

Elements of Macroeconomics Spring 2024

Week 5

10 Long Term Growth

10.1 Simple Interest vs Compounding

When working with growth rates, we need to multiply growth rates due to **compounding**! We receive interest from interest. In finance, we do not care that much about it. Why? Because adding growth rates is a good *approximation* **IF GROWTH RATES ARE SMALL AND THE TIME HORIZON SHORT!**

Why? the approximation

$$(1 + a) * (1 + b) \approx 1 + a + b \quad (1)$$

For very small numbers for a and b

To see this take a \$100 bond with a 2% yield. If we want to know what we get after 5 years, we could either do it correctly with compounding or adding them up

$$\$100 * (1.02)^5 = 110.41 \quad (2)$$

$$\$100 * (1 + 0.02 * 5) = 110.00 \quad \rightarrow \text{error is } 0.4\% \quad (3)$$

But, if interest rates or timer horizon increase, the approximation gets much worse!

$$\$100 * (1.02)^{50} = 269.16 \quad (4)$$

$$\$100 * (1 + 0.02 * 50) = 200.00 \quad \rightarrow \text{error is } 34.6\% \quad (5)$$

$$\$100 * (1.20)^5 = 248.83 \quad (6)$$

$$\$100 * (1 + 0.2 * 50) = 200.00 \quad \rightarrow \text{error is } 24.4\% \quad (7)$$

10.2 Long Term Growth

The most important formula is:

$$\% \Delta Y = \% \Delta L + \% \Delta LP \quad (8)$$

In words, change in long term output growth can only be achieved through either a change in labor growth or a change in labor productivity growth.