INTERNATIONAL TRADE - ECON 245

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TECHNOLOGY DIFFERENCES

LITERATURE OVERVIEW

- In the HOV model we assumed FPE.
  - Only proved for 2 by 2 case
  - First extends to general N by N case, then asymmetric N by M cases
- Key generalizations of Stolper-Samuelson and Ryvczynski:
  - For a change in the price of each good there will exist some factor that gains in real terms and another that loses.
  - For an increase in the endowment of each factor there myst be a good whose output and another good whose output falls

DORNBUSCH, FISCHER, SAMUELSON (1977)

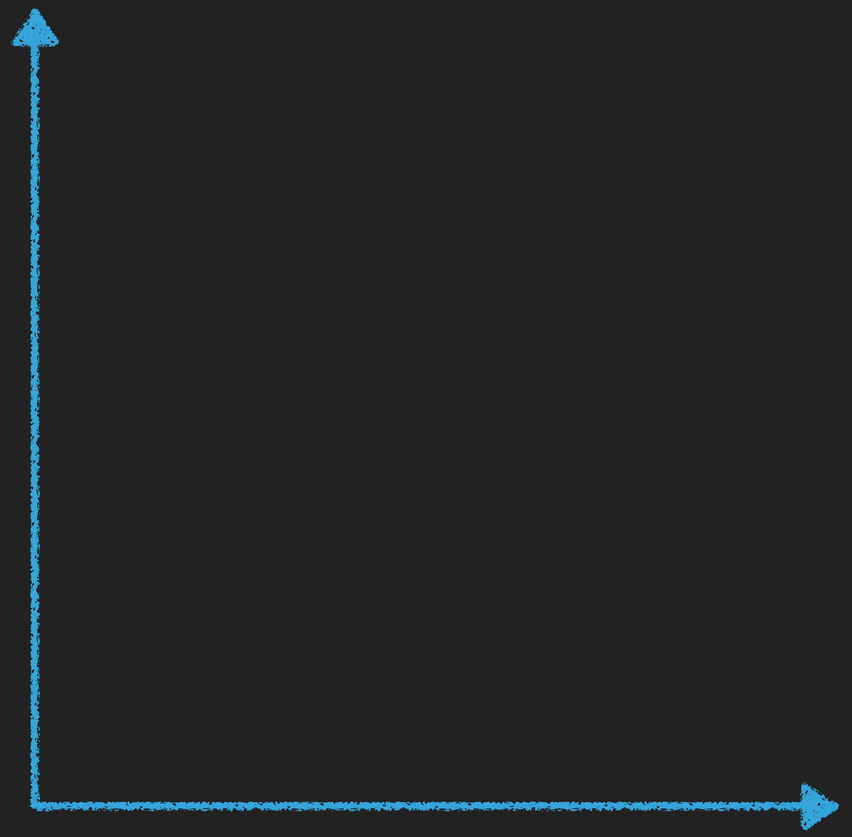
DORNBUSCH, FISCHER, AND SAMUELSON 1977

- Continuum of industries indexed by $z \in [0,1]$
- Perfect Competition
- $a(z), a^\star(z)$ units of labor required to produce good z at home and abroad
- Single factor of production is labor: $L, L^\star$ workers at home and abroad
- Workers have Cobb-Douglas preferences:

$$U = \int_0^1 \ln\left[c(z)\right] dz, U^\star = \int_0^1 \ln\left[c^\star(z)\right] dz$$

DORNBUSCH, FISCHER, AND SAMUELSON 1977

- Define relative efficiency in producing good z: $A(z) \equiv a^\star(z)/a(z)$
- Prices under autarky in each country are: $p(z) = a(z)w, p^\star = a^\star(z)w^\star$
  - Under free trade $p(z) = p^\star = \min(a(z)w, a^\star(z)w^\star)$'
  - "Cutoff good" z' such that $w/w^\star = A(z')$
  - $[0,z']$ are produced in home country, rest abroad
  - World expenditure on domestic good $z'(wL + w^\star L^\star)$



DORNBUSCH, FISCHER, AND SAMUELSON 1977

- Labor market clearing at home implies

$$z'(wL + w^\star L^\star) = wL \Rightarrow w/w^\star = (z'/(1-z'))(L^\star/L) \equiv B(z')$$

- The intersection of $A(z)$ and $B(z)$ pin down z'
- $B(z)$ slopes upward:
  - higher demand for home goods leads to a higher relative home wage
- $A(z)$ slopes downward:
  - Higher relative wage makes home less competitive for given good z

GAINS FROM TRADE

- Consumption of good z is given by $w/p(z)$
- Under autarky $p(z) = a(z)w$ so that welfare of consumers is simply:

$$U_A \equiv -\int_0^1 \ln\left[a(z)\right] dz$$

- Under free trade $[z',1]$ are produced abroad:

$$U_T \equiv -\int_0^{z'} \ln\left[a(z)\right] dz + \int_{z'}^1 \ln\left[w/(a^\star(z)w^\star\right] dz$$

GAINS FROM TRADE

- Under free trade $[z', 1]$ are produced abroad:

$$U_T - U_A = \int_{z'}^{1} \ln\left[A(z')/A(z)\right] dz \quad U_T^\star - U_A^\star = \int_{0}^{z'} \ln\left[A(z)/A(z')\right] dz$$

- Both countries gain from trade if $0 < z' < 1$ and $A(0) > A(z') > A(1)$
- Gains from trade even if one country has the absolute advantage for all z
  - Simply offset by high wage which makes production of some z too expensive

GAINS FROM TRADE: POPULATION GROWTH

- If the foreign country grows, it increases the market size for home
  - The $B(z)$ curve shifts to the left, so that $w/w^\star$ rises
- Taking total derivative+using Leibniz integral rule we can sign welfare effect:

$$dU_T = (1 - z')\left(\frac{dw}{w} - \frac{dw^\star}{w^\star}\right) > 0 \quad dU_T^\star = z'\left(\frac{dw^\star}{w^\star} - \frac{dw}{w}\right) < 0$$

- This does not capture much of the growth we see say in China
  - What about technological progress instead of population growth?

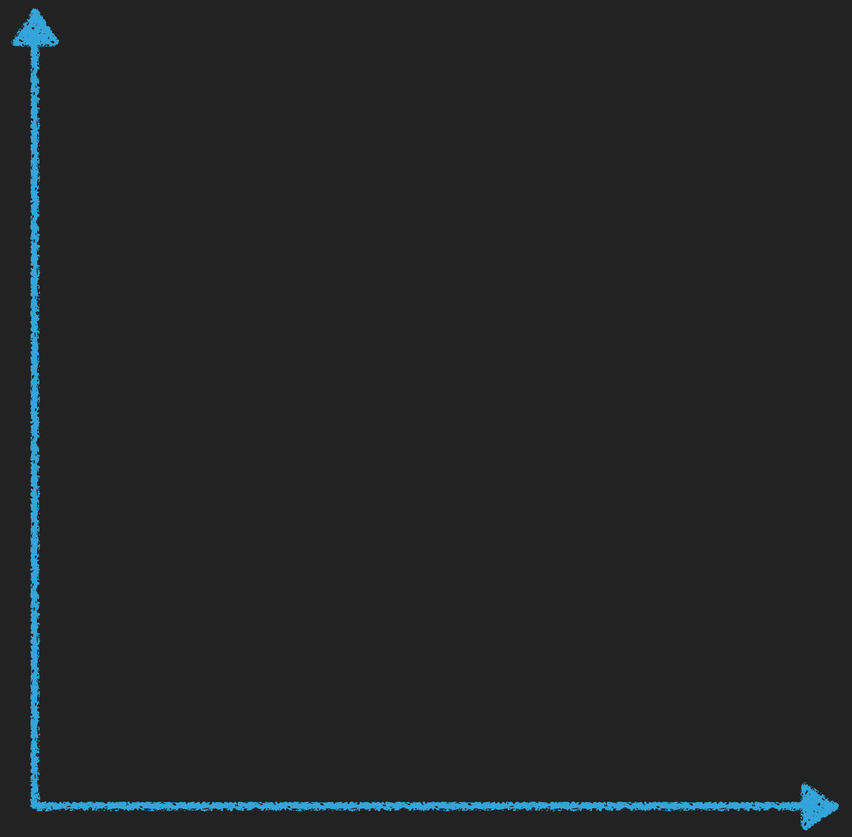
GAINS FROM TRADE: TECHNOLOGICAL PROGRESS

- We model reductions in $a(z), a^{\star}(z)$: $g(z) = -d\ln[a(z)], g^{\star}(z) = -d\ln[a^{\star}(z)]$
- Taking total derivatives and using Leibniz rule once more:

$$dU_T = \int_0^{z'} g(z)dz + \int_{z'}^{1} g^{\star}(z)dz + (1-z')(dw/w - dw^{\star}/w)$$

- Growth has a positive direct effect, but once agains alters the TOT
- Use $\ln A(z') = \ln B(z')$ to solve for wage change expression:

$$dw/w - dw^{\star}/w = \varphi(z')\left[g(z') - g^{\star}(z')\right] \quad \text{where} \quad \varphi(z') < 1$$



DORNBUSCH, FISCHER, SAMUELSON (1980)

DORNBUSCH, FISCHER, AND SAMUELSON 1980

- DFS also applied their modeling insights to create a $2 \times 2 \times \infty$ HO model
  - Labor and capital are factors; home is labor abundant
  - Continuum of goods $z \in [0,1]$
  - Unit cost function for good z: $c(w, r, z) = wa_L(z) + ra_K(z)$
    - Leontief production function with same technologies home+abroad
    - Index goods so that $a_L(z)/a_k(z)$ is non-decreasing in z

DORNBUSCH, FISCHER, AND SAMUELSON 1980

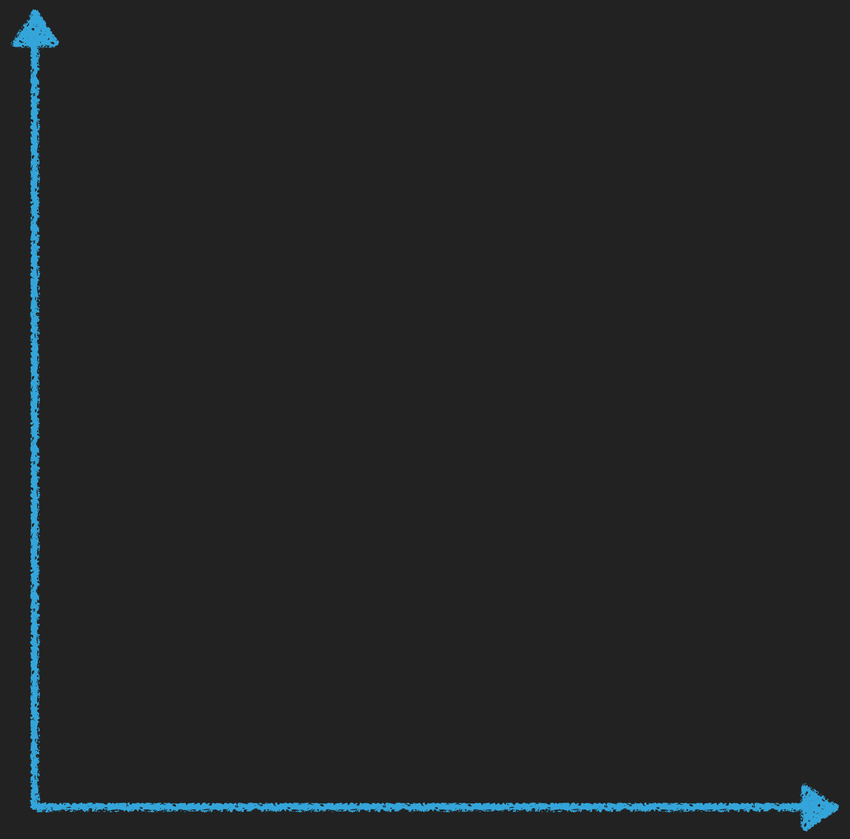
- Assume no FPE. Since home is abundant in labor: $w/r < w^\star/r^\star$
- With free trade the unit price of good z is given by:

$$p(z) = p^\star(z) = \min\{c(w, r, z), c(w^\star, r^\star, z)\}$$

- A useful object is the ratio of unit costs at home and abroad:

$$\frac{c(w, r, z,)}{c(w^\star, r^\star, z)} = \frac{(w/r)\left[a_l(z)/a_k(z)\right] + 1}{(w^\star/r^\star)\left[a_l(z)/a_k(z)\right] + 1}\frac{r}{r^\star}$$

  - Given assumptions this is non-increasing in z



This looks very similar to $A(z)$ before!

Highlights similarity of the two models

once you have a continuum of goods!

DORNBUSCH, FISCHER, AND SAMUELSON 1980

- There exists then again a cutoff good z' where unit costs are equal
- So foreign country has CA in capital intensive good and will export it; home has CA in labor intensive good and will export that
  - This is in line with our assumption on labor abundance of home
- Aside: the FPE set is now *smooth,* and production indeterminate within it
  - Outside the FPE set, contrary to usual case with large number of goods there is no production indeterminacy with a continuum of goods

DAVIS, WEINSTEIN 2001

DAVIS AND WEINSTEIN 2001

- Trefler showed that technology differences are key to reconcile HOV model with data.
  - But *how much* technological heterogeneity is needed?
- Davis and Weinstein (2001) propose an elegant way of answering this
- *Key insights*: Without FPE capital-labor ratios of traded goods must be systematically related to each country's endowments.
  - Higher capital-labor ratio in home, implies higher capital/labor intensities in *all* its traded goods.

DAVIS AND WEINSTEIN 2001

- DW model relationship btw factor intensities and endowments as follows:

$$\ln a^i_{jk} = \alpha^i + \beta_{jk} + \gamma_k(K^i/L^i) + \epsilon^i_{jk}$$

countries $i = 1,\ldots, C$; traded goods $j = 1,\ldots, N$; factors $k = 1,\ldots, M$; (K^i/L^i) capital to labor endowment; random error ϵ^i_{jk}

- 20 OECD countries, 34 goods, 2 factors (capital+labor) in 1985
- α^i captures general technology differences across countries, β_{jk} differences across sector-factor pairs, and γ_k differences dependent on factor endowments

DAVIS AND WEINSTEIN 2001

- Using different variants of this regression that construct the tech matrix A^i
  - Use these resulting technology matrices to construct the factor content of trade
- Does the factor content of trade match relative endowments?
  - If all OECD countries use same tech (β_{ij}) sign test right 47% of cases
  - If also included general technology differences (α^i) 50%
  - If allow technologies to vary with endowments (γ_k) 86%
  - If model exports as proportional to destination GDP: 92%
- They systematically show importance of each modeling assumption in closing gap