Note on Compounding • 1.011 Project Evaluation • Lecie Lu • MIT Center for Transportation Studies

Question:
If the annual interest rate (discretely compounded) is 12%, then what is the equivalent monthly interest rate?

1. The Quick Way

We simply take 12%, and we divide it by 12. This gives 1%, which is approximately correct. For the majority of project evaluation work, this will suffice. This is an overestimate, since a nominal monthly interest rate of 1% will cause compounding every month, but 12% annual interest rate causes compounding only once a year. Exhibit 1 illustrates the error.

2. The Mathy Way

If we want the money to grow at a rate of 12% per year, what is the percentage rate I must grow the money at every month, to arrive at a 12% growth at the end of the year? Supposing we had $1.00, and it needs to be $1.12 at the end of this year, what’s the monthly growth rate, compounded every month? This is a mathematical problem:

$1.12 = $1.00*(1+i_{\text{monthly}})^{12}$

To obtain $i_{\text{monthly}}$, we solve (either analytically, or using Excel’s Solver) the endecintic equation:

$i_{\text{monthly}} = (1+i_{\text{year}})^{(1/12)} -1$

The result is shown in Exhibit 2.

Exhibit 1: The quick way to calculate monthly nominal interest rate from the annual interest rate. Exhibit 2: The right way to calculate monthly nominal interest rate from the annual interest rate.