

FN201: Lecture Note 4

Time Value of Money

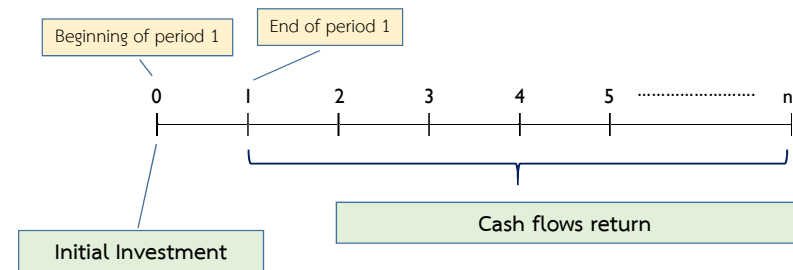
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Overview

Application:

Feasibility Analysis, Investment Analysis, etc.

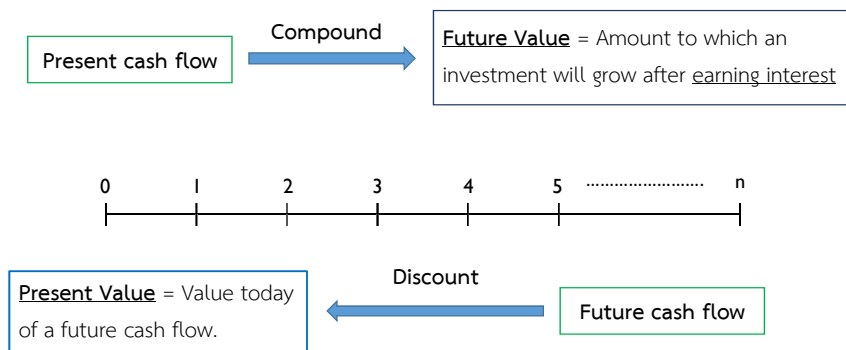
Investment time line



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Future Value vs. Present Value

Investment time line



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Cash Flows Pattern

1. Single sum
2. Annuity
3. Perpetuity
4. Uneven cash flows

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Types of Interest

Example: What is the future value of \$10,000 for the next 3 year if interest is 5% for one year?

1. Simple interest

Principal = 10,000			
Interest	= 500	= 500	= 500
Future Value			= 11,500
0	1	2	3

2. Compound interest

Principal = 10,000			
Interest	= 500	= 5% x (10,000 + 500) = 1,025	= 5% x (10,000 + 1,025) = 1,576.25
Future Value			= 11,576.25

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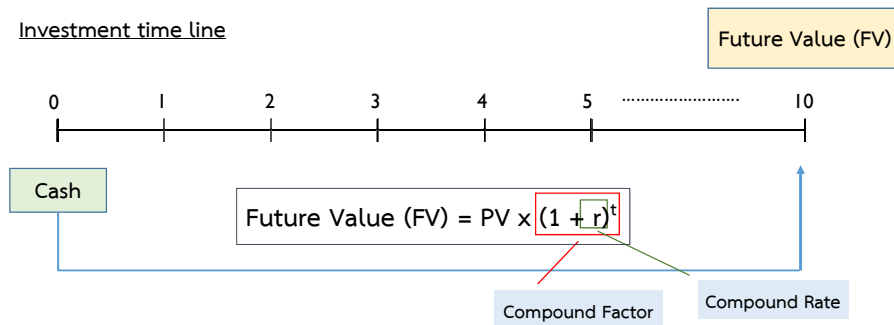
Single Sum Cash Flows:

Present Value and Future Value

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Future Value

Investment time line

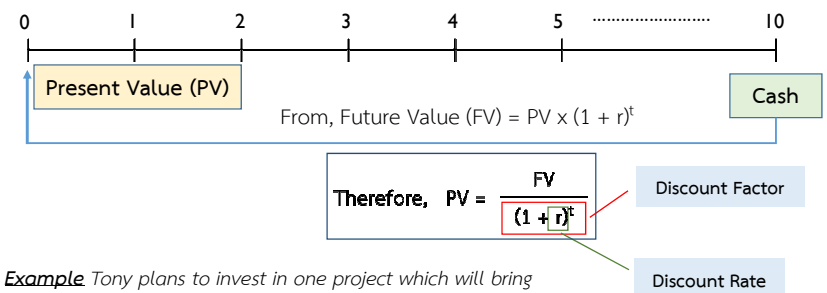


Example What is the future value of \$400,000 if interest is compounded annually at a rate of 5% for five year? – Using Table (FVIF)

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Present Value

Investment time line



Example Tony plans to invest in one project which will bring back return at \$450,000 at the end of 8th year, what is the present value of that project? – Using Table (PVIF)

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Example – Future Value

1. If you need \$6,000 5 years from now, how much of a deposit must you make in your savings account first year, assuming an 8 percent annual interest rate?
2. You estimate an ancient wood-horse will be worth \$2,000,000 when you retire at the end of twenty years. If you expect a 12% return on your investment, how much will you pay for it?

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Example – Future Value

3. As part of your financial planning, you wish to purchase a new car exactly 5 years from today. The car you wish to purchase costs \$14,000 today, and your research indicates that its price will increase by 2% to 4% over the next 5 years due to inflation.
 - a. Estimate the price of the car at the end of 5 years if inflation is (1) 2% per year, and (2) 4% per year.
 - b. How much more expensive will the car be if the rate of inflation is 4% rather than 2%?
 - c. If return from saving in bank is 8%, how much should you save money to get a new car at the end of 5th year if inflation is (1) 2% per year, and (2) 4% per year?

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Example – Present Value

1. The first comic book featuring Superman was sold in 1938. In 2005, the estimated price for this comic book in good condition was about \$485,000. This represented a return of 25.90 percent per year. For this to be true, what must the comic book have sold for when new?
2. Imprudential, Inc., has an unfunded pension liability of \$700 million that must be paid in 20 years. To assess the value of the firm's stock, financial analysts want to discount this liability back to the present. If the relevant discount rate is 8.5 percent, what is the present value of this liability?
3. Ron Jaffe has been given an opportunity to receive \$20,000 (6 years from now). If he can earn 10 percent on his investments, what is the most he should pay for this opportunity?

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Example – Present Value

4. You just won a lottery that promises to pay you \$1,000,000 exactly 10 years from today. Because that \$1,000,000 payment is guaranteed by the government in which you live, opportunities exist to sell claim today for an immediate single cash payment.
 - a. What is the least you will sell your claim for if you can earn the following rates of return on similar-risk investments during the 10-year period? (1) 6%, (2) 9%, and (3) 12%.
 - b. Rework part (a) under the assumption that the \$1,000,000 payment will be received in 15 rather than 10 years.
 - c. From the finding in parts (a) and (b), discuss the effect of both size of rate of return and the time until receipt of payment on the present value of the future sum.

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Annuity Cash Flows: Present Value and Future Value

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Future Value and Present Value for Annuities Due

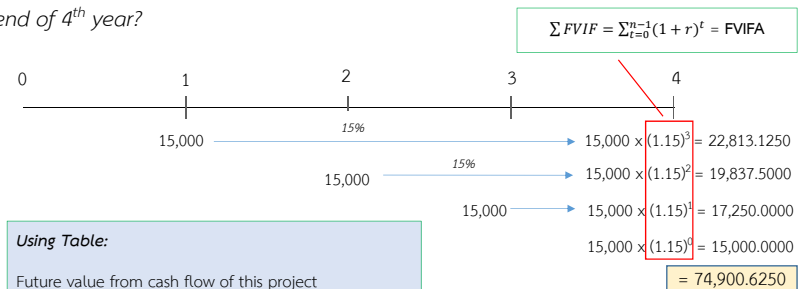
Ordinary Annuities = Payment at the end of period

Annuities Due = Payment at the beginning of period

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Future Value

Assume that BMX company receives annuity cash flows from project invested \$15,000 at the end of each year until 4th year with an annual growth rate 15%. Find future value at the end of 4th year?



Using Table:

Future value from cash flow of this project

$$= 15,000 \times FVIFA_{15\%,4}$$

$$= 15,000 \times 4.993 = 74,895.0000$$

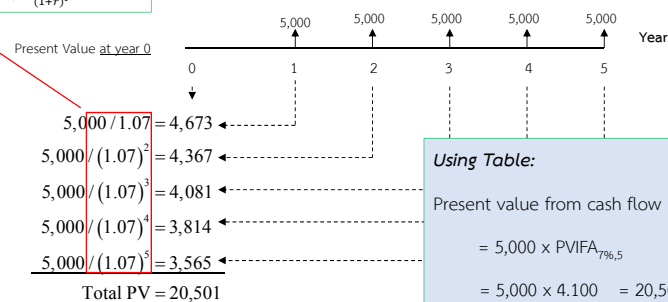
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Present Values

Example

Tiburon Autos offers you "easy payments" of \$5,000 per year, at the end of each year for 5 years. If interest rates are 7%, per year, what is the cost of the car?

$$\Sigma PVIF = \Sigma_{t=1}^n \frac{1}{(1+r)^t} = PVIFA$$



Using Table:

Present value from cash flow

$$= 5,000 \times PVIFA_{7\%,5}$$

$$= 5,000 \times 4.100 = 20,500$$

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Future Value and Present Value of Ordinary Annuities

Example

- David and Helen Zhang are saving to buy a boat at the end of five years. If the boat costs \$20,000 and they can earn 10% a year on their savings, how much do they need to put aside at the end of years 1 through 5?
- A 55-year-old executive will retire at age 65 and expects to live to age 75. Assuming a 10 percent rate of return, calculate the amount he must have available at age 65 in order to receive \$10,000 annually from retirement until death.
- You want to buy a new car, but you can make an initial payment of only \$2,000 and can afford monthly payments of at most \$400.
 - If the interest rate on auto loans is 12 percent and you finance the purchase over 48 months, what is the maximum price you can pay for the car?
 - How much can you afford if you finance the purchase over 60 months?

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Future Value and Present Value for Annuities Due

Ordinary Annuities = Payment at the end of period

Annuities Due = Payment at the beginning of period

Future value of Annuities Due

$$= \text{Cash flows} \times (\text{FVIFA}_{r\%,n}) \times (1+r)$$

Present value of Annuities Due

$$= \text{Cash flows} \times (\text{PVIFA}_{r\%,n}) \times (1+r)$$

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Future Value and Present Value for Annuities Due

Example:

Answer the questions that follow:

Case	Amount of Annuity	Interest	Period (Years)
A	2,500	8%	10
B	500	12%	6
C	30,000	20%	5
D	11,500	9%	8
E	6,000	14%	30

- Assume you deposit the amount of annuity, calculate the future value when it is (1) an ordinary annuity, and (2) an annuity due.
- Assume you have the annuity return from investment, calculate the present value when it is (1) an ordinary annuity, and (2) an annuity due.
- Compare the finding in parts a.1 vs. a.2, and b.1 vs. b.2. All else being identical, which type of annuity – ordinary or annuity due – is preferable? Why?

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Future Value and Present Value for Annuities Due

- A store offers two payment plans. Under the installment plan, you pay 25 percent down and 25 percent of the purchase price in each of the next 3 years. If you pay the entire bill immediately, you can take a 10 percent discount from the purchase price. Which is a better deal if you can borrow or lend funds at a 6 percent interest rate?
- Annuity and Annuity Due Payments.**
 - If you borrow \$1,000 and agree to repay the loan in five equal annual payments at an interest rate of 12 percent, what will your payment be?
 - What if you make the first payment on the loan immediately instead of at the end of the first year?

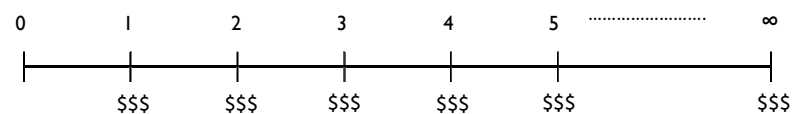
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Present Value of Perpetuity Cash Flows

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Present Value of Perpetuity Cash Flows

Regular perpetuity



Regular perpetuity

$$\text{Present Value} = \frac{\$ \$ \$}{r}$$

Perpetuity Due

$$\text{Present Value} = \$ \$ \$ + \frac{\$ \$ \$}{r}$$

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Present Value of Perpetuity Cash Flows

Example:

1. You want to invest in long-lived company with perpetuity dividend and risk (as presented by different values of discount rates) as below table. Which company would bring you highest present value?

Company	Annual amount	Interest
A	20,000	8%
B	100,000	10%
C	3,000	6%
D	60,000	5%

2. A local bank will pay you \$100 a year for your lifetime if you deposit \$2,500 in the bank today. If you plan to live forever, what interest rate is the bank paying?

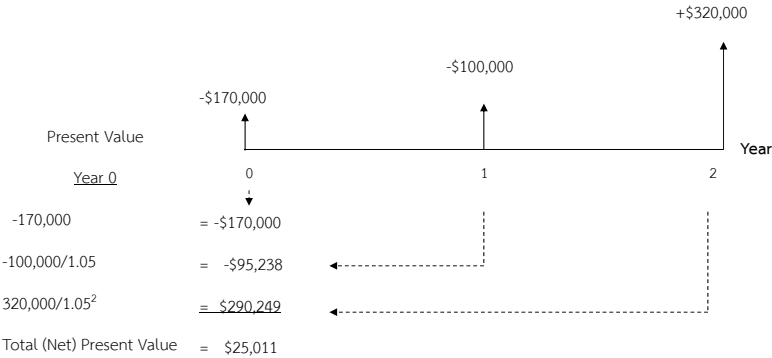
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Present Value of Uneven Cash Flows

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Present Value of Uneven Cash Flows

Assume that the cash flows from the construction and sale of an office building is as follows. Given a 5% required rate of return.



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Present Value of Uneven Cash Flows

Example:

1. Candy Parker has been offered an opportunity to receive the following mixed stream of revenue over the next 3 years. What is present value of this opportunity given interest rate at 15%?

Year	Annual amount
1	1,000
2	2,000
3	500

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Present Value of Uneven Cash Flows

Example:

2. As a financial consultant for ABCCompany, which project results in the most profitable (Hint: by calculating present value of the streams of cash flows). Assume that the firm's opportunity cost is 12%.

A		B		C	
Year	Cash Flows	Year	Cash Flows	Year	Cash Flows
1	-2000	1	10000	1-5	10000/year
2	3000	2-5	5000/year	6-10	8000/year
3	4000	6	7000		
4	6000				
5	8000				

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Example – 1:

Mike Polanski is 30 years of age and his salary next year will be \$40,000. Mike forecasts that his salary will increase at a steady rate of 5% per annum until his retirement at age 60.

- If the discount rate is 8%, what is the PV of these future salary payments?
- If Mike saves 5% of his salary each year and invests these savings at an interest rate of 8%, how much will he have saved by age 60?
- If Mike plans to spend these savings in even amounts over the subsequent 20 years, how much can he spend each year?

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Example – 2:

A couple thinking about retirement decide to put aside \$3,000 each year in a savings plan that earns 8 percent interest. In 5 years they will receive a gift of \$10,000 that also can be invested.

- a. How much money will they have accumulated 30 years from now?
- b. If their goal is to retire with \$800,000 of savings, how much extra do they need to save every year?

Question?