MASTER IN BUSINESS ADMINISTRATION

TIME VALUE OF MONEY

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Agenda

- Introduction
- Capitalization rule
- Present and future value
- Perpetuities and annuities
- Conclusion
- References

Introduction (1/2)

Cash flows value is affected by its time scheduling

The main reasons are related to:

Capital productivity

Uncertainity

Inflation

Introduction (2/2)

For evaluation the time value of the money is necessary to consider:

Capitalization rule

Present and future value

Perpetuities and annuities

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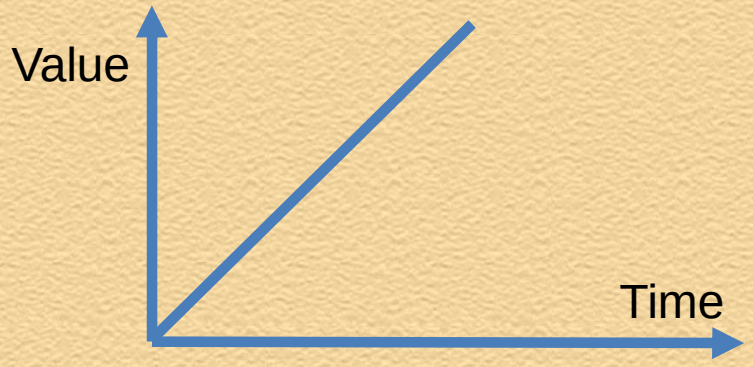
Capitalization rule (1/4)

Simple interest rule

Interest rates growth is linearly related with the lenght of the time horizon

it



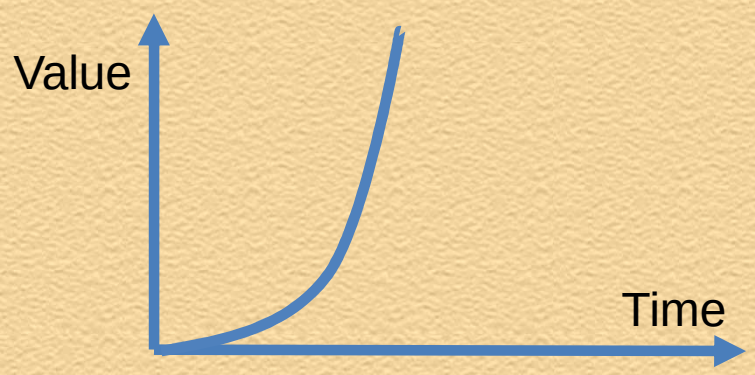
where i is the interest rate and t is the number of periods

Capitalization rule (2/4)

<u>Compound interest rate rule</u>

Capital invested grows exponentially with the lenght of the time horizon

i^t



where i is the interest rate and t is the number of periods

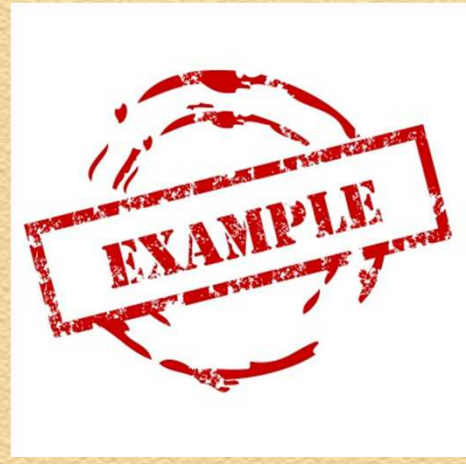
Capitalization rule (3/4)

Effective Annual Interest Rate

$$EAR = (1 + MR)^{12} - 1$$

Annual Percentage Rate

$$APR = MR \times 12$$



Find the APR (the stated interest rate) for each case.

APR	Compounding Period	
12.00%	**1**	month
8.00%	**3**	month
10.00%	**6**	month

APR	Compounding Period	EAR
12.00%	12/ year	**12.68%**
8.00%	4/ year	**8.24%**
10.00%	2/ year	**10.25%**

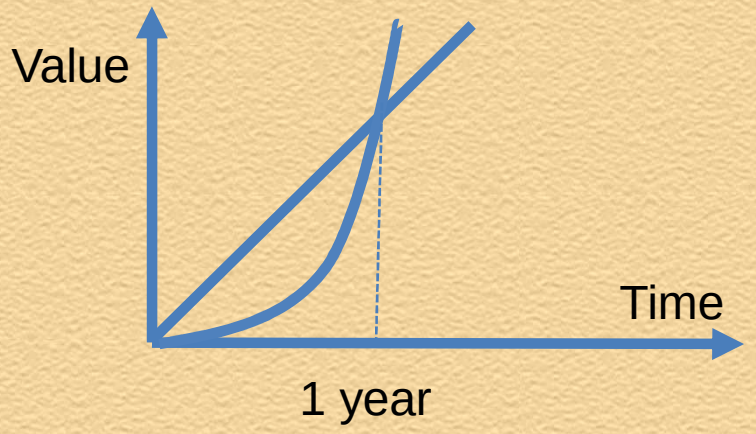
Find the effective annual interest rate for each case.

EAR	Compounding Period	
10.00%	**1**	month
6.09%	**6**	month
8.24%	**3**	month

EAR	Compounding Period		Per-Period Rate	APR
10.00%	**12**	/ Year	0.8%	**9.60%**
6.09%	**2**	/ Year	3%	**6.00%**
8.24%	**4**	/ Year	2%	**8.00%**

Capitalization rule (4/4)

Interest rule choiche



Short Time horizon = highest results for simple interest rate rule

Medium-LongTime horizon = highest results for compound interest rate rule

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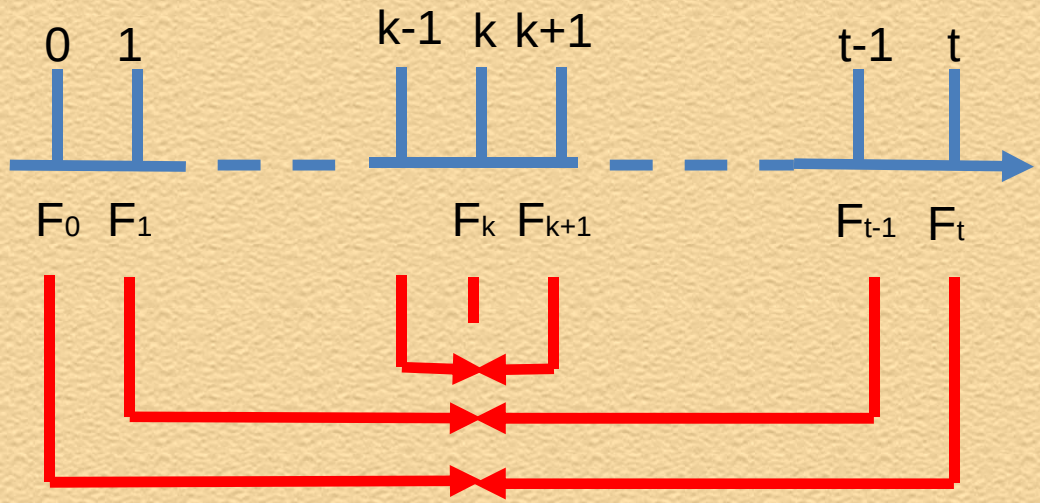
Present and future value (1/5)

In order to compare cash flows generated on different time in necessary to tranform them in equivalent values at a unique time



How to select the k threshold?

Full Actualization

Full Capitalization

Present and future value (2/5)

Discount rate

r

Discount factor

$$\frac{1}{(1+r)^t}$$

Present value

$$PV = \frac{FV}{(1+r)^t}$$

Present and future value (3/5)

Discount rate

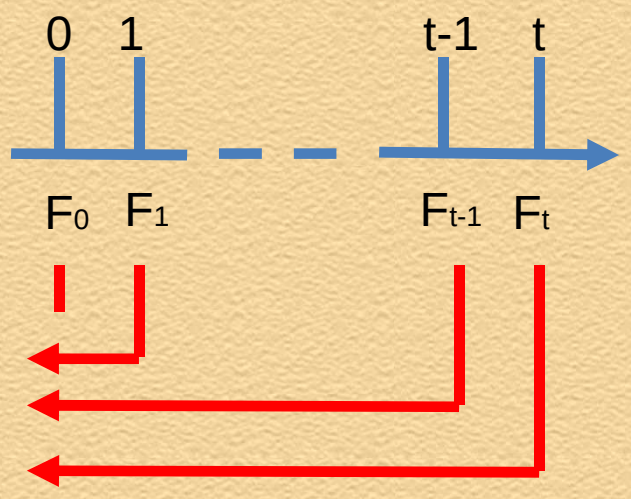
r

Discount factor

$$\frac{1}{(1+r)^t}$$

Present value

$$PV = \sum_{t=0}^{n} \frac{F_t}{(1+r)^t}$$



Present and future value (4/5)

Capitalization rate

r

Capitalization factor

$(1 + r)^t$

Pre value

$\mathrm{F}V = PV \times (1 + r)^t$

Present and future value (5/5)

Capitalization rate

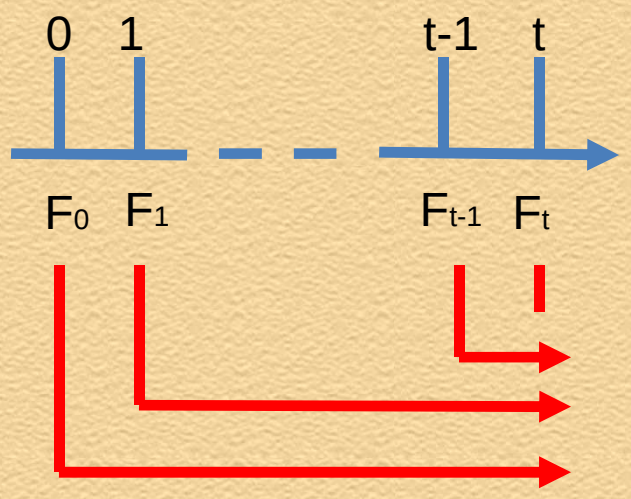
r

Capitalization factor

$(1+r)^t$

Future value

$$FV = \sum_{t=0}^{n} PV \times (1+r)^t$$



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Perpetuies and annuities (1/2)

Prepetuies are equally-spaced, level streams of cash flows lasting for a unlimited period of time

$$PV = \sum_{t=1}^{\infty} \frac{CF}{(1+r)^t} \cong \frac{CF}{r}$$

Fixed amount

$$PV = \sum_{t=1}^{\infty} \frac{CF(1+g)^t}{(1+r)^t} \cong \frac{CF_1}{r-g}$$

Fixed grow rate

Perpetuies and annuities (2/2)

Annuities are equally-spaced, level streams of cash flows lasting for a limited period of time.

$$PV = \sum_{t=1}^{\infty} \frac{CF}{(1+r)^t} - \sum_{t=k}^{\infty} \frac{CF}{(1+r)^t} \cong \frac{CF}{r} - \frac{\frac{CF}{r}}{(1+r)^k}$$

$$PV = \sum_{t=1}^{\infty} \frac{CF(1+g)^t}{(1+r)^t} - \sum_{t=k}^{\infty} \frac{CF(1+g)^t}{(1+r)^t} \cong \frac{CF_1}{r-g} - \frac{\frac{CF_k}{r-g}}{(1+r)^k}$$

Text

Your landscaping company can lease a truck for $8,000 a year (paid at year end) for 6 years. It can instead buy the truck for $40,000. The truck will be valueless after 6 years. If the interest rate your company can earn on its funds is 7%, is it cheaper to buy or lease?

Solution

$$PV = \frac{-8{,}000}{0.07} - \frac{\frac{-8{,}000}{0.07}}{(1.07)^6} = -38{,}132.32\$$$

Since -$40,000 (the cost of buying a truck)< -$38,132.32 it is less expensive to lease than to buy.

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Conclusion

- The comparison of cash flows available at different time periods could be performed only once you define the capitalization rule and the evaluation point
- Perpetuities and annuities allow to compute easily the present value of long term investments

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References

Mattarocci G. (2014), Managerial Finance, Mc-Graw hill, Chapter 5

Slides are available on the website