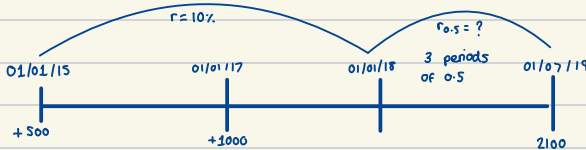


1. On January 1, 2015 you put €500 in a savings account. On January 1, 2017 you deposit another €1,000 in the account. Today, July 1, 2019, you have exactly €2,100 in this account. The real annual rate is 10% up until January 1, 2018.

How much is the semiannual rate after January 1, 2018?

(5.95%)



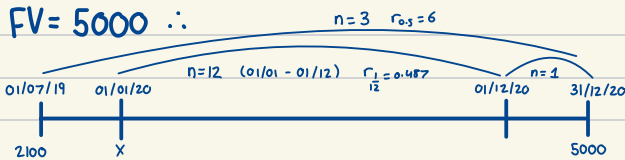
3 compounds between 01/01/15 to change of rate

$$2100 = 500 \cdot (1.1)^3 \cdot (1+r)^3 + 1000 \cdot (1.1) \cdot (1+r)^3 \quad \text{use solve for } r$$

$$r = 0.05954 \cdot 100 = 5.95\% \quad r \text{ is } r_{0.5} = 5.95\%$$

2. Today, July 1, 2019, you have €2,100 on your savings account. On December 31, 2020 you would like to have €5,000. To obtain this, how much do you need to deposit each month during one year with the first deposit on January 1, 2020? Suppose the semiannual rate is 6%.

difference in answer is
bc for this ans $1(\%) = 0.98$



common mistake not
bringing 2100 forward
3n (semi-annual) and
not accounting for diff
between 01/12 and 31/12

$$(1.06)^{\frac{1}{12}} = 1.00976 \therefore r_{\frac{1}{12}} = 0.976\%$$

$$5000 = 2100 \cdot (1.06)^3 + (X \cdot 5.1270.976\%) \cdot 1.00976 \quad \text{Solve for } X$$

$$X \cdot \frac{(1.00976)^{12} - 1}{0.00976}$$

Method 2

$$\boxed{\text{PMT} = 195.39}$$

$$5000 - (2100 \cdot (1.06)^3) = 2498.87$$

$$\frac{2498.87}{1.00976} = 2474.71 \Rightarrow$$

TVM Solver

$n=12$

$1(\%) = 0.976$

$PV=0$

$\text{PMT}=?$

$FV=2474.71$

3. After a couple of years of working, you decide it is time to buy a house. The bank grants you a loan of €250,000. You will pay off the loan during 25 years by constant monthly payments with a monthly rate of 0.75%. Calculate in two different ways the principal you pay at the 24th payment. (€264.80)

$$250\,000 \cdot x \cdot a_{\overline{300}|0.75\%} \quad x = 2097.99$$

$$1) \leq \text{Int}(24, 24) = 1833.19 \quad 2097.99 - 1833.19 = 264.80$$

$$2) \leq \text{Prn}(24, 24) = 264.80$$

4. The bank also has another offer for you: an endowment mortgage. Here, you again borrow €250,000, but pay back the capital all at once after 25 years, so no principal payments in between. Of course you need to pay interest every month at an APR of 9%. In order to pay back the principal after 25 years, you are going to invest money every month in a fund. The invested money will be used to pay back the bullet loan. The fund's monthly return is 1.2%.

$$\text{APR} = 9\% \quad \text{monthly} = 9/12 = 0.75\%$$

$$\text{Payment} = \text{Interest} + \text{Payment}$$

$$\text{Int} = 250\,000 \cdot 0.0075 = 1875$$

$$250\,000 \cdot x \cdot S_{\overline{300}|1.2\%} \quad x = 86.15$$

$$a) 1875 + 86.15 = 1961.15$$

$$b) 250\,000 = 1961.15 \cdot S_{\overline{300}|r}$$

$$r_{\frac{1}{12}} = 0.68\%$$

TVM Solver

$$n = 300$$

$$I(\%) = ?$$

$$PV = 0$$

$$PMT = 1961.15$$

$$FV = 250\,000$$

5. You are interested in buying a bond. It is issued at a price of 98.2% and has a 4.5% coupon every year for 5 years. Repayment is at par. What is the net yield of this bond when you have to pay withholding taxes of 30%? (3.55%)

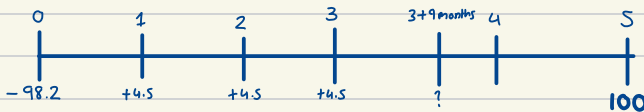
$$n = 5 \quad I(\%) = ? \quad PV = -98.2 \quad PMT = (4.5 \cdot 0.7) \quad FV = 100$$

= 3.55% note PV is neg, to avoid sign change error. Imagine you are paying out PV (98.2) and receiving PMT & FV

6. Suppose you can sell the bond of question 5 at 101%, right after receiving the first coupon. How much is your return over this whole holding period (you do not have to take into account withholding taxes)? (7.43%)

$$n = 1 \quad |(\%) = ? \quad PV = -98.2 \quad PMT = 4.5 \quad FV = 101 \\ = 7.43\%$$

7. You have kept the bond from question 5, but you are hesitant to sell it 9 months after the 3rd coupon at par redemption price. What is the yield to maturity that you will have earned on this bond (you do not have to take into account withholding taxes)? (5.04%)



$$n = 3 + \frac{9}{12} = 3.67 \\ |(\%) = ? \\ PV = -98.2 \\ PMT = 4.5 \\ FV = 100$$

note by putting $n =$ to 3yrs & 9months it will automatically calculate mid-coupon gain of 3.375 that is added to sale price

8. A 5-year loan of €10,000 is being repaid by equal monthly installments, beginning January 2020 and continuing through December 2024. APR = 12% is used. At what time will the outstanding principal first fall below one half of the original amount of the loan? (after 35 months)

$$10\,000 = X \cdot a_{\overline{60}|1\%} \quad X = 222.40 \quad \text{by working out PV of 5000 and adding means annuity formula has to also = 5000 relative to } n, \text{ hence why } 5000 = X \cdot a_{\overline{n}|1\%} \text{ etc. wouldn't work}$$

$$10\,000 = \left(222.40 \cdot \frac{1 - (1.01)^{-n}}{0.01} \right) + \frac{5000}{1.01^n} \quad \text{solve for } n \text{ on calculator}$$

$n = 34.42 \therefore$ after 35 months or after payment on 01/11/2022

can be solved in 1 step on TWM

$$n = ? \quad |(\%) = 1 \quad PV = -10\,000 \quad PMT = 222.40 \quad FV = 5000 \\ = 34.42$$

Very Important Note

When entering values into finance solver...

If solving PV and $FV = 0$ sign of PMT doesn't matter

However on bonds or the previous question for example where solving for $I(\%)$ or n and $PV \neq 0$, $FV \neq 0$ then...

Sign of PMT & FV must be the same and opposite of PV.

Example (using previous question)

$n = ?$ gives 34.42

$I(\%) = 1$

$PV = -10000$ ✓

$PMT = 222.40$

$FV = 5000$

$n = ?$ gives 34.42

$I(\%) = 1$

$PV = 10000$ ✓

$PMT = -222.40$

$FV = -5000$

$n = ?$ gives (-) 62.9

$I(\%) = 1$

$PV = (-) 10000$ ✗

$PMT = (-) 222.40$

$FV = (-) 5000$