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Compounding

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Compounding #Question 34

- An interest rate is quoted as 5% per annum with semiannual compounding.
- What is the equivalent rate with

  (a) annual compounding,

  (b) monthly compounding, and

  (c) continuous compounding?

- (Skip) Question 4.11, 4.18, 4.31

Compounding #Question 13

- An investor receives $1,100 in one year in return for an investment of $1,000 now.
- Calculate the percentage return per annum with:

  (a) Annual compounding

  (b) Semiannual compounding

  (c) Monthly compounding

  (d) Continuous compounding

Compounding #Question 19

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- A deposit account pays 4% per annum with continuous compounding,
- but interest is actually paid quarterly.
- How much interest will be paid each quarter on a $10,000 deposit?

Zero Rates / Bond Pricing

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Zero Rates / Bond Pricing #Question 21

- A 3-year bond provides a coupon of 8% semiannually and has a cash price of 104.
- What is the bond's yield?

Zero Rates / Bond Pricing #Question 33

- A 5-year bond provides a coupon of 5% per annum, payable semiannually.
- Its price is 104.
- What is the bond's yield?
- You may find Excel's Solver useful.

Zero Rates / Bond Pricing #Question 28

- A 5-year bond with a yield of 7% (continuously compounded) pays an 8% coupon at the end of each year.

(a) What is the bond's price?

(b) What is the bond's duration?

(c) Use the duration to calculate the effect on the bond's price of a 0.2% decrease in its yield.

(d) Recalculate the bond's price on the basis of a 6.8% per annum yield and verify that the result is in agreement with your answer to (c).

Zero Rates / Bond Pricing #Question 29

- The cash prices of 6-month and 1-year Treasury bills are 94.0 and 89.0.
- A 1.5-year Treasury bond that will pay coupons of $4 every 6 months currently sells for $94.84.
- A 2-year Treasury bond that will pay coupons of $5 every 6 months currently sells for $97.12.
- Calculate the 6-month, 1-year, 1.5-year, and 2-year Treasury zero rates.

Zero Rates / Bond Pricing #Question 12

- The 6-month and 1-year zero rates are both 5% per annum.
- For a bond that has a life of 18 months and pays a coupon of 4% per annum (with semiannual payments and one having just been made),
- the yield is 5.2% per annum.
- What is the bond's price?
- What is the 18-month zero rate? All rates are quoted with semiannual compounding.

Zero Rates / Bond Pricing #Question 20

- Suppose that 6-month, 12-month, 18-month, 24-month, and 30-month zero rates are, respectively, 4%, 4.2%, 4.4%, 4.6%, and 4.8% per annum, with continuous compounding.
- Estimate the cash price of a bond with a face value of 100 that will mature in 30 months and pay a coupon of 4% per annum semiannually.

Zero Rates / Bond Pricing #Question 32

- The table below gives Treasury zero rates and cash flows on a Treasury bond.
- Zero rates are continuously compounded.

(a) What is the bond's theoretical price?

(b) What is the bond's yield assuming it sells for its theoretical price?

Maturity (years)	*Zero rate*	*Coupon payment*	*Principal*
0.5	2.0%	$20	
1.0	2.3%	$20	
1.5	2.7%	$20	
2.0	3.2%	$20	$1,000

Zero Rates / Bond Pricing #Question 22

- Suppose that the 6-month, 12-month, 18-month, and 24-month zero rates are 5%, 6%, 6.5%, and 7%, respectively.
- What is the 2-year par yield?

Zero Rates / Bond Pricing #Question 24

- A 10-year 8% coupon bond currently sells for $90.
- A 10-year 4% coupon bond currently sells for $80.
- What is the 10-year zero rate?
- (*Hint*: Consider taking a long position in two of the 4% coupon bonds and a short position in one of the 8% coupon bonds.)

Forward Rates / FRA

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Forward Rates / FRA #Question 14

- Suppose that risk-free zero interest rates with continuous compounding are as follows:

Maturity (months)	*Rate (% per annum)*
3	3.0
6	3.2
9	3.4
12	3.5
15	3.6
18	3.7

- Calculate forward interest rates for the second, third, fourth, fifth, and sixth quarters.

- (Skip) Question 4.23

Forward Rates / FRA #Question 15

- Assuming that SOFR rates are as in Problem 4.14,
- what is the value of an FRA where
- the holder will pay SOFR and receive 4.5% (quarterly compounded) for
- a three-month period starting in one year on a principal of $1,000,000?

Maturity (months)	*Rate (% per annum)*
3	3.0
6	3.2
9	3.4
12	3.5
15	3.6
18	3.7

- (Skip) Question 4.30 Swap

Duration

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Duration #Question 17

- What does duration tell you about the sensitivity of a bond portfolio to interest rates?
- What are the limitations of the duration measure?

Duration #Question 28

- A 5-year bond with a yield of 7% (continuously compounded) pays an 8% coupon at the end of each year.

(a) What is the bond's price?

(b) What is the bond's duration?

(c) Use the duration to calculate the effect on the bond's price of a 0.2% decrease in its yield.

(d) Recalculate the bond's price on the basis of a 6.8% per annum yield and verify that the result is in agreement with your answer to (c).

Duration #Question 35

- Portfolio A consists of a 1-year zero-coupon bond with a face value of $2,000 and a 10-year zero-coupon bond with a face value of $6,000.
- Portfolio B consists of a 5.95-year zero-coupon bond with a face value of $5,000.
- The current yield on all bonds is 10% per annum.

(a) Show that both portfolios have the same duration.

(b) Show that the percentage changes in the values of the two portfolios for a 0.1% per annum increase in yields are the same.

(c) What are the percentage changes in the values of the two portfolios for a 5% per annum increase in yields?

- (Skip) Question 4.36 DerivaGem

Term Structure

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Term Structure #Question 16

- The term structure of interest rates is upward-sloping.
- Put the following in order of magnitude:

  (a) The 5-year zero rate

  (b) The yield on a 5-year coupon-bearing bond

  (c) The forward rate corresponding to the period between 4.75 and 5 years in the future
- What is the answer when the term structure of interest rates is downward sloping?

Term Structure #Question 25

- Explain carefully why liquidity preference theory is consistent with
- the observation that the term structure of interest rates tends to be upward-sloping more often than it is downward-sloping.

Term Structure #Question 26

- When the zero curve is upward-sloping,
  the zero rate for a particular maturity is greater than the par yield for that maturity.
- When the zero-curve is downward-sloping, the reverse is true.
- Explain why this is so.

Miscellaneous #Question 27

- Why does a loan in the repo market involve very little credit risk?