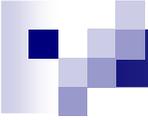


University of Cassino
Economics and Business
Academic Year 2019/2020

International Economics
International Trade
(trade and production factors
– lecture 4)

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Towards Modern Trade Theory

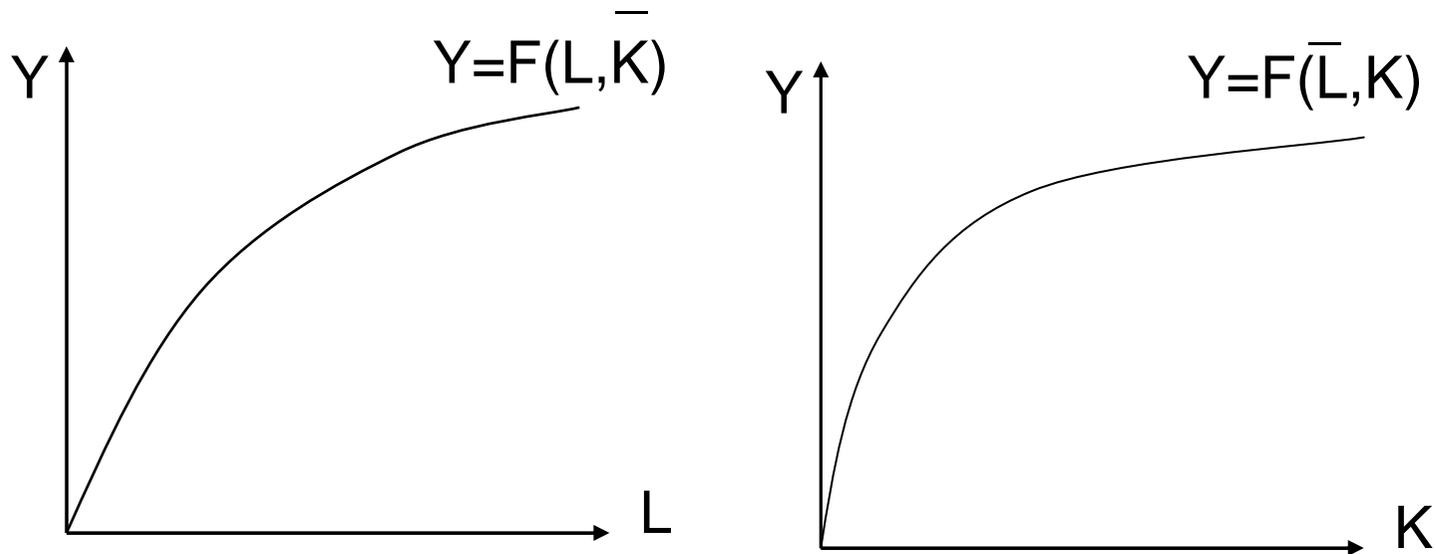
- Adam Smith and David Ricardo assumed that each country would have its own technology, climate, and resources, and that these differences would give rise to differences in productivity (and thus differences in comparative advantage).
- In the 20th century, manufacturing became important, and thus capital and labor are the main factors of production.
 - productivity depends on how much capital wrt labor is employed
 - trade depends on relative abundance of capital.



Introduction to the production function

- $Y = F(L, K)$ where
 - L, K production factors or inputs
 - Y = production (flow variable)
 - L = labor hours (or no. of workers with standard working time) (flow variable)
 - K = real capital (stock variable)
 - F = production function

Properties of the production function



$F_L > 0$ Marginal Productivity of Labor (MPL) = w

$F_K > 0$ Marginal Productivity of capital (MPK) = r

MPL is decreasing ($F_{LL} < 0$)

MPK is decreasing ($F_{KK} < 0$)



Returns to scale of the production function

The returns to scale are constant if:

$$aY = F(aL, aK)$$

i.e. by multiplying each production factor by a positive constant a , production Y is multiplied by a .

For example:

if $Y = L^{0.6}K^{0.4}$ and if $a=2$,

then $2Y = (2L)^{0.6}(2K)^{0.4}$

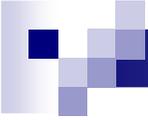
although: $2Y > (2L)^{0.6}(K)^{0.4}$ and $2Y > (L)^{0.6}(2K)^{0.4}$

being *MPL* and *MPK* decreasing.



Modern Trade Model (Heckscher-Ohlin)

- This model states that the different endowments of factors of production between countries can explain their *differences of productivity*.
 - (I step): If the US has abundance of one factor (relatively to the trading country), the price of such factor is lower (in autarky).
 - (II step): If a good employs more the abundant factor than another good, then the US finds it convenient to produce and export such good.
 - (III step): the US specializes in such good, but not completely.

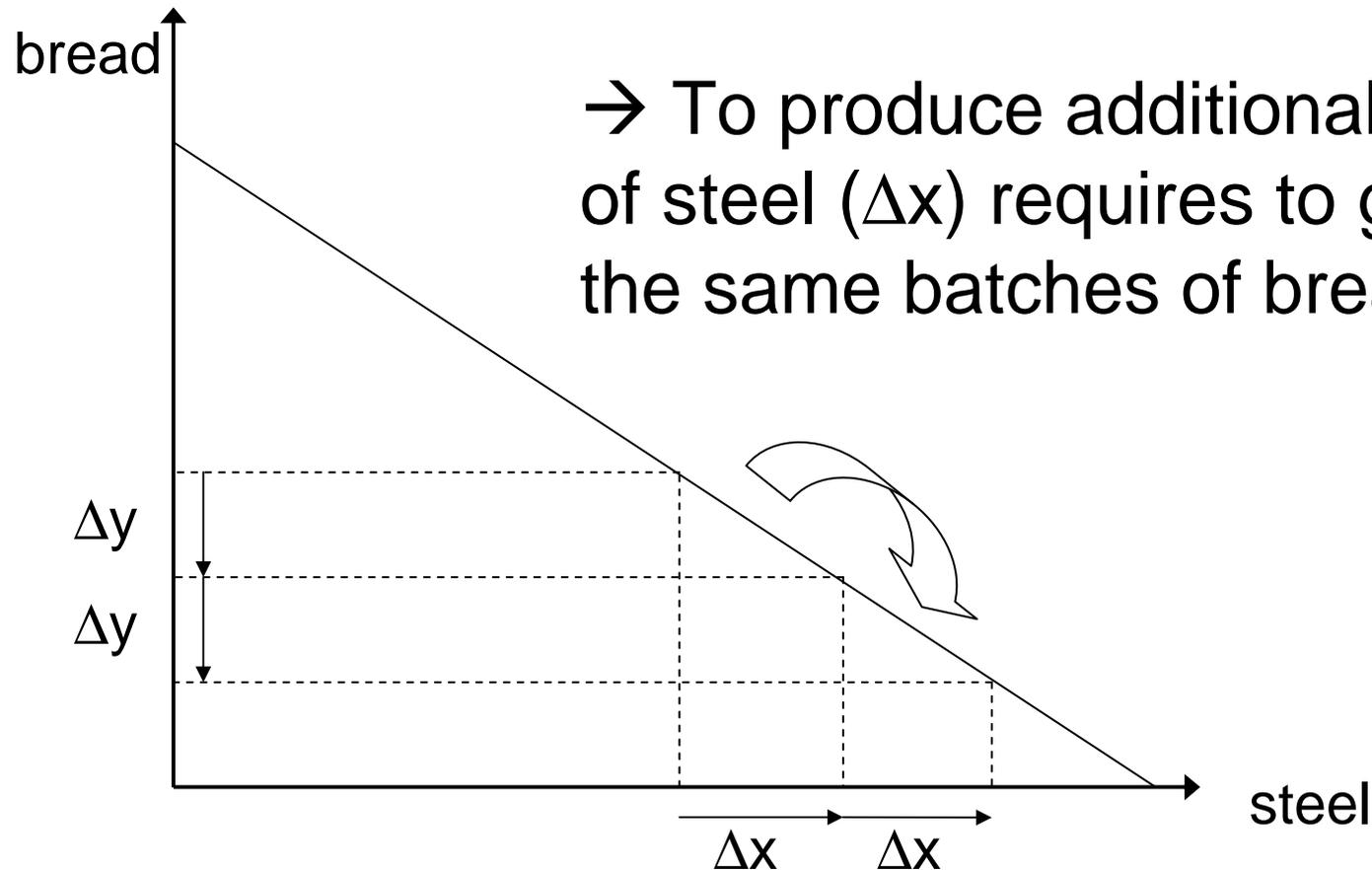


Assumptions

- Two countries (US, Canada), two goods (bread, steel), two factors (L,K)
- Both countries use the same technology (the same 'well-behaved' production function)
- The US is K-abundant, Canada is L-abundant
- Steel is K-intensive, bread is L-intensive
- Perfect mobility of labor between sectors
- Immobility of labor across countries
- Factors are fully employed
- Markets are perfectly competitive

Recalling the linear PPC

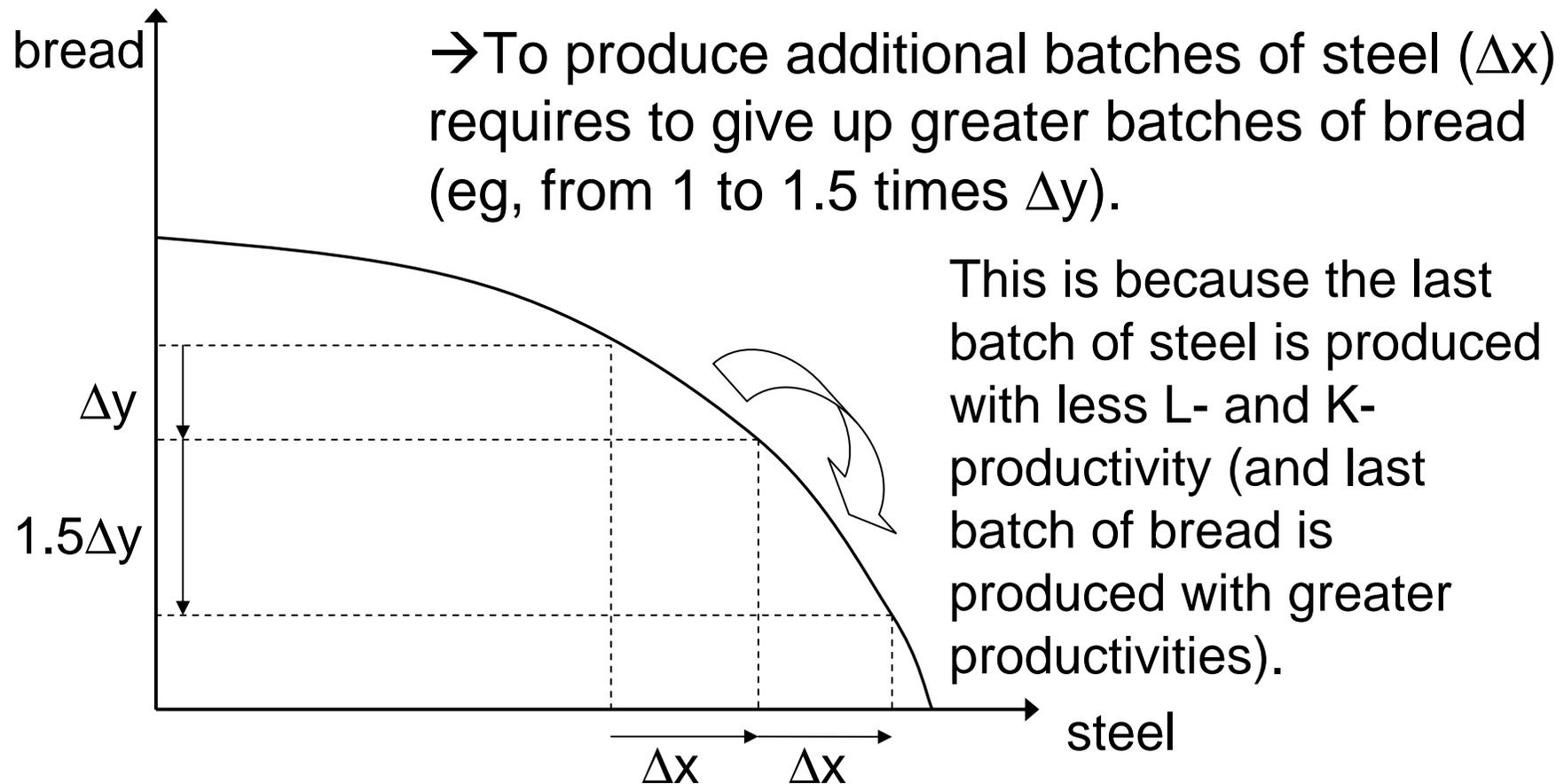
Assumptions: - full employment of only labour,
- constant productivity of labour



→ PPC is a straight line.

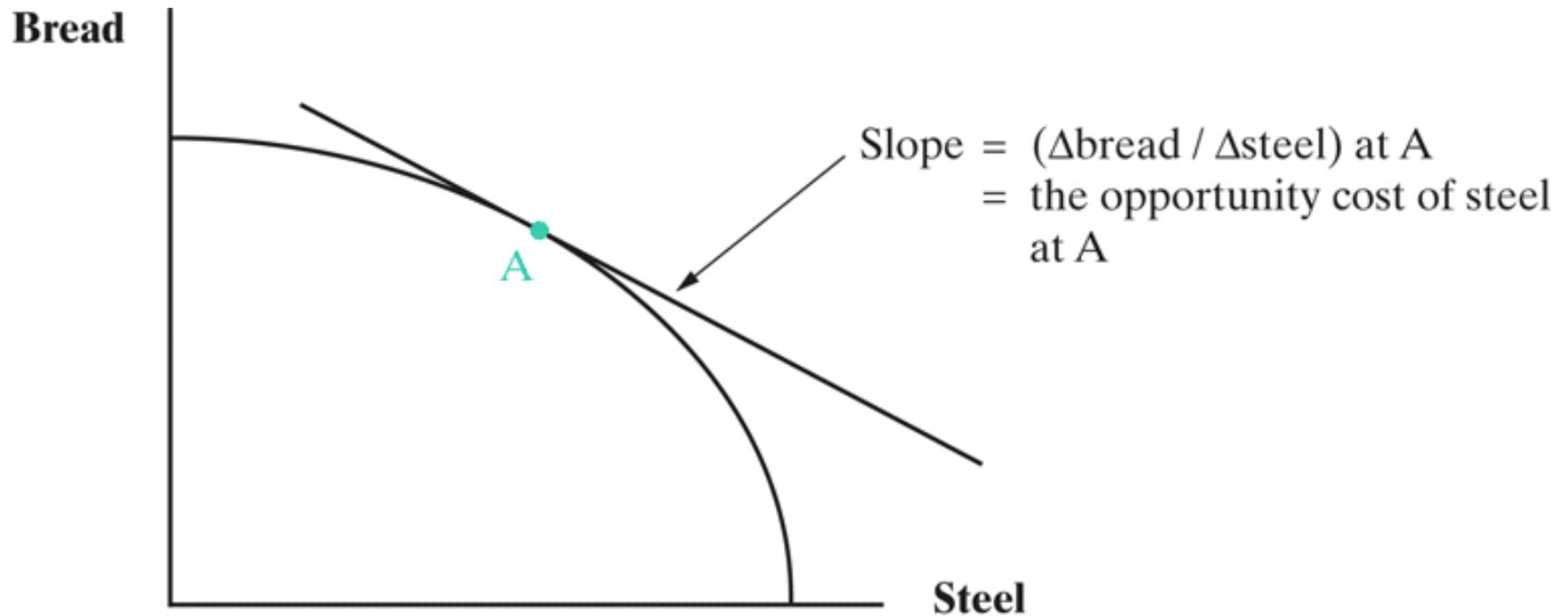
Concave Production Possibility Curve

- Assumptions:* - full employment of labour and capital,
- decreasing marginal productivities of L and K



→ PPC is not a straight line, but it is concave.

PPC and opportunity costs



The opportunity cost of steel is measured by the slope of the tangent at the point of production.

→ Producing more steel increases its opportunity cost, because its marginal productivity diminishes.

Factor Abundance (example)

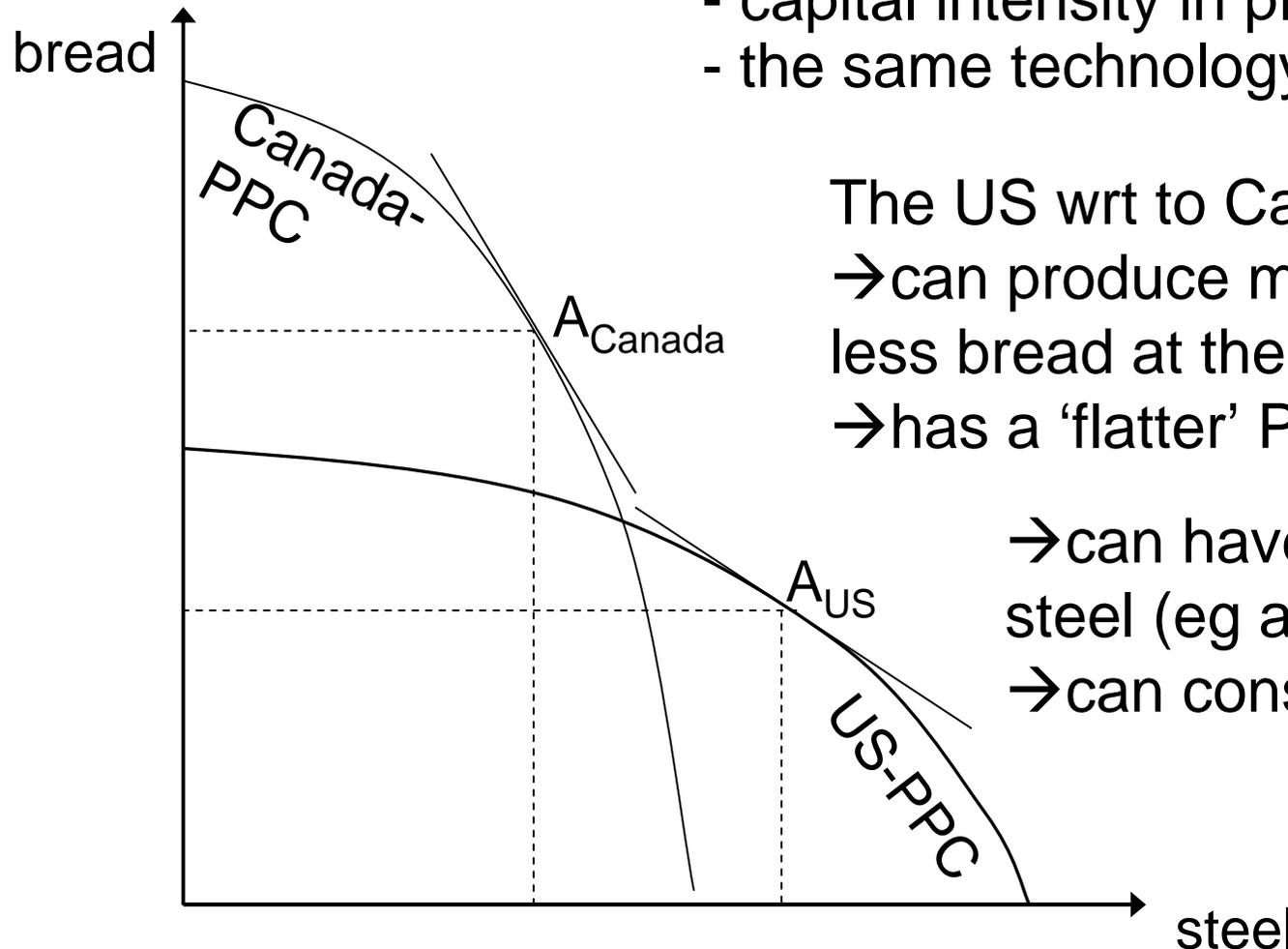
	United States	Canada
Capital	50 machines	2 machines
Labor	150 workers	10 workers

The United States is capital abundant and Canada is labor abundant.

- US capital-labor ratio: K_{us} / L_{us} is $50/150$ or $1/3$
- Canadian capital-labor ratio: K_{can} / L_{can} is $2/10$ or $1/5$
- The US is the relatively capital-abundant country because: $(K/L)_{US} > (K/L)_{Can.}$ or $1/3 > 1/5$
- Canada is relatively labor-abundant (although its absolute labor endowment is less than that of the US).

PPCs and equilibrium in autarky

Assumptions: – capital abundance in the US,
- capital intensity in producing steel,
- the same technology as in Canada.



The US wrt to Canada:

→ can produce more steel and less bread at the maximum;

→ has a 'flatter' PPC

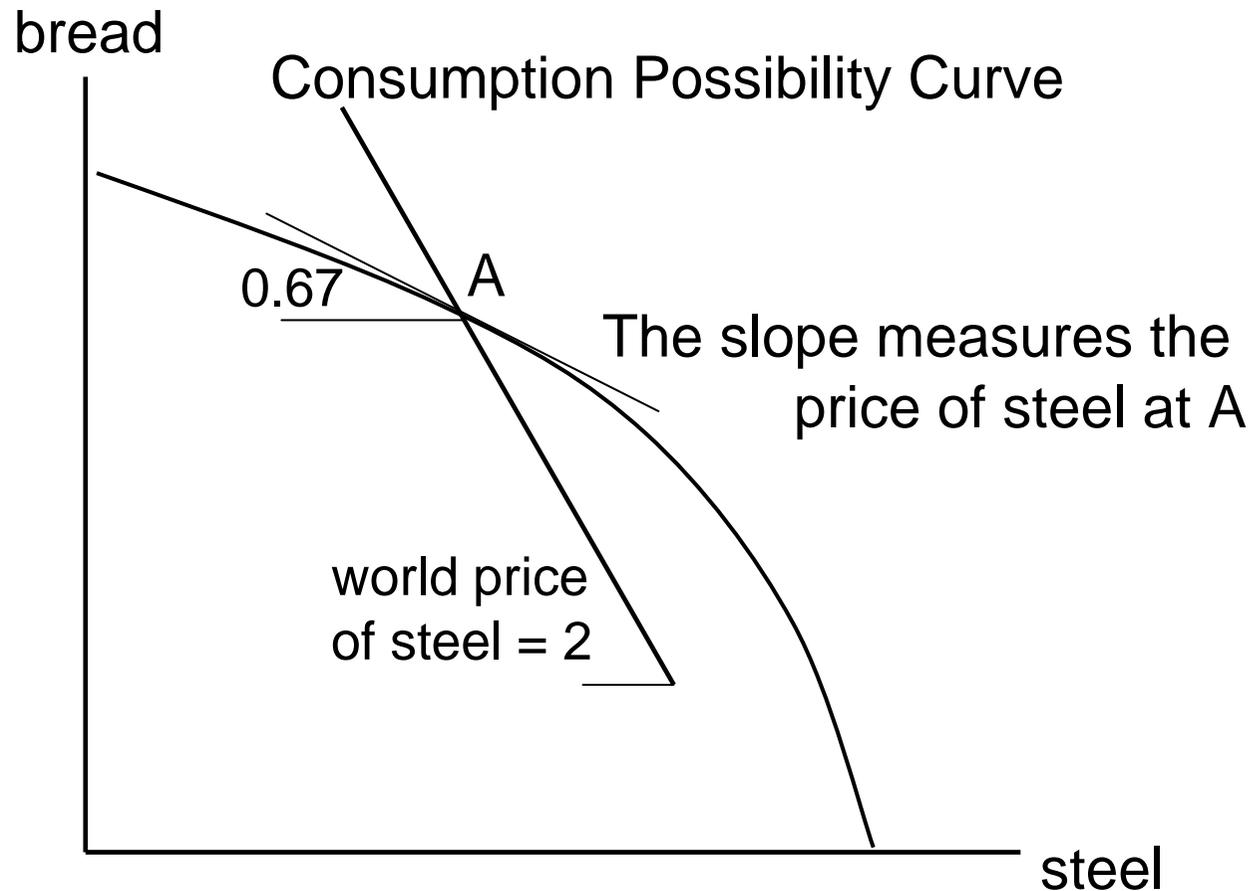
→ can have lower prices of steel (eg at the points A_s);

→ can consume more steel

Opening to trade of the US

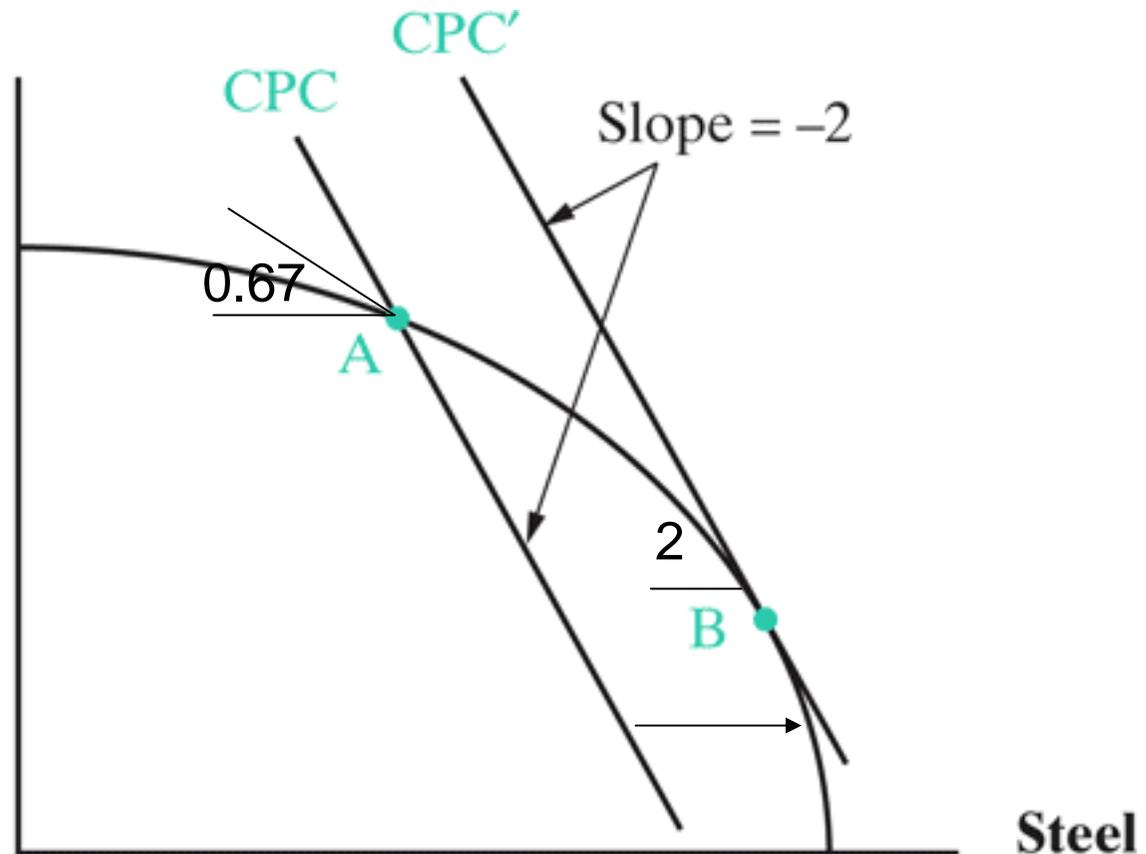
Assumptions:

- the US can trade with Canada when it consumes steel and bread at A;
- the world price of steel is $= 2$ (< 0.67).
- It is convenient to sell steel to Canada.



Moving toward specialisation with trade

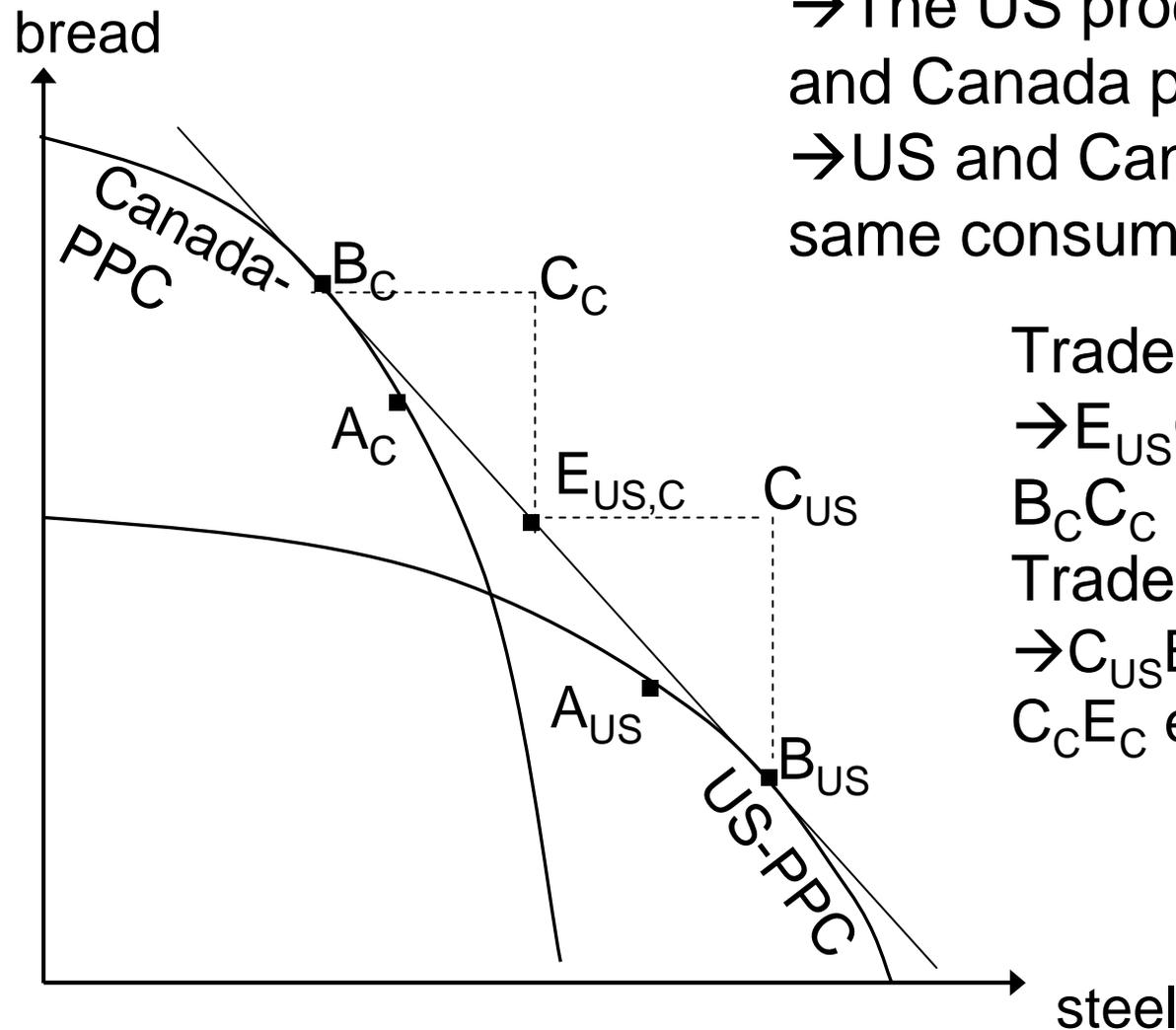
The US exports steel to Canada at higher price and import bread at lower price. It moves from A to B, and CPC to CPC'. Specialization of production is **incomplete**.



CPC is the trade line if production is at A. Production at B maximizes income.

In fact, CPC' represents greater combinations of steel and bread.

PPCs and equilibrium with trade



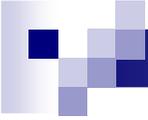
→ The US produces at B_{US}
 and Canada produces at B_C
 → US and Canada can have the
 same consumption at $E(>PPCs)$.

Trade of steel:

→ $E_{US} C_{US}$ exports of US =
 $B_C C_C$ imports of Canada

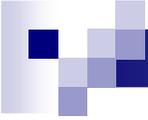
Trade of bread:

→ $C_{US} B_{US}$ imports of US =
 $C_C E_C$ exports of Canada



First conclusions

- The US, which is capital-abundant:
 - export the more capital-intensive product,
 - import the more labor-intensive product.
- Canada, which is labor-abundant:
 - export the more labor-intensive product
 - import the more capital-intensive product.



Trade and income distribution

- The US, by specializing in producing steel, increases the demand for capital and decreases the demand for labor, so that:
 - capital earnings increase and labor earnings diminish *regardless of sector* (steel and bread).
- Therefore, labor earnings diminish for two reasons:
 1. because opening trade implies that the price of bread diminishes being bought from Canada (which is labor-abundant),
 2. because the US demand less labor, being specialised in capital-intensive production (*magnification effect*).



Determination of relative earnings (Stolper-Samuelson theorem)

- The increase in the price of a good (eg steel) raises the income earned by factors that are used more intensively in its production (capital).
 - Conversely, a fall in the price of a good (bread) lowers the income of the factors used less intensively in its production (labor).
- The more abundant factor gains from trade, whereas the less abundant factor loses.



Generalisation of the Modern Model of International Trade

- Whereas the **Ricardian model** assumed:
 - only one homogeneous input: labor,
 - constant sets of tradeoffs (linear PPC),
 - different technologies (labor productivities) across countries.
- The **factor-endowment model** assumes:
 - multiple inputs → different factor intensities and endowments,
 - decreasing marginal productivities (concave PPC)
 - the same technology (production function) across countries.



Factor intensities of major products

Arable Land and Other Natural Resource-Intensive Products:

Agricultural products (food and raw materials)

Fuels and mining products (ores and other minerals, fuels, and nonferrous metals)

Capital-Intensive Products:

Iron and steel

Agricultural chemicals

Automotive products (automotive vehicles, parts, and engines)

R&D Scientists and Other Highly Skilled Labor-Intensive Products:

Chemicals (pharmaceuticals and other chemicals, excluding agricultural)

Office and telecommunications equipment

Civilian aircraft, engines, and parts

Machinery (power generating, nonelectrical, and electrical machinery)

Scientific and controlling instruments

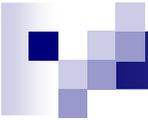
Unskilled Labor-Intensive Products

Textiles

Clothing and footwear

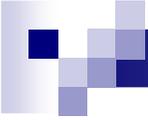
Personal and household goods

Source: World Trade Organizations, *International Trade Statistics*, (Geneva: WTO, 2008); and J. Romalis, "Factor Proportions and the Structure Commodity of Trade," *American Economic Review*, March 2004, pp. 67–97.



The example of the US

- The U.S. is richly endowed with: natural resources, skilled labor, and physical capital (wrt to unskilled)
 - We thus expect that: The U.S. will export agricultural products (particularly those requiring skilled labor and physical capital), machinery and industrial goods (requiring physical capital and scientific and engineering skills)
 - In fact: Major U.S. exports include grain products made with much capital little labor inputs; and commercial aircraft made with physical capital and skilled labor



Winners and losers from trade

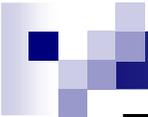
- Even though free trade provides overall gains for a country, there are winners and losers (effects of restructuring on owners of factors rather than on sectors).
- Owners of relatively abundant factor are favored.
- Owners of relatively scarce factor are disfavored.



Wage inequalities in the US

Source of Wage Inequality	Contribution (in percent)
Technological change	37.7
Trade	10.1
Stagnant minimum wage	7.2
Decline of unions	4.4
Immigration	2.9
Unexplained	37.7

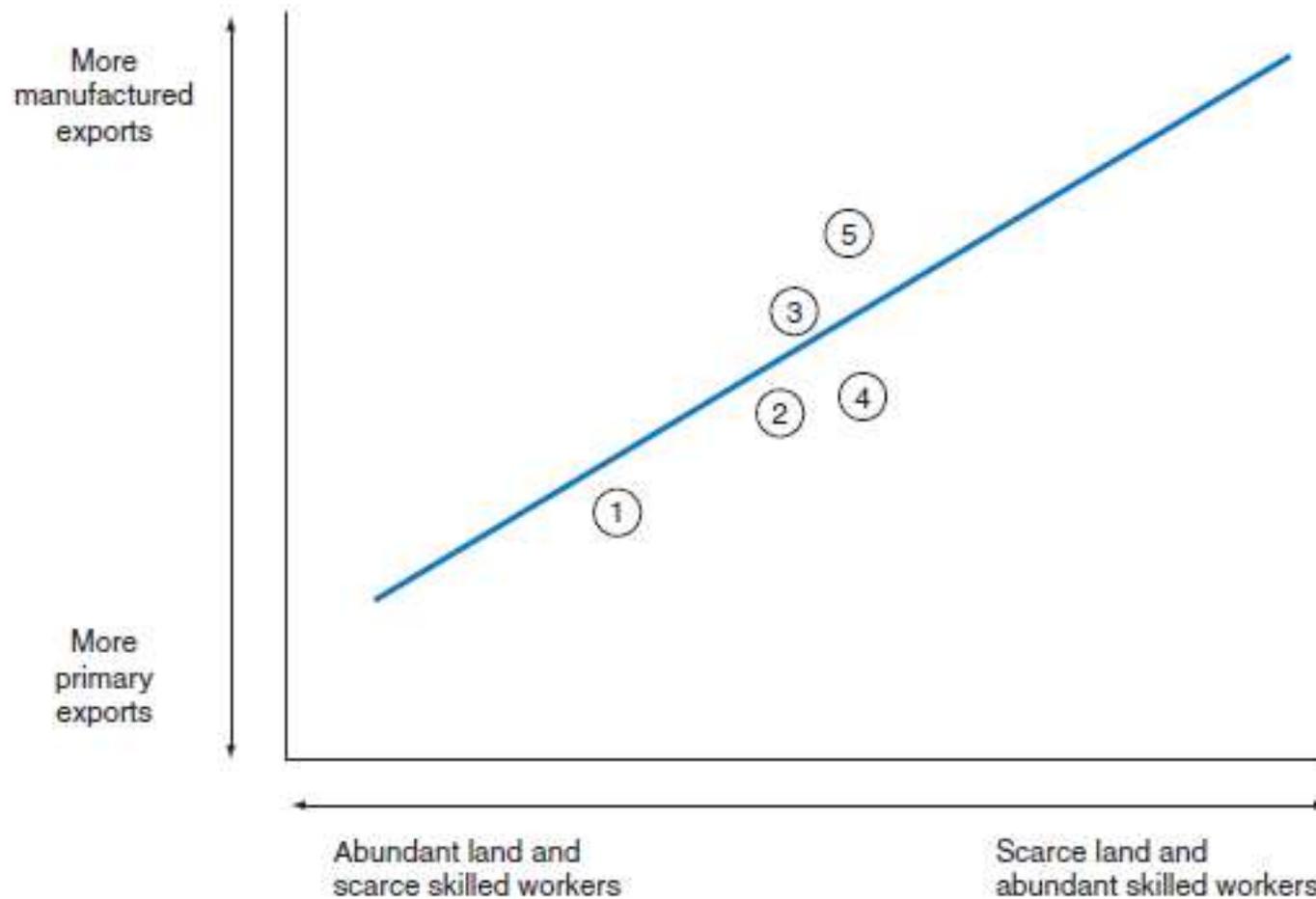
Source: "At the Heart of the Trade Debate: Inequity," *The Wall Street Journal*, October 31, 1997, p. A2.



Empirical Tests of the Factor Endowment Model

- Tests of theories based on factor endowments yield mixed results.
- Reasons:
 - Factors are many (eg: unskilled, skilled, managerial, etc. labor) and not uniformly defined;
 - Some factors can be greatly complementary.

Comparative advantage with skill&land

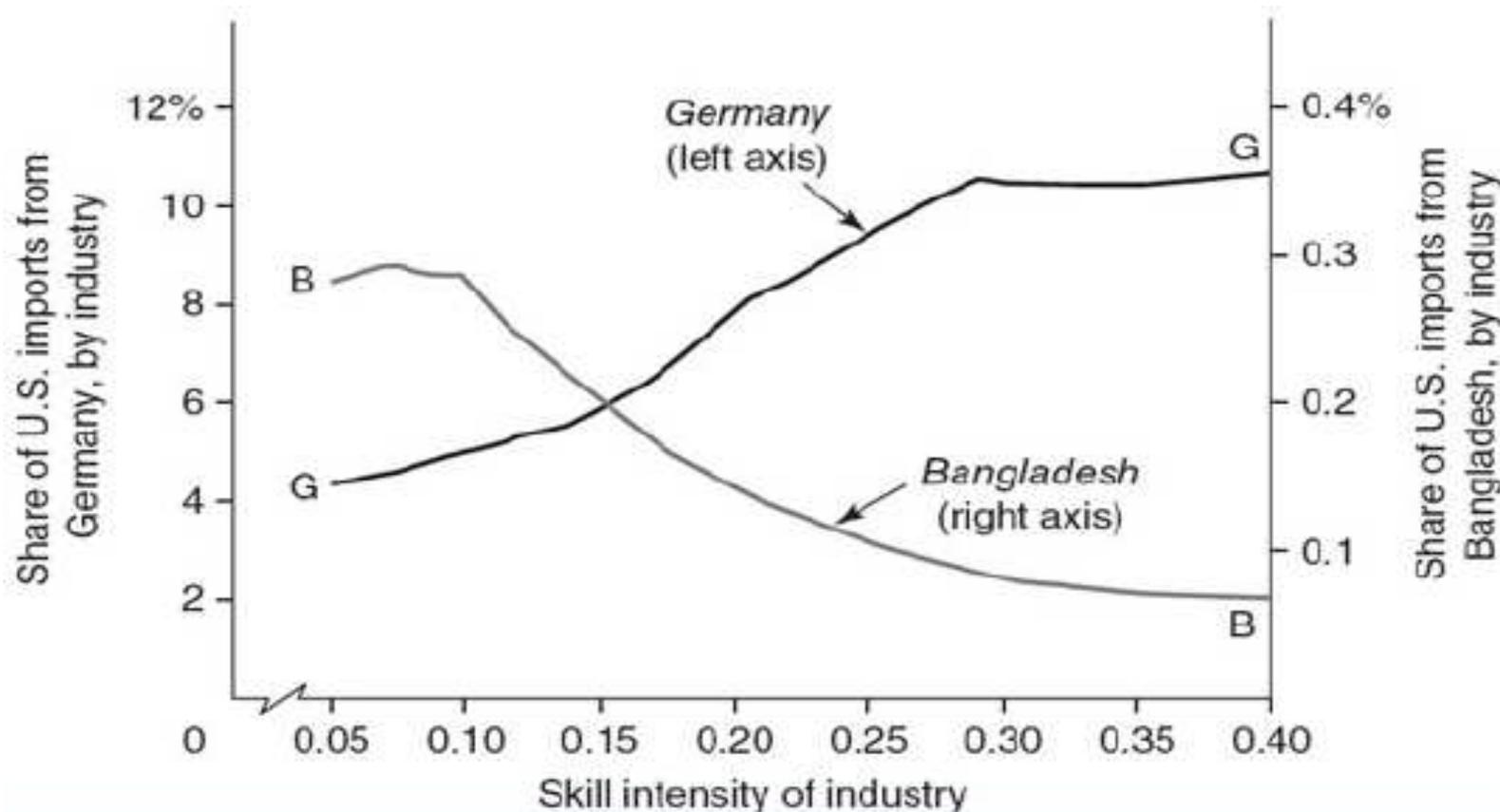


Legend:

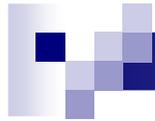
(1) Sub-Saharan Africa; (2) Latin America and the Caribbean; (3) South Asia;
(4) East Asia and the Pacific; (5) Industrial market economies

Source:
World Bank,
Report,
1995, p.59

Skill intensity and US import shares



The more intensive is skilled labor, the larger the US import share from countries with abundant skilled labor



On sector-mobility of production factors

- Ultimately, the effects on income of an opening of trade depends on the flexibility of the affected factors
 - If labor is stuck in bread production and unable to move to making steel, it will be hurt much worse than when it is flexible and free to move
 - Labor may be unflexible because specifically skilled in producing bread.
- What about the case of specific factors?

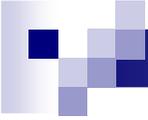


Specific Factors Model

- Let us assume that:
 - (1) land and capital are immobile and cannot migrate (**specific factors**);
 - (2) labor is fully mobile and can migrate from one sector to another (variable factor)

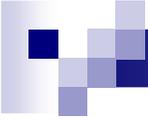
	Outputs	
Inputs	Bread	Steel
Specific factors	Land	Capital
Variable factors	Labor	Labor

The specific factors of land and capital can be used to produce only one good. The variable factor of labor is used in both bread and steel production.



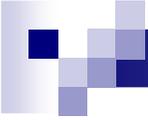
Results of the Specific Factors Model

- The main result is unchanged: Canada exports bread, and the United States exports steel.
- Capital owners in Canada are hurt by international trade because their capital will remain redundant. Similarly for land owners in the US.



Generalising the Specific Factors Model

- Factors specific to import industries greatly lose as a result of trade.
- Factors specific to export industries greatly gain as a result of trade.
- The income distribution effect on labor is indeterminate:
 - if workers can move easily to the expanding sector, they may gain,
 - if they are specific to import sectors, they greatly lose,
 - as consumers, they gain from lower prices.



The case of single natural resource

- Typical example: a country is greatly endowed with a single natural resource (commodity) with respect to capital.
 - specialization in the production intensive of natural resource attracts all labor and the available capital, thus leaving other sectors undeveloped.
 - price fluctuations of the dominant commodity in exports makes income vulnerable to crises.
 - political conflicts to control the commodity become more likely.
 - **Resource curse**

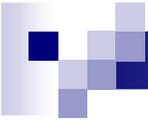


Fluctuation of oil (relative) price

Year	1972	1973	1974	1978	1979	1980	1985
Petroleum Prices (\$/barrel)	2.89	3.24	11.60	13.39	30.21	36.68	27.37
Real Petroleum Prices (\$/barrel)	2.89	3.00	9.51	7.70	15.82	17.14	9.34

Year	1986	1990	1998	2000	2005	2008	2011
Petroleum Prices (\$/barrel)	14.17	22.99	13.07	28.23	53.40	97.03	140.00
Real Petroleum Prices (\$/barrel)	4.69	6.51	2.90	5.73	8.99	14.83	15.80

Source: elaborations of D. Salvatore (*International Economics*, Wiley, 2013)
from data in IMF, *International Financial Statistics*, Washington DC, various
issues



Ten Largest Oil Reserves

Country	Reserves* (2011)	(Fuel Exports ÷ Total Exports) × 100
Saudi Arabia	266.7	80.7
Canada	178.1	20.0
Iran	136.2	74.2
Iraq	115.0	98.2
Kuwait	104.0	83.4
Venezuela	99.4	90.0
UAE	97.8	32.5
Russia	60.0	57.0
Libya	43.7	88.6
Nigeria	36.2	83.9

*Billions (thousands of millions) of barrels, given current technology.

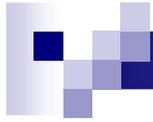
Sources: U.S. Energy Information Administration; World Trade Organization.



Enriching the Factor Endowment Model

- Besides factor endowments, trade is affected by
 - Timing in the economic development (technological differences)
 - Economies of scale
 - Corporate structures
 - Economic policies.

- We will see these issue in the next lectures.



End of the fourth lecture
of
International Trade
M. Pugno