Rules to remember (or learn!)

Often, we want to get an estimate, or the sense of how markets are changing. Having some quick estimation rules can be very useful. Here's a list of some used often in the course.

- Remember that if you are dividing by a fraction, that is equivalent to multiplying by the inverse of the denominator. For example, $[4 / \frac{1}{2}] = 4*2 = 8$. That makes sense since if you had 4 pies and you cut them each in half, you would have 8 pieces. (So cool, eh? Makes you think that people like Newton and Hawking really were up to something…!)

This will come in handy many times throughout the course – like convincing yourself that the elasticity is not equal to the slope, solving for equilibria, etc. (more on this in Chapter 4)

- The percentage change of a variable is equal to the change in that variable divided by the amount of the variable, or

  $[(X_2 - X_1)/ X_1] = \%\Delta X$, as we saw earlier, the *delta* symbol is the symbol for "change," so we can rewrite the above expression to read

  $\%\Delta X = \Delta X/X$, with $\Delta X = (X_2 - X_1)$

- If you want to find the percentage change of the product of two variables, that can be approximated by adding the percentage changes of the two variables.

  $\%\Delta (xy) \approx \%\Delta x + \%\Delta y$

For example, the famous quantity equation relating the nominal value of output to the money supply times the velocity of money,

$MV = PY$[1],

This can be put into percentage growth terms, using this rule:

$\%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Y$,

so that if the velocity of money (which is the ratio of the value of all transactions divided by the money supply) is fixed, or $\%\Delta V = 0$, then if we want prices to be stable (note that the percentage change of prices is inflation), then the growth rate of money should rise at the rate growth of real income. (we'll see later, with much more detail (!) -- this is known as the Friedman Rule)

- The percentage change of a ratio is approximately equal, for relatively small percentage changes, the difference of the percentage change of the variables.

  $\%(x/y) \approx \%x - \%y$

[1] The University of Chicago Professor and Nobel Prize Winner (and "monetarist" – more later) Milton Friedman famously had a version of this equation as his license plate!

So, for example, if you are trying to estimate the percentage change in per capita income, and you know the growth in total income and the population growth, you can estimate per capita income growth.

For example, say Sub-Saharan Africa (SSA) had total income rising by 6%, with a population growth of 4%. We can estimate the per capita growth in income at 2%. (6% - 4%).

- Rule of 70

Another neat approximation is the "Rule of 70," so-called because it allows an estimate of how long an asset will double at a given rate of increase. By taking the growth rate of the variable and dividing it into 70, you can estimate the number of years in order for the principle to double. For example, let's suppose an asset is growing at 5%. That means a good guess is that the asset will double in about 14 years.[2]

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[2] At rates from about 6-10%, the Rule of 72 makes sense; however, for much greater or lower values, 72 needs to be adjusted. A rule of thumb is that for every 3 percentage points from 8% either add 1 or subtract 1 from 72. So, for example if the increase were 11%, then use 73 – for 5%, use 71, and so forth. The rule is derived from using natural logarithms. $2x = x(1+r)^n$, with n = number of years. Taking logs of both sides, $\ln(2) = .693 = n(\ln(1+r))$. From there, divide through by r and multiply left side by 100/100 to get into percentage terms. This leaves: $(69.3/r) = n$. We use "70" as a quick easier number to divide into…