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Econ-UA 323

Development Economics

Problem Set 1

(1) The idea behind purchasing power parity incomes is that poor countries often have a lower domestic price level. The International Comparison Program, which you can read about at

http://www.worldbank.org/en/programs/icp

tries to correct for these differences.

(a) Show that if all goods are perfectly traded, then there is no reason for any such correction.

(b) Why are nontraded goods generally cheaper in poor countries? If so, would their incomes look better (relative to the United States) when measured by the exchange-rate method or by the PPP method?

(c) McDonald's operates in various countries. It has been found that the relative price of a Big Mac is a better guide to the overall cost of living than estimates using the exchange rate. Why do you think this might be the case?

(d) What do you think would happen to non-traded prices in a country if its distribution of income became more unequal around the same average income?

(2) On leapfrogging. Why do you think that Asian technology (say, for tv or mobile phones) dominate their counterparts in the United States or Europe? After thinking about this, read on and see how one might write a little model of such a phenomenon.

You are the chief economic advisor of a country which has mobile phone capability (transmission frequencies, towers) already installed. This infrastructure generates a social value of x every year for the next T years. You are thinking of switching to a new infrastructure (say, for high quality cell transmissions) that will generate y every year, also for the next T years. The cost of setting up this infrastructure is C. Generate a simple algebraic rule that will tell you whether or not to scrap the current infrastructure and go for the new one.

Use this rule to provide an example in which the infrastructure is scrapped if x is close to 0 but not, say, if it is equal to $y/2$. Now formulate a hypothesis that suggests why countries that have poor infrastructure might be more likely to leapfrog over countries with better infrastructure insofar as the installation of new infrastructure is concerned.

(3) Make sure you understand the power of exponential growth (and of rapid exponential inflation) by doing the following exercises:

(a) Suppose that Brazil experiences inflation at 30% per month. How much is this per year? Do your calculations first without compounding (the answer then is obviously 360%). Now do it properly by compounding the inflation rate.

(b) How quickly will a country growing at 10% a year double its income? Quadruple its income? What about a country growing at 5% per year?

(c) Suppose a country's per capita income is currently growing at 5% per year. Then it shaves an additional percentage point off its population growth rate for the next twenty years, but overall income continues to grow at the same rate. How much richer (per capita) would the country be at the end of twenty years?

(4) Other interesting aspects of exponential change:

(a) If a country's per-capita income has been growing steadily at 2% per year and now stands at $50,000, what would have been its income 100, 200, 300 years ago? Can you use this to make the point that growth rates such as 2% per year are a relatively modern phenomenon?

(b) Beware of fluctuating growth rates! If a country grows at 2% in one year and shrinks by 2% the next year, what does its long-run income trajectory look like?

(c) Over the long-run, are you better off living in a country growing at 2% per year every year or a country that grows by 7% in one year and shrinks by 3% the next year?

(5) Construct an imaginary mobility matrix from a sample of countries that shows *no* mobility at all. What would it look like? What would a mobility matrix with "perfect mobility" look like? What would a mobility matrix look like if poor countries grow, on average, faster than rich countries?

(6) Look at the table on income shares in the second set of slides. We discussed why inequality might rise and fall over the course of development, though we also recognized that there was no inevitability about such an outcome. That said, here is a little model of structural transformation that could give you some of what you see in the data:

Suppose there are two sectors, call them A [agriculture] and M [manufacturing]. People earn say $5 an hour in agriculture and $10 an hour in manufacturing. Suppose we are interested in the share of the bottom 40% and the richest 20%. Let x be the share of people in manufacturing. Derive a formula that gives you the shares of income earned by the lowest 40% of the population and the richest 20% of the population as a function of x. This is a connection between structural transformation and the behavior of inequality.

(7) This question needs a bit more algebra. You do not need to complete it. But if you work hard at it you will see the important effect that compounding has. Suppose that Scrooge has some wealth W and some labor income y. Wealth is a *stock* of money; Scrooge can grow it by investing it at some rate of return r, which yields a flow of capital income rW during the year. Likewise, labor income y is a flow: each year, repeatedly, Scrooge gets a paycheck of y.

(a) Suppose that Scrooge's wealth is W_t in year t. Suppose that he saves a positive fraction s of his total income (capital and labor) in that year. Show how you would calculate Scrooge's new wealth W_{t+1} in year $t+1$.

(b) We will start our accounting from some year which we call $t = 0$. Use part (a) to develop a full equation for Scrooge's wealth, starting all the way from W_0 at date 0, showing that

$$W_{t+1} = \left[W_0 + \frac{y}{r}\right](1 + sr)^{t+1} - \frac{y}{r}. \tag{1}$$

(c) Now suppose that Scrooge and Stooge both start with the same wealth, have the same income y year after year, and the same rate of savings s. If Scrooge earns a rate of return r^1 on his wealth and Stooge earns r^2, what will happen to the ratio of Scrooge's wealth to Stooge's wealth as the years go by? Use Equation (1) even if you could do not derive it —just assume it for this question.

(d) Again, suppose that Scrooge and Stooge both start with the same wealth and this time they have the same savings rate as well as well as the same rate of return on their wealths. But Scrooge has twice the labor income of Stooge. Now what will happen to the ratio of Scrooge's wealth to Stooge's wealth as the years go by? Once again, use Equation (1).

(e) Why do you think that the answers to (c) and (d) differ so significantly?