

LAST NAME \_\_\_\_\_

FIRST NAME \_\_\_\_\_

$$P_0 = \frac{C}{(1+y)} + \frac{C}{(1+y)^2} + \dots + \frac{C+N}{(1+y)^T}$$

$$D = w_1 \times 1 + w_2 \times 2 + \dots + w_{T-1} \times T - 1 + w_T \times T$$

Mark your answers clearly: ambiguous or multiple answers for a question → zero points!

A zero coupon bond with maturity T is more subject to interest rate risk than a coupon bond with the same maturity.

- True
- False
- cannot tell based on the information that is provided

If a bond's rating is revised from AAA to BBB, then

- its yield to maturity increases
- its yield to maturity decreases
- its coupon rate increases
- its coupon rate decreases

If the government yield curve (i.e., the term structure of interest rates) makes an upward parallel move in which all the replacement rates for all the maturities go up by the same amount, then the price of a coupon-paying government bond would:

- increase
- stay the same
- decrease
- cannot tell based on the information that is provided

If the yield-curve is downward sloping, then one-year interest rates that will prevail in the future are expected to:

- decrease
- stay the same
- increase
- cannot tell based on the information that is provided

**Quiz questions continued in the back.**

**Problem:**

Coupon paying bond A has a par (face) value of €1 000, maturity of 2 years, and a coupon rate of 10%. The frequency of coupon payment is one year.

Coupon paying bond B has a par (face) value of €1 000, maturity of 2 year, a coupon rate of 5%, yield to maturity of 5%. Coupons are paid once a year.

Zero-coupon bond Z has a par (face) value of €1 000, maturity of 2 years, and a yield-to-maturity of 6%.

- a) What are the prices of the bonds B and Z in the bond market at  $t = 0$ ?
  
  
  
  
  
  
  
  
  
  
- b) What is the composition of the portfolio composed of bonds B and Z that replicates bond A?
  
  
  
  
  
  
  
  
  
  
- c) What is the price of the portfolio in part (b) that replicates bond A? (that is, what is the price of the “synthetic A”?)
  
  
  
  
  
  
  
  
  
  
- d) If bond A is selling for € 1 213.30 in the market, show how you can conduct arbitrage in a table with the first column explaining the transactions undertaken, the other columns detailing the cash flows at dates  $t=0$ ,  $t=1$  and  $t=2$ .

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$$P_0 = \frac{C}{(1+y)} + \frac{C}{(1+y)^2} + \dots + \frac{C+N}{(1+y)^T}$$

$$D = w_1 \times 1 + w_2 \times 2 + \dots + w_{T-1} \times T - 1 + w_T \times T$$

Mark your answers clearly: ambiguous or multiple answers for a question → zero points!

A zero coupon bond with maturity T is less subject to interest rate risk than a coupon bond with the same maturity.

- True
- False
- cannot tell based on the information that is provided

If a bond's rating is revised from BBB to AAA, then

- its yield to maturity increases
- its yield to maturity decreases
- its coupon rate increases
- its coupon rate decreases

If the government yield curve (i.e., the term structure of interest rates) makes an downward parallel move in which all the replacement rates for all the maturities go up by the same amount, then the price of a coupon-paying government bond would:

- increase
- stay the same
- decrease
- cannot tell based on the information that is provided

If the yield-curve is upward sloping, then one-year interest rates that will prevail in the future are expected to:

- decrease
- stay the same
- increase
- cannot tell based on the information that is provided

Quiz questions continued in the back.

**Problem:**

Coupon paying bond A has a par (face) value of €1 000, maturity of 2 years, and a coupon rate of 10%. The frequency of coupon payment is one year.

Coupon paying bond B has a par (face) value of €1 000, maturity of 2 year, a coupon rate of 4%, yield to maturity of 4%. Coupons are paid once a year.

Zero-coupon bond Z has a par (face) value of €1 000, maturity of 2 years, and a yield-to-maturity of 6%.

- a) What are the prices of the bonds B and Z in the bond market at  $t = 0$ ?
  
  
  
  
  
  
  
  
  
  
- b) What is the composition of the portfolio composed of bonds B and Z that replicates bond A?
  
  
  
  
  
  
  
  
  
  
- c) What is the price of the portfolio in part (b) that replicates bond A? (that is, what is the price of the “synthetic A”?)
  
  
  
  
  
  
  
  
  
  
- d) If bond A is selling for € 1 110 in the market, show how you can conduct arbitrage in a table with the first column explaining the transactions undertaken, the other columns detailing the cash flows at dates  $t=0$ ,  $t=1$  and  $t=2$ .

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$$D = w_1 \times 1 + w_2 \times 2 + \dots + w_{T-1} \times T - 1 + w_T \times T$$

Mark your answers clearly: ambiguous or multiple answers for a question → zero points!

A zero coupon bond with maturity T is more subject to interest rate risk than a coupon bond with the same maturity.

- True ←
- False
- cannot tell based on the information that is provided

If a bond's rating is revised from AAA to BBB, then

- its yield to maturity increases ←
- its yield to maturity decreases
- its coupon rate increases
- its coupon rate decreases

If the government yield curve (i.e., the term structure of interest rates) makes an upward parallel move in which all the replacement rates for all the maturities go up by the same amount, then the price of a coupon-paying government bond would:

- increase
- stay the same
- decrease ←
- cannot tell based on the information that is provided

If the yield-curve is downward sloping, then one-year interest rates that will prevail in the future are expected to:

- decrease ←
- stay the same
- increase
- cannot tell based on the information that is provided

Quiz questions continued in the back.

**Problem:**

Coupon bond A has a par (face) value of €1 000, maturity of 2 years, and a coupon rate of 10%. The frequency of coupon payment is one year.

Coupon bond B has a par (face) value of €1 000, maturity of 2 year, a coupon rate of 5%, yield to maturity of 5%. Coupons are paid once a year.

Zero-coupon bond Z has a par (face) value of €1 000, maturity of 2 years, and a yield-to-maturity of 6%.

- a) What are the prices of the bonds B and Z in the bond market at  $t = 0$ ?

$$P_B = 50/1.05 + 1050/1.05^2$$

$$P_Z = 1000/1.06^2 = 890.00$$

- b) What is the composition of the portfolio composed of zero coupon bonds B and Z that replicates bond A?

$$\begin{aligned} Y_B * 50 &= 100 & \Rightarrow & Y_b = 2 \\ Y_B * 1050 + Y_Z * 1000 &= 1100 & \Rightarrow & Y_Z = -1 \end{aligned}$$

- c) What is the price of the portfolio in part (b) that replicates bond A? (that is, what is the price of the “synthetic A”?)

$$P_R = 2 * 1000 - 1 * 890 = 1110$$

- d) If bond A is selling for €1 213.30 in the market, show how you can conduct arbitrage in a table with the first column explaining the transactions undertaken, the other columns detailing the cash flows at dates  $t=0$ ,  $t=1$  and  $t=2$ .

	T=0	T=1Y	T=2Y
Buy 2 bond B	-2*200	2*50	2*1050
Short 1 bond Z	890	0	-1000
Short 1 bond A	1213.30	-100	-1100
	<b>103.3</b>	<b>0</b>	<b>0</b>

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Mark your answers clearly: ambiguous or multiple answers for a question → zero points!

A zero coupon bond with maturity T is less subject to interest rate risk than a coupon bond with the same maturity.

- True
- False ←
- cannot tell based on the information that is provided

If a bond's rating is revised from B to A, then

- its yield to maturity increases
- its yield to maturity decreases ←
- its coupon rate increases
- its coupon rate decreases

If the government yield curve (i.e., the term structure of interest rates) makes an downward parallel move in which all the replacement rates for all the maturities go up by the same amount, then the price of a coupon-paying government bond would:

- increase ←
- stay the same
- decrease
- cannot tell based on the information that is provided

If the yield-curve is upward sloping, then one-year interest rates that will prevail in the future are expected to:

- decrease
- stay the same
- increase ←
- cannot tell based on the information that is provided

Quiz questions continued in the back.

**Problem:**

Coupon bond A has a par (face) value of €10,000, maturity of 2 years, and a coupon rate of 10%. The frequency of coupon payment is one year.

Coupon bond B has a par (face) value of €1000, maturity of 2 year, a coupon rate of 4%, yield to maturity of 4%. The frequency of coupon payment is one year.

Zero-coupon bond Z has a par (face) value of €1000, maturity of 2 years, and a yield-to-maturity of 5%.

- a) What are the prices of the bonds B and Z in the bond market at  $t = 0$ ?

$$P_B = 40/1.04 + 1050/1.04^2 = 1000$$

$$P_Z = 1000/1.05^2 = 907.03$$

- b) What is the composition of the portfolio composed of zero coupon bonds B and Z that replicates bond A?

$$\begin{aligned} Y_B * 40 &= 100 & \Rightarrow & Y_b = 5/2 \\ Y_B * 1040 + Y_Z * 1000 &= 1100 & \Rightarrow & Y_Z = -3/2 \end{aligned}$$

- c) What is the price of the portfolio in part (b) that replicates bond A? (that is, what is the price of the “synthetic A”?)

$$1000 * 5/2 - 907.7 * 3/2 = 1139.05$$

- d) If bond A is selling for €1 110 in the market, show how you can conduct arbitrage in a table with the first column explaining the transactions undertaken, the other columns detailing the cash flows at dates  $t=0$ ,  $t=1$  and  $t=2$ .

	T=0	T=1Y	T=2Y
Short 5/2 bond B	$1000 * 5/2$	$- 5/2 * 40$	$-5/2 * 1040$
Buy 3/2 bond Z	$- 907.7 * 3/2$	0	1000
Buy 1 bond A	- 1 110	100	1100
	<b>39.05</b>	<b>0</b>	<b>0</b>