GEOGRAPHICAL ECONOMICS "B"

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week 7

Two-region Krugman model

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1 Krugman model

1.1 Production structure

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

Krugman model – basis

- **Two regions: 1, 2: R1, R2**
- 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 $R1$, N_2 firms in $R2$. Monopolistic competition – producers are competing, but they have market power
- In the case of manufacturing goods there are transportations 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

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 porduct if imported would be more expensive – transportation costs
  - Because of liking for variety, they would like to consume some units of all varieties

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

1.2 Geography steps in: two regions

Two regions

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

Two regions

- Laborers: γ in the manufacturing, $1-\gamma$ in the food sector
- the distirbution of L within the food sector: ϕ_1, ϕ_2, within the manufacturing sector: λ_1, λ_2

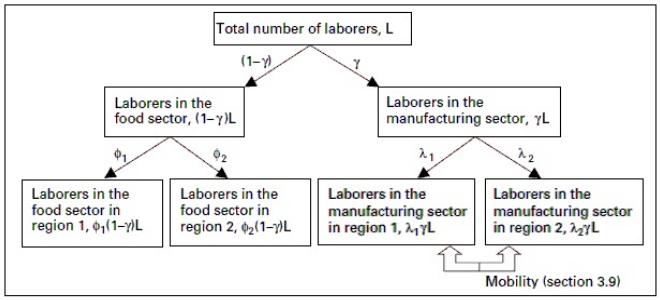


Figure 3.6 Division of labor between the regions
Notes: $\phi_1+\phi_2=1$; $\lambda_1+\lambda_2=1$.

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

1.3 Short-run equilibrium

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)

Short-run equilibrium

- 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

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)

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)

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

1.4 Long-run equilibrium

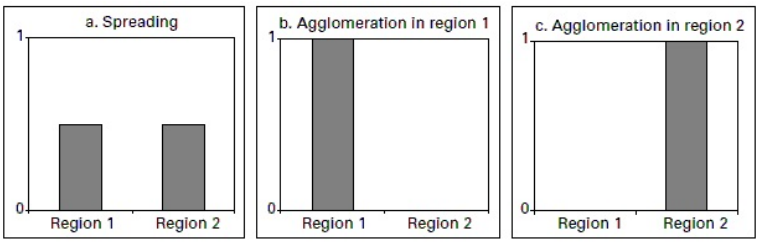
Long-run equilibrium

- 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 1 *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.*

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: $\lambda_1 = \lambda_2 = 0.5$



1.5 Dynamics

The model of economic geography

The model of economic geography – essential elements

1. increasing returns to scale (internal – IRS wtihin 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 $w_1 = w_2 = \overline{w}$,
2. all the workers are in one region

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

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.)

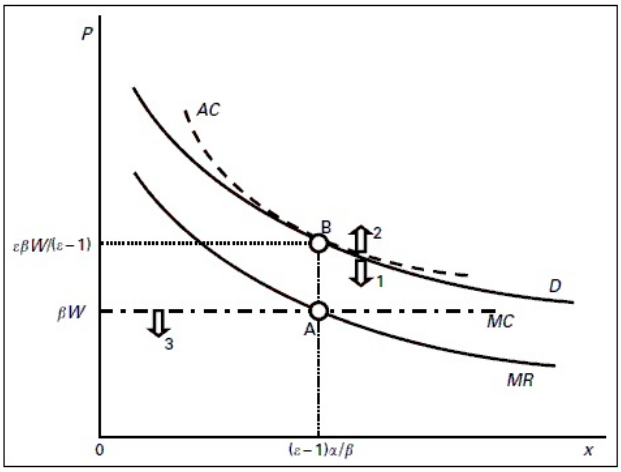
Home market effect (HME)

- 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 manufaturing 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

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.

Simple D-S effects



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.

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

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