

Discussion of “Capital Accumulation and International Trade” by Fernando Alvarez and Robert E. Lucas, Jr.

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Economic growth and the law of diminishing returns

- Modeling savings:

$$\frac{dk}{dt} = y(k) - c - \delta \cdot k$$

$$\frac{1}{c} \cdot \frac{dc}{dt} = \frac{r(k) - \delta - \rho}{\sigma}$$

- Modeling production:

$$y(k) = f(k) = k^\varphi$$

$$r(k) = f'(k) = \varphi \cdot k^{\varphi-1}$$

- The parameter φ measures DRS and determines the *position* of the steady state and the *speed of convergence*.
- How does trade affect the functions $y(k)$ and $r(k)$?

Ricardian trade and terms-of-trade effects: Armington

- Assume each country produces one good (only *intensive* margin):

$$p = D \cdot f(k)^{-\frac{1}{\varepsilon}}$$

- Now production is:

$$y(k) = p \cdot f(k) = D \cdot k^{\varphi \cdot \frac{\varepsilon-1}{\varepsilon}}$$

$$r(k) = p \cdot f'(k) = D \cdot \varphi \cdot k^{\varphi \cdot \frac{\varepsilon-1}{\varepsilon} - 1}$$

- The combination of parameters $\varphi \cdot \frac{\varepsilon-1}{\varepsilon} \leq \varphi$ determines the *position* of the steady state and the *speed of convergence*.
- Terms-of-trade effects strengthen DRS.

Ricardian trade and terms-of-trade effects: Eaton-Kortum

- Each country produces many goods (*intensive* and *extensive* margins!):

$$y(k) = D \cdot k^{\varphi \cdot \frac{\beta + \alpha \cdot \theta}{\beta + \theta}}$$

$$r(k) = D \cdot \varphi \cdot k^{\varphi \cdot \frac{\beta + \alpha \cdot \theta}{\beta + \theta} - 1}$$

- The combination of parameters $\varphi \cdot \frac{\beta + \alpha \cdot \theta}{\beta + \theta} \leq \varphi$ determines the *position* of the steady state and the *speed of convergence*.
- Key effects of trade on capital accumulation:
 - ▶ Domestic capital accumulation hits DRS earlier
 - ▶ Foreign capital accumulation fosters growth
- Key assumptions about industries:
 - ▶ Strong cross-country differences in technologies
 - ▶ Weak cross-industry differences in factor proportions

Heckscher-Ohlin trade and structural transformation

- Two industries with different factor proportions $\varphi_1 \leq \varphi_2$:

$$y(k) = \begin{cases} p_1 \cdot k_1^{\varphi_1} & k \leq \bar{k}_1 \leq \bar{k}_2 \\ p_1^{\frac{\varphi_2}{\varphi_2 - \varphi_1}} \cdot p_2^{\frac{-\varphi_1}{\varphi_2 - \varphi_1}} + p_1^{\frac{\varphi_2 - 1}{\varphi_2 - \varphi_1}} \cdot p_2^{\frac{1 - \varphi_1}{\varphi_2 - \varphi_1}} \cdot k & \bar{k}_1 \leq k \leq \bar{k}_2 \\ p_2 \cdot k^{\varphi_2} & \bar{k}_1 \leq \bar{k}_2 \leq k \end{cases}$$

$$r(k) = \begin{cases} \varphi_1 \cdot p_1 \cdot k_1^{\varphi_1 - 1} & k \leq \bar{k}_1 \leq \bar{k}_2 \\ p_1^{\frac{\varphi_2 - 1}{\varphi_2 - \varphi_1}} \cdot p_2^{\frac{1 - \varphi_1}{\varphi_2 - \varphi_1}} & \bar{k}_1 \leq k \leq \bar{k}_2 \\ \varphi_2 \cdot p_2 \cdot k^{\varphi_2 - 1} & \bar{k}_1 \leq \bar{k}_2 \leq k \end{cases}$$

- The key parameter varies across income levels, $\varphi \equiv 0.5 \cdot (\varphi_1 + \varphi_2)$:
 - Poor countries: $\varphi_1 \leq \varphi$
 - Middle-income countries: $1 \geq \varphi$
 - Rich countries: $\varphi_2 \geq \varphi$
- Structural transformation weakens DRS (within cones, and also as we move up in the industry ladder).

So, in what world do we live?

- Ricardian trade creates terms-of-trade effects:
 - ▶ Domestic capital accumulation hits DRS earlier
 - ▶ Foreign capital accumulation fosters growth
- Heckscher-Ohlin trade allows structural transformation:
 - ▶ Domestic capital accumulation hits DRS later
 - ▶ Foreign capital accumulation deters growth
- How strong are cross-country differences in technologies? How strong are cross-industry differences in factor intensities?
- Industrial structure matters!
 - ▶ Do industrial countries specialize in Ricardian industries?
 - ▶ Do emerging markets specialize in Heckscher-Ohlin industries?
- What about increasing returns and imperfect competition?