Question #1 of 26

Question ID: 1210276

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) 101.837.

B) 103.572.

C) 102.659.

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

(Study Session 12, Module 33.1, LOS 33.d)

Related Material

SchweserNotes - Book 4

Question #2 of 26

Question ID: 1210280

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%

(Study Session 12, Module 33.2, LOS 33.e)

Related Material

SchweserNotes - Book 4

Question #3 of 26

Question ID: 1210290

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

A) more flexible as it does not need a volatility estimate.

B) more suitable when valuing securities whose cash flows are interest rate path dependent.

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.

(Study Session 12, Module 33.2, LOS 33.h)

Related Material

SchweserNotes - Book 4

Question #4 of 26

Question ID: 1210284

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 =

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

(Study Session 12, Module 33.2, LOS 33.g)

Related Material

SchweserNotes - Book 4

Question #5 of 26

Question ID: 1210267

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) $102.20

B) $104.09

C) $102.15

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

(Study Session 12, Module 33.1, LOS 33.b)

Related Material

SchweserNotes - Book 4

Question #6 of 26

Question ID: 1210286

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) $100.88

B) $102.72

C) $101.15

Explanation

Path 2 value =

$$\frac{3.0}{(1.02)} + \frac{3.0}{(1.02)(1.02805)} + \frac{103.0}{(1.02)(1.02805)(1.030216)} = 101.15$$

(Study Session 12, Module 33.2, LOS 33.g)

Related Material

SchweserNotes - Book 4

Question #7 of 26

Question ID: 1210270

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) 5.342%

B) 4.63%

C) 6.747%

Explanation

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

(Study Session 12, Module 33.1, LOS 33.c)

Related Material

SchweserNotes - Book 4

Question #8 of 26

Question ID: 1210271

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

A) Non-negative interest rates.

B) Mean reversion of 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.

(Study Session 12, Module 33.1, LOS 33.c)

Related Material

SchweserNotes - Book 4

Question #9 of 26

Question ID: 1210277

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) 98.67.

C) 98.98.

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

(Study Session 12, Module 33.1, LOS 33.d)

Related Material

SchweserNotes - Book 4

Question #10 of 26

Question ID: 1210273

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

A) The convexity of a bond changes over time.

B) Future interest rate changes are difficult to forecast.

C) The price of the bond is known at maturity.

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.

(Study Session 12, Module 33.1, LOS 33.d)

Related Material

SchweserNotes - Book 4

Question #11 of 26

Question ID: 1210266

The process of stripping is *most* likely to be used to earn arbitrage profits in a situation where:

A) a portfolio of treasury strips is trading for a lower price than an intact treasury bond.

B) one treasury bond trades at a lower price than another treasury bond with identical characteristics.

C) Security valuations are not consistent with the value additivity principle.

Explanation

If the principle of value additivity holds, it will not be possible to earn arbitrage profits through stripping (or reconstitution). If a portfolio of strips is trading for less than the price of an intact bond, one can purchase the strips, combine them ("reconstitution"), and sell them as a bond. Similarly, if the bond is worth less than its component parts, one could purchase the bond, break it into a portfolio of strips ("stripping"), and sell those components. When one security trades at a lower price than another security with identical characteristics, this is known as dominance, and the arbitrage required to earn a profit involves going long the underpriced security and short the overpriced security.

(Study Session 12, Module 33.1, LOS 33.a)

Related Material

SchweserNotes - Book 4

Question #12 of 26

Question ID: 1210282

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

Roit 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 not calibrated properly because it is not consistent with market prices.

B) The tree is calibrated properly.

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

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.

(Study Session 12, Module 33.2, LOS 33.e)

Related Material

SchweserNotes - Book 4

Question #13 of 26

Question ID: 1210283

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) 32

B) 4

C) 64

Explanation

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

(Study Session 12, Module 33.2, LOS 33.g)

Related Material

SchweserNotes - Book 4

Question #14 of 26

Question ID: 1210289

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.

(Study Session 12, Module 33.2, LOS 33.h)

Related Material

SchweserNotes - Book 4

Question #15 of 26

Question ID: 1210272

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) 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. Additionally, adjacent forward rates in a nodal period are *two* standard deviations apart.

(Study Session 12, Module 33.1, LOS 33.c)

Related Material

SchweserNotes - Book 4

Question #16 of 26

Question ID: 1210291

Suppose that we calculate the value of an option-free, fixed-rate coupon bond, discounting the cash flows using two methods:

I. the zero-coupon yield curve.
II. an arbitrage-free binomial lattice.

Compared to the first methodology, the second method is expected to produce:

A) a higher value in the presence of volatility.

B) a lower value if the bond carries a coupon higher than the corresponding benchmark bond.

C) the same value.

Explanation

Because these two valuation methods are arbitrage-free, the two values obtained must be the same. An option-free bond that is valued by discounting by the spot rates should have the same value as if the binomial interest rate tree was used.

(Study Session 12, Module 33.2, LOS 33.f)

Related Material

SchweserNotes - Book 4

Question #17 of 26

Question ID: 1210285

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

Path 4 value =

$$\frac{3.0}{(1.02)} + \frac{3.0}{(1.02)(1.02078)} + \frac{103.0}{(1.02)(1.02078)(1.022384)} = 102.58$$

(Study Session 12, Module 33.2, LOS 33.g)

Related Material

SchweserNotes - Book 4

Question #18 of 26

Question ID: 1210281

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

Roit 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 / $e^{2 \times 0.10}$ = 7.5835%

(Study Session 12, Module 33.2, LOS 33.e)

Related Material

SchweserNotes - Book 4

Question #19 of 26

Question ID: 1210275

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 and interest rate probabilities are used 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 are weighted by the bond's duration 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.

(Study Session 12, Module 33.1, LOS 33.d)

Related Material

SchweserNotes - Book 4

Question #20 of 26

Question ID: 1210274

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

A) convexity from duration.

B) the current value of a bond based on possible final values of the bond.

C) one portion of the yield curve from another portion.

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."

(Study Session 12, Module 33.1, LOS 33.d)

Related Material

SchweserNotes - Book 4

Question #21 of 26

Question ID: 1210268

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) $93.15

C) $98.49

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:

Value =

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

(Study Session 12, Module 33.1, LOS 33.b)

Related Material

SchweserNotes - Book 4

Question #22 of 26

Question ID: 1210269

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) 8.437%

C) 6.445%

Explanation

Upper node interest rate = 6.25 × $e^{2 \times 0.15}$ = 8.437%

(Study Session 12, Module 33.1, LOS 33.c)

Related Material

SchweserNotes - Book 4

Question #23 of 26

Question ID: 1210287

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) $101.88

C) $100.18

Explanation

Path 1 value =

$$\frac{3.0}{(1.02)} + \frac{3.0}{(1.02)(1.02805)} + \frac{103.0}{(1.02)(1.02805)(1.040787)} = 100.18$$

(Study Session 12, Module 33.2, LOS 33.g)

Related Material

SchweserNotes - Book 4

Question #24 of 26

Question ID: 1210288

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.

(Study Session 12, Module 33.2, LOS 33.h)

Related Material

SchweserNotes - Book 4

Question #25 of 26

Question ID: 1210278

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) 98.52.

B) 97.53.

C) 99.81.

Explanation

The option-free bond price tree is as follows:

		100.00
	A ==> 99.74	
99.81		100.00
	100.16	
		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 + 3) + 0.5 × (100 + 3))/(1 + 0.0653/2) = 99.74. The bond values at the other nodes are obtained in the same way.

The calculation for node 0 or time 0 is

> 0.5[(99.74 + 3)/(1+ 0.063/2) + (100.16 + 3)/(1 + 0.063/2)] =
>
> 99.81

(Study Session 12, Module 33.1, LOS 33.d)

Related Material

SchweserNotes - Book 4

Question #26 of 26

Question ID: 1210279

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 $e^{2 \times 0.10}$ = 11.3132%

(Study Session 12, Module 33.2, LOS 33.e)

Related Material

SchweserNotes - Book 4