Econ 580, Lecture Notes 5

Andres Rodriguez-Clare

Penn State University

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Where do TFP differences come from? Some clues come from a sector-level analysis: agriculture, manufacturing and services.

The largest differences in productivity arise in agriculture (why?), and poor countries allocate a large fraction of their labor to agricultur (why?), magnifying the aggregate importance of agricultural productivity differences.

Little catch-up in productivity for services.

Paper: Duarde and Restuccia, "The Role of the Structural Transformation in Aggregate Productivity"

Some facts:

Importance of aggriculture declines steeply with income: Figure 1 in Restuccia, Yang and Zhu.

Importance of services raises steeply with income.

Structural transformation: distribution of labor hours across the 3 sectors. Figure 2.

Agriculture exhibits highest growth rate in productivity, followed by industry... growth in services is relatively low. United States: 3.8%, 2.4%, and 1.3% for 1956 - 2004. Same ranking in 23 out of the 29 countries in sample. Figure 3. Averages: 4%, 3.1% and 1.3%.

Few countries have higher productivity growth than US.

Model - $Y_i = A_i L_i$, $i \in \{a, m, s\}$,

$$\max_{L_i \geq 0} \{p_i A_i L_i - w L_i\}$$

Consumers have per-period Stone-Geary preferences,

$$U(c_a, c) = a \log(c_a - \bar{a}) + (1 - a) \log(c)$$

where c is a consumption aggregate of manufacturing and services.

These preferences imply that spending in aggriculture is

$$E_a = P_a \bar{a} + a(I - P_a \bar{a})$$

so

$$E_a / I = (1 - a) P_a \bar{a} / I + a$$

The share of spending in aggriculture decreases with income and converges to a as $I \to \infty$.

To get the share of income devoted to services increasing with income, assume

$$c = [b c_m^{\rho} + (1 - b)(c_s + \bar{s})^{\rho}]$$

with $\bar{s} > 0$, $b \in (0, 1)$, and $\rho < 1$.

So consumers maximize

$$\max_{c_i \geq 0} \left\{ a \log(c_a - \bar{a}) + (1 - a) \frac{1}{\rho} \log \left[b c_m^{\rho} + (1 - b)(c_s + \bar{s})^{\rho} \right] \right\}$$

subject to

$$p_a c_a + p_m c_m + p_s c_s = wL$$

Market clearing: $L_a + L_m + L_s = L$ and $c_i = Y_i$.

Normalizing $w = 1$, prices are $p_i = 1/A_i$.

Allocation satisfies

$$L_a = (1-a)\frac{\bar{a}}{A_a} + a\left(L + \frac{\bar{s}}{A_s}\right)$$

and

$$L_m = \frac{(L - L_a) + \bar{s}/A_s}{1+x}$$

where

$$x \equiv \left(\frac{b}{1-b}\right)^{1/(\rho-1)} \left(\frac{A_m}{A_s}\right)^{\rho/(\rho-1)}$$

Note: if $\bar{s} = 0$ and $b = 1/2$ then using $\varepsilon \equiv 1/(1-\rho)$ we can write

$$\frac{L_m}{L - L_a} = \frac{A_m^{\varepsilon-1}}{A_m^{\varepsilon-1} + A_s^{\varepsilon-1}}$$

If $\bar{s} = 0$ (homotheticity) then $L_s/L_m = x$ and changes in A_m/A_s are the only source of labor reallocation between manufacturing and services - with $\varepsilon < 1$ ($\rho < 1$) have that if growth in A_s is lower than in A_m then L_s/L_m increases.

If $\bar{s} > 0$ then even if A_m/A_s stays constant, $\bar{s}/A_s$ would fall with increasing A_s, leading to a decline in L_m given L_a.

Note the implications of these preferences for aggregate labor productivity. Assuming $c = c_m$, labor productivity is

$$\frac{A}{L} = \frac{A_a L_a}{L} + \frac{A_m(L - L_a)}{L}$$

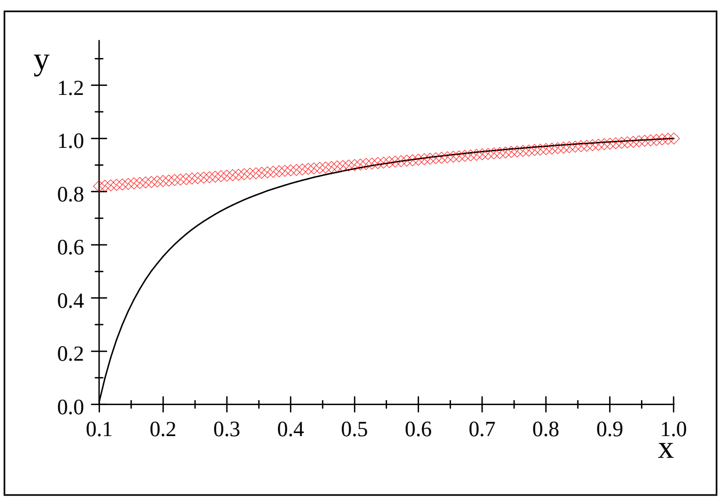
with

$$L_a = (1 - a)\frac{\bar{a}}{A_a} + aL$$

so

$$A/L = (1-a)\bar{a} + A_a a + A_m(1-a) - A_m(1-a)\bar{a}/A_a$$

Using $a = 0.99$ and $\bar{a} = 0.11$ then we get ($y = A/L$ and $x = A_a$):



Calibration

Normalize $A_{a,0} = A_{m,0} = A_{s,0} = 1$ for the US.

Use $A_{i,t+1} = (1 + \gamma_{i,t})A_{i,t}$ and data on growth rate in sector i per year for $1956 - 2004$ for the US go generate a panel for US.

Set $a = 0.1$.

Given values for ρ and b, set $\bar{a}$ and $\bar{s}$ to match allocation in US in 1956.

Choose b and ρ to match reallocation in manufacturing and aggregate productivity growth (2%). Figure 4.

For the rest of countries: (1) set $A_{i,0}$ to match sectoral allocation in 1956, (2) use domestic data on sector level growth rates of labor productivity with $A_{i,t+1} = (1 + \gamma_{i,t})A_{i,t}$ to generate series for each country.

Figures 5-9.

Counterfactuals.