6. External returns to scale

Assumption of productivity

- Labour productivity (α) not constant
- Unrealistic assumption (theory of comp adv): all industries interchangeable, just specialise in higher relative productivity industry
    - Some industries have positive spillovers (manufacturing)
    - Specialisation need not to be fixed (based on current comp adv)
- Ex: SK's export miracle: overtime, SK shifted export from primary resources (minerals) to manufacturing (electronics, automobiles), exports >40% GNP with manufacturing occupying 90%

Manufacturing

- Reasons for manufacturing:
    - Empirics: manufacturing jobs tend to pay 10% more wages, holding all other constant
    - Empirics: large share of R&D (research development) from manufacturing
- Graham's case for protection: manufacturing has special properties, promote local industry even without natural comp adv
    - Similar to IIP, but *permanent* protection
    - Analysed with ERS

ERS External returns to scale

- Production function: produce α_M units of M per unit of time
    - $Q_M = \alpha_M L_M$
        - Manufacturing output = labour productivity *employment of M
        - Max output firm can produce given level of inputs
    - Diff country size (L size) may = higher productivity
- Marginal product of labour (MPL) – productivity
    - $MPL_M = \frac{\mathrm{d}Q_M}{\mathrm{d}L_M}$, $MPL_M = \alpha_M$ (α_M constant in linear model)
    - But productivity evolves with industry so α_M should not constant
        - Hiring additional worker = more additional output

- Increasing external returns to scale (ERS): $Q_M = L_M^2$
    - $MPL_M = 2L_M$ → linear in L, MPL increase in L
    - <u>More worker in industry = higher labour productivity increase</u>
            - ERS: labour productivity α depends on scale of industry
        - Labour productivity increase in L_M: positive externality

- Decreasing external returns to scale (ERS): $A = \alpha_A L_A^{1/2}$
  - $MPL_A = (½\alpha_A)/(\sqrt{L})$ → MPL decrease in L
  - more worker in industry = lower labour productivity increase

- ERS matter:
  - Productivity growth comes from
    - within productivity: better trading, education
    - structural change: movement of labour away low productivity (agriculture commodity) to high productivity (high tech)
  - Some country exhibits negative structural change: move from high to low productivity, ERS industries to low-prod (decrease in prod)
  - Countries need critical mass (big enough L) in industry to competitive – protection allow local to achieve scale and acquire comp adv: calculate MPL

Ricardian with ERS

- SK and JP have identical production functions:
  - $Q_A = \alpha_A L_A$
    - α constant, linear function = labour productivity (MPL) constant
    - Nominal wage: $w = \alpha_A P_A$ → worker contribution to revenue
  - $Q_M = \alpha_M L_M^2$
    - α constant but non-linear function = labour productivity not constant
    - Nominal wage: $w = \alpha_M L_M P_M$
      - bc more worker=increase prod in scale, wage increase to keep up with prod (perfect comp market)
      - so L pop size affects comp adv now (as relative P and α use concept of equal w)
    - Comparative adv: though same α and production function but diff L pop sizes = diff OC and comp adv

Not wage=MPL*P =2αLP bc does not use profit max but 0 profit condition bc ERS

- Calculation: SK has 10L (L_A+L_M) , JP has 20L , half in each industry
  - SK L_A=5, SK L_M=5; JP L_A=10, JP L_M=10
  - Autarky relative price of M: same wage (w)
    - $\alpha_M L_M P_M = \alpha_A P_A$
    - $\frac{P_M}{P_A} = \left(\frac{\alpha_A}{\alpha_M}\right)\left(\frac{1}{L_M}\right)$ → OC of M (relative price of M) depends L_M
      - Higher L_M (higher prod) = lower OC of M (lower autarky relative price)
  - Let $\alpha_M = \alpha_M^* = 1$ and $\alpha_A = \alpha_A^* = 1$
    - $L_M = 5$ in South Korea $\longrightarrow P_M/P_A = 0.2$
    - $L_M^* = 10$ in Japan $\longrightarrow P_M^*/P_A^* = 0.1$
      - JP higher employment in M = comp adv even worker not inherently more prod

- If M is special and more desired and if increasing ERS in M: <u>smaller country = comp disadv</u>
- If increasing ERS → *smaller countries should consider protect local industry*
    - *BUT L size *does not* guarantee comp adv in increasing ERS industry (if has sufficiently unproductive labour can have lower OC=comp adv bc in relative terms)
- If decreasing ERS → larger L = less productive = lower OC in that industry

Protection pros and cons

- Empirics: if protection is necessary, do the following
    - Aim to achieve dynamic efficiency via international competitiveness (make export globally competitive)
    - Provide flexibility so allow private initiative to flourish
    - Obtain and continuously update info to judge potential comp adv (SK: close relationship between gov and exporters, so allow info flow)
    - Only limited number of industries should be targeted
- Against protection:
    - Protection means higher prices (lower CS)
    - OC in protection expenditure (subsidy and not healthcare education)
    - Embeddedness: needs to be interaction between private and public sectors throughout the process
        - Bureaucrats need to be in between arms-length relationship and full capture (or corruption scandals)
    - Discipline: must have way to punish under-performers or disengage if policy not working
        - Use automatic sunset clauses or establish binding targets (achieve specific goals in exchange for export protection)
    - Accountability: must have way to hold relevant public agency accountable
        - Cannot use other reasons to permanently fund the industries

7. Heckscher-Ohlin model

Setup

- Country export things not higher relative productivity in: Brazil biggest exporter of soybean – not the most productive country
- Other reason for trade patterns: relative endowment
  - Two countries: **Brazil** and **China**.
  - Two products: **manufacturing** and **agriculture**
  - Two factors of production.
    1. Labour (L)
    2. Land (K)

Ricardian: only 1 factor of production

- Countries have diff factor endowments:
  - Brazil has L units of labour and K units of land
  - China has L∗ units of labour and K∗ units of land

Assumptions

Adding to Ricardian

1) B is **relatively** land-abundant and C is **relatively** labour-abundant
   - Relatively: compare land to labour ratio of B and that of C, B>C
   - $\frac{K}{L} > \frac{K^*}{L^*}$ → not absolute difference
2) Agriculture is **relatively** land-intensive
   - a_{ij}: amount of factor i needed to produce product j
   - Agriculture higher land-labour ratio: $\frac{a_{KA}}{a_{LA}} > \frac{a_{KM}}{a_{LM}}$
   - Abundance: compare countries; intensity: compare industries
   - Ex: M needs 20 workers and 5 land (needs 4 times worker as land), A needs 5 workers and 10 land (needs 2 times as land), A is relatively land intensive
3) Production technology used to produce two products identical across countries
   - Ricardian: diff α (prod function parameter) = diff comp adv
   - HO: no diff α - prod function (tech) not source of comp adv but endowment
     - B and C have same equilibrium K/L ratios in both industries
     - Just diff factors of production
4) Consumer preferences same across countries
5) Workers fully mobile across industries within a country: no cost from changing job
6) Products traded freely, but workers immobile across countries
7) Market for both factors of production must clear: total supply demand equal (for land and worker)

Heckscher-Ohlin theorem

- As both market for factors must clear –
- Labour market
  - $L_A + L_M = L$
  - $a_{LA}A + a_{LM}M = L$.
    - a_{LA} and a_{LM}: labour required to produce one unit of output (A or M)
    - A and M: total output of products
  - $a_{LM}M = L - a_{LA}A$
  - $$\boxed{M = \left(\frac{1}{a_{LM}}\right) L - \left(\frac{a_{LA}}{a_{LM}}\right) A}$$
    - If allocate all worker to M (complete specialise): A=0 → production capacity of M: $\boxed{\overline{M} = \frac{L}{a_{LM}}}$, each worker produce a_{LM}
      - $\overline{M}$ increases in L labour (M labour-intensive)
- Land market
  - $a_{KA}A + a_{KM}M = K$
    - a_{KA} and a_{KM}: land required to produce one unit of output (A or M)
    - $a_{KA}A$ is the total land used in A, same for $a_{KM}M$
  - $a_{KA}A = K - a_{KM}M$.
  - $$A = \left(\frac{1}{a_{KA}}\right) K - \left(\frac{a_{KM}}{a_{KA}}\right) M$$
    - If allocate all worker to A (complete specialise): M=0 → production capacity of A: $\boxed{\overline{A} = \frac{K}{a_{KA}}}$, each land produce a_{KA}
      - $\overline{A}$ increases in K land (A land-intensive)

- Relative production capacity of A: A/M ratio
  - Home (B): $$\frac{\overline{A}}{\overline{M}} = \frac{K/a_{KA}}{L/a_{LA}} = \left(\frac{K}{L}\right)\left(\frac{a_{LA}}{a_{KM}}\right)$$
  - Foreign (C): $$\frac{\overline{A}^*}{\overline{M}^*} = \left(\frac{K^*}{L^*}\right)\left(\frac{a^*_{LA}}{a^*_{KM}}\right)$$

- Assume same prod tech so $a_{LA} = a^*_{LA}$ and $a_{KM} = a^*_{KM}$
- Assume B is more relatively land-abundant: $\frac{K}{L} > \frac{K^*}{L^*} \longrightarrow \frac{\overline{A}}{\overline{M}} > \frac{\overline{A}^*}{\overline{M}^*}$
  - B prod capacity of A > C prod capacity of A
    - bc B more relatively land-abundant, C is more labour-abundant (so adv in M)