

# Microeconomic modeling of foreign trade

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# Outline

1. Improved Ricardo model
2. Heckscher–Olin model
3. Pricing in the exchange market
4. New trade theory of P.Krugman

# Models of trade

- ▶ the model of a small country, which assumes that the volume of foreign trade of the country in question does not affect world market prices, in this sense, the country is small;
- ▶ the model of two countries, in which international trade is reduced to trade between two countries, each of which by its exports and imports affects the market conditions of another country.

# Improved Ricardo model



# Theory comparative benefits

- ▶ if countries specialize in the production of those goods which they can produce at relatively lower cost than in other countries, trade will be mutually beneficial for both countries, regardless of whether the production in one of them is absolutely more efficient than in the other.

# Model assumptions

- ▶ no capital outflow (for direct trade);
- ▶ the economy of each country operates in conditions perfect competition;
- ▶ no costs for delivery of products from one country to another;
- ▶ constant productivity in both countries;
- ▶ in all countries the same currency is used or the exchange rate of the national currency is always equal to one.

# Example

- ▶  $L_A = 10800$
- ▶  $U = (Q_T + 30) \cdot (Q_W + 10)$
- ▶  $Q_{T,A} = L_T / 100,$
- ▶  $Q_{W,A} = L_W / 120,$
- ▶  $L_T$  and  $L_W$  - the amount of labor allocated, respectively, for the production of cloth and wine.

England

- ▶  $L_P = 10800$
- ▶  $U = (Q_T + 30) \cdot (Q_W + 10)$
- ▶  $Q_{T,P} = L_T / 90$
- ▶  $Q_{W,P} = L_W / 80,$
- ▶  $L_T$  and  $L_W$  - the amount of labor allocated, respectively, for the production of cloth and fault.

Portugal

# Solution

$$Q_{T,A} = \frac{L_T}{100} = \frac{10800 - L_W}{100} \Rightarrow L_W = 10800 - 100Q_{T,A}$$

$$Q_{W,A} = \frac{L_W}{120} = \frac{10800 - 100Q_{T,A}}{120} = 90 - \frac{5}{6}Q_{T,A}$$

▶  $MRPT_{T,W} = 5/6.$

$$U = (Q_T + 30)(Q_W + 10) \rightarrow \max$$

$$Q_{W,A} = 90 - 0,833Q_{T,A}$$

▶  $Q_{T,A} = 45; Q_{W,A} = 52.5.$

$$Q_{T,P} = \frac{L_T}{90} = \frac{10800 - L_W}{90} \Rightarrow L_W = 10800 - 90Q_{T,P}$$

$$Q_{W,P} = \frac{L_W}{80} = \frac{10800 - 90Q_{T,P}}{80} = 135 - \frac{9}{8}Q_{T,P}$$

▶  $MRPT_{T,W} = 9/8.$

$$U = (Q_T + 30)(Q_W + 10) \rightarrow \max$$

$$Q_{W,A} = 135 - 1,125Q_{T,A}$$

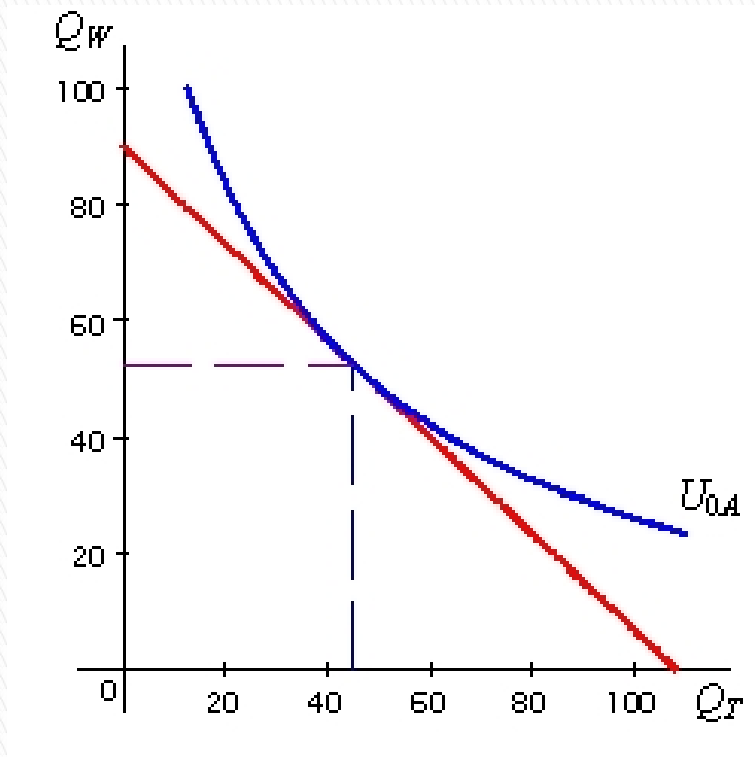
▶  $Q_{T,P} = 49.4; Q_{W,P} = 79.4$

England

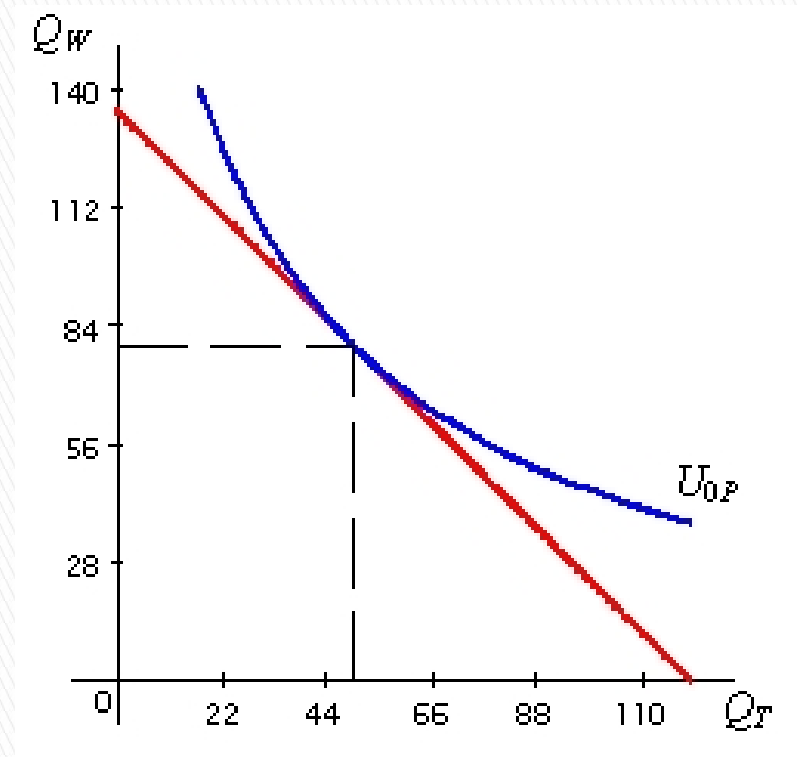
Portugal



# Absence of trade

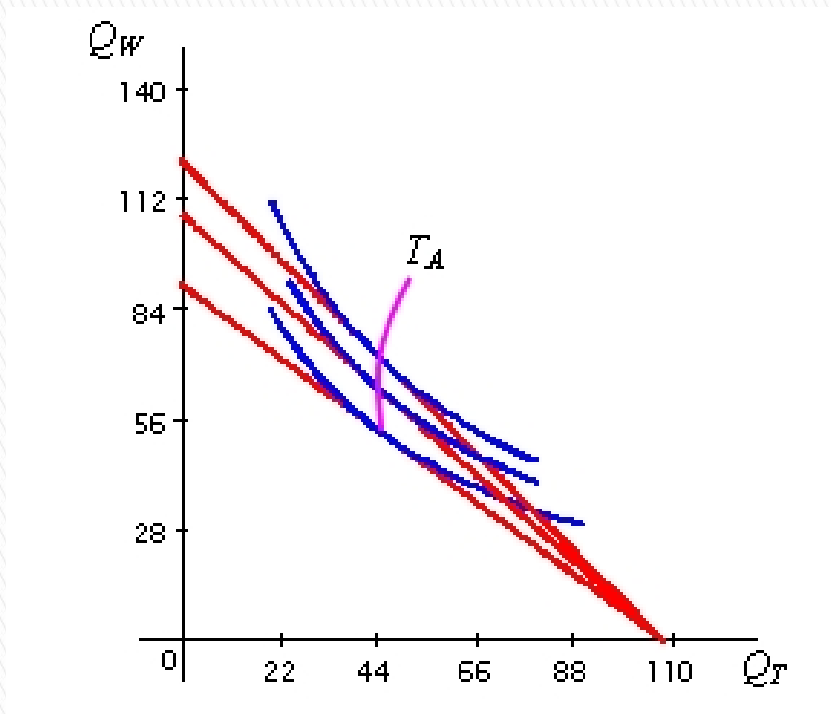


England

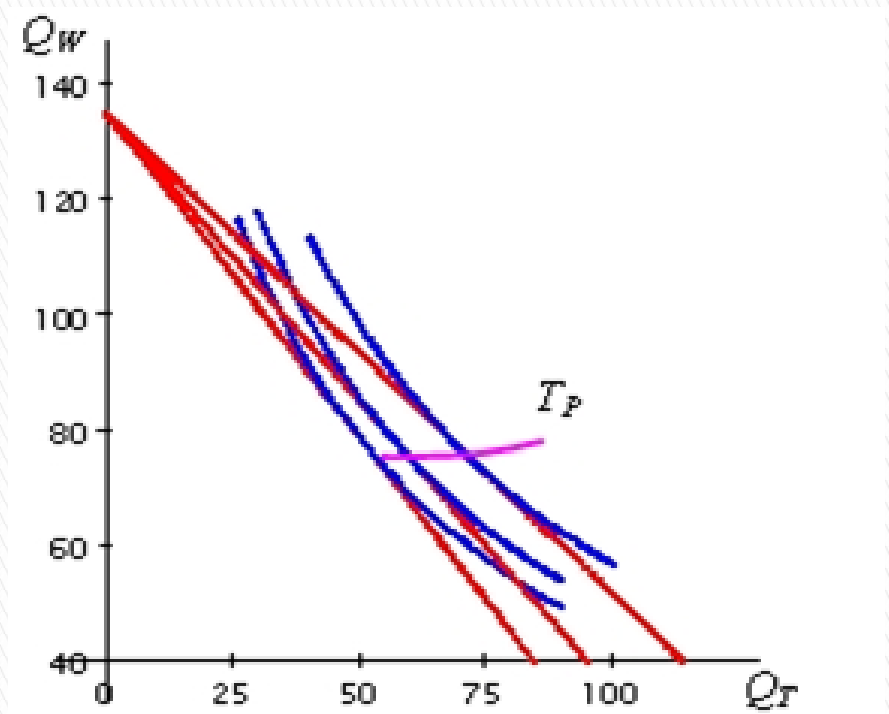


Portugal

# Curve of trade



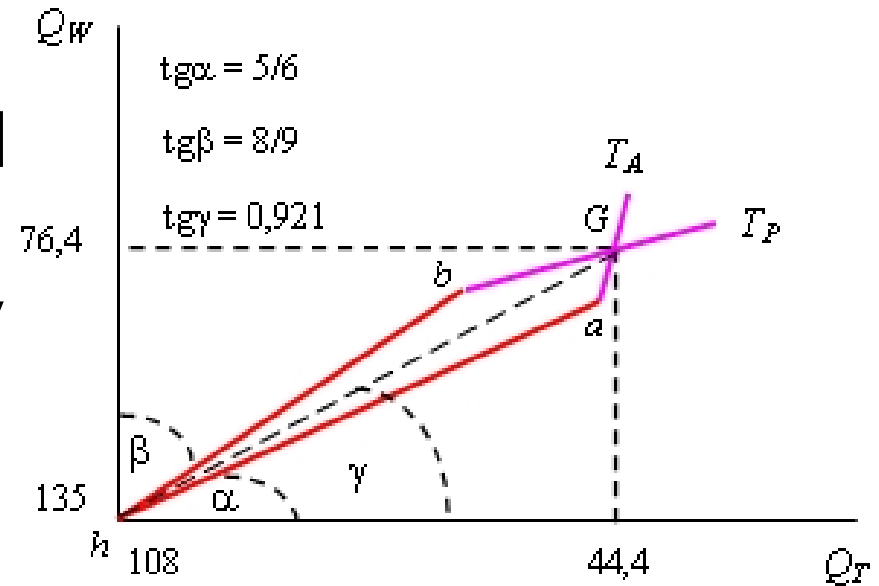
England



Portugal

# Equilibrium

- ▶ A state of equilibrium in trade between England and Portugal is achieved when neither country can increase its welfare without reducing the welfare of another country.



# Heckscher–Olin model

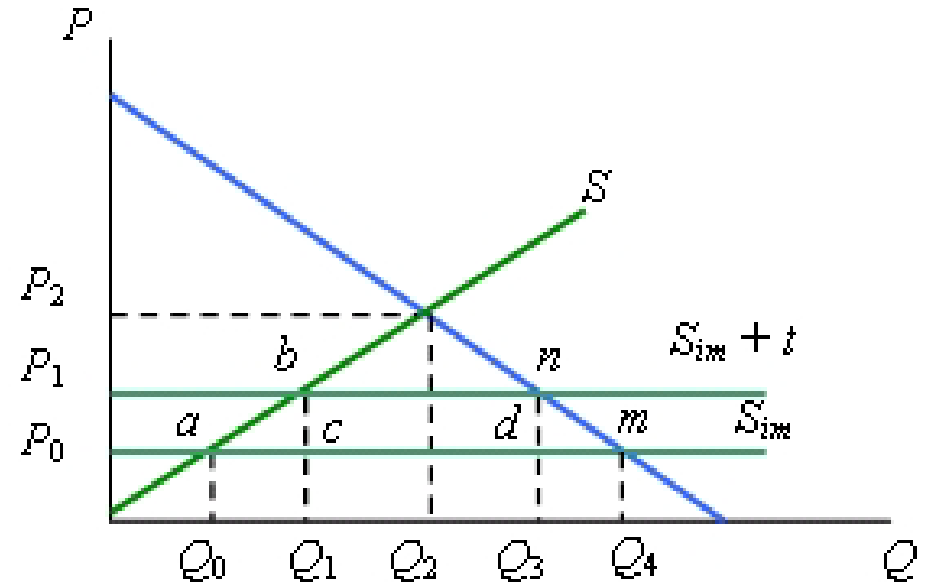


# Heckscher–Olin model

- ▶ Heckscher and Olin explained the comparative advantages in production with different equipment of countries with the main factors of production.
- ▶ two countries
- ▶ in each produced and consumed two identical types of goods,
- ▶ in production two identical types of factors are used production.

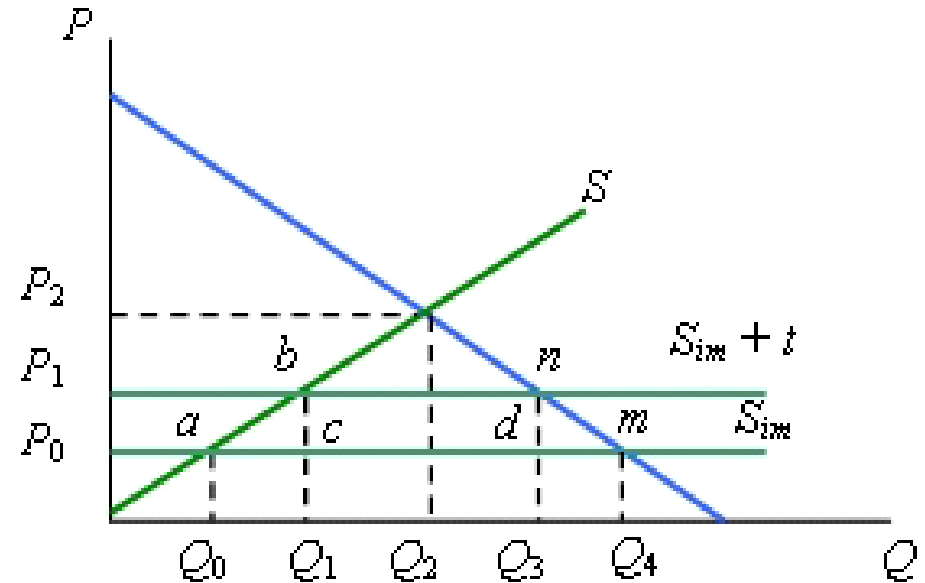
# Model effects - 1

- ▶ *effect of protection of domestic production: the volume of domestic supply will increase from  $Q_0$  to  $Q_1$*



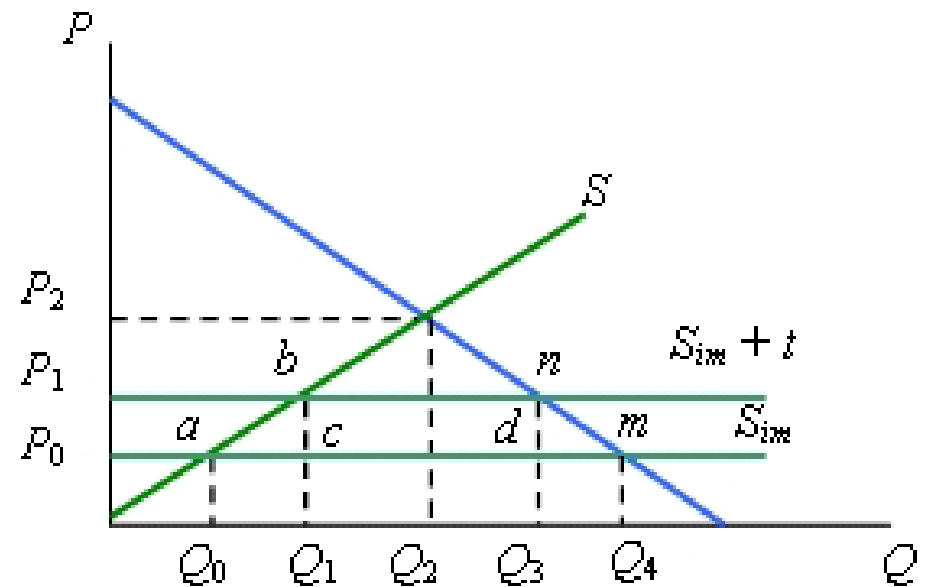
# Model effects - 2

- ▶ *consumption effect*.  
the volume of domestic consumption will decrease from  $Q_4$  to  $Q_3$



# Model effects – 3

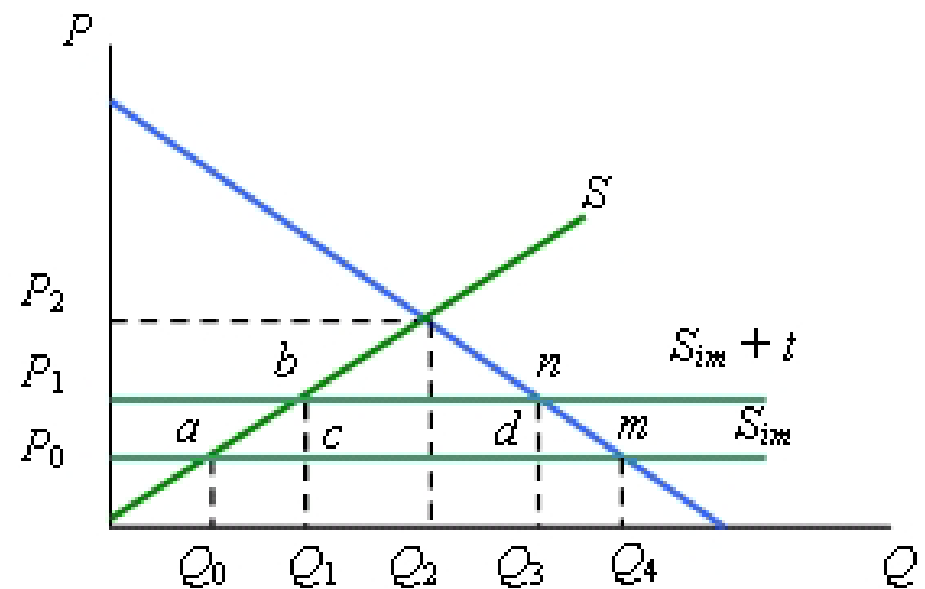
- ▶ *the effect of foreign trade*: the volume of imports will decrease by  $(Q_1 - Q_0) + (Q_4 - Q_3)$





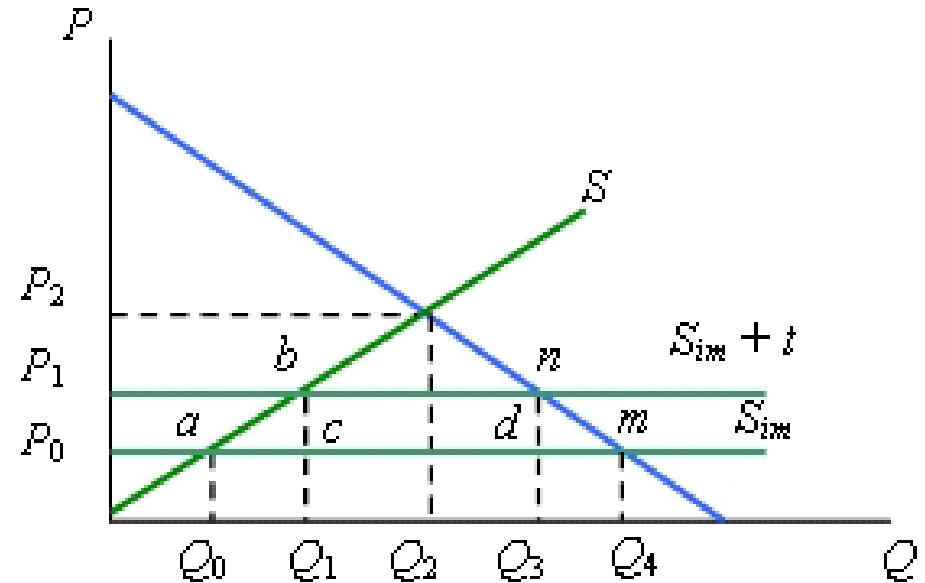
# Model effects – 4

- ▶ *balance of payments effect*. imports in value terms will decrease by  $[(Q_1 - Q_0) + (Q_4 - Q_3)]P_0$



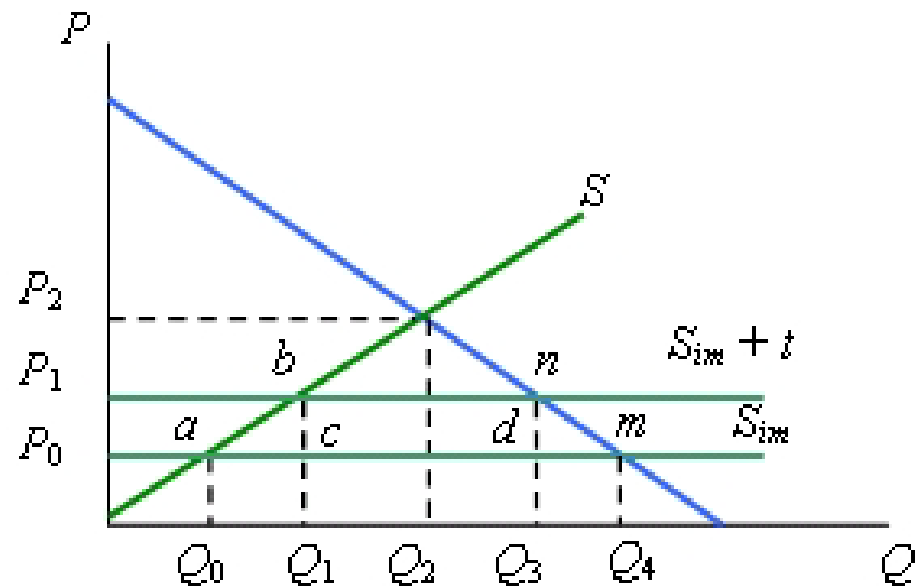
# Model effects – 5

- ▶ *the effect of customs duties: the amount of duties collected will increase by  $(Q_3 - Q_1)(P_1 - P_0)$*



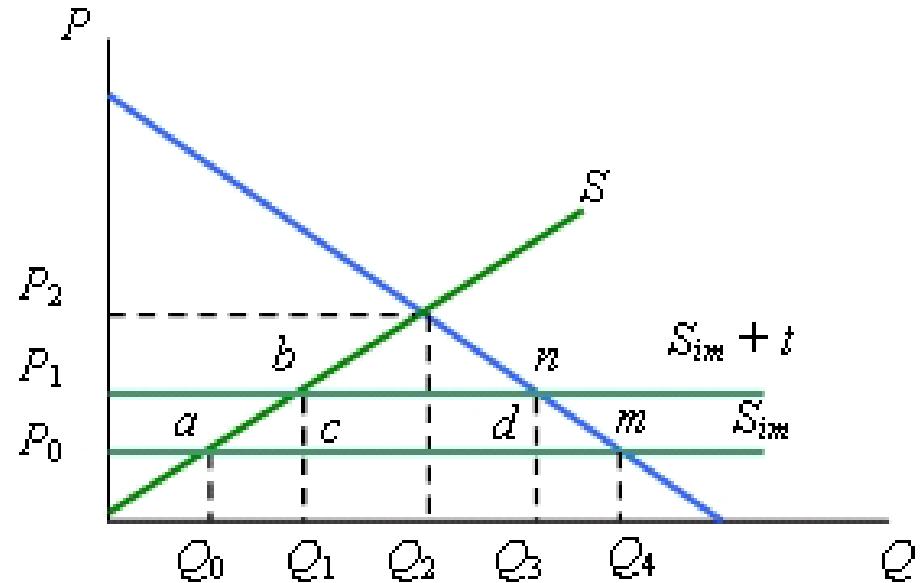
# Model effects – 6

- ▶ *redistribution effect*.  
 surplus producers  
 will grow in area  
 $P_0abP_1$ , and  
 consumer surpluses  
 will decrease by area  
 $P_0mnP_1$

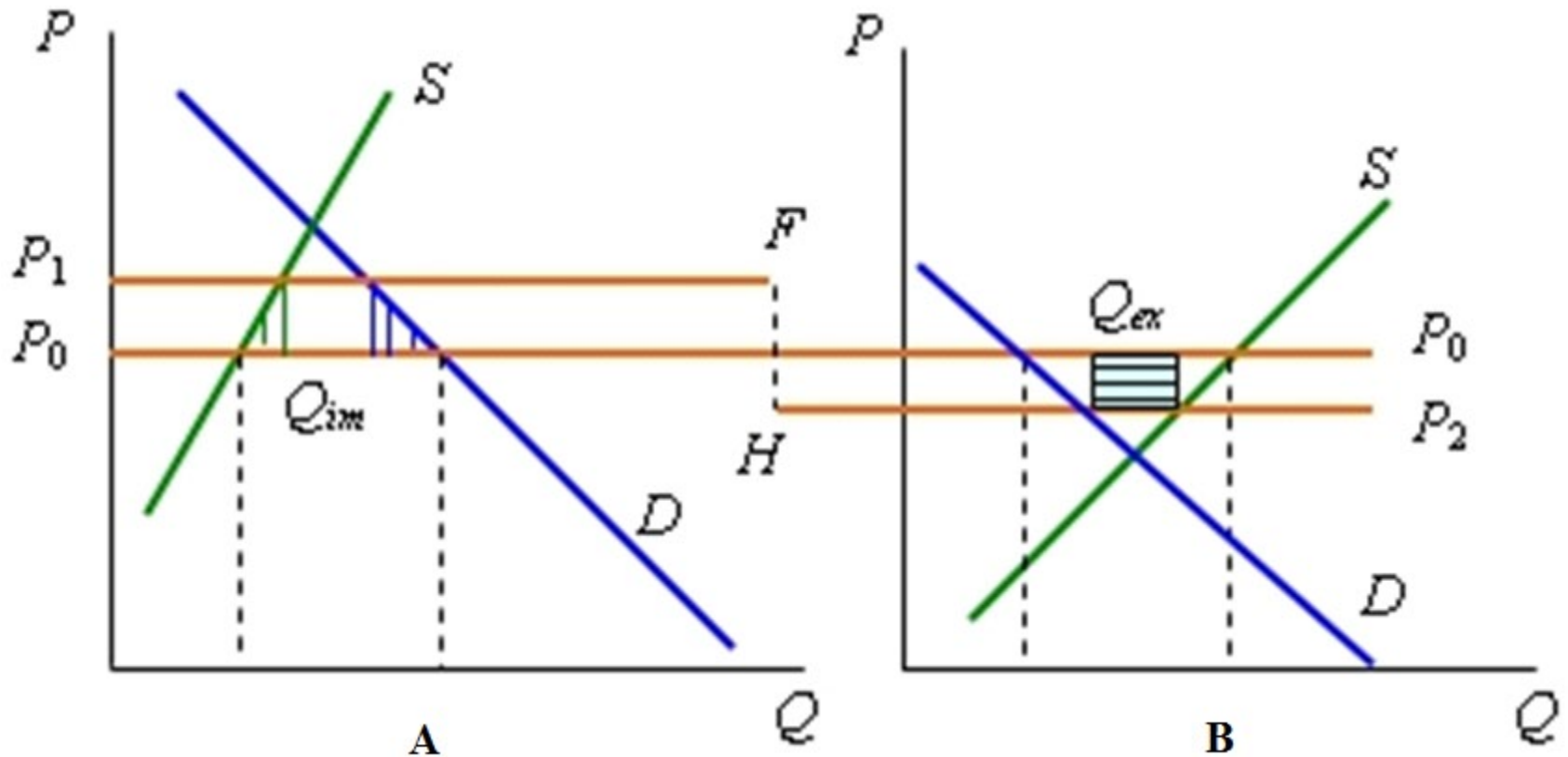


# Model effects - 7

- ▶ *effect of economic losses*: the difference between the loss of consumers and the gain of producers, reduced by customs duties represent the net loss of society, equal to the sum of the areas of triangles *abc* and *mnd*



# Consequences of import duty



# Model: conclusions

- ▶ producers and the state benefit from the introduction of duties, while consumers lose;
- ▶ the introduction of tariffs on goods, the volume of imports of which is quite elastic in price, is accompanied by net losses of society.

# Pricing in the exchange market



# Basics of the model

▶  $D^D = P^Z Q_{im},$

▶  $D^S = P^Z Q_{ex},$

▶  $D^D$  – currency demand

▶  $Q_{im}$  – quantity of imported goods

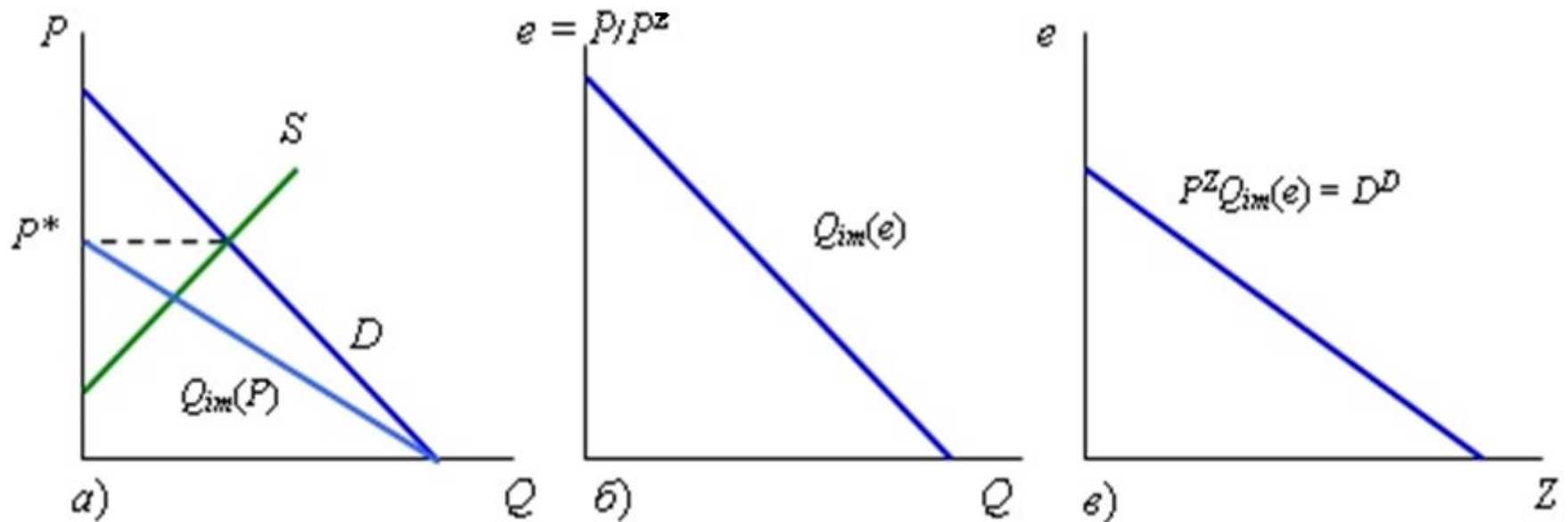
▶  $D^S$  – currency supply

▶  $Q_{ex}$  – number exported goods

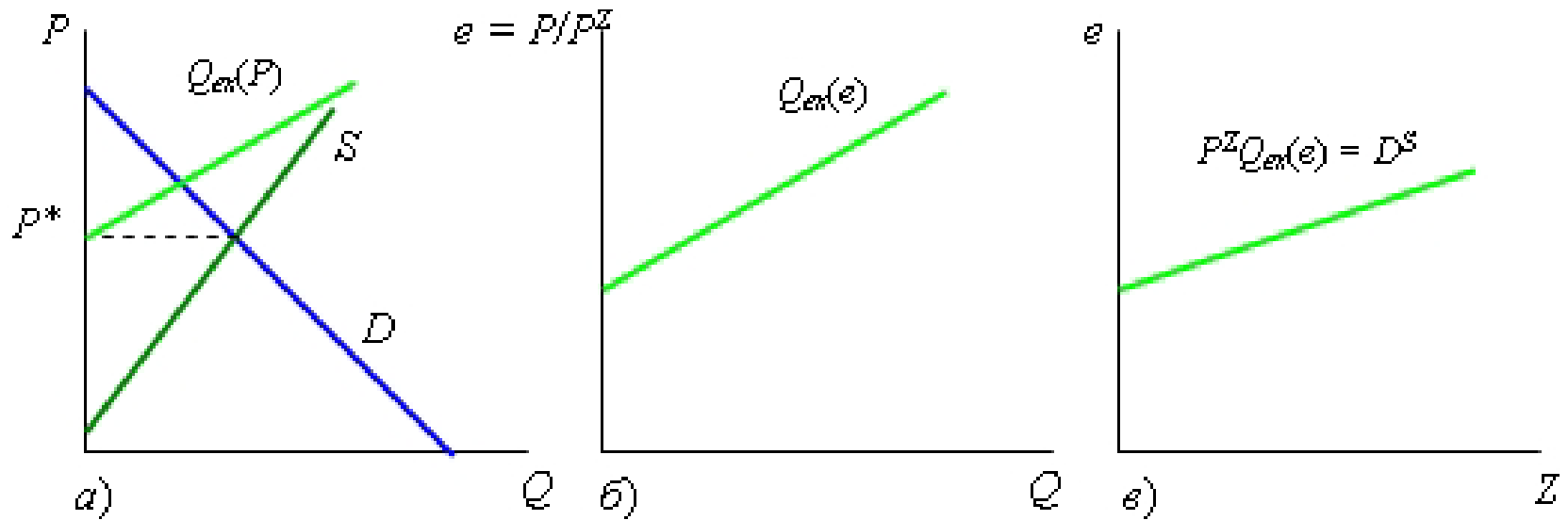
▶  $P^Z$  – the price of imported / exported goods in foreign currency



# Building demand for currency



# Construction of the currency supply curve



# Exchange course

- ▶ The point of intersection of graphs  $D^D(e)$  and  $D^S(e)$  determines the national exchange rate of currency

# Example

- ▶ Country imports only one type of goods ( $F$ ) and exports other types of goods ( $H$ ).
- ▶ World market price of goods  $F$  is \$10, and good  $H$  – \$11.
- ▶ Functions of supply and demand of both goods within the country:

$$Q_{F,A}^D = 130 - 5P_{F,A}; Q_{F,A}^S = 4P_{F,A} - 5;$$

$$Q_{H,A}^D = 94 - 2P_{H,A}; Q_{H,A}^S = 12P_{F,A} - 5.$$

# Solution – 1

- ▶ We will find functions of import and export of the country:

$$Q_{F,A}^{im} = Q_{F,A}^D - Q_{F,A}^S = 135 - 9P_{F,A};$$

$$Q_{H,A}^{ex} = Q_{H,A}^S - Q_{H,A}^D = 14P_{H,A} - 98.$$

- ▶ Demand and supply of currency in the country :

$$D^D = P_F^Z Q_{F,A}^{im} = 135P_F^Z - 9P_{F,A}P_F^Z = 135P_F^Z - 9e(P_F^Z)^2$$

$$D^S = P_H^Z Q_{H,A}^{ex} = 14P_{H,A}P_H^Z - 98P_H^Z = 14e(P_H^Z)^2 - 98P_H^Z$$

# Solution – 2

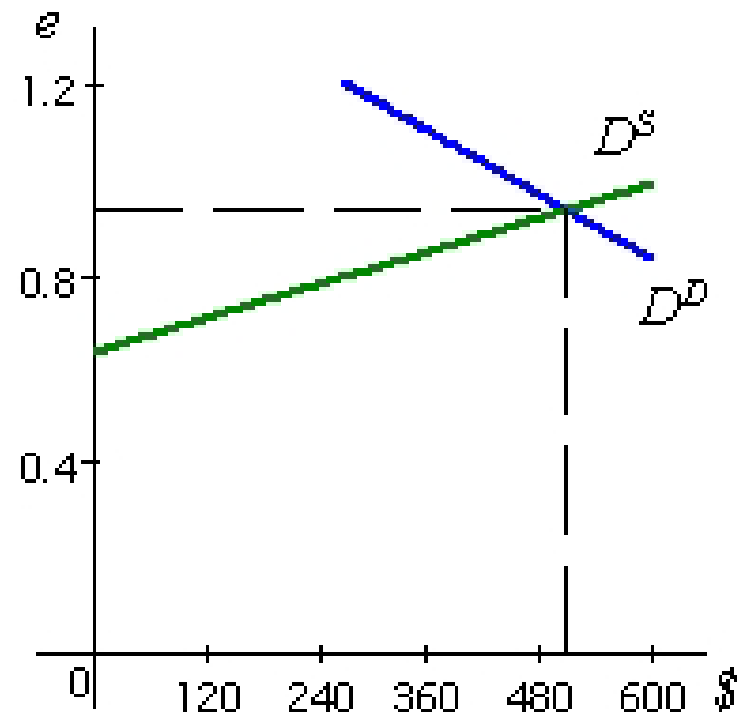
- ▶ With world prices for goods:

$$D^D = 1350 - 900e;$$

$$D^S = 1694e - 1078.$$

- ▶ Equilibrium in the foreign exchange market

$$e = 0.936$$



# Solution – 3

Amount	Production		Consumption	
	$e = 0.936$	$e = 1$	$e = 0.936$	$e = 1$
$Q_F$	32.4	35	83.2	80
$Q_H$	119.6	128	73.4	72

# New Krugman trade theory





# Krugman model

- ▶ economic development and prosperity of the state directly depend on its size, as it is most profitable to produce a large number of identical goods and services. As a result, a country with a large population benefits more.

# Model explanation – 1



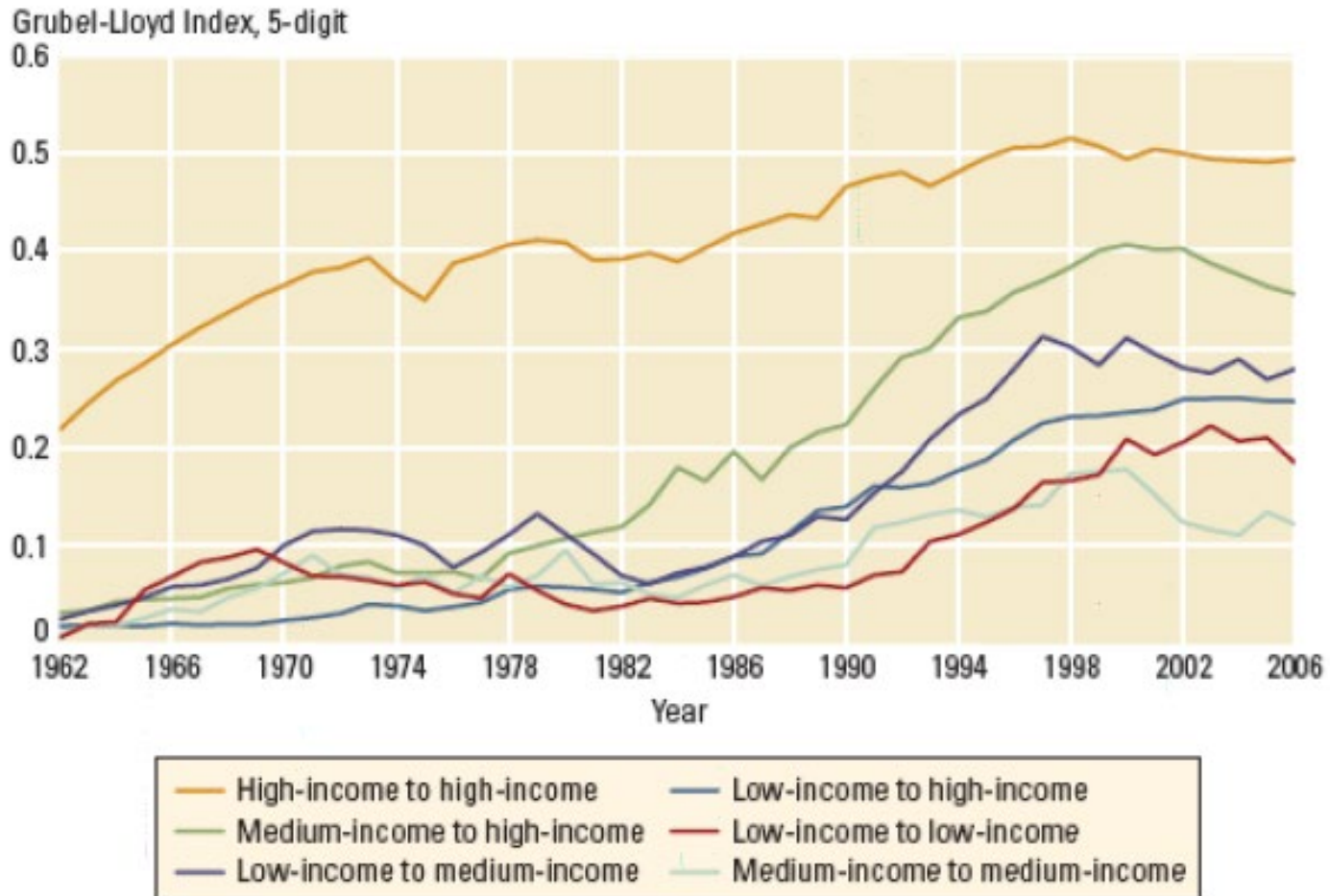
# Model explanation - 2



# Model explanation – 3

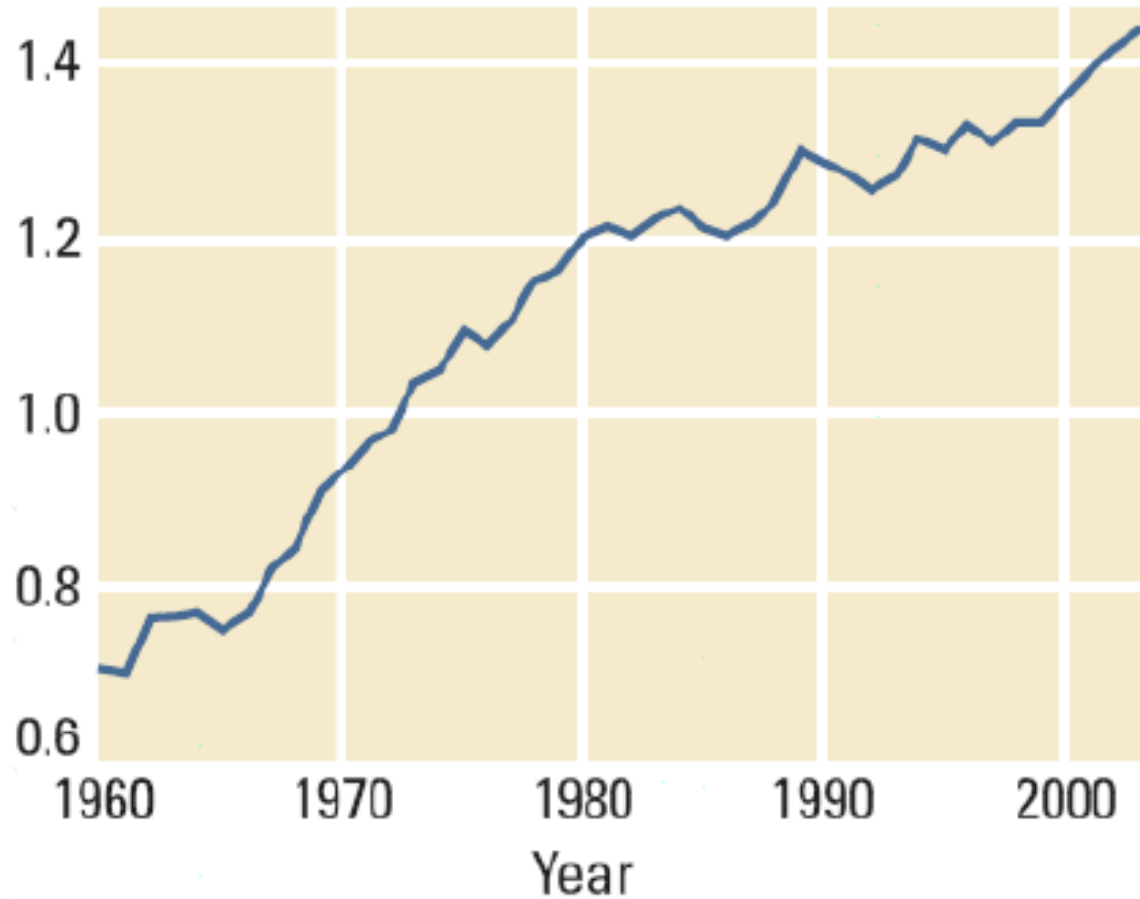


# Model explanation - 4



# Model explanation – 5

Distance coefficient



# Krugman Model – 1

- ▶  $S$  – size internal market;
  - ▶  $S^*$  – size foreign market ( $S > S^*$ );
  - ▶  $F$  – expenses at the opening factory;
  - ▶  $\tau$  – transport costs by unit of output.
- 
- ▶ Conclusion: if  $F > \tau S^*$ , it is more profitable to have one factory within the country and export products.

# Krugman Model – 2

- ▶  $S$  – the size of the entire market;
- ▶  $\mu$  is the share of central employees (“footloose” workers) in general demand;
- ▶  $F$  – costs at the opening factory;
- ▶  $\tau$  – transport costs by unit products;
- ▶ demand is uniform (agglomerate – periphery)



# Implementation of the model

- ▶ Sales to the periphery
- ▶  $S (1 - \mu) / 2$ .
- ▶ Profitably concentrate production at home, if
- ▶  $F > \tau S (1 - \mu) / 2$  or  $F / S > \tau (1 - \mu) / 2$ .

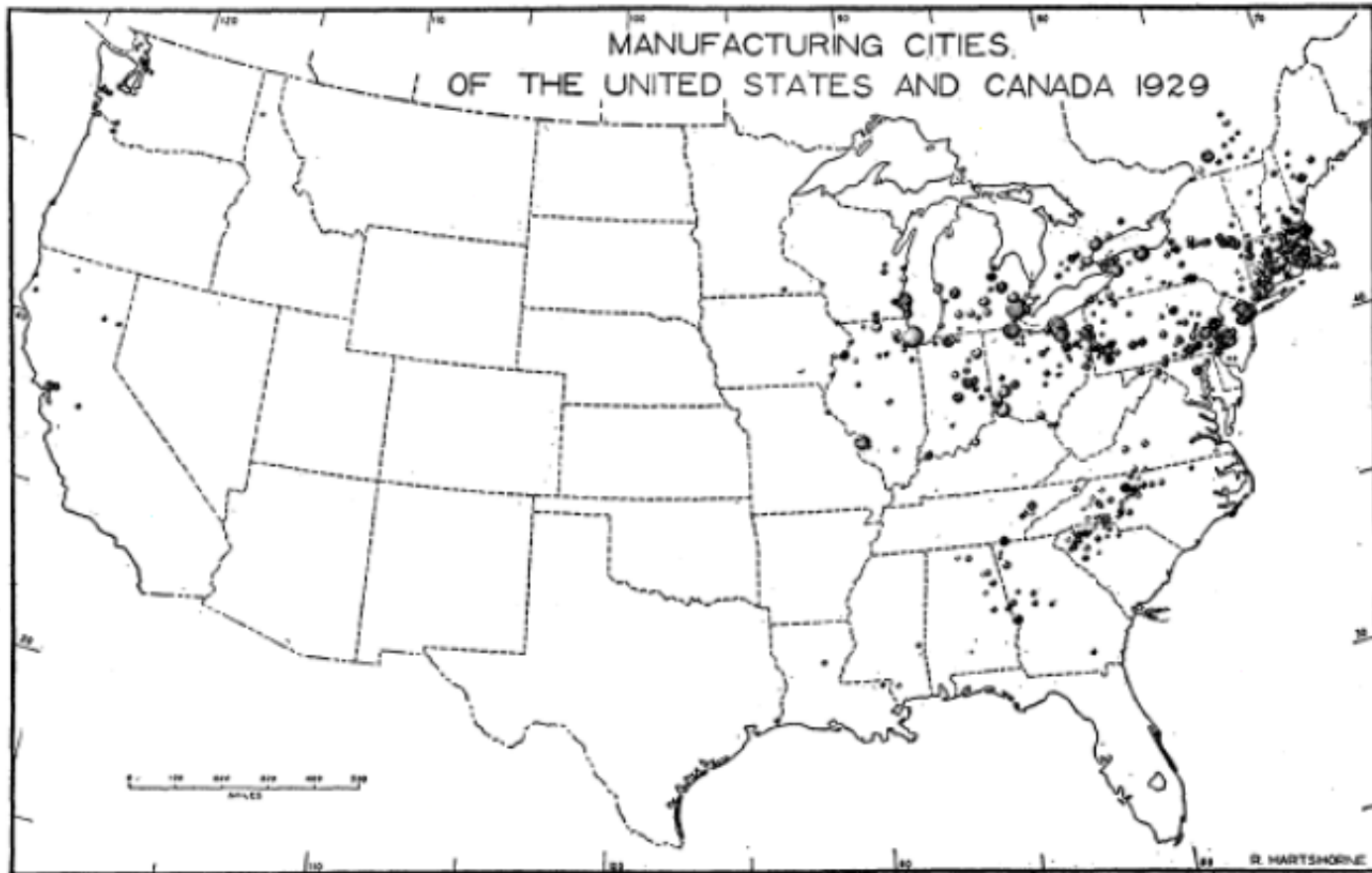
# What happened during 1850–1860?

- ▶ Large-scale production  $\Rightarrow$  more F / S
- ▶ Railways  $\Rightarrow$  below  $\tau$
- ▶ Industrialization  $\Rightarrow$  above  $\mu$

It caused problems:

- ▶ Increasing income inequality
- ▶ Reduction of "good jobs"

# Manufactory belts: the beginning



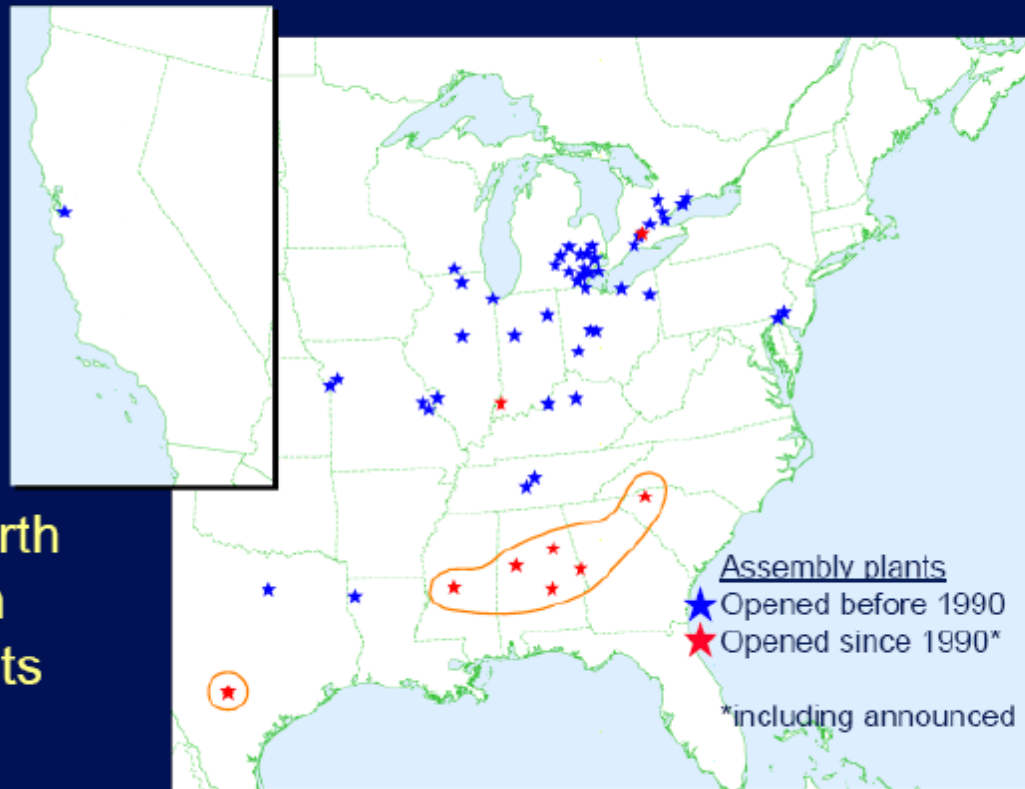
# Manufactory belts: development



# Manufactory belts: modernity

## Evolution of assembly geography: 2006+

7 of 9 North  
American  
transplants  
in Deep  
South



# Conclusions from the model

- ▶ growing profits were an important force shaping the world economy;
- ▶ this force may be in decline today, or even absent;
- ▶ this decline is the key to understanding what is happening in the world today.

# Example

- ▶ Boeing spends 5 billion on the development of Boeing 777
- ▶ If Boeing will make 100 model 777 aircraft
  - fixed costs will be 5 billion / 100 = 50 million;
  - variable costs of \$ 80 million per aircraft
  - total costs 50 + 80 = 130 million.
- ▶ If Boeing make 500 aircraft, the total cost will be 90 million

# Thank you!