

Value

Rüdiger John, 2008-09-30

Compound Interest and Present Values

Compound interest

Compound interest means you invest a payment and you reinvest the interest in subsequent periods. For calculating, you need the starting balance, interest and the period.

Example: Value of €150 invested at 5% compound interest.

The longer the funds are invested, the greater the average with compound interest.

Simple interest

Simple interest is where you have the same interest at any period. You have the same basis on every period of investment.

Example: Value of €150 invested at 5% simple interest.

Periods of time

Private persons: calculating with 365 days a year and the exact days in a month.

Business people: calculating mainly in Europe with 360 days a year and 30 days per month.

The **Compounding Intervals** are decided by the cash flow of the payment. In Germany, most corporations pay interest on their bonds annually. In the United States and Britain, most pay interest semi-annually.

Example: (Six months) Investment of €100 in a bond that paid interest of 10% per annum compounded semi-annually would amount to €105 after the first six months,

and by the end of year it would amount to $1.05^2 \times 100 = \text{€}10.25$. In other words, 10% compounded semiannually is equivalent to 10.25% compounded annually.

Example: monthly payment

Present Value

The present value is the discounting on the corresponding period. The discount factor is reciprocal to the accumulation factor.

Key Questions are:

What is the present value of €100 to be received 10 years from now if the opportunity cost of capital is 10%?

How much would I have to invest now in order to receive €100 after 10 years, given an interest rate of 10%?

The answer to the first question:

$$PV = 100 / (1.10)^{10} = \text{€}38.55$$

The answer to the second question:

$$\text{Investment} \times (1.10)^{10} = \text{€}38.55$$

$$\text{Investment} = 100 / (1.10)^{10} = \text{€}38.55$$

You can think of discounting as moving back along the bottom line from value to present value.

Continuous Compounding

Continuous Compounding describes an arrangement in which accumulated interest is added back to the principal to ensure additional interest is earned on the entire balance from that moment on. When interest is declared to be principal, this process is known as continuous compounding.

As it turns out, there are many occasions in finance when continuous compounding is useful. As we will see shortly, one application is in capital budgeting.

To explain: $PV = C/r$

$$PV = C(1/r - 1/r \times 1/e^{rt})$$