The Arbitrage-Free Valuation Framework

Test ID: 7441665

Question #1 of 38

Question ID: 472602

Tim Brospack is generating a binomial interest rate tree assuming a volatility of 15%. Current 1-year spot rate is 5%. The 1-year forward rate in the second year is either a low estimate of 5.250% or a high estimate of 7.087%.The middle 1-year forward rate in year three is estimated at 6.25%. The lower node 1-year forward rate in year three is *closest* to:

✓ **A) 4.63%**

✗ **B)** 6.747%

✗ **C)** 5.342%

Explanation

Lower node interest rate = 6.25 / $e^{2 \times 0.15}$ = 4.63%

Question #2 of 38

Question ID: 463785

The volatility assumption in a Monte Carlo simulation is important, because it determines the:

✗ **A) speed of prepayments.**

✗ **B)** level of prepayments.

✓ **C)** dispersion of future interest rates and the number of possible paths that may be followed.

Explanation

The volatility assumption in a Monte Carlo simulation is important because it determines the dispersion of future interest rates and the number of possible paths that may be followed.

Question #3 of 38

Question ID: 472694

Relative to the binomial model, Monte Carlo method is *most likely*:

✓ **A) more suitable when valuing securities whose cash flows are interest rate path dependent.**

✗ **B)** more flexible as it does not need a volatility estimate.

✗ **C)** less flexible in forcing interest rates to mean revert.

Explanation

Monte Carlo method does not require that cash flows of a security are path dependent and hence is suitable alternative to the binomial model to value securities such as mortgage backed securities whose cash flows are path dependent. The model generating interest rates paths in a Monte Carlo simulation is based on an assumed level of volatility (i.e., model needs a volatility input). The model generating interest rates in a Monte Carlo simulation can incorporate bounds for interest rates to force mean reversion of rates. Such bounded optimization is not possible in a binomial model.

Question #4 of 38

Question ID: 463765

The purpose of relative value analysis is to determine:

✗ **A)** **the return differential from riding the yield curve.**

✓ **B)** whether a bond is fairly valued using a benchmark yield.

✗ **C)** whether a stock is fairly valued using present value calculations.

Explanation

The purpose of relative value analysis is to determine whether a bond is fairly valued. The bond's spread over some benchmark is compared to that of a required spread to determine whether the bond is fairly valued. The required spread will be that available on comparable securities.

Question #5 of 38

Question ID: 463774

Which of the following is a *correct* statement concerning the backward induction technique used within the binomial interest rate tree framework? From the maturity date of a bond:

✗ **A)** **the corresponding interest rates are weighted by the bond's duration to discount the value of the bond.**

✗ **B)** a deterministic interest rate path is used to discount the value of the bond.

✓ **C)** the corresponding interest rates and interest rate probabilities are used to discount the value of the bond.

Explanation

For a bond that has N compounding periods, the current value of the bond is determined by computing the bond's possible values at period N and working "backwards" to the present. The value at any given node is the probability-weighted average of the discounted values of the next period's nodal values.

Question #6 of 38

Question ID: 463771

With respect to interest rate models, backward induction refers to determining:

✗ **A)** **convexity from duration.**

✗ **B)** one portion of the yield curve from another portion.

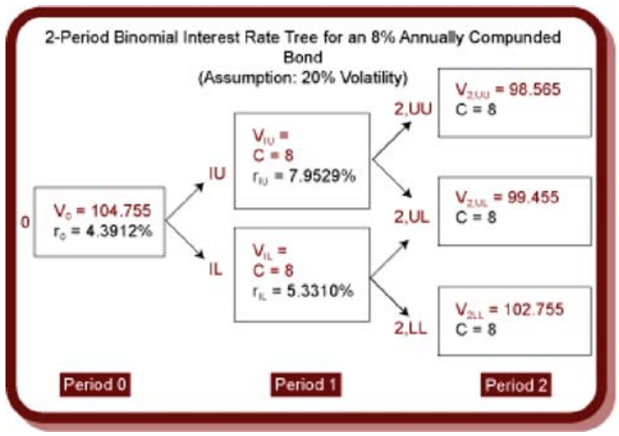
✓ **C)** the current value of a bond based on possible final values of the bond.

Explanation

Backward induction refers to the process of valuing a bond using a binomial interest rate tree. For a bond that has N compounding periods, the current value of the bond is determined by computing the bond's possible values at period N and working "backwards."

Questions #7-12 of 38

Dawn Adams, CFA, along with her recently hired staff, have responsibilities that require them to be familiar with backward induction methodology as it is used with a binomial valuation model. Adams, however, is concerned that some of her staff, particularly those not enrolled in the CFA program, are a little weak in this area. To assess their understanding of the binomial model and its uses, Adams presented her staff with the first two years of the binomial interest rate tree for an 8% annually compounded bond (shown below). The forward rates and the corresponding values shown in this tree are based on an assumed interest rate volatility of 20%.



A member of Adams" staff has been asked to respond to the following:

Question #7 of 38

Question ID: 463776

Compute V_{1L}, the value of the bond at node 1L.

✗ **A) $101.05.**

✗ **B)** $95.99.

✓ **C)** $103.58.

Explanation

V_{1L} = (½)[(V_{2LU} + C) / (1 + r_{1L})] + [($V_{2,LL}$ + C) / (1 + r_{1L})]

V_{1L} = (½)[(99.455 + 8) / (1 + 0.05331)] + [(102.755 + 8) / (1 + 0.05331)] = $103.583

(Study Session 14, LOS 47.i)

Question #8 of 38

Question ID: 463777

Compute V_{1U}, the value of the bond at node 1U.

✗ **A) $91.72.**

✗ **B)** $99.01.

✓ **C)** $99.13.

Explanation

V_{1U} = (½)[($V_{2,UU}$ + C) / (1 + r_{1U})] + [($V_{2,UL}$ + C)/(1 + r_{1U})]

V_{1U} = (½)[(98.565 + 8) / (1 + 0.079529)] + [(99.455 + 8) / (1 + 0.079529)] = $99.127

(Study Session 14, LOS 47.i)

Question #9 of 38

Question ID: 463778

Compute V_0, the value of the bond at node 0.

✓ **A) $104.76.**

✗ **B)** $99.07.

✗ **C)** $101.35.

Explanation

$V_0 = (½)[(V_{1U} + C) / (1 + r_0)] + [(V_{1L} + C) / (1 + r_0)]$

From the previous question the value for V_{1U} was determined to be $99.127

$V_0 = (½)[(99.127 + 8) / (1 + 0.043912)] + [(103.583 + 8)/(1 + 0.043912)] = \$104.755$

(Study Session 14, LOS 47.i)

Question #10 of 38

Question ID: 463779

Assume that the bond is putable in one year at par ($100) and that the put will be exercised if the computed value is less than par. What is the value of the putable bond?

✓ **A) $105.17.**

✗ **B)** $103.04.

✗ **C)** $95.38.

Explanation

The relevant value to be discounted using a binomial model and backward induction methodology for a putable bond is the value that will be received if the put option is exercised or the computed value, whichever is greater.

In this case, the relevant value at node 1U is the exercise price ($100.000) since it is greater than the computed value of $99.127. At node 1L, the computed value of $103.583 must be used.

Therefore, the value of the putable bond is:

$V_0 = (½)[(100.00 + 8) / (1 + 0.043912)] + [(103.583 + 8) / (1 + 0.043912)] = \$105.17314$
(Study Session 14, LOS 47.i)

Question #11 of 38

Question ID: 463780

Assume that the bond is putable in one year at par ($100) and that the put will be exercised if the computed value is less than par. What is the value of the put option?

✓ **A) $0.42.**

✗ **B)** $3.70.

✗ **C)** $1.86.

Explanation

$V_{putable} = V_{nonputable} + V_{put}$

Rearranging, the value of the put can be stated as:

$V_{put} = V_{putable} - V_{nonputable}$

$V_{putable}$ was computed to be $105.173 in the previous question, and $V_{nonputable}$ was determined to be $104.755 in the question prior to that. So the value of the embedded put option for the bond under analysis is:

$105.173 − 104.755 = $0.418

(Study Session 14, LOS 47.e, i)

Question #12 of 38

Question ID: 463781

Which of the following statements regarding the option adjusted spread (OAS) for a callable bond is *least* accurate?

✗ **A) The OAS is the spread on a bond with an embedded option after the embedded option cost has been removed.**

✓ **B)** The OAS is equal to the Z-spread plus the option cost.

✗ **C)** The OAS for a corporate bond must be calculated using a binomial interest rate model.

Explanation

The OAS is equal to the Z-spread *minus* the option cost. Both of the other choices are true statements. (Study Session 14, LOS 47.g)

Question #13 of 38

Question ID: 463770

Why is the backward induction methodology used to value a bond rather than a forward induction scheme?

✓ **A) The price of the bond is known at maturity.**

✗ **B)** The convexity of a bond changes over time.

✗ **C)** Future interest rate changes are difficult to forecast.

Explanation

The objective is to value a bond's current price while the bond price at maturity is known. Therefore, price at maturity is used as a starting point, and we work backward to the current value.

Question #14 of 38

Question ID: 472691

A 3-year, 3% annual pay, $100 par bond is valued using pathwise valuation. The interest rate paths are provided below:

Path	Year 1	Year 2	Year 3
1	2%	2.8050%	4.0787%
2	2%	2.8050%	3.0216%
3	2%	2.0780%	3.0216%
4	2%	2.0780%	2.2384%

The value of the bond in path 2 is closest to:

✓ **A) $101.15**

✗ **B)** $100.88

✗ **C)** $102.72

Explanation

$$\text{Path 2 value} = \frac{3.0}{(1.02)} + \frac{3.0}{(1.02)(1.02805)} + \frac{103.0}{(1.02)(1.02805)(1.030216)} = 101.15$$

Question #15 of 38

Question ID: 472688

For a 3-year, semiannual coupon payment bond, the number of interest rate paths that would be generated using the pathwise valuation is closest to:

✗ **A) 64**

✗ **B)** 4

✓ **C)** 32

Explanation

For a 3-year, semiannual coupon bond, there will be six nodal periods resulting in $2^{(6-1)}$ = 32 paths.

Question #16 of 38

Question ID: 463783

A putable bond with a 6.4% annual coupon will mature in two years at par value. The current one-year spot rate is 7.6%. For the second year, the yield volatility model forecasts that the one-year rate will be either 6.8% or 7.6%. The bond is putable in one year at 99. Using a binomial interest rate tree, what is the current price?

✗ **A) 98.885.**

✗ **B)** 98.190.

✓ **C)** 98.246.

Explanation

The tree will have three nodal periods: 0, 1, and 2. The goal is to find the value at node 0. We know the value at all nodes in nodal period 2: V_2=100. In nodal period 1, there will be two possible prices:

$V_{i,U}$ = [(100 + 6.4) / 1.076 + (100+6.4) / 1.076] / 2 = 98.885

$V_{i,L}$ = [(100 + 6.4) / 1.068 + (100 + 6.4) / 1.068] / 2 = 99.625.

Since 98.885 is less than the put price, $V_{i,U}$ = 99

V_0 = [(99 + 6.4) / 1.076) + (99.625 + 6.4) / 1.076)] / 2 = 98.246.

Question #17 of 38

Question ID: 463764

The following are the yields on various bonds. The relevant benchmark is that of Treasury securities.

Treasury Bond Yield	4.00%
Bond Sector Yield	4.50%
Comparable Bond Yield	6.00%
ABC Bond Yield	6.50%

Is the ABC bond undervalued or overvalued and why? Using relative value analysis, the ABC bond is:

✗ **A) overvalued because its spread is greater than that of comparable bonds.**

✓ **B)** undervalued because its spread is greater than that of comparable bonds.

✗ **C)** undervalued because its yield is greater than that of Treasuries.

Explanation

The purpose of relative value analysis is to determine whether a bond is fairly valued. The bond's spread over some benchmark is compared to that of a required spread to determine whether the bond is fairly valued. The required spread will be that available on comparable securities. In this example, the relevant benchmark was Treasury securities. The spread for ABC bonds over Treasuries was 2.5%. The spread for comparable bonds over Treasuries was 2.0%. The higher spread for ABC bonds means that they are relatively undervalued (their price is low because their yield is higher).

Question #18 of 38

Question ID: 472599

Which of the following choices is least-likely a property of a binomial interest rate tree?

✓ **A) Mean reversion of interest rates.**

✗ **B)** Non-negative interest rates.

✗ **C)** Higher volatility at higher rates.

Explanation

A binomial interest rate tree has two desirable properties: non-negative interest rates and higher volatility at higher rates. Binomial trees do not force mean reversion of rates.

Question #19 of 38

Question ID: 463766

The following are the yields on various bonds. The relevant benchmark is that of the bond sector.

Treasury Bond Yield	3.00%
Bond Sector Yield	3.25%
Comparable Bond Yield	5.75%
ABC Bond Yield	5.50%

Is the ABC bond undervalued or overvalued and why? Using relative value analysis, the ABC bond is:

✗ **A)** **undervalued because its spread is less than that of comparable bonds.**

✓ **B)** overvalued because its spread is less than that of comparable bonds.

✗ **C)** undervalued because its yield is less than that of Treasuries.

Explanation

The purpose of relative value analysis is to determine whether a bond is fairly valued. The bond's spread over some benchmark is compared to that of a required spread to determine whether the bond is fairly valued. The required spread will be that available on comparable securities. In this example, the relevant benchmark was the bond sector. The spread for ABC bonds over the bond sector was 2.25%. The spread for comparable bonds over the bond sector was 2.50%. The lower spread for ABC bonds means that they are relatively overvalued (their price is high because their yield is lower).

Question #20 of 38

Question ID: 477718

Sam Roit, CFA, has collected the following information on the par rate curve, spot rates, and forward rates to generate a binomial interest rate tree consistent with this data.

Maturity	*Par Rate*	*Spot Rate*
1	5%	5.000%
2	6%	6.030%
3	7%	7.097%

The binomial tree generated is shown below (one year forward rates) assuming a volatility level of 10%:

0	**1**	**2**
5%	7.7099%	C
	A	9.2625%
		B

Riot also generated another tree using the same spot rates but this time assuming a volatility level of 20% as shown below:

0	**1**	**2**
5%	8.9480%	13.8180%
	5.9980%	9.2625%
		6.2088%

The one-year forward rate represented by 'C' is closest to:

✗ **A)** **7.4223%**

✓ **B)** 11.3132%

✗ **C)** 8.7732%

Explanation

Value represented by 'C' = 9.2625 x $e^{2x0.10}$ = 11.3132%

Question #21 of 38

Question ID: 472693

Increasing the number of paths generated in a Monte Carlo simulation is *most likely* to increase the:

✗ **A)** **utility of the model.**

✗ **B)** fundamental accuracy of the estimated value.

✓ **C)** statistical accuracy of the estimated value.

Explanation

Increasing the number of paths would increase the statistical accuracy of the estimate but does nothing for the fundamental accuracy of the estimated value which depends on the quality of model inputs. Model utility depends on valuation accuracy of the model and hence would not increase as we increase the number of paths.

Question #22 of 38

Question ID: 472604

Sam Roit, CFA, has collected the following information on the par rate curve, spot rates, and forward rates to generate a binomial interest rate tree consistent with this data.

Maturity	*Par Rate*	*Spot Rate*
1	5%	5.000%
2	6%	6.030%
3	7%	7.097%

The binomial tree generated is shown below (one year forward rates) assuming a volatility level of 10%:

0	1	2
5%	7.7099%	C
	A	9.2625%
		B

Riot also generated another tree using the same spot rates but this time assuming a volatility level of 20% as shown below:

0	1	2
5%	8.9480%	13.8180%
	5.9980%	9.2625%
		6.2088%

The one-year forward rate represented by 'A' is closest to:

✓ **A)** **6.3123%**

✗ **B)** 5.4223%

✗ **C)** 6.7732%

Explanation

Value represented by 'A' = 7.7099 / $e^{2 \times 0.10}$ = 6.3123%

Question #23 of 38

Question ID: 472689

A 3-year, 3% annual pay, $100 par bond is valued using pathwise valuation. The interest rate paths are provided below:

Path	Year 1	Year 2	Year 3
1	2%	2.8050%	4.0787%

2	2%	2.8050%	3.0216%
3	2%	2.0780%	3.0216%
4	2%	2.0780%	2.2384%

The value of the bond in path 3 is closest to:

✓ **A) $101.85**

✗ **B)** $99.88

✗ **C)** $100.02

Explanation

Answer: Path 3 value =

$$\frac{3.0}{(1.02)} + \frac{3.0}{(1.02)(1.02078)} + \frac{103.0}{(1.02)(1.02078)(1.030216)} = 101.85$$

Question #24 of 38

Question ID: 463768

Using the following interest rate tree of semiannual interest rates what is the value of an option free semiannual bond that has one year remaining to maturity and has a 6% coupon rate?

> 6.53%
> 6.30%
> 5.67%

✗ **A) 97.53.**

✓ **B)** 99.89.

✗ **C)** 98.52.

Explanation

The option-free bond price tree is as follows:

> 100.00
> A ==> 99.79
> 99.89 100.00
> 100.20
> 100.00

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

Price_A = (prob × (P_{up} + coupon/2) + prob × (P_{down} + coupon/2))/(1 + rate)$^{0.5}$ = (0.5 × (100 + 3) + 0.5 × (100 + 3))/(1 + 0.0653)$^{0.5}$ = 99.79. The bond values at the other nodes are obtained in the same way.

The calculation for node 0 or time 0 is

0.5[(99.79 + 3)/(1+ 0.063)$^{0.5}$ + (100.20 + 3)/(1 + 0.063)$^{0.5}$] =

99.89

Question #25 of 38

Question ID: 472601

Tim Brospack is generating a binomial interest rate tree assuming a volatility of 15%. Current 1-year spot rate is 5%. The 1-year forward rate in the second year is either a low estimate of 5.250% or a high estimate of 7.087%. The middle 1-year forward rate in year three is estimated at 6.25%. The upper node 1-year forward rate in year three is *closest* to:

✗ **A) 7.747%**

✗ **B)** 6.445%

✓ **C)** 8.437%

Explanation

Upper node interest rate = 6.25 × $e^{2x0.15}$ = 8.437%

Question #26 of 38

Question ID: 472600

Which of the following choices is *least-likely* a property of a binomial interest rate tree?

✓ **A) Adjacent forward rates in a nodal period are one standard deviation apart.**

✗ **B)** Higher volatility at higher rates.

✗ **C)** Non-negative interest rates.

Explanation

A binomial interest rate tree has two desirable properties: non-negative interest rates and higher volatility at higher rates. Additionally, adjacent forward rates in a nodal period are *two* standard deviations apart.

Question #27 of 38

Question ID: 472692

A 3-year, 3% annual pay, $100 par bond is valued using pathwise valuation. The interest rate paths are provided below:

Path	Year 1	Year 2	Year 3
1	2%	2.8050%	4.0787%
2	2%	2.8050%	3.0216%
3	2%	2.0780%	3.0216%
4	2%	2.0780%	2.2384%

The value of the bond in path 1 is closest to:

✗ **A) $98.77**

✓ **B)** $100.18

✗ **C)** $101.88

Explanation

$$\text{Path 1 value} = \frac{3.0}{(1.02)} + \frac{3.0}{(1.02)(1.02805)} + \frac{103.0}{(1.02)(1.02805)(1.040787)} = 100.18$$

Question #28 of 38

Question ID: 463782

A callable bond with an 8.2% annual coupon will mature in two years at par value. The current one-year spot rate is 7.9%. For the second year, the yield-volatility model forecasts that the one-year rate will be either 6.8% or 7.6%. The call price is 101. Using a binomial interest rate tree, what is the current price?

✓ **A) 101.000.**

✗ **B)** 100.279.

✗ **C)** 100.558.

Explanation

The tree will have three nodal periods: 0, 1, and 2. The goal is to find the value at node 0. We know the value for all the nodes in nodal period 2: V_2=100. In nodal period 1, there will be two possible prices:

$V_{1,U}$ =[(100+8.2)/1.076+(100+8.2)/1.076]/2 = 100.558

$V_{1,L}$ =[(100+8.2)/1.068+(100+8.2)/1.068]/2= 101.311

Since $V_{1,L}$ is greater than the call price, the call price is entered into the formula below:

V_0=[(100.558+8.2)/1.079)+(101+8.2)/1.079)]/2 = 101.000.

Question #29 of 38

Question ID: 463769

For a putable bond, callable bond, or putable/callable bond, the nodal-decision process within the backward induction methodology of the interest rate tree framework requires that at each node the possible values will:

✓ **A) not be higher than the call price or lower than the put price.**

✗ **B)** include the face value of the bond.

✗ **C)** be, in number, two plus the number of embedded options.

Explanation

At each node, there will only be two values. At each node, the analyst must determine if the initially calculated values will be below the put price or above the call price. If a calculated value falls below the put price: $V_{i,U}$ = the put price. Likewise, if a calculated value falls above the call price, then $V_{i,L}$ = the call price. Thus the put and call price are lower and upper limits, respectively, of the bond's value at a node.

Question #30 of 38

Using the following interest rate tree of semiannual interest rates what is the value of an option free bond that has one year remaining to maturity and has 5% coupon rate with semi-annual coupon payments.

Today	6 Months
	7.30%
6.20%	
	5.90%

✗ **A) 97.53.**

✗ **B)** 98.98.

✓ **C)** 98.67.

Explanation

The option-free bond price tree is as follows:

		100.00
	A → 98.89	
98.67		100.00
	99.56	
		100.00

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

$Price_A$ = (prob × (P_{up} + (coupon / 2)) + prob × (P_{down} + (coupon / 2)) / (1 + (rate / 2)) = (0.5 × (100 + 2.5) + 0.5 × (100 + 2.5) / (1 + (0.0730 / 2)) = 98.89. The bond values at the other nodes are obtained in the same way.

The calculation for node 0 or time 0 is

0.5[(98.89 + 2.5) / (1+ 0.062 / 2) + (99.56 + 2.5) / (1 + 0.062 / 2)] =

0.5(98.3414 + 98.9913) = 98.6663

Question #31 of 38

The government bond spot rate curve is given below:

Maturity (years)	Spot rate
0.5	1.25%
1.0	1.30%
1.5	1.80%
2.0	2.00%
2.5	2.20%
3.0	2.25%
3.5	2.28%
4.0	2.30%

Compute the issue price of a 3-year, 3% semiannual coupon government bond with a par value of $100.

✗ **A) $102.15**

✗ **B)** $104.09

✓ **C)** $102.20

Explanation

Value =

$$\frac{1.50}{\left[1+\frac{0.0125}{2}\right]^{1}}+\frac{1.50}{\left[1+\frac{0.013}{2}\right]^{2}}+\frac{1.50}{\left[1+\frac{0.018}{2}\right]^{3}}+\frac{1.50}{\left[1+\frac{0.02}{2}\right]^{4}}+\frac{1.50}{\left[1+\frac{0.022}{2}\right]^{5}}+\frac{101.50}{\left[1+\frac{0.0225}{2}\right]^{6}}$$

= $102.20

Question #32 of 38

Question ID: 463784

A bond with a 10% annual coupon will mature in two years at par value. The current one-year spot rate is 8.5%. For the second year, the yield volatility model forecasts that the one-year rate will be either 8% or 9%. Using a binomial interest rate tree, what is the current price?

✓ **A) 102.659.**

✗ **B)** 101.837.

✗ **C)** 103.572.

Explanation

The tree will have three nodal periods: 0, 1, and 2. The goal is to find the value at node 0. We know the value in nodal period 2: V_2=100. In nodal period 1, there will be two possible prices:

$V_{1,U}$=[(100+10)/1.09+(100+10)/1.09]/2= 100.917

$V_{1,L}$=[(100+10)/1.08+(100+10)/1.08]/2= 101.852

Thus

V_0=[(100.917+10)/1.085+(101.852+10)/1.085]/2= 102.659

Question #33 of 38

Question ID: 472690

A 3-year, 3% annual pay, $100 par bond is valued using pathwise valuation. The interest rate paths are provided below:

Path	Year 1	Year 2	Year 3
1	2%	2.8050%	4.0787%
2	2%	2.8050%	3.0216%
3	2%	2.0780%	3.0216%
4	2%	2.0780%	2.2384%

The value of the bond in path 4 is closest to:

✗ **A) $100.02**

✗ **B)** $101.88

✓ **C)** $102.58

Explanation

$$\text{Path 4 value} = \frac{3.0}{(1.02)} + \frac{3.0}{(1.02)(1.02078)} + \frac{103.0}{(1.02)(1.02078)(1.022384)} = 102.58$$

Question #34 of 38

Question ID: 472603

Sam Roit, CFA, has collected the following information on the par rate curve, spot rates, and forward rates to generate a binomial interest rate tree consistent with this data.

Maturity	*Par Rate*	*Spot Rate*
1	5%	5.000%
2	6%	6.030%
3	7%	7.097%

The binomial tree generated is shown below (one year forward rates) assuming a volatility level of 10%:

0	1	2
5%	7.7099%	C
	A	9.2625%
		B

Riot also generated another tree using the same spot rates but this time assuming a volatility level of 20% as shown below:

0	1	2
5%	8.9480%	13.8180%
	5.9980%	9.2625%
		6.2088%

Is the binomial tree using the 20% volatility assumption calibrated properly?

✗ **A) The tree is calibrated properly.**

✗ **B)** The tree is not calibrated properly because adjacent nodes are not appropriate standard deviations apart.

✓ **C)** The tree is not calibrated properly because it is not consistent with market prices.

Explanation

The tree is not calibrated properly - it does not value 3-year 7% bond at par (i.e., the market price):

$$V_{2,UU} = \frac{107}{(1.13818)} = \$94.01$$

$$V_{2,UL} = \frac{107}{(1.092625)} = \$97.93$$

$$V_{2,LL} = \frac{107}{1.062088} = \$100.74$$

$$V_{1,U} = \frac{1}{1.08948} \times \left[\frac{94.01 + 97.93}{2} + 7\right] = \$94.51$$

$$V_{1,L} = \frac{1}{1.05998} \times \left[\frac{97.93 + 100.74}{2} + 7\right] = \$100.31$$

$$V_0 = \frac{1}{1.05} \times \left[\frac{94.51 + 100.32}{2} + 7\right] = \$99.44$$

The adjacent nodes in the binomial tree for any nodal period are all two standard deviations apart.

Question #35 of 38

Question ID: 463773

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

✗ **A) Max(par value, discounted value).**

✓ **B)** Max(put price, discounted value).

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

Explanation

When valuing a putable 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 exercise price, whichever is greater.

Question #36 of 38

Question ID: 472598

Government par curve is provided below:

Maturity (years)	Par rate
1	5.0%
2	6.0%
3	6.5%
4	7.0%

The value of a 4-year, 5% annual pay, $100 par government bond is closest to:

✗ **A) $101.12**

✗ **B)** $98.49

✓ **C)** $93.15

Explanation

Answer: First we compute the spot rates:

S_1: (given) = 5%

S_2: $100 = \frac{6.0}{(1.05)} + \frac{106.0}{(1+S_2)^2} \rightarrow S_2$ +6.03%

S_3: $100 = \frac{6.5}{(1.05)} + \frac{6.5}{(1.0603)^2} + \frac{106.5}{(1+S_3)^3} \rightarrow S_3 = 6.56\%$

S_4: $100 = \frac{7.0}{(1.05)} + \frac{7.0}{(1.0603)^2} + \frac{7.0}{(1.0656)^3} + \frac{107.0}{(1+S_4)^4} \rightarrow S_4 = 7.10\%$

Then we use the spot rates to value the 4-year, 5% annual pay bond:

$$\text{Value} = \frac{5.0}{(1.05)^1} + \frac{5.0}{(1.0603)^2} + \frac{5.0}{(1.0656)^3} + \frac{105.0}{(1.071)^4} = 93.15$$

Question #37 of 38

Question ID: 472605

Sam Roit, CFA, has collected the following information on the par rate curve, spot rates, and forward rates to generate a binomial interest rate tree consistent with this data.

Maturity	*Par Rate*	*Spot Rate*
1	5%	5.000%
2	6%	6.030%
3	7%	7.097%

The binomial tree generated is shown below (one year forward rates) assuming a volatility level of 10%:

0	1	2
5%	7.7099%	C
	A	9.2625%
		B

Riot also generated another tree using the same spot rates but this time assuming a volatility level of 20% as shown below:

0	1	2
5%	8.9480%	13.8180%
	5.9980%	9.2625%
		6.2088%

The one-year forward rate represented by 'B' is closest to:

✓ **A) 7.5835%**

✗ **B)** 7.4223%

✗ **C)** 8.7732%

Explanation

Value represented by 'B' = 9.2625 / $e^{2\times0.10}$ = 7.5835%

Question #38 of 38

Question ID: 463772

A binomial model or any other model that uses the backward induction method cannot be used to value a mortgage-backed security (MBS) because:

✓ **A) the cash flows for the MBS are dependent upon the path that interest rates follow.**

✗ **B)** the prepayments occur linearly over the life of an interest rate trend (either up or down).

✗ **C)** the cash flows for an MBS only depend on the current rate, not the path that rates have followed.

Explanation

A binomial model or any other model that uses the backward induction method cannot be used to value an MBS because the cash flows for the MBS are dependent upon the path that interest rates have followed.