to compute the value of the call option. Using the given information what is the value of the embedded call option?

- ✓ **A) $2.04.**
- ✗ **B)** $1.21.
- ✗ **C)** $0.00.

Explanation

The call option value is simply the difference between the value of the callable and the non-callable bond.

Call Option Value = $100.83 − $98.79 = $2.04 (Study Session 14, LOS 47.e)

Question #71 of 88

Question ID: 463792

Wall is a little confused over the relationship between the embedded option and the callable bond. How does the value of the embedded call option change when interest rate volatility increases? The value:

- ✗ **A)** **decreases.**
- ✗ **B)** may increase or decrease.
- ✓ **C)** increases.

Explanation

All option values increase when the volatility of the underlying asset increases. This is due 47.e)

Question #72 of 88

Question ID: 463793

Wall wonders how the value of the callable bond changes when interest rate volatility increases. How will an increase in volatility affect the value of the callable bond? The value:

- ✗ **A)** **increases.**
- ✗ **B)** may increase or decrease.
- ✓ **C)** decreases.

Explanation

The value of the callable bond decreases if the interest rate volatility inreases because the value of the embedded call option increases. Since the value of the callable bond is the difference between the value of the non-callable bond and the value of the embedded call option, its value has to decrease. (Study Session 14, LOS 47.e, f)

Question #73 of 88

Question ID: 463794

Wall now turns his attention to the value of the embedded call option. How does the value of the embedded call option react to an increase in interest rates? The value of the embedded call is most likely to:

- ✓ **A)** **decrease.**
- ✗ **B)** increase.
- ✗ **C)** remain the same.

Explanation

There are two different effects that an increase in interest rate will cause in this situation. The first (and primary) impact stems from the relationship between interest rates and bond values: when interest rates increase, bond values decrease. Since the underlying asset to the option (the bond) decreases in value, the option will decrease in value also. The second (and much smaller) effect stems from the fact that when interest rates are higher, call option prices are generally higher because holding a call (rather than the underlying) is more attractive when interest rates are high. However, this secondary effect is likely to be smaller than the impact of the change in bond value. (Study Session 14, LOS 47.e, f)

Question #74 of 88

Question ID: 463795

Wall believes he understands the relationship between interest rates and straight bonds but is unclear how callable bonds change as interest rates increase. How do prices of callable bonds react to an increase in interest rates? The price:

✓ **A)** **decreases.**

✗ **B)** may increase or decrease.

✗ **C)** increases.

Explanation

Since the bond has a fixed coupon it becomes relatively less attractive to investors when interest rates increase. Its cash flows are now discounted at a higher discount rate which reduces the value of the bond. (Study Session 14, LOS 47.e, f)

Question #75 of 88

Question ID: 463856

The primary benefit of owning a convertible bond over owning the common stock of a corporation is the:

✗ **A)** **bond has more upside potential.**

✓ **B)** bond has lower downside risk.

✗ **C)** conversion premium.

Explanation

The straight value of the bond forms a floor for the convertible bond's price. This lowers the downside risk. The conversion premium is a disadvantage of owning the convertible bond, and it is the reason the bond has lower upside potential when compared to the stock.

Question #76 of 88

Question ID: 463813

Using the following tree of semiannual interest rates what is the value of a 5% callable bond that has one year remaining to maturity, a call price of 99 and pays coupons semiannually?

> 7.76%
> 6.20%
> 5.45%

✗ **A)** **99.01.**

✓ **B)** 98.29.

✗ **C)** 97.17.

Explanation

The callable bond price tree is as follows:

> 100.00
> A → 98.67
> 98.29 100.00
> 99.00

100.00

As an example, the price at node A is obtained as follows:

$Price_A$ = min[(prob × (P_{up} + (coupon / 2)) + prob × (P_{down} + (coupon/2)) / (1 + (rate / 2)), call price] = min[(0.5 × (100 + 2.5) + 0.5 × (100 + 2.5)) / (1 + (0.0776 / 2)), 99} = 98.67. The bond values at the other nodes are obtained in the same way.

Question #77 of 88

Question ID: 463828

An analyst has constructed an interest rate tree for an on-the-run Treasury security. The analyst now wishes to use the tree to calculate the convexity of a callable corporate bond with maturity and coupon equal to that of the Treasury security. The usual way to do this is to calculate the option-adjusted spread (OAS):

✓ **A)** **shift the Treasury yield curve, compute the new forward rates, add the OAS to those forward rates, enter the adjusted values into the interest rate tree, and then use the usual convexity formula.**

✗ **B)** compute the convexity of the Treasury security, and add the OAS.

✗ **C)** compute the convexity of the Treasury security, and divide by (1+OAS).

Explanation

The analyst uses the usual convexity formula, where the upper and lower values of the bonds are determined using the tree.

Question #78 of 88

Question ID: 463841

For a convertible bond, which of the following is *least* accurate?

✗ **A)** **The conversion ratio times the price per share of common stock is a lower limit on the bond's price.**

✓ **B)** The issuer can decide when to convert the bonds to stock.

✗ **C)** A convertible bond may be putable.

Explanation

All of these are true except the possibility of the issuer to force conversion. The bondholder has the option to convert.

Question #79 of 88

Question ID: 472699

Sharon Rogner, CFA is evaluating three bonds for inclusion in fixed income portfolio for one of her pension fund clients. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years. Rogner computes the OAS of bond A to be 50bps using a binomial tree with an assumed interest rate volatility of 15%.

If Rogner revises her estimate of interest rate volatility to 20%, the computed OAS of Bond B would *most likely* be:

✗ **A)** **equal to 50bps.**

✓ **B)** lower than 50bps.

✗ **C)** higher than 50bps.

Explanation

The OAS of the three bonds should be same as they are given to be identical bonds except for the embedded options (OAS is after removing the option feature and hence would not be affected by embedded options). Hence the OAS of bond B would be 50 bps absent any changes in assumed level of volatility.

When the assumed level of volatility in the tree is increased, the value of the embedded call option would increase and the *computed* value of the callable bond would decrease. The constant spread now needed to force the computed value to be equal to the market price is therefore lower than before. Hence an increase in volatility estimate reduces the computed OAS for a callable bond.

Question #80 of 88

Question ID: 463845

A convertible bond has a conversion ratio of 12 and a straight value of $1,010. The market value of the bond is $1,055, and the market value of the stock is $75. What is the market conversion price and premium over straight value of the bond?

	Market conversion price	Premium over straight value
✓ **A)**	**$87.92**	**0.0446**
✗ **B)**	$75.00	0.1029
✗ **C)**	$84.17	0.1222

Explanation

The market conversion price is:

(market price of the bond) / (conversion ratio) = $1,055 / 12 = $87.92.

The premium over straight price is:

(market price of bond) / (straight value) − 1 = ($1,055 / $1,010) − 1 = 0.0446.

Question #81 of 88

Question ID: 463797

For a callable bond, the value of an embedded option is the price of the option-free bond:

✗ **A)** **plus the price of a callable bond of the same maturity, coupon and rating.**

✗ **B)** plus the risk-free rate.

✓ **C)** minus the price of a callable bond of the same maturity, coupon and rating.

Explanation

The value of the option embedded in a bond is the difference between that bond and an option-free bond of the same maturity, coupon and rating. The callable bond will have a price that is less than the price of a non-callable bond. Thus, the value of the embedded option is the option-free bond's price minus the callable bond's price.

Question #82 of 88

Question ID: 463821

The option adjusted spread (OAS) is used to analyze risk by adjusting for the embedded options. Which of the following risks does the OAS reflect?

✗ **A)** **Maturity risk.**

✓ **B)** Credit risk.

✗ **C)** Prepayment risk.

Explanation

The OAS reflects credit risk and liquidity risk.

Question #83 of 88

Question ID: 463826

An analyst has constructed an interest rate tree for an on-the-run Treasury security. The analyst now wishes to use the tree to calculate the duration of the Treasury security. The usual way to do this is to estimate the changes in the bond's price associated with a:

✗ **A)** **parallel shift up and down of the forward rates implied by the binomial model.**

✓ **B)** parallel shift up and down of the yield curve.

✗ **C)** shift up and down in the current one-year spot rate all else held constant.

Explanation

The usual method is to apply parallel shifts to the yield curve, use those curves to compute new sets of forward rates, and then enter each set of rates into the interest rate tree. The resulting volatility of the present value of the bond is the measure of effective duration.

Question #84 of 88

Question ID: 472703

Joseph Dentice, CFA is evaluating three bonds. All three bonds have a coupon rate of 3%, maturity of five years and are generally identical in every respect except that bond A is an option-free bond, bond B is callable in two years and bond C is putable in two years.

If interest rates increase, the duration of which bond is *most likely* to decrease?

✗ **A)** **Bond A.**

✗ **B)** Bond B.

✓ **C)** Bond C.

Explanation

Increase in rates would increase the likelihood of the put option being exercised and reduce the expected life (and duration) of the putable bond the most.

Question #85 of 88

Question ID: 463803

With the zero volatility spread (Z-spread) approach the value of an asset-backed security (ABS) is the present value of cash flows discounted at the spot rates plus the Z-spread. This means the Z-spread technique does not incorporate prepayments and thus would be appropriate to value:

✗ **A)** **high quality home equity loans.**

✗ **B)** auto loans or high quality home equity loans.

✓ **C)** auto loans or credit card loans.

Explanation

The Z-spread would be appropriate for valuing auto or credit card backed securities, because neither are likely to refinance.

Question #86 of 88

Question ID: 463839

Which of the following *correctly* describes one of the basic features of a convertible bond? A convertible bond is a security that can be converted into:

✗ **A)** **another bond at the option of the issuer.**

✓ **B)** common stock at the option of the investor.

✗ **C)** common stock at the option of the issuer.

Explanation

The owner of a convertible bond can exchange the bond for the common shares of the issuer.

Question #87 of 88

Question ID: 463842

For a convertible bond with a call provision, with respect to the bond's convertibility feature and the call feature, the Black-Scholes option model can apply to:

✗ **A)** **neither features.**

✓ **B)** only one feature.

✗ **C)** both features.

Explanation

The Black-Scholes model applies to the convertibility feature just as it does to the common stock. The Black-Scholes model is not appropriate for the call feature because the volatility of the bond cannot be assumed constant.

Question #88 of 88

Question ID: 463800

A callable bond and an option-free bond have the same coupon, maturity and rating. The callable bond currently trades at par value. Which of the following lists *correctly* orders the values of the indicated items from lowest to highest?

✗ **A)** **Embedded call, $0, callable bond, option-free bond.**

✗ **B)** Embedded call, callable bond, $0, option-free bond.

✓ **C)** $0, embedded call, callable bond, option-free bond.

Explanation

The embedded call will always have a positive value prior to expiration, and this is especially true if the callable bond trades at par value. Since investors must be compensated for the call feature, the value of the option-free bond must exceed that of a callable bond with the same coupon and maturity and rating.