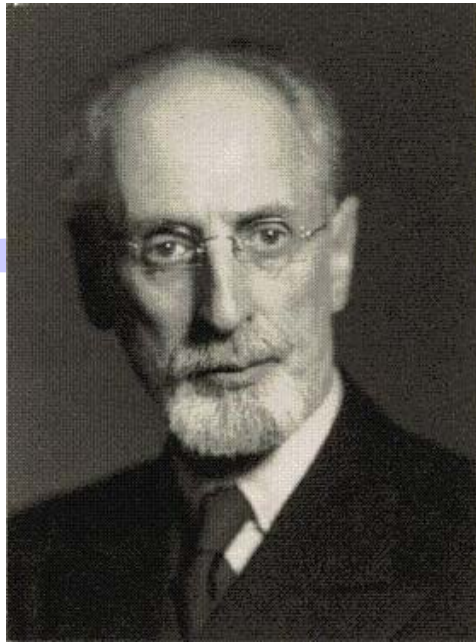


International Economics #2

The neo-classical model of international trade

Outline

- 1. The HOS model**
- 2. Openness and income inequalities: the Stolper-Samuelson theorem**
- 3. The role of factor endowment: the Rybczynski theorem**
- 4. The Leontieff paradox**



Eli Heckscher
(1879-1952)

« The Effect of Foreign Trade on the Distribution of Income », 1919



Bertil Ohlin
(1899-1979)

Interregional and International Trade, 1933



Paul Samuelson
(1915-)

Foundations of Economics Analysis, 1947

1. The HOS Model

Heckscher-Ohlin-Samuelson

Assumptions

- 2 countries, 2 goods, 2 production factors (2×2×2)
- Factors are mobile across sectors but immobile across countries
- Free trade, no transportation costs

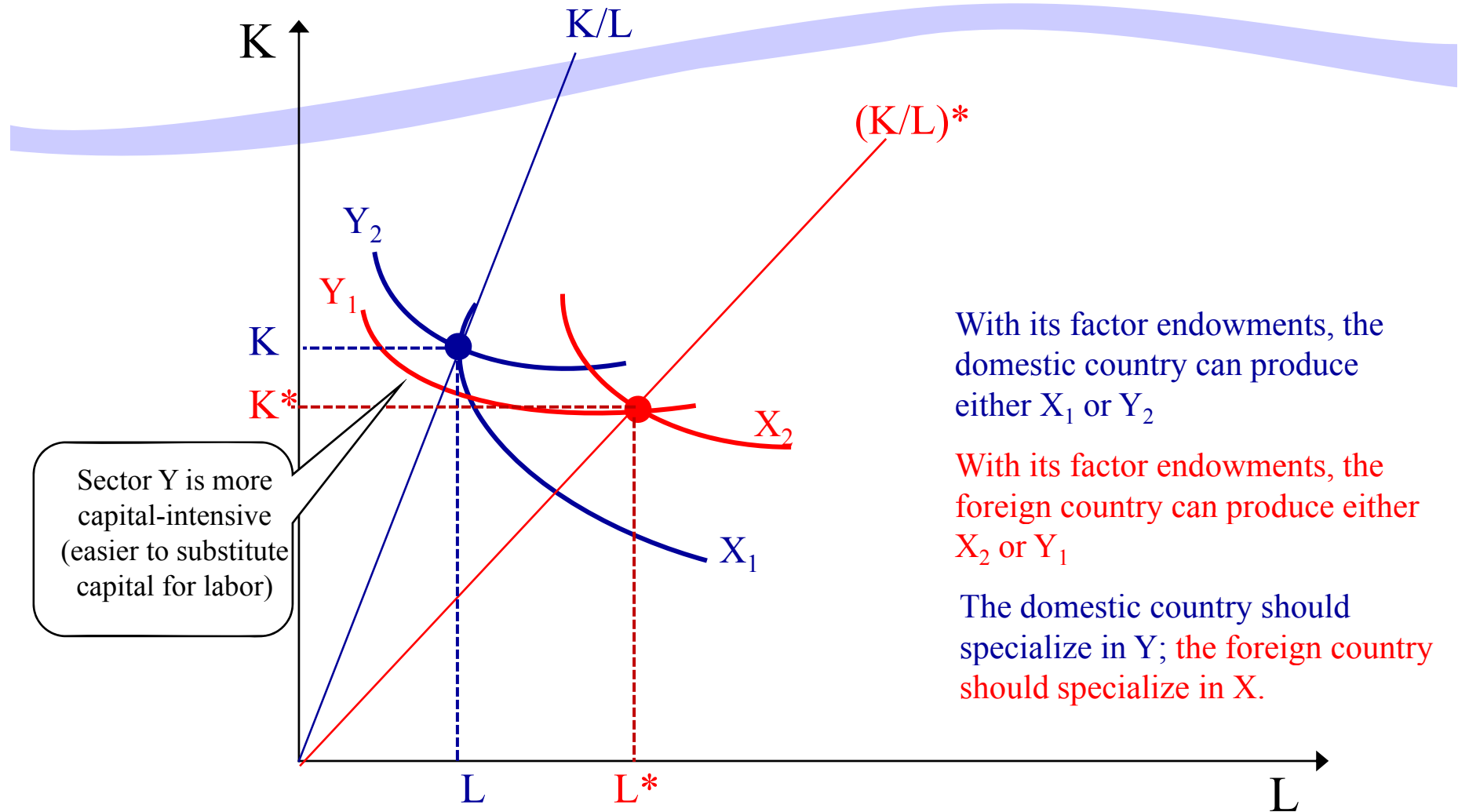
Results

- Origin of comparative advantages
- Specialization raises social welfare but unequally across individuals

The model

- 2 goods: X (labor intensive), Y (capital intensive)
- 2 factors: K, L, mobile across sectors (hence same factor prices).
 - Technical coefficients L/Y , K/Y depend on relative factor prices w/r (substitutability)
- Same production functions in the two countries, X more labor-intensive, Y more capital-intensive.
- Domestic country relatively better endowed with capital than with labor compared to foreign country (*):
 $(K/L) > (K^*/L^*)$
- Equilibrium of factor markets:
 - Labor: $L_X + L_Y = L$
 - Capital: $K_X + K_Y = K$
 - Same in the foreign country (K^* , L^*)
- Perfect competition:
 - Zero profit at equilibrium
- Budget constraint:
 $Y = wL + rK$

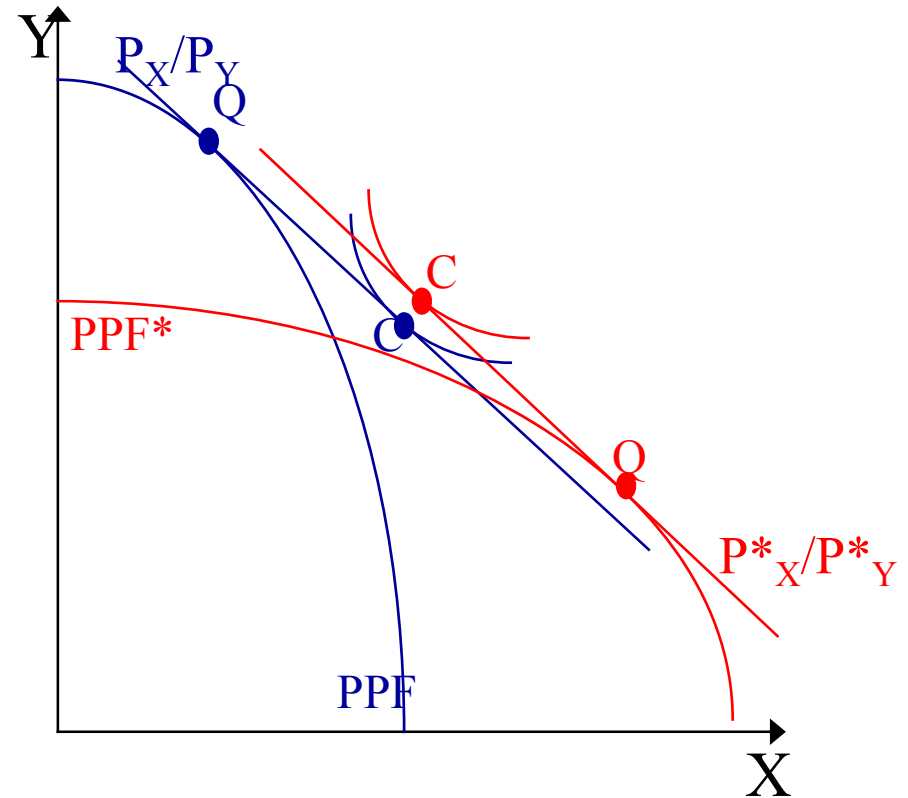
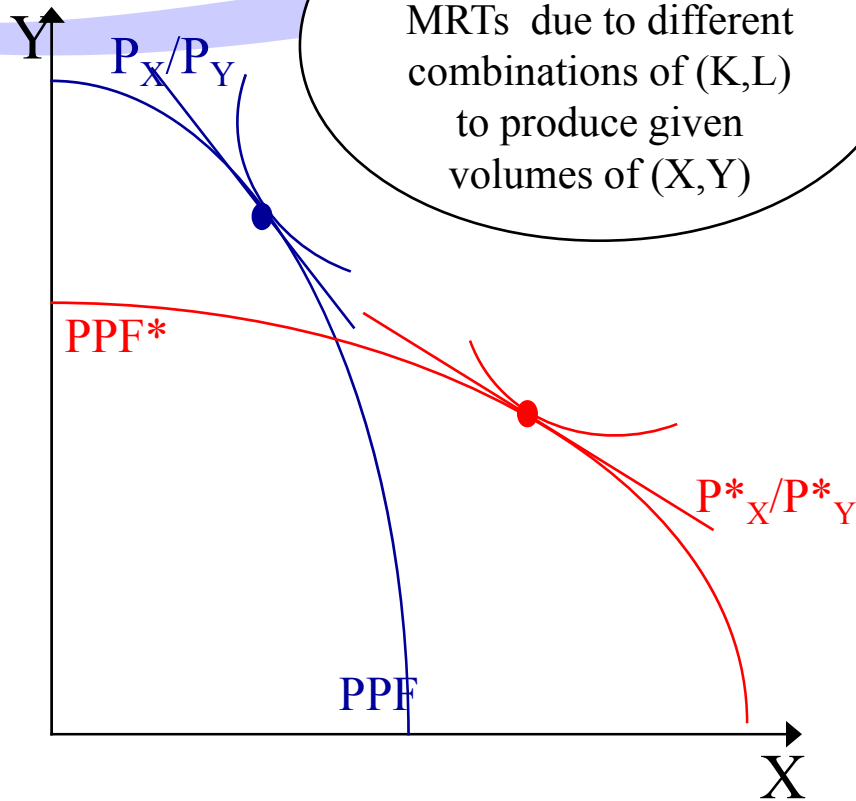
Consequence of relative endowments



Autarky

Open economy

Same production functions but different MRTs due to different combinations of (K,L) to produce given volumes of (X,Y)



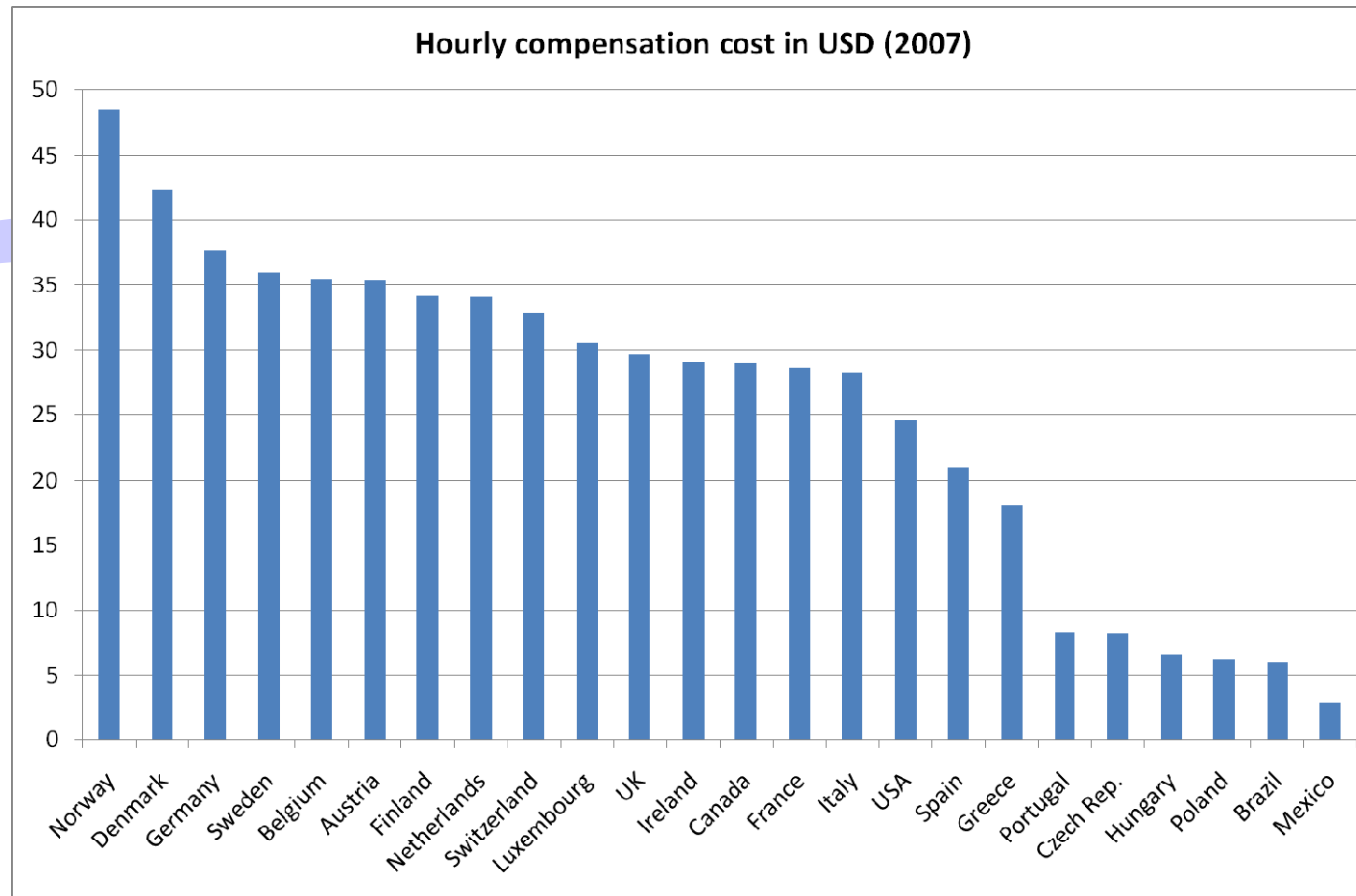
Equalization of factor prices

- **Autarky:** $P_X/P_Y > P_X^*/P_Y^*$
- **Open economy:** the domestic country produces less of good X (labor intensive) and more of good Y (capital intensive)
 - This makes the relative price of labor w/r fall in the domestic country and rise in the foreign country
- Opening up the economy leads to **relative factor price equalization** across the two countries, *even though factors are immobile internationally*
 - This results from price equalizing marginal cost in each sector. Since prices equalize internationally, marginal costs should equalize too in each sector.
 - Since production functions are the same in the two countries, the marginal cost is the same for each factor.
- **Example**
 - $P_X = w^\alpha r^{1-\alpha} = w^*{}^\alpha r^{*1-\alpha}$ and $P_Y = w^\beta r^{1-\beta} = w^*{}^\beta r^{*1-\beta}$
 - Then: $(w/r)^{\alpha-\beta} = (w^*/r^*)^{\alpha-\beta}$

Heckscher-Ohlin-Samuelson theorem:

“International trade leads to relative factor price equalization through international price equalization.”

Empirical evidence: no wage equalization



Source: US Bureau of Labor Statistics (August 2009).

Limitation of the HOS theorem



- Transportation costs
- Tariff and non-tariff barriers
- Imperfect competition (hence price \neq marginal cost)
- Different production functions across countries
- Limited inter-industry mobility

International trade and income inequalities

Stolper-Samuelson theorem

“A rise in the relative price of a good increases the relative remuneration of the factor which is intensively used in the production of this good and reduces the remuneration of the other factor.”

- Hence opening up the economy leads to:
 - A **rise** in the real remuneration of the relatively **abundant** factor
 - A **fall** in the real remuneration of the relatively **scarce** factor
- There are winners and losers
 - In the North, winners are the owners of physical and human capital
 - In the South, winners are unskilled workers
- Losers can theoretically be compensated through (preferably lump-sum) fiscal transfers from winners:
 - In reality, physical and human capital are mobile internationally, which makes it difficult to tax them (tax competition)

Demonstration

- Zero profit:

$$P_X X = w L_X + r K_X \quad \Rightarrow \quad P_X = w a_{LX} + r a_{KX}$$

$$P_Y Y = w L_Y + r K_Y \quad \Rightarrow \quad P_Y = w a_{LY} + r a_{KY}$$

with $a_{LX} = L_X/X$, $a_{KX} = K_X/X$, etc.

- Differentiate P_X et P_Y for a given production structure (given a_{ij}):

$$dP_X = a_{LX} dw + a_{KX} dr$$

$$dP_Y = a_{LY} dw + a_{KY} dr$$

- Denote $\theta_{KX} = a_{KX} r / P_X$ and $\theta_{LX} = a_{LX} w / P_X$ (same for Y)

$$\frac{dP_X}{P_X} = \theta_{LX} \frac{dw}{w} + \theta_{KX} \frac{dr}{r} \qquad \frac{dP_Y}{P_Y} = \theta_{LY} \frac{dw}{w} + \theta_{KY} \frac{dr}{r}$$

Demonstration (continued)

- The evolution of factor prices then is:

$$\frac{dw}{w} = \frac{\theta_{KY} \frac{dP_X}{P_X} - \theta_{KX} \frac{dP_Y}{P_Y}}{\theta_{KY} \theta_{LX} - \theta_{KX} \theta_{LY}}$$

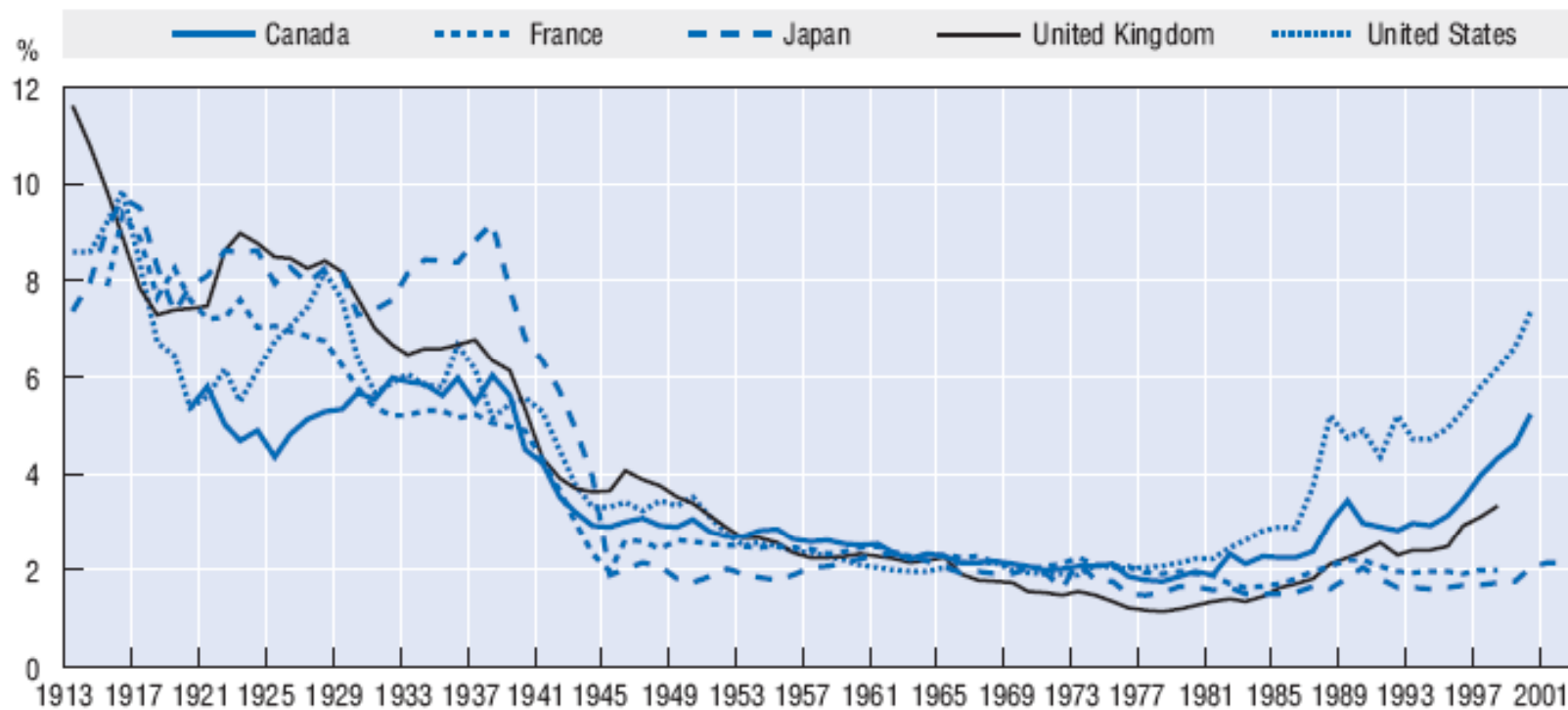
$$\frac{dr}{r} = \frac{\theta_{LX} \frac{dP_Y}{P_Y} - \theta_{LY} \frac{dP_X}{P_X}}{\theta_{KY} \theta_{LX} - \theta_{KX} \theta_{LY}}$$

Since $\theta_{KY} > \theta_{KX}$ (Y is more capital intensive) and $\theta_{LX} > \theta_{LY}$ (X is more labor intensive), the denominator of both expressions is positive. It can be concluded that:

- if P_X (price of the relatively labor-intensive good) rises, then w (the remuneration of labor) increases while r (the remuneration of capital) falls
- if P_Y (price of the relatively capital-intensive good) increases, then w (the remuneration of labor) falls while r (the remuneration of capital) rises.

Openness to trade and inequalities

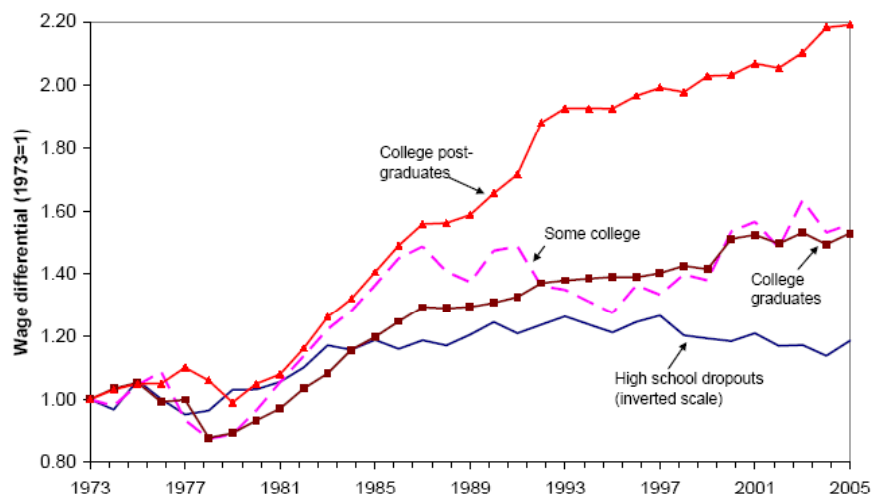
Top 0.1% income share in 5 OECD countries, 1913-2001



Source: Piketty and Saez (2006).

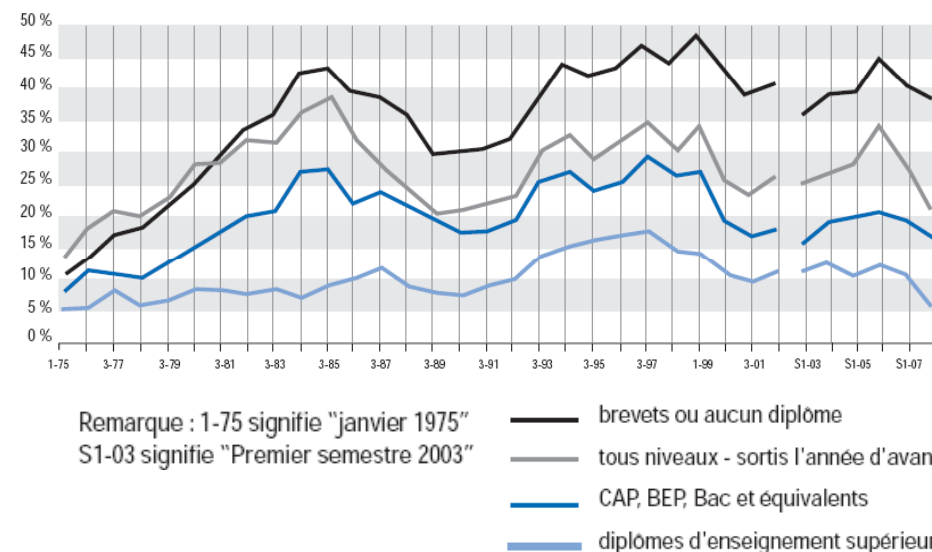
Wage inequalities in the US, unemployment inequalities in France

US: Hourly wage differentials relative to high school graduates (men)



Source: Th. Lemieux, “The Changing Nature of Wage Inequality”, *Journal of Population Economics*, No. 21, pp. 21-48, 2008.

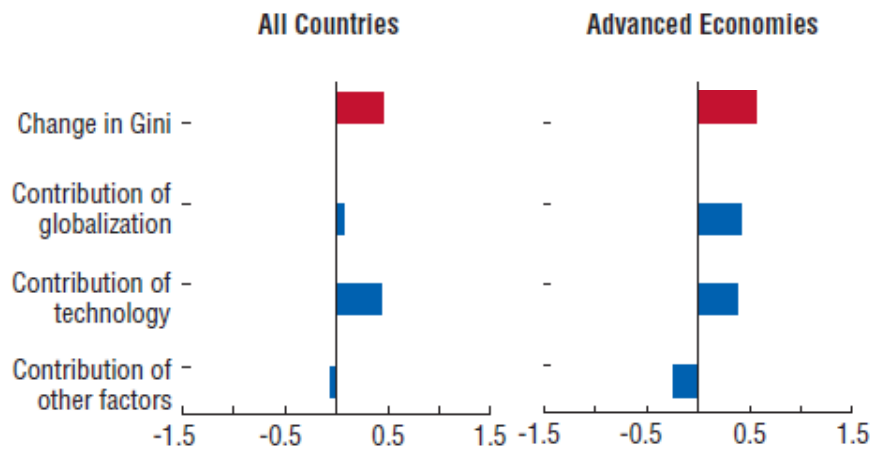
France: Unemployment rate 1-4 years after exiting the education system



Source: INSEE, 2009.

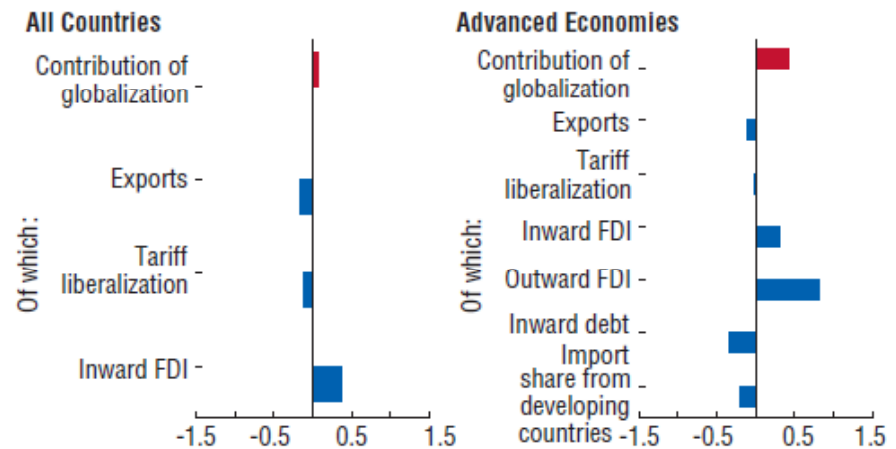
Explaining changes in income inequality

Regression of Gini coefficient on globalization and technology-related variables



Average annual % change of Gini coefficient

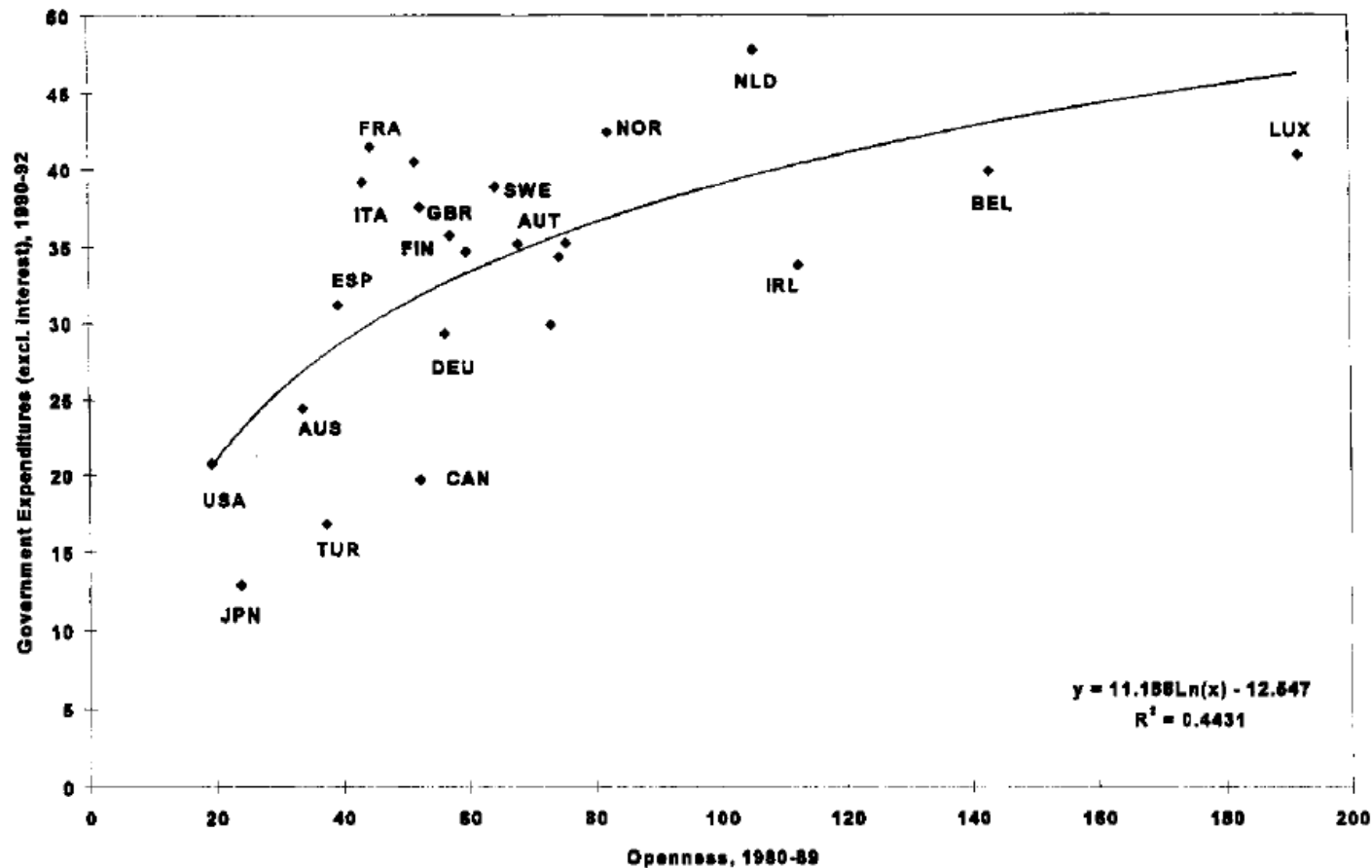
Decomposition of globalization effects on inequality



Average annual % change of Gini coefficient

Source: IMF, *World Economic Outlook*, October 2007.

Compensating losers: trade openness and public expenditures



Source: D. Rodrik, "Why Do More Open Economies Have Bigger Governments?", *Journal of Political Economy*, vol. 106, No. 5, 1998, pp. 997-1032.

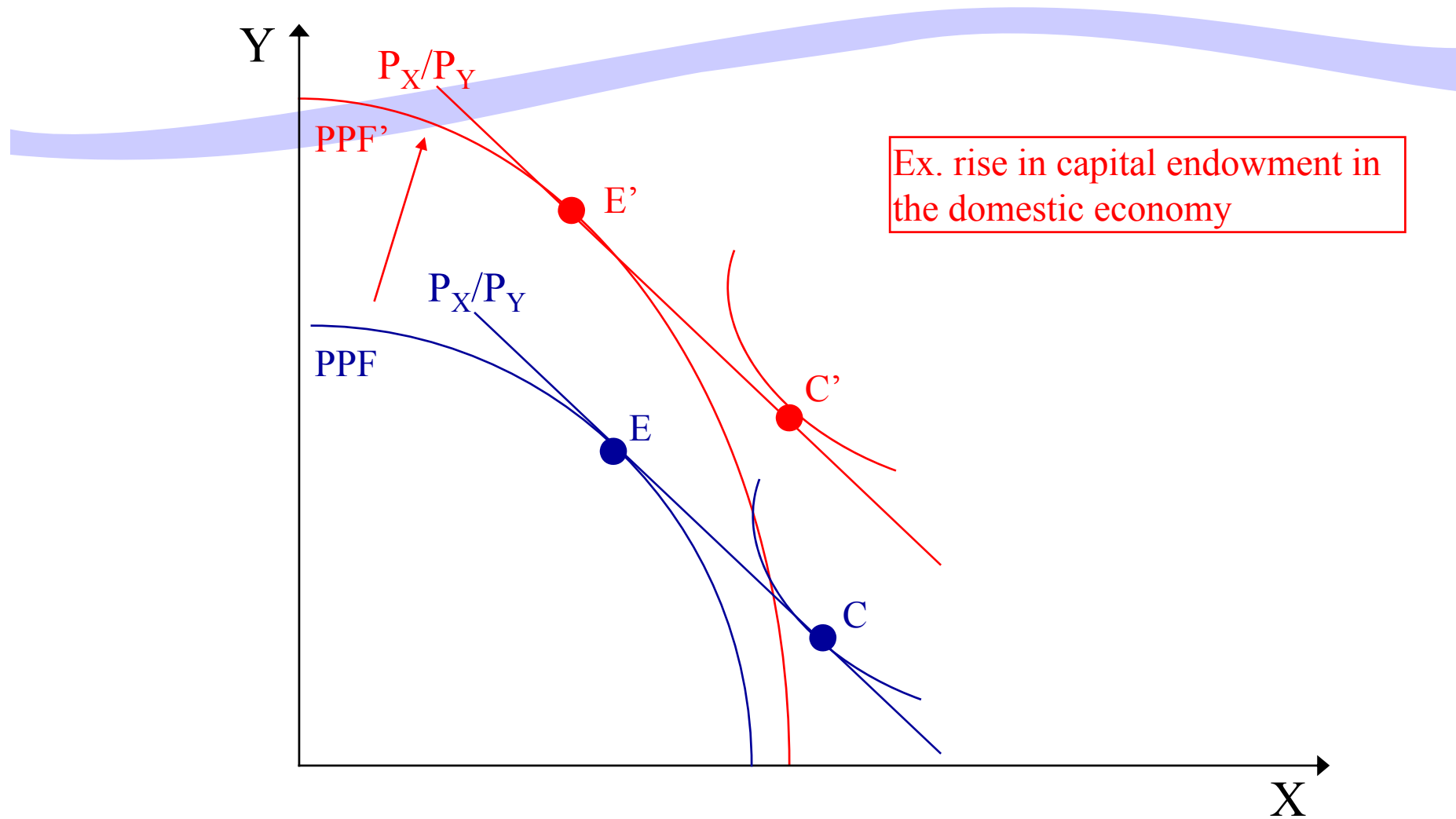
Variations in factor endowments

Rybczynski theorem

“For a given relative price, a higher endowment in one factor makes the production that uses this factor more intensively increase and the production that uses it less intensively decrease.”

- Consequences for a **small economy** (exogenous prices):
 - A rise in factor endowment is necessarily beneficial because the country can either:
 - Export more, hence import more and consume more (export-biased growth);
 - Import less, export less, but consume more (import-substitution growth).
 - Comparative advantages can change over time. Ex. Japan, NICs1, NICS2, China, Vietnam.

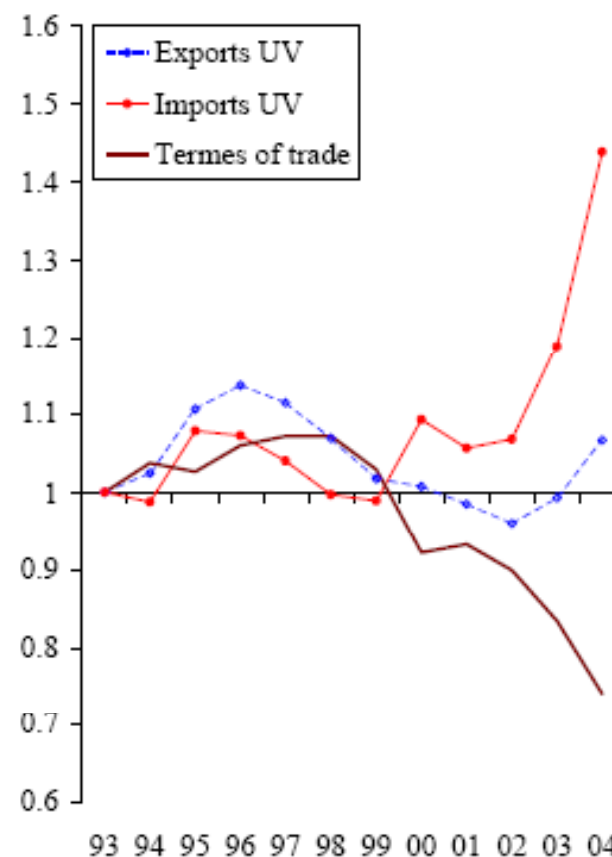
The Rybczynski theorem



Limitations of the Rybczynski theorem

- In a **big country**, prices are endogenous:
 - Export-biased growth deteriorates terms of trade, which may offset the positive impact of higher endowment = *“impoverishing growth”*. Ex. China.
 - Justification to *import-substitution policies*

Terms of trade in China



Source: Lemoine (2007).

The Leontieff ‘paradox’

- Leontieff (1953):
 - US exports are labor intensive
 - $K/L = 13992$ \$/person-year
 - US imports (or, rather, US substitutes to imports) are more capital intensive
 - $K/L = 18184$ \$/person-year
- Contradicts the theory of comparative advantage!

Possible explanations:

- Some imports have no substitute(ex. raw materials)
- Protection of labor-intensive industries
- Calculation should be based on bilateral trade
- Heterogeneity of factors (labor skills) or missing factors (land)
- Different technologies
- Limited inter-industry mobility
- Imperfect competition on goods and factor markets
- Vertical division of labor (exchange of tasks rather than goods).

Other attempts to validate HOS



- Heckscher-Ohlin-Vanek (1968)
 - Exports of factor services should match world distribution of factors as compared with world distribution of GDP
 - *ex.* Export of labor-intensive goods if $(L/L_{\text{world}}) > (Y/Y_{\text{world}})$
- Bowen, Leamer et Sveikaukas (1987)
 - Fail to find ‘correct’ ranking of countries
- Trefler (1993, 1995)
 - 9 factors, 33 countries, year 1983
 - 28% correlation between net factor exports and factor endowments
 - problem: net exports are close to zero.

Conclusion

- At this stage, we have explained:
 - why countries with different technologies and/or different production factor endowments trade with each other (ex: US and China);
 - why different goods are being exchanged (‘inter-industry trade’);
 - why openness to trade may increase wage inequality
- We have *not* explained:
 - why similar countries trade with each other (ex: France and Germany);
 - why similar goods are being exchanged (‘intra-industry trade’);
 - labor and capital location choices