SAVINGS, INVESTMENT, AND GROWTH

Suppose that output per worker is Y/N = f(K/N).

K is increased via investment, but also depreciates over time:

$K_{t+1} = (1-d) K_t + I_t$

So:

$K_{t+1} - K_t = I_t - dK_t$

Divide by N:

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = \frac{I_t}{N} - d\frac{K_t}{N}$$

But I = sY

so

$\Delta (K/N) = s(Y/N) - d(K/N)$

Implications:

1. The savings rate has no effect on the *long-run* growth rate

2. But it does determine the *level* of output in the long run

3. An increase in the savings rate can produce a temporary acceleration of growth, but eventually runs into diminishing returns

4. Long run sustained growth depends on technological progress

MEASURING TECHNOLOGICAL PROGRESS

1. Technology is judged by its results - we usually cannot directly measure the economic impact of an invention, so we look for indirect evidence of progress

2. Ultimate definition: anything that shifts $Y = f(K/N)$ up is technological progress

Hence technological progress is measured as the *residual*: the difference between how much output would have risen without technological progress, and how much it actually rose

HOW THE RESIDUAL IS CALCULATED

1. Direct method: estimate the production function somehow, then calculate as in preceding figure

2. “Growth accounting”: create an index of “input”, the same way that we create an index of output to measure real GDP - e.g., value capital, labor etc. at the prices of some base year. Then compare growth in input with growth in output

Typical approach: let X be index of input, consisting of capital and labor. Let r be rate of return on capital, w be wage rate of labor

$$? X = r? K + w? N$$

Now we suppose that actual growth in Y is due both to input and to technological change, say

$$? Y = r? K + w? N + ? A$$

A little algebra:

$$? Y/Y = (rK/Y)(? K/K) + (wN/Y)(? N/N) + ? A/Y$$

Growth = growth of capital×capital share + growth of labor×labor share + residual

SOME IMPORTANT RESULTS FROM GROWTH ACCOUNTING:

1. Solow: most growth in US per capita income since 1900 due to technology, not capital

2. The Soviet Union issue: in the late 50s, early 60s SU growing very fast: “we will bury you”. But residual small, suggesting diminishing returns.

3. The information technology paradox: residual has been much smaller in the United States since early 1970s. If we’re so smart, why aren’t we rich?

4. The East Asian controversy: before 1997, growth rates of output in E. Asia very high, but, like SU circa 1962, residual unimpressive. Was this an early warning of crisis?

TECHOLOGY AND STRUCTURAL CHANGE

1. Obvious examples: cars replace carriages, etc.

2. Less obvious: deindustrialization

Fact: steadily diminishing share of work force producing goods; manufacturing was 35 percent in 1950, about 16 percent now

Why? Mainly because of rapid technological progress in manufacturing

Example: the hot-dog-and-bun economy

Consumers insist 1 hot dog per bun and vice versa
Labor requirement for dog: 2
Labor requirement for bun: 2
120 million workers
Results: 60 million workers in each industry, total output 30 million hd-b combos

Now let productivity in hot dogs double (1 worker per dog)
Result if full employment: output of 40 million hd-b combos, with employment of 40 million in dogs, 80 million in buns