Effective and Nominal rate of Interest

Nominal Interest Rate : **The compound interest compounded annually is known as Nominal rate of Interest.**

Effective Rate of Interest : The compound interest compounded more than once in a year, (it may be half-yearly, quarterly, monthly and etc.) then the actual percentage of interest per year is known as Effective Rate of Interest.

Relation between Nominal and Effective rate of interest:

$i_e = (1 + \frac{i}{m})^m - 1$

$i = \frac{r}{100}$

i_e = effective rate of interest

i = nominal rate of interest

m = number of compounding, for half-yearly the number of compounds is 2, for quarterly it is 4, for monthly it is 12 and so on.

Question.1 Find the effective rate equivalent to the nominal rate of 8% converted quarterly ?

Solution: $i_e = (1 + \frac{i}{m})^m - 1$

$i = \frac{r}{100}$

$i_e = (1 + \frac{0.08}{4})^4 - 1 = (1.02)^4 - 1 = 1.0824 - 1$

$i_e = 0.0824 \Rightarrow r = 8.24\%$

Question.2 Find the effective rate equivalent to the nominal rate of 10% converted half-yearly ?

Solution: $i_e = (1 + \frac{i}{m})^m - 1$

$i = \frac{r}{100}$

$i_e = (1 + \frac{0.1}{2})^2 - 1 = (1.05)^2 - 1 = 1.1025 - 1$

$i_e = 0.1025 \Rightarrow r = 10.25\%$

Question.3 Find the effective rate equivalent to the nominal rate of 12% p.a. compounded quarterly ?

Solution: $i_e = (1 + \frac{i}{m})^m - 1$

$i = \frac{r}{100} = \frac{12}{100} = 0.12$

$i_e = (1 + \frac{0.12}{4})^4 - 1 = (1.03)^4 - 1 = 1.12550881 - 1$

$i_e = 0.12550881 \Rightarrow r = 12.55\%$

Question.4 Find the effective rate equivalent to the nominal rate of 9% p.a. compounded monthly ?

Solution: $i_e = (1 + \frac{i}{m})^m - 1$

$i = \frac{r}{100} = \frac{9}{100} = 0.09$

$i_e = (1 + \frac{0.09}{12})^{12} - 1 = (1.0075)^{12} - 1 = 1.0938068977 - 1$

$i_e = 0.0938068977 \Rightarrow r = 9.38\%$

Question.5 Which investment scheme is more profitable 3 % per year compounded monthly or 3.12 % per year simple interest ? $((1.0025)^{12} = 1.03042)$

Solution: now we apply formula to find effective rate of interest $i_e = (1 + \frac{i}{m})^m - 1$

So, first we find effective rate of interest for 3 % compounded monthly

$i_e = (1 + \frac{i}{m})^m - 1 = (1 + \frac{0.03}{12})^{12} - 1 = (1 + 0.0025)^{12} - 1 = (1.0025)^{12} - 1$

$= 1.03042 - 1$

$i_e = 0.03042$

$r_e = 3.042$ % (per year)

3.12 % per year simple interest is higher than 3 % per year compounded monthly.

So, 3.12 % per year simple interest is the best investment option.

Question.6 Which investment scheme is more profitable 12 % per year compounded monthly or 12.5 % per year simple interest ? $((1.0025)^{12} = 1.03042)$

Solution: now we apply formula to find effective rate of interest $i_e = (1 + \frac{i}{m})^m - 1$

So, first we find effective rate of interest for 12 % compounded monthly

$i = \frac{r}{100} = \frac{12}{100} = 0.12$

$i_e = (1 + \frac{i}{m})^m - 1 = (1 + \frac{0.12}{12})^{12} - 1 = (1 + 0.01)^{12} - 1 = (1.01)^{12} - 1 =$

$1.1268250301 - 1$

$i_e = 0.1268250301$

$r_e = 12.68$ % (per year)

Note: 12 % per year compounded monthly is equal to 12.68 % per annum.

12 % per year compounded monthly is higher than 12.5 % per year simple interest.

So, 12 % per year compounded monthly is the best investment option.

Question.7 Which investment scheme is more profitable 10% per year compounded quarterly or 10.2% per annum compounded half yearly ?

Solution: now we apply formula to find effective rate of interest $i_e = (1 + \frac{i}{m})^m - 1$

So, first we find effective rate of interest for 10 % compounded quarterly

$i = \frac{r}{100} = \frac{10}{100} = 0.10$

$i_e = (1 + \frac{i}{m})^m - 1 = (1 + \frac{0.10}{4})^4 - 1 = (1 + 0.025)^4 - 1 = (1.025)^4 - 1 = 1.1038128906 - 1$

$i_e = 0.1038128906$

$r_e = 10.38$ % (per year)

Note: 10 % per annum compounded quarterly is equal to 10.38% p.a. compounded annually

Now, we find effective rate of interest for 10.2 % compounded half-yearly

$i = \frac{r}{100} = \frac{10.2}{100} = 0.102$

$i_e = (1 + \frac{i}{m})^m - 1 = (1 + \frac{0.102}{2})^2 - 1 = (1 + 0.051)^2 - 1 = (1.051)^2 - 1 = 1.104601 - 1$

$i_e = 0.104601$

$r_e = 10.46$ % (per year)

Note: 10.2 % per annum compounded half-yearly is equal to 10.46% p.a. compounded annually

Thus, 10.2 % per annum compounded half-yearly is the better option than 10% p.a. Compounded quarterly.