June 19, 2019

The Principles of Financial Management - Shin, Seungho

* Time Value of Money (TVM) ; time = money

The main goal / primary objective of financial management / financial manager is to *maximize shareholders' wealth / the long-term value of the firm's stock. Firm's stock values depend on the timing of the cash flows investors expect from an investment. In other words, * a dollar expected soon is worth more than a dollar expected in the distant future. Reason why financial manager(s) must understand the time value of money and its impact on stock prices.

Part I.

- Present values and Future values ; PV and FV hereafter : P

Discounting ↓ Compounding ↑

*** $FV = PV \times (1 + \text{interest})^N$; $PV = \frac{FV}{(1+\text{interest})^N}$ → future value factor!

Periods 0 — 1 — 2 — 3

PV(100) 105 110.25 115.76

Compounding Process →

How to read this time line?

$PV_0 = 100$
Interest = 5%
# of years / periods = 3

* Given information, we can calculate future values (FV_1, FV_2, FV_3). How come?

$FV_1 = PV_0 \times (1+\text{Interest})^N = 100 \times (1+5\%)^1 = 105$

$FV_2 = PV_0 \times (1+\text{Interest})^N = 100 \times (1+5\%)^2 = 100 \times (1+5\%) \times (1+5\%) = 110.25$

$FV_3 = PV_0 \times (1+\text{Interest})^N = 100 \times (1+5\%)^3 = 100 \times (1+5\%) \times (1+5\%) \times (1+5\%) = 115.76$

* $PV \times (1+r)^n = FN$ → referred as rr, dr, opc, or cc

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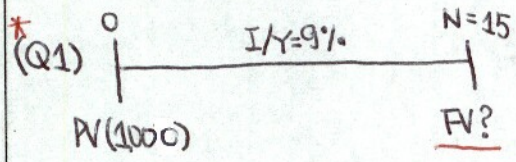
*** Practice questions!

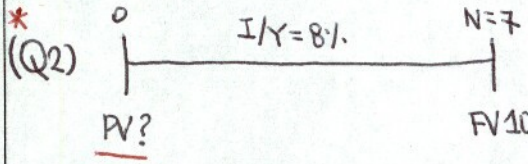
(Q1)



① With a "financial" calculator; N=15, I/Y=9, PV=-1,000, PMT=Ø, FV=3,642.5
(outflow) (inflow)

② With a "regular calculator and brain"; $FV_{15} = 1{,}000 \times (1+9\%)^{15} = 3{,}642.5$

(Q2)

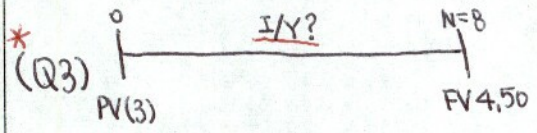


(You will get a negative #, indicating that PV is a cash outflow)

① With a financial calculator; N=7, I/Y=8, PMT=Ø, FV=10,000, PV=(5,834.9)

② With a regular calculator and brain; $PV_0 = \frac{10{,}000}{(1+8\%)^7} = 5{,}834.9$

(Q3)



① With a financial calculator; N=8, PV=-3, PMT=Ø, FV=4.5, I/Y=5.20

② With a regular (scientific) calculator and brain; $4.5 = 3 \times (1+\text{interest})^8$

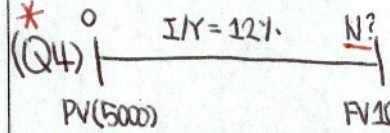
$1.5 = (1+\text{interest})^8$ then, $\ln 1.5 = 8 \cdot \ln(1+\text{interest})$,

$0.0507 = \ln(1+\text{interest})$,

$e^{0.0507} = e^{\ln(1+\text{interest})}$,

$1.0520 = 1+\text{interest}$; interest = 0.0520

(Q4)



① With a financial calculator; I/Y=12, PV=-5,000, PMT=Ø, FV=10,000, N=6.12

② With a (regular) scientific calculator and brain; $5000 \times (1+12\%)^N = 10{,}000$

$2 = (1.12)^N$ then, $\ln 2 = N \cdot \ln 1.12$; $0.6931 = N \cdot 0.1133$; N = 6.12

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※ interest rates are usually referred to as discount rates.

- required rate of return = "nominal risk-free rate" + default risk premium + liquidity risk premium + maturity risk premium.

※ nominal risk-free rate = real risk-free rate + expected inflation rate
(U.S. Treasury bills) (≈ inflation premium)

- How to Compare Interest rate? * EAR!

① Annual Percentage Rate (APR) or Quoted/Stated rate) is calculated by the periodic rate times the # of periods/year
→ Also called Nominal Interest Rate ($I_{Nominal}$)

② * Effective Annual Rate (EAR) represents the annual rate of interest actually being earned after adjustments have been made for different compounding periods. *

$$EAR = \left[1 + \frac{I_{Nominal}}{M}\right]^{M} - 1$$

ex) nominal rate is 9% with semi-annual compounding, find EAR.

$$EAR = \left[1 + \frac{0.09}{2}\right]^{2} - 1 = 0.092 = 9.2\%$$

*** ③ If a loan or an investment uses annual compounding, its nominal rate is same about its EAR. * If compounding occurs more than once a year, $EAR > I_{Nominal}$ must!

Part II

- * Annuity (Annuities) is a steam of "equal payments" or "equal cash flows" that occurs at equal/fixed intervals over a given period.
(auto loans, Student loans, and mortgages)

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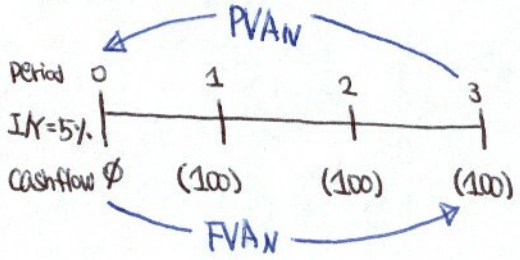
*** Annuity (Annuities)

- ① Ordinary (deferred) Annuity
  - ⓐ FVA_N
  - ⓑ PVA_N
- ② Annuity Due
  - ⓒ FVA_{Due}
  - ⓓ PVA_{Due}
- ③ perpetuity
  - ⓔ $PV_{perpetuity}$

* ① Ordinary (deferred) annuity ;



ⓐ Future value of an ordinary annuity over N periods, FVA_N

$$FVA_N = PMT \cdot (1+interest)^{N-1} + PMT \cdot (1+interest)^{N-2} + PMT \cdot (1+interest)^{N-3} + \cdots + PMT \cdot (1+interest)^{0}$$

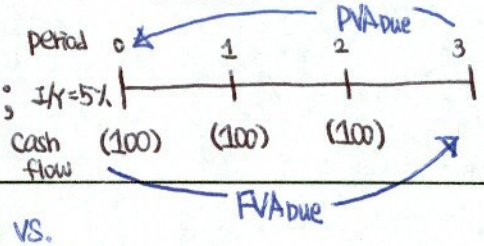
$$= PMT \cdot \left[\frac{(1+interest)^{N}-1}{interest} \right]$$

ⓑ Present value of an ordinary annuity over N periods, PVA_N

$$PVA_N = \frac{PMT}{(1+interest)^{1}} + \frac{PMT}{(1+interest)^{2}} + \cdots + \frac{PMT}{(1+interest)^{N}}$$

$$= PMT \cdot \left[\frac{1-\frac{1}{(1+interest)^{N}}}{interest} \right]$$

* ② Annuity Due ;



* ① vs. ② ; end of each period vs. beginning of each period

ⓒ $FVA_{Due} = FVA_N \times (1+interest)$

ⓓ $PVA_{Due} = PVA_N \times (1+interest)$

③* Perpetuity is a financial instrument that provides a fixed payment "over an infinite period" of time / "forever."

ⓔ Present value of perpetuity, $PV_{perpetuity} = PMT/interest$

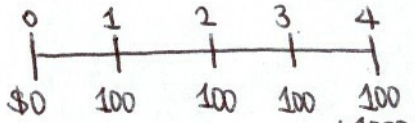
• Uneven Cash Flows (Non-Constant cash flows)

↕

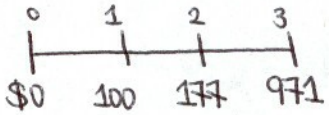
Annuity (Constant cash flows)

① Examples of uneven cash flows

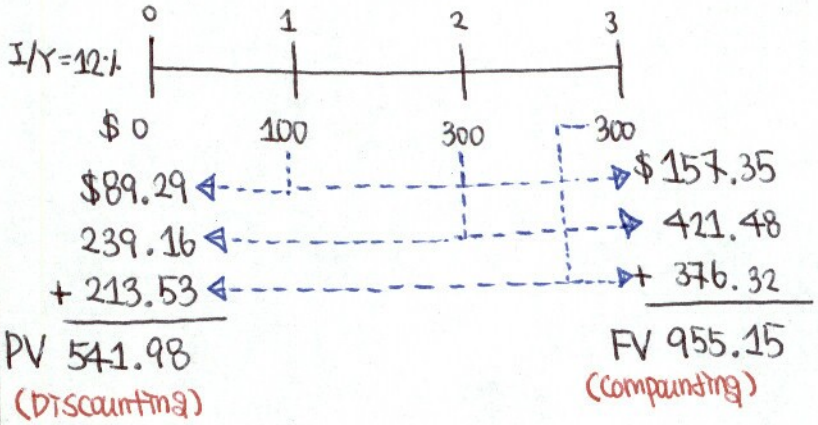
ⓐ Annuity + additional payment



ⓑ Irregular Cash flows



②* PV and FV of uneven cash flows case!



※ IRR = Internal Rate of Return means the rate of return the investment provides.

Part III

- Amortized Loans? A loan that is to be repaid in equal amounts on a monthly, quarterly, or annual basis.

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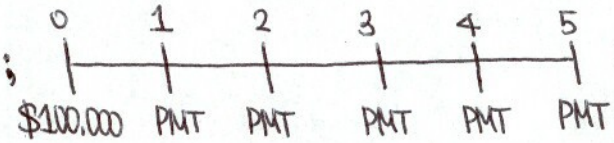
Example question;

You borrow $100,000 on a car loan, and it is to be repaid in five equal payments at the end of each of the next 5 years with 6% interest.

(Step 1) time line;



(Step 2) find PMT $\$100{,}000 = \frac{PMT}{(1.06)^1} + \frac{PMT}{(1.06)^2} + \cdots + \frac{PMT}{(1.06)^5}$

PMT = -23,739.64

(Step 3) Construct its loan schedule;

Amount borrowed : $100,000
Years : 5
Rates : 6%.
PMT : -$23,739.64

Year	Beginning Amount	Payment	Interest	Repayment of principle	Ending Balance
1	$100,000	$23,739.64	$6,000	$17,739.64	$82,260.36
2	82,260.36	23,739.64	4935.62	18,804.02	63,456.34
3	63,456.34	23,739.64	3,807.38	19,932.26	43,524.08
4	43,524.08	23,739.64	2,611.44	21,128.20	22,395.89
5	22,395.89	23,739.64	1,343.75	22,395.89	∅