TIME VALUE OF MONEY

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What is time value of money?

The basic idea of the time value of money concept is the difference in the value of one euro invested today in comparison to one euro earned in the future. The reason for this is the change in the value of money over the time. The euro on hand today can be used to invest and earn interest or capital gains. A euro promised in the future is actually worth less than a euro today because of inflation.

Provided money can earn interest, this core principle of finance holds that any amount of money is worth more the sooner it is received. At the most basic level, the time value of money demonstrates that, all things being equal, it is better to have money now rather than later.

To talk about the time value of money we need to set up a timeline. It is a graphical presentation of some cash flow expected in a specific period of time. We will use as an example a four-year timeline for an amount of 1000 euro today. PV is present value and represents 1000 euro on hand today and FV stands for future value of this amount after four years.

Cash	PV=1000				FV=?
Time/Periods	0	1	2	3	4

Time 0 is today and it is also the beginning of period 1. Time 3 is the end of period 3 and the beginning of period 4. One period can be one year, one month, one week. So let us try to answer the question: How does the value of 1000 euro change over the time? A euro in hand today is worth more than a euro to be received in the future. The reason for this is the fact, that you can invest the euro today, earn some interest and end up more than a euro in the future.

The process of going to future values (FVs) from present values (PVs) is called compounding. Future Value (FV) is the amount to which a cash flow or series of cash flows will grow over a given period of time when compounded at a given interest rate. Present Value (PV) is the value today of a future cash flow or series of cash flows. Compounding is the arithmetic process of determining the final value of a cash flow or series of cash flows when compound interest is applied.

So let us refer back to our example of 4 year time line and assume the deposit of 1000 euro in a bank that pays an interest 4%:

Cash	PV=1000	1040,00	1081,60	1124,86	1169,86
Time/Periods	0	1	2	3	4
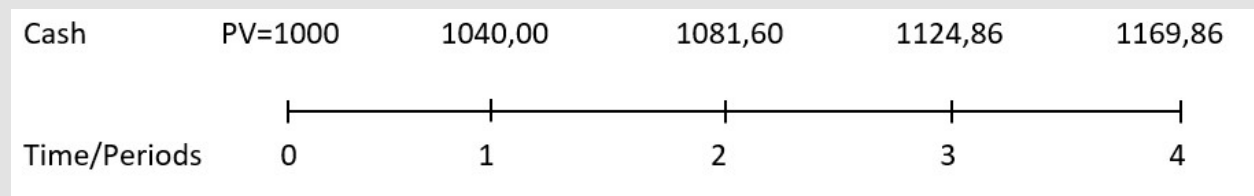
To calculate the value at the end of each period we have to multiply the initial amount and each succeeding amount by (1+i) = (1.04).

How to calculate present and future value?

Note that we know different types of interest: simple interest, compound interest or periodic compounding.

Simple interest we use in situations when the interest in each period is calculated only on the initial value. That means that the interest is not earned on previous interests. The formula for calculating the future value based on the simple interest is following:

$$FV = PV (1 + i * n)$$

Where:

FV   is the future value

PV   is the present value

i   is the interest

n   is the number of periods

Compound interest is a type of compounding in that the interest is earned also on previous interests. The formula for calculating the future value based on the compound interest is following:

$$FV = PV (1 + i)n$$

Periodic compounding is used when the interest is paid more than once over one period. An example is when a bank pays the interest more than once a year. The formula is:

$$FV = PV (1 + i / m) (n * m)$$

Where:

FV   is the future value

PV   is the present value

i   is the interest

n   is the number of periods

m   is the number of times the interest is paid in one   period (monthly = 12, quarterly = 4)

Previous formulas can be also used for calculating the present value based on the future values. This process is called discounting.

The time value of money affects the process of investment valuation and investment decision. To take into account that the value of money received in different time periods changes is in case of investment valuation is very important. The reason for this is that each investment is linked to a longer time period.

For example let`s calculate the present value, future value of the following expected cash flows. We expect the cash flow at the end of the first year 10 000 euro, at the end of the third year 5 600 euro and at the end of the fourth year 8 700 euro. Calculate the present value and the future value in year 5 using the compound interest when the fixed interest over the whole period is 3, 5%:
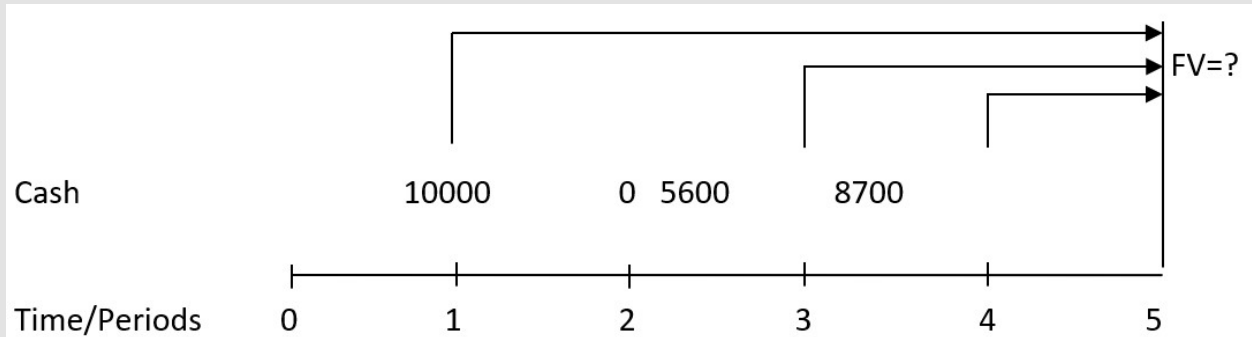
Solution:

Discounting to PV:
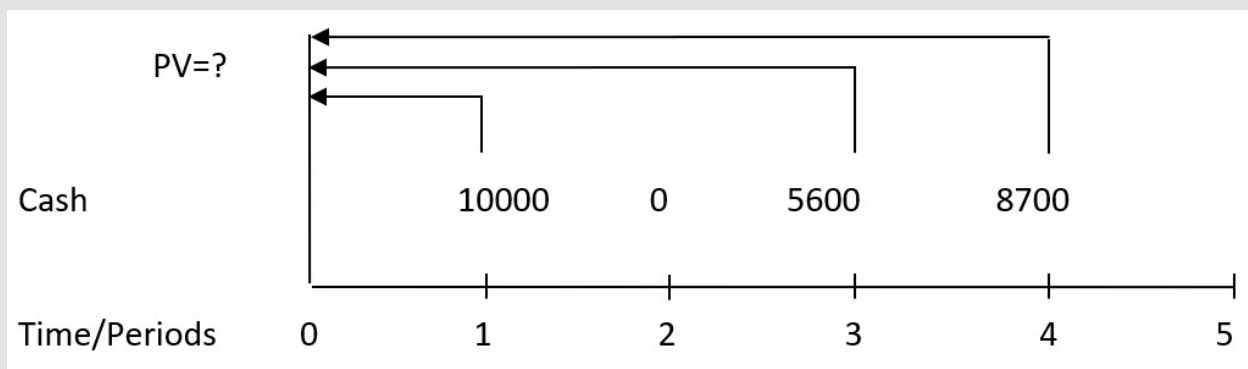
$$PV = \frac{10000}{(1 + 0,035)^1} + \frac{5600}{(1 + 0,035)^3} + \frac{8700}{(1 + 0,035)^4}$$
$$PV = 9661{,}84 + 5050{,}88 + 7581{,}55 = \mathbf{22294,27}$$

The present value of the future cash flows in the previous figure is 22 294, 27 euro.

Compounding to FV:

$$FV = 10000(1 + 0,035)^4 + 5600(1 + 0,035)^2 + 8700(1 + 0,035)^1$$
$$FV = 11475,23 + 5998,86 + 9004,50 = \mathbf{26478,59}$$

The future value of expected cash flows according the example is 26 478, 59 euro. It means that the value of 26 478,59 euro in five years is equal to 10 000 euro in one year + 5 600 euro in three years + 8 700 euro in four years under the condition of the interest of 3,5%.

EXERCISES:

1.   If the interest rate is 4 percent annually, how much money will be on your account in one year if there is 750 EUR today? How much money will be on your account if the interest rate is a) 2 percent, b) 6 percent?

2.   Let us assume that the interest rate is 2 percent annually and you put on your account 500 EUR. How much money will be on your account in a) 2 years, b) 4 years, c) 10 years?

3.   You are expecting to receive 1000 EUR in a) one year b) two years c) 5 years. What is the equivalent value of the received amount today?

4.   You are expecting to receive 1000 EUR in one year. What is the equivalent value of this amount a) today, b) in two years, c) in 5 years? Interest rate is 5 percent.

5.   You have 1000 EUR cash. Interest rate is a) 1 percent b) 5 percent c) 20 percent. What amounts will you not earn in one year if you keep cash in your pocket rather than depositing it on your banking account? Explain.