

# GEOGRAPHICAL ECONOMICS B





NEW

SZÉCHENYI PLAN

# GEOGRAPHICAL ECONOMICS

## B

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Course Material Developed by Department of Economics,

Faculty of Social Sciences, Eötvös Loránd University Budapest (ELTE)

Department of Economics, Eötvös Loránd University Budapest

Institute of Economics, Hungarian Academy of Sciences

Balassi Kiadó, Budapest



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**06 40 638 638**



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ELTE Faculty of Social Sciences, Department of Economics

# Geographical Economics "B"

week 7

## TWO-REGION KRUGMAN MODEL

Authors: Gábor Békés, Sarolta Rózsás  
Supervised by Gábor Békés

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# Outline

- 1 Krugman model
  - Production structure
  - Geography steps in: two regions
  - Short-run equilibrium
  - Long-run equilibrium
  - Dynamics

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Krugman model

Production  
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# Basis

- Krugman model (1991)
- <http://www.koz-gazdasag.hu/images/stories/4per2/13-krugman.pdf>
- For now BGM Chapter 3.3
- Topics for today: Two-region model
  - Production structure
  - Short-run equilibrium
  - Long-run equilibrium
  - Basis of dynamics

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# Krugman model – basis

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- **Two regions: 1, 2:  $R_1, R_2$**
- Two sectors: food and manufacturing
- Laborers in the food sector, CRS, region 1 – they sell in region 1 or 2. There are no transportation costs.
- Manufacturing:  $N_1$  firms in  $R_1$ ,  $N_2$  firms in  $R_2$ . Monopolistic competition – producers are competing, but they have market power
- In the case of manufacturing goods there are transportation costs if the good produced in one region is not sold there

# Transportation costs

- Transportation cost – a necessary element
- Samuelson (1952) iceberg transportation costs – a part melts.  
Cost = what does not arrive
- = von Thünen – wheat falling off from the wagon
- $T > 1$  units of good need to be shipped to ensure that 1 unit arrives
- Advantage: there is no separate transportation sector

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# Consumers

- Consumers: food and manufacturing good
- Food is homogeneous:
  - Consumers don't care whether they consume domestic or import wheat
  - Provided that there are no transportation costs prices are the same
- Consumption of manufacturing goods: variety matters
  - domestic and – if they are available – import goods as well
  - The same product if imported would be more expensive – transportation costs
  - Because of liking for variety, they would like to consume some units of all varieties

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# The source of dynamics

- nominal vs real value
  - wage – wage expressed in the numeraire
  - real wage – price-level adjusted = purchasing power
- mobile sector (manufacturing) vs immobile sector (food)
  - laborers in the food sector are immobile
  - laborers in the manufacturing sector are mobile between the two regions (regional vs international models)
  - manufacturing firms are also mobile between the two regions
- it is possible that all the manufacturing firms and laborers are located in one region

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# Two regions

- BGM Chapters 3.7-3.9
- Two regions,
  - demand and supply side,
  - transportation costs.
- Question: who is where?

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# Two regions

- Laborers:  $\gamma$  in the manufacturing,  $1 - \gamma$  in the food sector
- the distribution of  $L$  within the food sector:  $\phi_1, \phi_2$ , within the manufacturing sector:  $\lambda_1, \lambda_2$

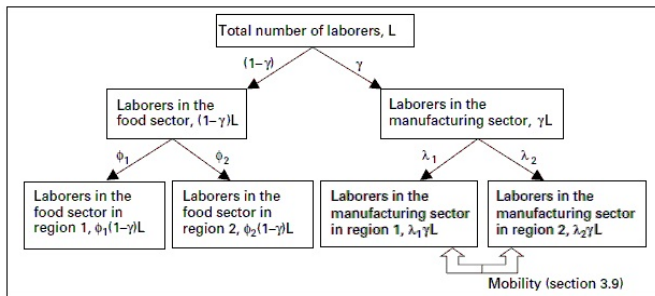


Figure 3.6 Division of labor between the regions

Notes:  $\phi_1 + \phi_2 = 1$ ;  $\lambda_1 + \lambda_2 = 1$ .

# Region 1: production

- The mass of laborers in the food sector:  $\phi_1(1 - \gamma)L$ 
  - = output of food sector (1:1)
  - = wage income in the food sector
- Manufacturing: there can be different conditions in the two regions:
  - Wages:  $W_1$  and  $W_2$
  - Prices: let's consider one product: if its price is  $p_1$  in region 1 then it is the same increased by transportation costs in region 2,  $p_2 = Tp_1$
  - The size of manufacturing sector: it depends on the number of laborers in the given region
  - Within a region: the number of firms = a function of laborers

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# Equilibrium

- The point is regional mobility
- Equilibrium, dynamics
- The essence of Economic Geography
- Equilibrium
  - short-run: the distribution of laborers is given
  - long-run: long-run equilibrium under endogeneous flow of laborers
  - describing dynamics (transition)

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# Short-run equilibrium

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- Assumptions:
  - food sector laborers' market is in equilibrium – the amount of food
  - manufacturing sector laborers' market is in equilibrium – the amount of products
  - zero profit (food sector: CRS, manufacturing: free entry)
- Income in a given region = wage for the manufacturing and food sector workers in the same region
- Prices: productions costs, transportation costs
- Region 1:  $p_1$ , region 2:  $Tp_1$
- or  $p_1$  is the f.o.b. (factory gate) price,  $Tp_1$  is the c.i.f. (import) price

# Conditions of the equilibrium

- Dominant factors of the equilibrium
  - ① the price of local products is a function of local wage
  - ② the prices of imported goods are higher because of transportation costs
  - ③ the number of local products depends on the number of local workers

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# Region 1: price-level

- We assume that the prices of goods within a region are identical, but differ across regions
- What determines the price-level of region 1?
- It is a weighted average of domestic and import products' prices
- market size (it is increasing in  $N$ )
- external factors (e.g. production function, preferences)

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# Equilibrium

- The wages are determined by the product market equilibrium.
- There is a demand from both regions
- Supply = aggregate demand
- The supply,  $x_1$ , is not exactly the same as the demand. Why?
- Because the transportation cost is a loss (it melts on the way)

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# Wages – equilibrium

- The number of firms (aggregate supply) will grow till the profits are zero – equilibrium condition
- We are looking for the equilibrium in the wages, not in the prices
- Wages in region 1 are higher if the market size is greater (local and other market), the transportation cost is lower

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# Long-run equilibrium

- The equations determining long-run equilibrium: income, price-level, wage (manufacturing) and real wage
- What is novelty:
  - real wage – manufacturing wage adjusted by the price index
  - Long-run equilibrium = where real wages are equal

## Theorem

*In the long-run the labor force is mobile. The two-region world is in equilibrium, if the real wages in the two regions are identical. In this case there is no incentive to relocate.*

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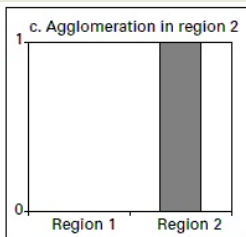
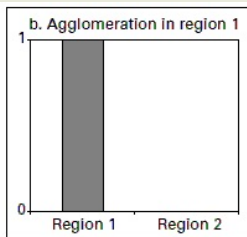
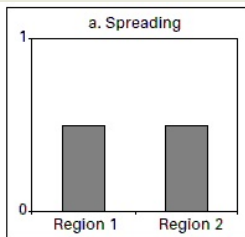
Short-run equilibrium

Long-run equilibrium

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# Equilibriate distributions

- Agglomeration in region 1:  $\lambda_1 = 1, \lambda_2 = 0$
- Agglomeration in region 2:  $\lambda_1 = 0, \lambda_2 = 1$
- Spreading, the two regions are completely identical:  
 $\lambda_1 = \lambda_2 = 0.5$



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# The model of economic geography

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## The model of economic geography – essential elements

- ① increasing returns to scale (internal – IRS within manufacturing goods)
- ② imperfect competition (D-S monopolistic competition)
- ③ location: firms/region ( $R1, R2$ )
- ④ transportation cost ( $T_{12}$ )
- ⑤ mobility for factors of production (labor mobility because of real wage)

# The source of dynamics

- Manufacturing workers move according to real wages
- The long-run equilibrium is achieved if
  - ① the distribution of laborers is such that  $w_1 = w_2 = \bar{w}$ ,
  - ② all the workers are in one region

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# The source of dynamics 2

- What are the economic factors determining dynamics (motion of laborers)?
- The model is complicated and non-linear...
- But at the symmetric equilibrium we can identify the main factors:
- The agglomeration is stimulated by:
  - ① Price index effect
  - ② Home market effect, HME
    - Spreading is stimulated by:
  - ③ Extent-of-competition effect
- The balance between the three effects determine dynamics

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# Price index effect

- What does this mean?
- The price index falls if the market size ( $N$ ) grows
- Large market is advantageous because of lower prices. This is the price index effect of agglomeration.
  - (The products are cheaper because less products have to be imported under given transportation costs.)

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# Home market effect (HME)

- Under non-zero transportation costs the region with higher aggregate income (higher GDP) will have
  - a more than proportional variety of products
  - a higher than proportional rate of manufacturing laborers
- This is the home market effect.
- Under certain parameters – there are transportation costs, the products are substitutes of each other – if income grows by 10%, then there will be 20% more products available

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# The extent-of-competition effect

- As we've seen in the bigger market the prices are lower
- We've also seen that  $p_{i1}$  depends on external factors
- Lower price index ( $I_1$ )  $\Rightarrow$  lower demand ( $x_{i1}$ )
- Fiercer competition (larger variety of products) reduces demand for certain goods through lower price index. This is the extent-of-competition effect.

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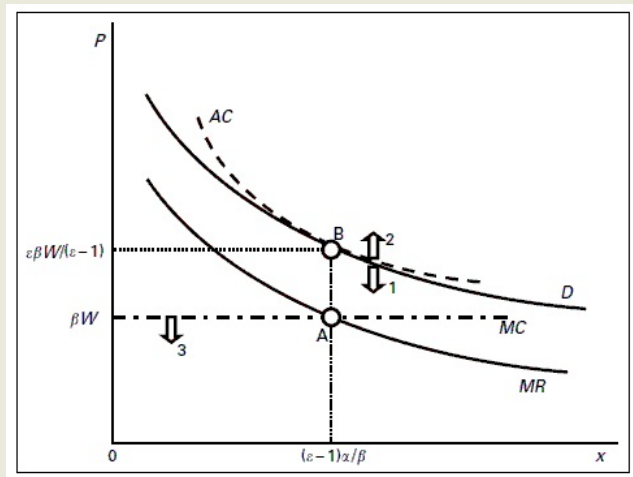
**Dynamics**

## Simple D-S effects

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# Effects

- **Competition:** As a new firm enters,  $I$  falls and so does the demand,  $x$ . (The demand and MR curve shifts downward.)  
Consequently, profit falls.
  - This effect works **against** agglomeration.
- **Home market:** Furthermore, the new firm raises new demand for laborers, which increases demand for local goods. (The demand and MR curve shifts upward.)
  - This effect is self-reinforcing and **stimulates** agglomeration.
- **Price index effect:** If the price index falls – cheaper living costs, real wages are increasing – nominal wages are decreasing. MC shifts downward, profitability grows, number of new firm entries grow.
  - This effect is self-reinforcing and **stimulates** agglomeration.

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# Effects 2

- The balance between the three forces determines the equilibrium.
- If a firm arrives from the spreading equilibrium
  - If its profit grows, then the original equilibrium is not stable, more firms will come
  - If its profit falls, then it is worth returning, the original equilibrium is stable

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# Key terms

- iceberg transportation costs
- short-run and long-run equilibria
- elements of the model of economic geography
- price index effect
- home market effect
- extent-of-competition effect

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