Finance

CFA Level 1

Volume 1 - Quantitative Methods

Future Value Formula

$$FV_N = PV(1+r)^N$$

The future value after N time periods (FV_N) is equal to the present value (PV) multiplied by one plus the interest rate (r) raised to the N_{th} power.

- Note that both the interest rate r and the time period N must be in the same units (i.e. if N is stated in months, then r should be the monthly interest rate, unannualized).
- Another way of saying this is that the future value after N periods (FV_N) is the present value (PV) scaled by a factor of $(1+r)^N$.

Compounding

The future value formula (above) is used when interest is compounded annually. When interest is compounded more frequently, one uses:

$$FV_N = PV\left(1+\frac{r_s}{m}\right)^{mN}$$

This can be used for any discrete division of a time interval. When interest is compounded *continuously*, the formula becomes:

$$FV_N = PVe^{r_s N}$$

- r_s = **stated annual interest rate/Quoted interest rate** (when interest is compounded more frequently than annually, financial institutions often state the annual interest rate as opposed to breaking it down into more precise units).
- m = Number of compounding periods per year (i.e. 12 if compounded monthly).
- N = Years (N can always be interpreted as years in the above equation).
- FV_N = Future value after N years.
- PV = Present value.

Annual Percentage Yield (APY)

As one can see from the above formulas, the **effective annual rate** (synonymous to annual percentage yield) is often slightly different than the stated annual interest rate, which can make a large difference over time.

This leads to the need for a "standardized" rate, a rate that allows interest rates that are compounded at different frequencies to be compared. **Enter APY**. The annual percentage yield gives one the ability to aptly compare stated annual interest rates with different compounding periods.

If compounding is discrete (most often the case):

$$APY(EAR) = \left(1+\frac{r_s}{m}\right)^m - 1$$

If compounding is continuous:

$$APY(EAR) = e^{r_s} - 1$$