The Stolper-Samuelson and Rybczynski theorems

Sanna-Randaccio Lecture 13

The **Stolper-Samuelson** theorem: the impact of trade liberalization (and protectionism) on the distribution of income between capital and labour *within* a country.

The **Rybczynski** theorem: the impact of growth due to an increase in factor endowments on the level of production of the two goods, when relative factor prices are constant.
Stolper-Samuelson Theorem

Enunciation

Proof

• Relationship between goods and factor prices

• Relationship between optimum factor ratio and marginal productivity

• Relationship between marginal productivity and real factor reward
The Stolper Samuelson Theorem

With constant returns to scale and incomplete specialization, an increase in the relative price of a good raises the real remuneration of the factor used intensively in the production of that good and decreases the real remuneration of the other factor.

It analyzes the impact of international trade on income distribution within a country.
Assuming that \( \left( \frac{K}{L} \right)_y > \left( \frac{K}{L} \right)_x \)

If \( \frac{p_x}{p_y} \uparrow \) we have that \( \frac{w}{r} \uparrow \)

and thus \( \left( \frac{K}{L} \right)_x \uparrow \) and \( \left( \frac{K}{L} \right)_y \uparrow \)

Labour (capital) marginal product increases (decreases). Thus the real remuneration of labour (capital) increase (decreases) in terms of both goods.
If constant returns to scale a factor marginal product $= f \left( \frac{K}{L} \right)$ (radiality)

Thus

$$MPL_j = f \left( \frac{K_j}{L_j} \right)$$

$$MPK_j = f \left( \frac{K_j}{L_j} \right)$$

With $j = X, Y$

From profit maximization

$$p_xMPL_x = w$$

$$p_xMPK_x = r$$

$$p_yMPL_y = w$$

$$p_yMPK_y = r$$

From which:

$$\frac{w}{p_x} = MPL_x \uparrow$$

$$\frac{w}{p_y} = MPL_y \uparrow$$

$$\frac{r}{p_x} = MPK_x \downarrow$$

$$\frac{r}{p_y} = MPK_y \downarrow$$
Winners and losers from trade liberalization

Owners of a country’s abundant factor gain from trade liberalisation, while owner of the scarce factor lose.

There are trade gains at the aggregate country level, however the scarce factor lose from opening to trade.

Trade, by changing goods prices (and thus factor prices) influence income distribution (via its effects on real factor rewards)

These effects on income distribution derive from differences in factor intensity between goods.
The NORTH-SOUTH CASE

North (abundant in skilled labour (SL)) and South (abundant in non-skilled labour (NSL)) liberalize trade (good Y is SL intensive)

In the NORTH \( \frac{p_x}{p_y} \downarrow \)

Thus the real reward of SL increases and the real reward of NSL decreases.

In the NORTH free trade leads to a decrease in the real reward of non qualified labour and to a rise of skilled labour reward as compared to autarky. Viceversa in the SOUTH.
**The magnification effect**

Assuming that

\[
\left( \frac{K}{L} \right)_y > \left( \frac{K}{L} \right)_x
\]

If \( \frac{p_x}{p_y} \uparrow \) we have that \( \frac{w}{r} \uparrow \)

We also have

\[
\frac{w}{p_x} = MPL_x \uparrow \\
\frac{r}{p_x} = MPK_x \downarrow
\]

\[
\frac{w}{p_y} = MPL_y \uparrow \\
\frac{r}{p_y} = MPK_y \downarrow
\]

From which: \( \dot{w} > \dot{p}_x > \dot{p}_y > \dot{r} \)
Growth and Trade: Increase in Factor Endowments

The Rybczynski Theorem

If relative commodity prices are constant and there is incomplete specialization, an increase in the endowment of a factor will lead to an increase in production of the good using that factor intensively and a decrease in the output of the other good.
If \( \frac{p_x}{p_y} \) is constant also \( \frac{w}{r} \) is constant

\[ \left( \frac{K}{L} \right)_x \quad \text{and} \quad \left( \frac{K}{L} \right)_y \]
do not change.

Let us assume that the quantity of labour increases. Since \( \frac{w}{r} \) is unchanged, in the new equilibrium point (A') the MRTS, common to both sectors, is the same as in the pre-growth equilibrium point (A). Therefore the new equilibrium point should be identified by the crossing of the ray \( O_x A \) with the ray \( O'y A \) which is parallel to \( O_y A \).
Analysis with the Transformation Curve

• Increase in factor endowments and shape of the Transformation Curve. There is a non-neutral increase in the production possibilities. The increase is biased toward the production of the good intensive in the factor the supply of which has increased.

• Small economy: developing countries and the dynamics of comparative advantage

• Large economy: immigration and relative goods prices

Corollary: “The increase in a factor supply, given the other constant, will cause the decrease in the relative price of the good using intensively that factor”.
Rybczynski line

Markusen et al. p. 120