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Spatial Diversity in Economic Models

- Heterogeneity and Homogeneity -

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Introduction

In economics heterogeneity appears in many places. If we consider economics as an area of social science, we do not have to explain the heterogeneity and diversity of people as the centre of the research.

In the fundamental questions of economics heterogeneity plays an important role. Behind the question, “What to produce?”, one can clearly see the diversity, the heterogeneity of products, which is an important criterion to decide the concrete form of the market structure. Another fundamental question is “For whom do we produce?”. This shows the consumers’ diversity, namely the different preference systems in the background of individual decisions. This is the

basis for different demand, reservation prices and, finally, for individually different elasticitis. On the other hand the consumer is in the same moment labour force and the carrier of the human capital. Of course, heterogeneity appears in human capital too. The "How to produce?" is the motive of development. The pressure of technical improvement implies the innovations, whereby certain companies become more efficient than others; moreover these companies can achieve monopoly power. This is again a question of market structure.

Not one of the basic question, but also essential for diversity is the issue: "Where should we produce?". In the background of this topic there are the geographical conditions and the natural resources, that is how premises decisions are made. This theory is the tendency of classic spatial theory. It appears from this, that heterogeneity creates complex system. In order to manage this diversity, we have to collect the homogeneous elements, and we can draw conclusion from this to consider heterogeneous economy. Before doing so, first of all, one has to know what space means.

Interpretation of the Space

Space is not only an economic concept. In the science of philosophy space is compared to a container (objective/absolute space). (Révai Nagy Lexikona, Volume 18) It is imagined that the size of this container, of the absolute space is exogenously given and constant, therefore the processes going on in this container do not affect the space, but on the other hand, they are influenced by the space, for instance taking their shape according to the space containing them. Thus: space affects the elements, but there is no reaction from the elements to the space. (Faragó [2012])

The other tendency – the relativist space-perception – stands more closer to the social concern of space, because in this appears that there is a power forming space; in this case a reaction from the elements on the space does indeed exist. In Kant's philosophy, however, the space is assumed as an a priori condition, it is a necessary element for understanding the processes, the happenings – what are going on around us; or events all over the world. This interaction between the space and its elements are developing to higher levels and become more intensive through experiences. (Faragó [2012])

Although philosophy doesn't give space-definitions, it presents some space-interpretations. The science of definitions is mathematics. This science doesn't offer a general concept for the space, but many different space-categories are distinguished from each other, such as Euclidean space, vector space, metric space, topological space, etc. All of these mathematical spaces have a concrete structure, therefore it can be said that the space is a set with an added structure, i. e. there is no general space.

The different space interpretations in science can also be considered as a sign for space's heterogeneous character and its complexity. To understand what is the real effect of the space's structure on the economic processes, within the space one has to find or create units with similar, i. e. with homogeneous elements. The degree of homogeneity or of heterogeneity is a measure of the distance between the elements as well as between the subspaces containing similar elements.

Interpretation of the Distance

Normally distance is considered as length, but it is also possible to talk about distances, based on time or defined by costs. So-called time maps have been developed on the basis of time-distance, where the base of comparison is the time necessary to move from one point to another ; all point to be reached in the same time from a given starting point P are considered as to be in the same distance from P – whatever is the traditional distance. Cost-distance may be determined on the strength of road expenses. But differences observable in the levels of development between different countries can also be interpreted as a kind of distance. (Dusek – Szalkai [2006])

In the same way the distance in non-physical sense comes up in several economic theories. Let's consider for example the Lorenz-curve, where the income-disparities are the basis of the distance and hereby the Gini-index is formed, but distance can be also interpreted as income difference between individuals, regions, countries, etc. (For an example see Meyer [2012]). Moreover, in connection with the Hotelling-model additional kind of distance is go, because the distance can explain the product heterogeneity, i. e. the distance comes from feature differences of two products. Besides, in case of a market, prices are determined by demanded quantity and a price determined by supplied quantity; and the difference between prices is also a kind of distance. Of course if the market is in equilibrium, the distance is zero. Therefore it is the space itself and the distance defined there which implies the structure.
In the following point a well-done model of spatial economics will be considered: first the structure of the space will be derived, then we will be analyse how the structure could be changed by some elements of the space.

A classic – the basic model

If somebody is interested in spatiality, the Thünen-theory is inevitable. This model is well-known: Johann Heinrich von Thünen had assumed a so-called isolated state, with the following structure: the market (the city) is located in the centre, where the production of industrial goods is going on; the different agricultural products are produced in several areas around the city. These bands are called in the literature Thünen-rings. The Thünen-rings represent the heterogeneity of the spatial, namely the territorial structure of the state quite clearly. To understand this, we examine the formation of homogeneous rings in more details (SCHÖLER, K. [2005]).

The farmers (who are not the land owners, i. e. they have to pay rent for using the land) produce the agricultural products. The production involves costs, such as production and transportation costs; and the amount of money which remains as the difference between income and these costs, can be spent on land rent (g_i) (SUNTUM [1980]):

$$g_i(u) = (p_i - t_i u - k_i)e_i,$$

where p_i is the price of i product,

t_i is the transportation cost,

u represents the distance between the centre and the place of the production,

k_i means the production cost.

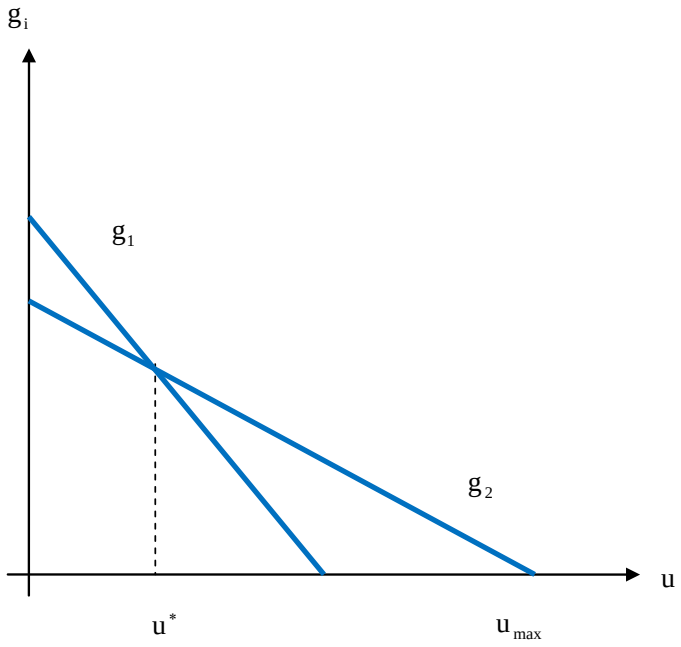
On a given unit of the area that product is produced which allows to pay the highest rent. So: if we assume two products and hereby there are two rings, the border of the rings will be, where the offered rents, based on the production of the two products, are equal to each other:

$$g_1(u) = g_2(u), \quad i = 1,2.$$

Thereby we can determine the distance between the border and the centre.

This is denoted with u*, and the graph represents this relation:

$$u^* = \frac{e_1(p_1 - k_1) - e_2(p_2 - k_2)}{e_1 t_1 - e_2 t_2}.$$



The value u* related to the crossing point of g1 and g2 is therefore the border between the areas, where product1 is produced as well as product2 may be produced too. If g1 is more higher than g2 ($g_1(u) > g_2(u)$), i. e. the rent of product 1 is larger than the rent of product2; then product1 is produced closer to the centre.

A classical – extending

After the interpretation of the intersection of the functions, let's examine the explanation of the horizontal axis segment of the rent function. For example: we denoted the axis segment of g2 function with u_{max}:

$$u_{max} = \frac{p_2 - k_2}{t_2}.$$

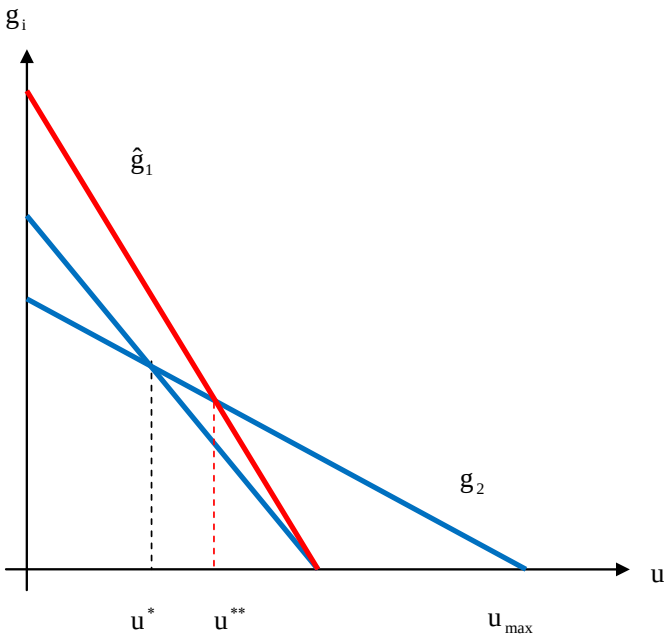
In this point the income does not cover the land rent, so the ring has a maximum size. It's clear, that the rise in prices and the decline in unit costs increase the size of the ring, and in this way, the area of the market. Moreover an infrastructural development – which reduced the transportation costs – has the same effect. In summary: the border of the production area of the isolated state is not exogenous, but it changes as a result of market processes. From this point of view Thünen internalized the natural conditions by using the transportation conditions.

If we extend the logic of this model to any other products, and we analyse solely the effects of changing transportation costs to the range of market, then it is no surprise that the Internet markets are spreading. In this case the transportation costs are reduced to quasi zero, and through the web we can trade without spatial limit.

The development of technology not only manifested itself in the change of means of transport, but also in the opportunity to have a better quality of agricultural land. In the formalized version of the model the quality of land appears in parameter e_i, because by using artificial fertilizer the yield of the unit territory can be improved. Because of improving the benefit, the yield goes up, so this influences the Thünen-rings.

In the following point we also assume that there are two agricultural products. As well as before let's presume, that g1 is more than g2, namely product 1 is produced closer to the market. Let's suppose further – ceteris paribus – in the case of product1 the yield increases related to a unit territory. This situation is represented in the graphic. We can see that the slope of function has changed, the curve became steeper. However, the point of intersection of

the horizontal axis and the benefit function does not change. So the maximum size of production area is constant, in spite of the fact that the Thünen-rings are transformed.



Besides these conditions the area of the first ring grows. This also means that all production areas have a maximum size, which – beyond a certain point – cannot be increased; therefore it is not useful to improve the quality of the land; until the rent function will be a vertical straight.

Summary

Thünen's theory provided a good basis for seeing that: a heterogeneous space can be split into homogeneous "subspaces"; so we can understand the structure of space easier. In the present paper the space has been interpreted in a very strong sense, distance has been considered in the traditional – physical – way. But already in this case it could be seen that nor the space, neither its structure are independent from economic activities.

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