RICHARD ROBINSON

ECONOMICS & PROJECT MANAGEMENT

Time Value of Money

Interest Rates

THE DIMENSION for an interest rate i is $c_1/c_2/T$ where c is a currency and T is the interest period. If an amount P is borrowed for N periods at i, the final amount is

$$F = P(1+i)^N = P(1+i_s)^m = P + I_c \qquad (1)$$

which is known as compounding where the total interest on such loan I_c is the compound interest. Consequently, the simple interest $I_s = PiN$ is such interest not compounded.

The *nominal interest rate* (NIR) is the conventional annual interest rate. Suppose a period is divided by m. If r is the NIR for the full period, the interest rate is

$$i_s = r/m \iff r = i_s m \qquad (2)$$

For example, a NIR of i / year compounded monthly is $i/12$ per month.

The *effective interest rate* is the actual interest rate given by

$$i_e = \frac{F}{P} - 1 = \left(1 + \frac{r}{m}\right)^m - 1 \sim e^r - 1 \qquad (3)$$

A cash flow diagram is a visualization of cash flows and interest over time. Note that N years from time t is the end of period N and beginning of $N+1$.
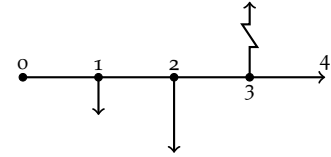

Figure 1: A cash flow diagram. The broken line at $t = 3$ indicates the net sum of the cash flow at that period.

Equivalence