Basic Heckscher-Ohlin Model

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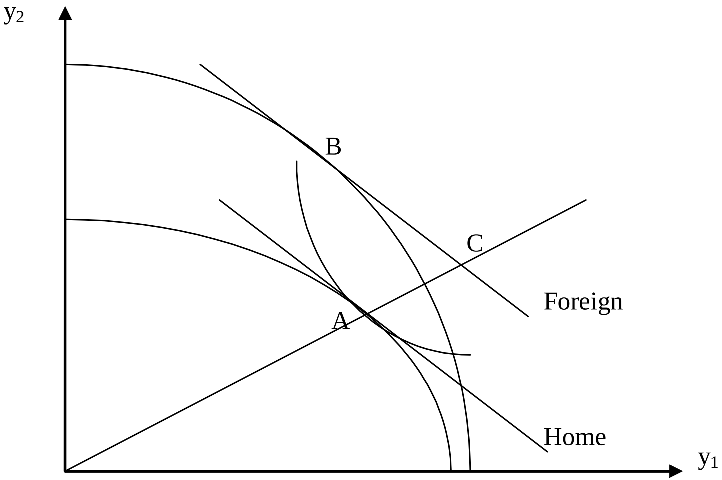
January 2009

Basic setup

- 2 countries: Home and Foreign ('*').
- 2 factors of production: K and L.
- 2 sectors: 1 and 2.
- Endowments: $K^*/L^* > K/L$, i.e., Foreign is relatively capital-abundant.
- Preferences: homothetic and identical across countries.
- Technologies: perfectly competitive and identical across countries. For a given w/r, the capital share is greater in sector 2 than in sector 1, i.e., sector 2 is relatively capital-intensive.

Autarky: relative prices



Autarky: relative prices

- Autarky equilibrium point in Home: tangency between indifference curve and PPF (point A). Slope gives Home autarky price: p_1 / p_2.
- Assume relative autarky price in Foreign is same as in Home.
    - Foreign production point: B.
    - Foreign consumption point (given identical homothetic preferences in both countries): C.
    - Compare B and C: excess demand for good 1 in Foreign.
- Conclusion: under autarky $p_1^* / p_2^* > p_1 / p_2$.
- Implication: Home has comparative advantage in the production of 1.

Rybczynski

- Take p_1 and p_2 as given.
- Denote by a_{Li} the amount of labor used to produced one unit of good i, and by a_{Ki} the amount of capital used to produce one unti of good i.
- Factor markets clear, so that

$$\begin{aligned} L &= a_{L1}y_1 + a_{L2}y_2 \\ K &= a_{K1}y_1 + a_{K2}y_2 \end{aligned}$$

- Totally differentiating (while assuming that goods prices are constant) gives

$$dL = a_{L1}dy_1 + a_{L2}y_2$$

so that

$$\frac{dL}{L} = \frac{y_1 a_{L1}}{L}\frac{dy_1}{y_1} + \frac{y_2 a_{L2}}{L}\frac{dy_2}{y_2}$$

Rybczynski

- Denote $\hat{x} = dx/x$. Define $\lambda_{Li} = y_i a_{Li}/L$ and $\lambda_{Ki} = y_i a_{Ki}/K$.
- Then:

$$\begin{pmatrix} \hat{L} \\ \hat{K} \end{pmatrix} = \begin{pmatrix} \lambda_{L1} & \lambda_{L2} \\ \lambda_{K1} & \lambda_{K2} \end{pmatrix} \begin{pmatrix} \hat{y_1} \\ \hat{y_2} \end{pmatrix}$$

- Solving out gives:

$$\begin{pmatrix} \hat{y_1} \\ \hat{y_2} \end{pmatrix} = \frac{1}{|\lambda|} \begin{pmatrix} \lambda_{K2} & -\lambda_{L2} \\ -\lambda_{K1} & \lambda_{L1} \end{pmatrix} \begin{pmatrix} \hat{L} \\ \hat{K} \end{pmatrix}$$

  where $|\lambda| = \lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1} = \lambda_{K2} - \lambda_{L2}$. Because sector 2 is relatively capital intensive, $\lambda_{K2} - \lambda_{L2} > 0$.

Rybczynski

- Suppose the relative endowment of capital increases: $\hat{K} - \hat{L} > 0$.
- Then:

$$\hat{y_1} = \frac{\lambda_{K2}\hat{L} - \lambda_{L2}\hat{K}}{\lambda_{K2} - \lambda_{L2}} = \hat{L} - \frac{\lambda_{L2}}{\lambda_{K2} - \lambda_{L2}}(\hat{K} - \hat{L}) < \hat{L}$$

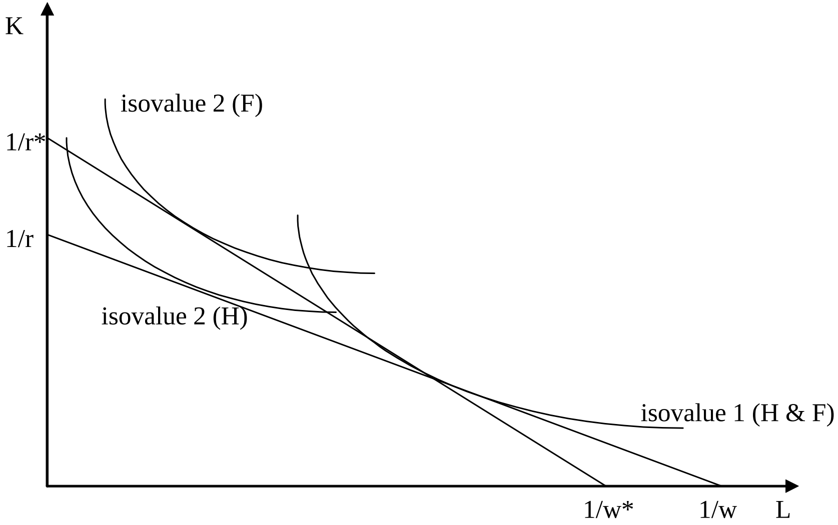
and

$$\hat{y_2} = \frac{\lambda_{L1}\hat{K} - \lambda_{K1}\hat{L}}{\lambda_{L1} - \lambda_{K1}} = \hat{K} + \frac{\lambda_{K1}}{\lambda_{L1} - \lambda_{K1}}(\hat{K} - \hat{L}) > \hat{K}$$

- Therefore,

$$\hat{y_2} > \hat{K} > \hat{L} > \hat{y_1}$$

Autarky: relative factor prices



Autarky: relative factor prices

- All prices expressed in terms of good 1.
- Relative positions of isovalue curves reflects capital-intensity of good 2: for a given w/r, the capital/labor ratio used in production is higher in good 2 than in good 1.
- Since good 2 is relatively more expensive at Home, the isovalue curve of good 2 is lower in Home than in Foreign.
- Result #1: $w^*/r^* > w/r$.
- Result #2: in real terms (measured in terms of good 1): $w^* > w$ and $r^* < r$. Same result would obtain in measured in terms of good 2.
- This is nothing else than Stolper-Samuelson.

Stolper-Samuelson

- Take w and r as given.
- Cost minimization gives the amount of labor, a_{Li}, and the amount of capital, a_{Ki}, used to produce one unit of good i.

$$p_i = c_i(w, r) = a_{Li} w + a_{Ki} r$$

- Totally differentiating (and applying envelope theorem) gives

$$dp_i = a_{Li} dw + a_{Ki} dr$$

so that

$$\frac{dp_i}{p_i} = \frac{w a_{Li}}{p_i} \frac{dw}{w} + \frac{r a_{Ki}}{p_i} \frac{dr}{r}$$

Stolper-Samuelson

- Denote $\hat{x} = dx/x$. Also denote the capital and labor shares as θ_{Li} and θ_{Ki}.
- Then:

$$\begin{pmatrix} \hat{p}_1 \\ \hat{p}_2 \end{pmatrix} = \begin{pmatrix} \theta_{L1} & \theta_{K1} \\ \theta_{L2} & \theta_{K2} \end{pmatrix} \begin{pmatrix} \hat{w} \\ \hat{r} \end{pmatrix}$$

- Solving out gives:

$$\begin{pmatrix} \hat{w} \\ \hat{r} \end{pmatrix} = \frac{1}{|\theta|} \begin{pmatrix} \theta_{K2} & -\theta_{K1} \\ -\theta_{L2} & \theta_{L1} \end{pmatrix} \begin{pmatrix} \hat{p}_1 \\ \hat{p}_2 \end{pmatrix}$$

where $|\theta| = \theta_{L1}\theta_{K2} - \theta_{K1}\theta_{L2} = \theta_{K2} - \theta_{K1}$. Because sector 2 is relatively capital intensive, $\theta_{K2} - \theta_{K1} > 0$.

Stolper-Samuelson

- Suppose the relative price of good 2 goes down: $\hat{p}_1 - \hat{p}_2 > 0$.
- Then:

$$\hat{w} = \frac{\theta_{K2}\hat{p}_1 - \theta_{K1}\hat{p}_2}{\theta_{K2} - \theta_{K1}} = \hat{p}_1 + \frac{\theta_{K1}}{\theta_{K2} - \theta_{K1}}(\hat{p}_1 - \hat{p}_2) > \hat{p}_1$$

and

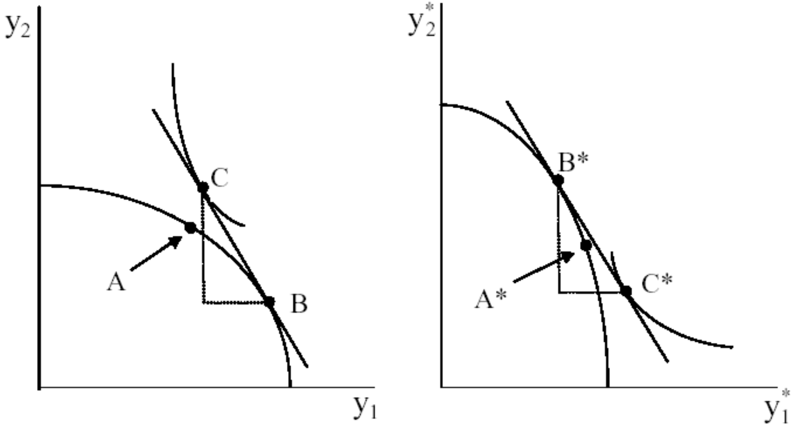
$$\hat{w} = \frac{\theta_{L1}\hat{p}_2 - \theta_{L2}\hat{p}_2}{\theta_{L1} - \theta_{L2}} = \hat{p}_2 - \frac{\theta_{L2}}{\theta_{L1} - \theta_{L2}}(\hat{p}_1 - \hat{p}_2) < \hat{p}_2$$

- Therefore,

$$\hat{w} > \hat{p}_1 > \hat{p}_2 > \hat{r}$$

Wages can buy more of both goods, and capital can buy less of both goods.

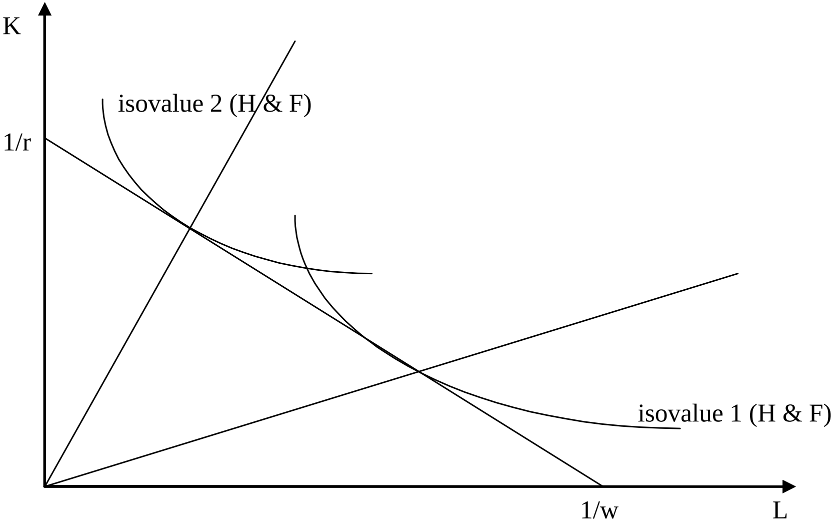
Free trade equilibrium



Free trade equilibrium

- In both countries there are gains from trade: compared to points A, both countries move to a higher indifference curve.
- In Home p_1 / p_2 increases, and in Foreign p_1^* / p_2^* decreases.
- Stolper-Samuelson implies that in Home workers gain and capital owners lose, whereas in Foreign workers lose and capital owners gain.
- Goods prices converge across countries. Implication for factor prices.

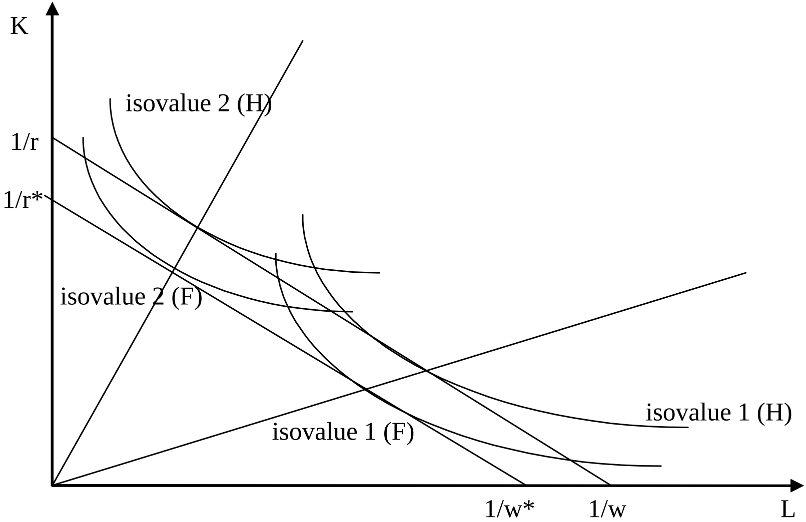
Factor price equalization



Factor price equalization

- The equalization of goods prices, together with the fact that technologies are identical, implies that the isovalue curves of both countries are identical.
- If, in addition, both countries produce both goods, and there are no factor intensity reversals, then factor prices will equalize across countries: $w = w^*$ and $r = r^*$.
- In other words, trade leads to factor price equalization if (i) technologies are identical across countries, (ii) both countries produce both goods, and (iii) there are no factor intensity reversals.
- This result implies that trade (mobility of goods), migration (mobility of labor) and capital movements (mobility of capital) are *substitutes*.

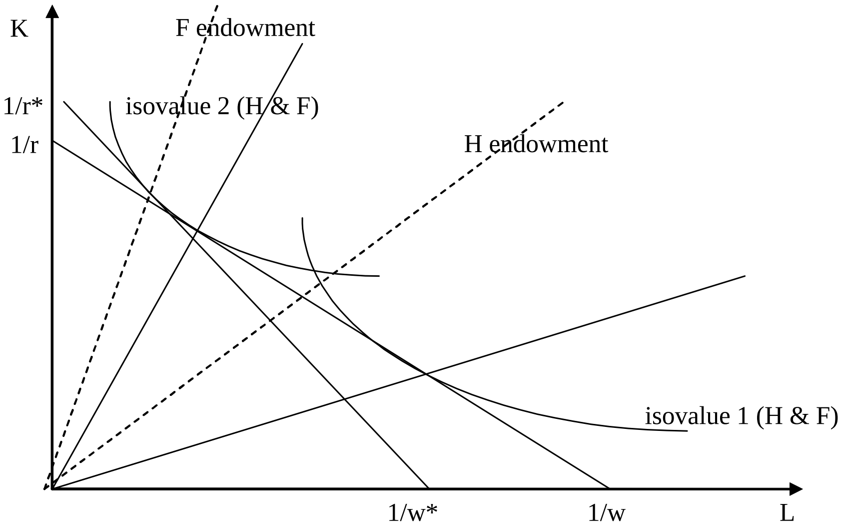
Differences in technologies



Differences in technologies

- Suppose TFP in Foreign is 20% higher than in Home in both sectors.
- Under free trade, both wages and returns to capital will be 20% higher in Foreign, compared to Home.
- Depending on whether the technologically advanced country is capital- or labor-abundant, trade may *decrease* or *increase* wage differences across countries. One can no longer presume that trade and migration will always be *substitutes*.

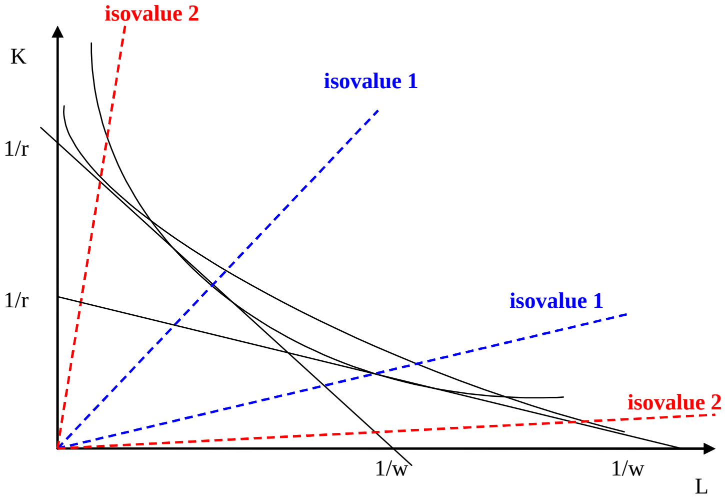
Full specialization in one of the two countries



Full specialization in one of the two countries

- The relative endowment of Home, K/L, is within the *cone of diversification*, so that it produces both goods.
- The relative endowment of Foreign, K^*/L^*, is outside the *cone of diversification*, so that it fully specializes in sector 2.
- In equilibrium, $r^* < r$ and $w^* > w$, so there is no full convergence of factor prices.
- However, there is still partial convergence, so that we can still say that trade and migration are substitutes.

Factor intensity reversals



Factor intensity reversals

- For high w/r, sector 2 is relatively capital-intensive; for low w/r, sector 2 is relatively labor-intensive.
- There are thus two different cones of diversification.
- It is very well possible that factor prices do not converge. Example: the relative endowments of Home and Foreign are located in different cones of diversification.